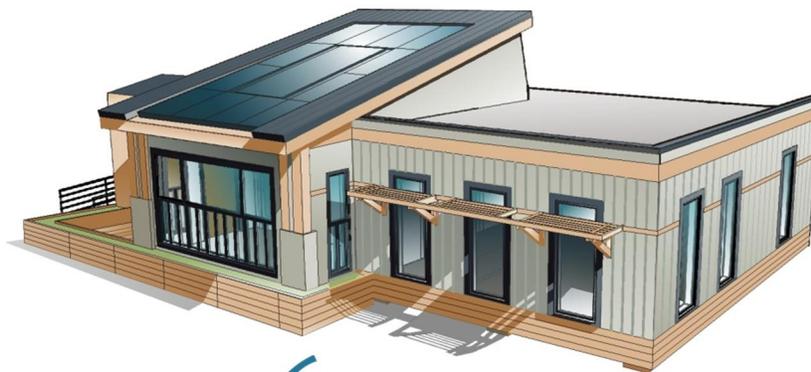


PROJECT MANUAL

U.S. Department of Energy/ Solar Decathlon 2011

Old Dominion University & Hampton University
TEAM TIDEWATER VIRGINIA



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As-Built

August 11, 2011

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Summary of Changes

03-22-2011 Revision

This is the second issue of the Project Manual for Team Tidewater Virginia's Unit6. The following changes have been included in this issue:

1. Specifications have been updated to reflect changes in design and product choices. The following sections have been removed:
 - 07 27 00 Air Barriers
 - 07 53 03 Elastomeric Membrane Roofing – Fully Adhered
 - 07 61 00 Sheet Metal Roofing
 - 08 11 15 Pre-Assembled Doors and Frames
 - 09 62 09 Resilient Flooring
 - 22 40 00 Plumbing Fixtures

The following sections have been added:

- 06 17 53 Shop Fabricated Wood Trusses
 - 07 21 16 Blanket Insulation
 - 07 26 00 Vapor Retarder
 - 07 41 13 Metal Roof
 - 07 46 00 Siding
 - 07 53 00 Elastomeric Membrane
 - 08 31 13 Access Doors
 - 08 35 13 Folding Doors
 - 08 55 00 Doors and Windows
 - 09 62 23 Bamboo Flooring
 - 13 42 00 Building Modules
 - 21 05 00 Fire Suppression
 - 23 05 93 Testing, Adjusting, and Balancing for HVAC
 - 23 07 00 HVAC Insulation
 - 23 81 26 Split-System Air Conditioners
 - 26 31 00 Photovoltaic Collectors
 - 32 94 00 Plant Accessories
2. Stamped and sealed structural calculations are reproduced in the Project Manual. Stamped and sealed structural drawings are reproduced in the BIM submission. The Unit 6 main structure is constructed by a modular manufacturer, while the deck, utility core, pergola, and planters are constructed by Team

Tidewater Virginia. The structure of the house modules is shown in shop drawings from the manufacturer and is stamped separately from the rest of the construction. Two sets of stamped drawings and calculations are therefore included: Those for the house modules, and those for the site construction.

3. Energy modeling results and discussion are included in the second issue.
4. The detailed water budget has been revised to reflect the specified appliances' reported water use. A copying error has been corrected in the clothes washer category, reducing the number of events from 16 to 8. The total water budget is now reduced to 773 gals.
5. Interconnection Application form has been updated, reflecting a change in PV modules and inverter.
6. The following changes have been made in the design:
 - HVAC air handler in laundry closet has moved up into the ceiling joist area and northward into the area over the back hall
 - Roof joists have been modified to run North-South in a portion of Module A, in order to allow ductwork to run between them
 - The parapet on the North of the roof has been removed to facilitate rainwater flow
 - Kitchen cabinetry has changed to closed front from the open shelving approach
 - Interior trim has been modified
 - Solar thermal collector is now in portrait rather than landscape orientation
 - Solar thermal system has changed from indirect closed-loop system with heat exchanger integrated in storage tank to indirect drainback system with heat exchanger in drainback reservoir
 - Deck has become panelized
 - Planter sizes decreased
 - A column was added to the living room entryway
 - Solar PV module arrangement has changed
 - Roof structure has changed
 - Built-in seating was removed from house interior
 - Gutter on the East façade was removed
 - The door to the utility core is now a piano-hinged piece of siding rather than a standard door
 - The planters integrated in the pergola now use a metal bottom rather than wood
 - Fire suppression supply water tank is added underneath a bench on the deck
 - Planters use stick frame wood construction
 - Footings in the foundation have increased in number and shapes are modified

- Height of picture rail and interior finishes changed
- The bookshelf in the living room is no longer built into the wall system
- Two of the clerestory windows in the kitchen are now operable
- The windows on the South façade shifted
- The corner details on the exterior façade changed
- The pergola connection to the house changed
- The roof rainwater drainage system from the sloped roof over the sunspace and kitchen runs into the planters below
- The planters are built in modules
- A landscape plan was added
- The woods used on the house are cypress and cedar for exterior trim
- House exterior colors changed
- The location of the tanks inside the utility core changed
- The photovoltaic manufacturer and module specification changed
- The PV modules are now mounted over a standing seam metal roof instead of EPDM

08-11-2011 Revision

This is the third issue of the Project Manual for Team Tidewater Virginia's Unit6. The following changes have been included in this issue:

1. Specifications have been updated to reflect changes in design and product choices. The following sections have been
 - Removed:

i. 07 53 00	ELASTOMERIC MEMBRANE ROOFING
ii. 08 31 13	ACCESS DOORS AND FRAMES
iii. 23 05 93	TESTING, ADJUSTING, AND BALANCING FOR HVAC
iv. 26 29 13	ENCLOSED CONTROLLERS
 - Added:

i. 06 61 00	FIBERGLASS-REINFORCED PLASTIC (FRP) FABRICATIONS
ii. 07 54 50	THERMOPLASTIC POLYOLEFIN (TPO) MEMBRANE ROOFING
iii. 21 41 00	STORAGE TANKS FOR FIRE SUPPRESSION
 - Modified:

i. 05 50 00	METAL FABRICATIONS
ii. 06 10 00	ROUGH CARPENTRY
iii. 06 15 00	WOOD DECKING
iv. 06 20 00	FINISH CARPENTRY
v. 07 21 00	THERMAL INSULATION
vi. 07 21 16	BLANKET INSULATION
vii. 07 21 19	FOAMED-IN-PLACE INSULATION

viii.	07 46 00	SIDING
ix.	07 46 23	WOOD SIDING
x.	07 62 00	SHEET METAL FLASHING AND TRIM
xi.	09 30 00	TILING
xii.	09 90 00	PAINTING AND COATING
xiii.	11 31 00	RESIDENTIAL APPLIANCES
xiv.	13 42 00	BUILDING MODULES
xv.	22 10 00	PLUMBING PIPING AND PUMPS
xvi.	22 30 00	PLUMBING EQUIPMENT
xvii.	23 56 13	HEATING SOLAR COLLECTORS
xviii.	23 81 26	SPLIT-SYSTEM AIR CONDITIONERS
xix.	26 05 26	GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS
xx.	26 27 26	WIRING DEVICES
xxi.	26 31 00	PV COLLECTORS
xxii.	26 51 00	INTERIOR LIGHTING
xxiii.	26 56 00	EXTERIOR LIGHTING
xxiv.	28 16 00	INTRUSION DETECTION

Manufacturer's specification sheets were added for appliances, HVAC, light fixtures, inverters, PV modules and other electrical equipment.

2. The following drawings have been

- Added:
 - i. CASEWORK Sheets A-601 to A-608
 - ii. PLANTERS Sheet L-603
- Deleted:
 - i. LANDSCAPE ELEVATIONS Sheets L-201 and 202
 - ii. E-603
 - iii. P-902
 - iv. M-602
- Edited:
 - i. INTERIOR ELEVATIONS Sheets A-213 to 216
 - ii. WALL SECTIONS Sheet A-311
 - iii. ROOF DETAILS Sheet A-501
 - iv. SECTION DETAILS Sheet A-503
 - v. SLOPED ROOF DETAILS Sheet A-504
 - vi. UTILITY CORE Sheets A-701 and 702
 - vii. ASSEMBLY PLAN Sheet G-004
 - viii. SHADING DIAGRAM Sheet G-601
 - ix. LANDSCAPE PLAN Sheet L-101

- x. E-601-A and E-601-B modified and consolidated to E-601
- xi. P-101, P-102, P-103, P-104, P-901, F-101, E-101, E-604

3. Interconnection Application form has been updated, reflecting a change in PV modules and inverter.

4. The following changes have been made in the design:

- The fire suppression tank has been removed from the planter bench. Instead, we will draw water from the large rainwater cistern, which will have an inviolable 250gal reserve at all times for fire suppression.
- An additional array of 6 PV modules was added.
- BioPCM phase change material was added to the sunspace floor, replacing concrete as a thermal mass. The BioPCM mat is inverted over an FRP grate, with the pockets of PCM nestled within the voids in the grate. The grate supports a tile floor laid on top of it in the standard manner.
- PCM was also added to the East wall of the sunspace in the wall cavity, against the cypress siding.
- The sunspace interior finish was changed to cypress shiplap below the module break.

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	Sheet G-004, D.C. Assembly Plan
Rule 4-2	Construction Equipment	Specifications for heavy machinery	Sheet G-004, D.C. Assembly Plan
Rule 4-3	Ground Penetration	Drawing(s) showing the locations and depths of all ground penetrations on the competition site	Sheet G-004, D.C. Assembly Plan
Rule 4-4	Impact on the Turf	Drawing(s) showing the location, contact area, and soil-bearing pressure of every component resting directly on the turf	Sheet G-004, D.C. Assembly Plan
Rule 4-5	Generators	Specifications for generators	Sheet G-004, D.C. Assembly Plan
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	Sheets F-101, P-101, P-103, P-104, L-301
Rule 4-6	Spill Containment	Specifications for all equipment, containers, and pipes that will contain fluids at any point during the event	22 30 00 Plumbing Equipment 22 10 00 Plumbing Pipes and Pumps 23 56 13 Heating Solar Collectors
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	Sheet S-701, Foundation Details
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	Sheet S-701, Foundation Details
Rule 5-2	Solar Envelope Dimensions	Drawing(s) showing the location of all house and site components relative to the solar envelope	A-211 and A-212, Elevations

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	Modular Manufacturer: Drawings - Z-109 to Z-116 Calculations - pp <u>12-49</u> Site Construction: Drawings - Z-201 to 209 Calculations - pp. <u>49-118</u>
Rule 6-2	Finished Square Footage	Drawing(s) showing all information needed by the rules officials to measure the finished square footage electronically	G-101 Finished Square Footage Compliance Plan
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 (Sunspace is included in finished square footage already.)
Rule 6-3	Entrance and Exit Routes	Drawing(s) showing the accessible public tour route and the ground surface area that will be covered by organizer-provided walkway material	G-103 ADA Tour Route Compliance Plan
Rule 7-1	Placement	Drawing(s) showing the location of all vegetation and, if applicable, the movement of vegetation designed as part of an integrated mobile system	L-102 Vegetation Plan
Rule 7-2	Watering Restrictions	Drawing(s) showing the layout and operation of greywater irrigation systems	Sheet P-601, P-103 NOTE: GREYWATER IRRIGATION SYSEM WILL NOT BE OPERATIONAL DURING COMPETITION
Rule 8-1	PV Technology Limitations	Specifications for photovoltaic components	26 31 00
Rule 8-3	Batteries	Drawing(s) showing the location(s) and quantity of all primary and secondary batteries and stand-alone, PV-powered devices	N/A

Rule 8-3	Batteries	Specifications for all primary and secondary batteries and stand-alone, PV-powered devices	N/A
Rule 8-4	Desiccant Systems	Drawing(s) describing the operation of the desiccant system	N/A
Rule 8-4	Desiccant Systems	Specifications for desiccant system components	N/A
Rule 8-5	Village Grid	Completed interconnection application form.	Project Manual, p. <u>121</u>
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-604
Rule 8-5	Village Grid	Specifications for the photovoltaics, inverter(s), terminal box, meter housing, service equipment, and grounding means	Photovoltaic Collectors 26 31 00 Grounding and Bonding 26 05 26
Rule 8-5	Village Grid	One-line electrical diagram	E-601-A/E-601-B
Rule 8-5	Village Grid	Calculation of service/feeder net computed load per NEC 220	E-604
Rule 8-5	Village Grid	Site plan showing the house, decks, ramps, tour paths, and terminal box	C-103 Site Utility Plan
Rule 8-5	Village Grid	Elevation(s) showing the meter housing, main utility disconnect, and other service equipment	TBD
Rule 9-1	Container Locations	Drawing(s) showing the location of all liquid containers relative to the finished square footage	Sheet C-103
Rule 9-1	Container Locations	Drawing(s) demonstrating that the primary supply water tank(s) is fully shaded from direct solar radiation between 9 a.m. and 5 p.m. EDT or between 8 a.m. and 4 p.m. solar time on October 1	C5/L-301 Utility Core Sections

Rule 9-2	Team-Provided Liquids	Quantity, specifications, and delivery date(s) of all team-provided liquids for irrigation, thermal mass, hydronic system pressure testing, and thermodynamic system operation	TBD
Rule 9-3	Greywater Reuse	Drawing(s) showing the layout and operation of greywater reuse systems	Sheets P-103 and P-601 NOTE: GREYWATER IRRIGATION SYSEM WILL NOT BE OPERATIONAL DURING COMPETITION
Rule 9-4	Rainwater Collection	Drawing(s) showing the layout and operation of rainwater collection systems	Sheet P-104
Rule 9-6	Thermal Mass	Drawing(s) showing the locations of liquid-based thermal mass systems	N/A
Rule 9-6	Thermal Mass	Specifications for components of liquid-based thermal mass systems	N/A
Rule 9-7	Greywater Heat Recovery	Drawing(s) showing the layout and operation of greywater heat recovery systems	N/A
Rule 9-8	Water Delivery	Drawing(s) showing the complete sequence of water delivery and distribution events	Sheet P-102
Rule 9-8	Water Delivery	Specifications for the containers to which water will be delivered	22 30 00 Plumbing Equipment
Rule 9-9	Water Removal	Drawing(s) showing the complete sequence of water consolidation and removal events	Sheet P-103
Rule 9-9	Water Removal	Specifications for the containers from which water will be removed	23 30 00 Plumbing Equipment
Rule 11-4	Public Exhibit	Interior and exterior plans showing entire accessible tour route	G-103 ADA Tour Route Compliance Plan

Structural Calculations

Stamped calculation sheets from the Licensed Structural Engineer are included in the March 22, 2011 submission of the Project Manual. Two sets of calculations are provided: One from the structural engineer for the modular home manufacturer who is providing the house modules, certifying the structure of the modules; and one from the structural engineer for the site construction, certifying all the constructed elements outside of the house modules, including foundations and solar panel wind loads. These sheets are reproductions of the stamped structural calculations which are submitted to NREL independently.

Modular Home Calculations

The following 36 pages are reproductions of the sealed and stamped structural calculations for the manufactured modules provided by the modular home builder.

Solar Decathlon House
Norfolk, Virginia
Haven Custom Homes

Structural Design Calculations

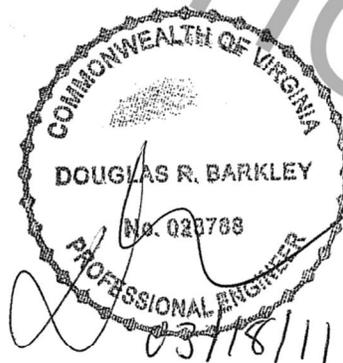
Project #: 11-91-0007

Submitted: March 17, 2011

Prepared By:

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Solar Decathlon House
 Norfolk, Virginia
 Haven Homes

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Appendix A

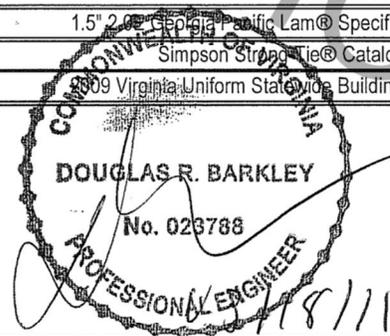
Foundation Level Loads & First Floor Beams	A1
First Floor Shear Wall & Hold Down Anchor Plan	A2
Beam Plan	A3
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Appendix B - Portal Frame Specifications

Appendix C - Exposure Maps

Appendix D - Connection Details & Sections

Governing Code	2009 Virginia Uniform Statewide Building Code
Wind Loading	ASCE 7-05 Chapter 6
Snow Loading	ASCE 7-05 Chapter 7
Wood Properties & Specifications	NDS 2005 Edition
Laminated Veneer Lumber Specifications	1.5" 2.0E Pacific Lam® Specifications
Wood Connector Product Specifications	Simpson Strong-Tie® Catalog 2011
All Connections Not Designed	2009 Virginia Uniform Statewide Building Code



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**Solar Decathlon House
Norfolk, Virginia
Haven Custom Homes**

By: Jamie MacDonnell
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1. Building and Location Information

Location and Code Contact	
County	Norfolk
State	Virginia
Applicable Code	IRC2009 w/ State Amendments
Contact at Local Bldg Dept.	NA
Phone # of Local Bldg Dept.	NA
Date of Contact	NA

Wind Load Criteria	
Wind Speed	100 mph
Exposure	C
Importance Factor	1.00
Enclosure	Fully Enclosed
Roof Pitch	3 : 12

Building Dimensions	
Height from Grade to 1st Floor	2.00 ft
Height of 1st Floor Walls	8.00 ft
Height of 2nd Floor Walls	0.00 ft
Height of 3rd Floor Walls	0.00 ft
Height of Ridge	7.17 ft
Mean Roof Height	13.59 ft
Building Width	30.33 ft
Building Length	34.00 ft

Module	Width
A	15.00 ft
B	12.88 ft
C	13.46 ft
MAX	15.00 ft

2. Pressure and Load Calculations

Dead Loads

Component		Roof	Floor	Exterior Walls
7/16" OSB Sheathing	1.5 psf			•
1/2" Plywood Sheathing	1.5 psf	•		
2x10 Members @ 16" o.c.	3.0 psf	•	•	
2x8 Members @ 16" o.c.	2.0 psf			
2x6 Members @ 16" o.c.	1.5 psf			•
2x4 Members @ 16" o.c.	1.0 psf			
Mechanical System	2.5 psf	•		
Insulation	1.0 psf	•	•	•
1/2" Gypsum Wall Board	2.2 psf			
Sub - Floor Assembly	3.0 psf		•	
Floor Finish	3.0 psf		•	
Shingles/Metal Roofing	3.0 psf	•		
Allowance for Int. Partitions	6.0 psf		•	
Exterior Siding	5.0 psf			•
Solar Panels	8.0 psf	•		
Total		19 psf	16 psf	9 psf
Design Load		20 psf	17 psf	10 psf



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Seismic Load Calculations

Mapped Spectral Response Acceleration: At Short Periods	$S_s = 0.12$
Site Coefficient	$F_a = 1.60$
Design Spectral Response Acceleration: At Short Periods	$S_{DS} = 0.13$
Seismic Design Category	A
Site Class Definition	D

Wind Load Pressures - C&C

Edge Distance $a = 3.03$ -ft

Component & Cladding Loads					
	Zone	A_e	General Pressures		Overhang
Roof Pressures	1	10	12.6	-19.9	-16.6
		20	11.4	-19.4	-16.1
		50	10.0	-18.7	-15.3
		100	8.9	-18.1	-14.8
	2	10	12.6	-34.7	-40.6
		20	11.4	-31.9	-40.6
		50	10.0	-28.3	-40.6
		100	8.9	-25.5	-40.6
	3	10	12.6	-51.4	-68.3
		20	11.4	-48.0	-61.7
		50	10.0	-43.6	-52.9
		100	8.9	-40.3	-46.2
Wall Pressures	4	10	21.8	-23.6	
		20	20.8	-22.7	
		50	19.5	-21.4	
		100	18.5	-20.4	
	5	10	21.8	-29.2	
		20	20.8	-27.2	
		50	19.5	-24.6	
		100	18.5	-22.7	
Windows & Doors					
Opening (sf)		Wind Pressures			
0 - 20		21.8	-29.2		
20.01 - 30		20.8	-27.2		
30.01 - 40		20.4	-26.4		
40.01 - 50		19.9	-25.5		

Component & Cladding - Negative Roof Pressure

$$P_{ccrn} := \frac{1}{2} (P_{rn1} + P_{rn2}) \cdot \text{psf} = -25.67 \cdot \text{psf}$$

$$P_{ccrvn} := P_{ccrn} \cdot \cos(\text{Angle}) = -24.9 \cdot \text{psf}$$

$$P_{ccrhn} := P_{ccrn} \cdot \sin(\text{Angle}) = -6.23 \cdot \text{psf}$$

Component & Cladding - Positive Roof Pressure

$$P_{ccrp} := \frac{1}{2} (P_{rp1} + P_{rp2}) \cdot \text{psf} = 11.45 \cdot \text{psf}$$

$$P_{ccrvp} := P_{ccrp} \cdot \cos(\text{Angle}) = 11.11 \cdot \text{psf}$$

$$P_{ccrhp} := P_{ccrp} \cdot \sin(\text{Angle}) = 2.78 \cdot \text{psf}$$

Component & Cladding Wall Pressure

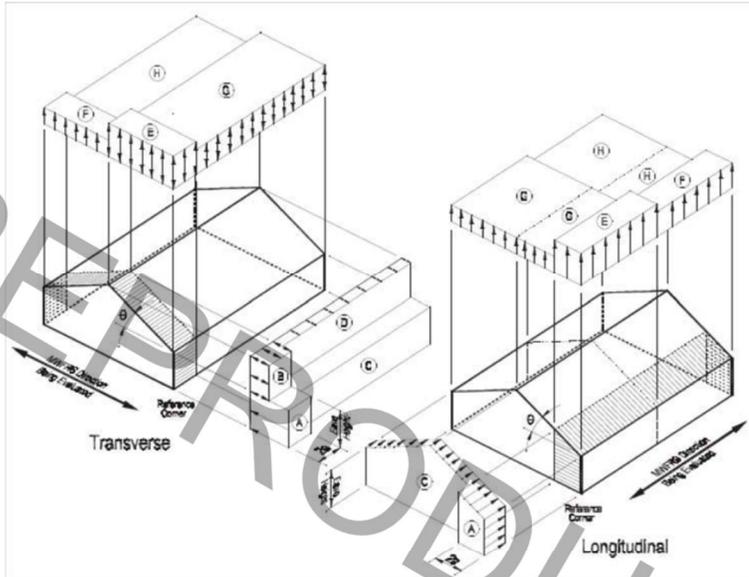
$$P_{ccw} := \max(|P_{wn}|, P_{wp}) \cdot \text{psf} = 27.22 \cdot \text{psf}$$



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Wind Load Pressures - MWFRS



Zones									
Horizontal Pressures				Vertical Pressures				Overhangs	
A	B	C	D	E	F	G	H	E _{OH}	G _{OH}
19.9 psf	-8.2 psf	13.3 psf	-4.9 psf	-19.1 psf	-12.4 psf	-13.3 psf	-9.5 psf	-26.7 psf	-20.9 psf

Adjustment Factor

$$\lambda := 1.21$$

Average Pressure on Walls

$$p_w := \lambda \cdot I_{wind} \cdot \left(\frac{2 \cdot a}{W} \cdot p_a + \frac{W - 2 \cdot a}{W} \cdot p_c \right) \cdot \text{psf} = 17.69 \cdot \text{psf}$$

Design Wind Pressure

$$p_w := 34 \text{ psf}$$

Average Vertical Pressures on Roof

$$p_{vg} := \lambda \cdot I_{wind} \cdot \left(\frac{2 \cdot a}{W} \cdot p_e + \frac{W - 2 \cdot a}{W} \cdot p_g \right) \cdot \text{psf} = -17.5 \cdot \text{psf}$$

Average Horizontal Pressure on Roof

$$p_{hr} := \lambda \cdot I_{wind} \cdot \left(\frac{2 \cdot a}{W} \cdot |p_b| + \frac{W - 2 \cdot a}{W} \cdot |p_d| \right) \cdot \text{psf} = 6.73 \cdot \text{psf}$$

Snow Load Calculations

Ground/Unbalanced Snow Load	$p_G = 10 \text{ psf}$
Flat Roof Snow Load	$p_f = 20 \text{ psf}$
Balanced Snow Load	$p_s = 20 \text{ psf}$



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Superimposed Live Loads

Floor Live Load	$LL_f = 50$ psf
Attic Live Load	$LL_a = 20$ psf
Roof Slope Reduction Factor	RF = 1.00
Roof Live Load	$LL_{rr} = 20$ psf

Basic Load Combinations

Load Combination
1 D + (L or S) + L
2 D + (W or 0.7E)
3 D + 0.75(W or 0.7E) + 0.75L + 0.75(L _r or S)
4 0.6D + (W or 0.7E)

Load Definition	Load Duration Factor - C _D
D = Dead Load	0.9
L = Live Load	1
L _r = Roof Live Load	1.25
S = Snow Load	1.15
E = Earthquake Load	1.33
W = Wind Load	1.6

Roof Loads		
Load Combination	Loads	C _D
1	40 psf	1.15
2	31 psf	1.6
3	43 psf	1.6
4	-17 psf	1.6
Design Load	43 psf	1.6

Floor Loads		
Load Combination	Loads	C _D
1	67 psf	1
2	17 psf	1.6
3	55 psf	1.6
4	10 psf	1.6
Design Load	67 psf	1

Wall Loads		
Load Combination	Loads	C _D
1	10 psf	0.9
2	10 psf	1.6
3	10 psf	1.6
4	6 psf	1.6
Design Load	10 psf	0.9



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3. Shear Wall Design

Sheathing Capacities

SHEAR WALL I - 7/16" OSB w/ 15GA staples
@ 4" edge spacing

$$v_1 := 0.82 \cdot 285 \text{plf} \cdot 1.4 = 327.18 \cdot \text{plf}$$

SHEAR WALL II - Mateline - 1/2" Gypsum w/ 1-5/8"
blued ring shank drywall nails @ 4" edge spacing and
FoamSeal Adhesive - each wall

$$v_2 := 2 \cdot 266 \text{plf} = 532 \cdot \text{plf}$$

SHEAR WALL III - 1/2" Gypsum w/ 1-5/8" blued ring
shank drywall nails @ 4" edge spacing and
FoamSeal Adhesive - both faces of wall

$$v_3 := 339 \text{plf}$$

Transverse Shear Walls

Wind Load on Walls

$$w_1 := \left(\frac{1}{2} \cdot h_1 \right) \cdot p_w + h_r \cdot p_{hr} = 184.24 \cdot \text{plf}$$

$$w_2 := 5 \text{ft} \cdot p_w = 170 \text{plf}$$

Shear Line	Wall Length	Wall Height	Open Length	Open Ht	Shear Wall (I, II, III)	Shear Line Forces	
						Shear Line	Force
1	21.33 ft	8 ft	0 ft	0 ft	1	1	1380 lbf
2	6.58 ft	8 ft	0 ft	0 ft	2	2	3000 lbf
3	12.875 ft	8 ft	3 ft	7 ft	1	3	1620 lbf

Shear Line	Opening Adjustment Factor - C _o	Wall Capacity	Applied Shear	Hold Down Anchor Force	Number of ST2122 ¹ Hold Down Anchor	Spacing of 8d Nails - OSB to Rim ²	Spacing of ST2122 ¹ - Stud to Rim
1	1.00	6.98 kip	> 1.38 kip	0.00 kip	0	4 in. o.c.	NA
2	1.00	3.50 kip	> 3.00 kip	3.33 kip	3	4 in. o.c.	NA
3	0.73	2.35 kip	> 1.62 kip	1.18 kip	1	4 in. o.c.	NA



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Longitudinal Shear Walls

Wind Load on Walls

$$w_1 := \left(\frac{1}{2} \cdot h_1 + h_r \right) \cdot p_w = 379.78 \cdot \text{plf}$$

$$w_2 := 5 \text{ft} \cdot p_w = 170 \text{ plf}$$

Shear Line	Wall Length	Wall Height	Open Length	Open Ht	Shear Wall (I, II, III)
1	15 ft	8 ft	5.92 ft	7 ft	1
1	10.08 ft	8 ft	2.75 ft	7 ft	1
2	5.67 ft	8 ft	0 ft	0 ft	2
2	3.33 ft	8 ft	0 ft	0 ft	2
2	6.67 ft	8 ft	0 ft	0 ft	3
3	3.08 ft	8 ft	0 ft	0 ft	1
3	7 ft	8 ft	3 ft	7 ft	1
3	2.83 ft	8 ft	0 ft	0 ft	1

Shear Line Forces	
Shear Line	Force
1	870 lbf
2	5010 lbf
3	1900 lbf

Shear Line	Opening Adjustment Factor - C _o	Wall Capacity	Applied Shear	Hold Down Anchor Force	Number of ST2122 ¹ Hold Down Anchor	Spacing of 8d Nails - OSB to Rim ²	Spacing of ST2122 ¹ - Stud to Rim
1	0.62	1.83 kip	> 0.45 kip	0.00 kip	0	4 in. o.c.	NA
1	0.70	1.67 kip	> 0.42 kip	0.17 kip	1	4 in. o.c.	NA
2	1.00	3.02 kip	> 2.14 kip	2.75 kip	2	4 in. o.c.	NA
2	1.00	1.77 kip	> 1.26 kip	2.87 kip	2	4 in. o.c.	NA
2	1.00	2.26 kip	> 1.61 kip	1.61 kip	2	4 in. o.c.	NA
3	1.00	1.01 kip	> 0.71 kip	1.69 kip	2	4 in. o.c.	NA
3	0.60	0.78 kip	> 0.55 kip	1.50 kip	1	4 in. o.c.	NA
3	1.00	0.93 kip	> 0.65 kip	1.70 kip	2	4 in. o.c.	NA



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4. Roof Connections

	Fastener	Loading	Capacity	Load Duration Factor	End Grain Factor	Toe-nail Factor	Adjusted Capacity
1	0.131x3-1/2" toe-nail	Shear	82 lbf	1.6	1	0.83	109 lbf
2	0.131x3-1/2" toe-nail	Withdrawal	21 lb/in	1.6	1	0.67	23 lb/in
3	0.131x3-1/2" end-nail	Shear	82 lbf	1.6	0.67	1	88 lbf
4	0.131x3-1/2" face-nail	Shear	82 lbf	1.6	1	1	131 lbf
5	0.131x3-1/2" face-nail	Withdrawal	21 lb/in	1.6	1	1	34 lb/in
6	#8x3" toe-screw	Shear	78 lbf	1.6	1	0.83	104 lbf
7	#8x3" toe-screw	Withdrawal	82 lb/in	1.6	1	0.67	88 lb/in
8	#8x3" end grain	Shear	78 lbf	1.6	0.67	1	84 lbf
9	#8x3" end grain	Withdrawal	82 lb/in	1.6	0.75	1	98 lb/in
10	#8x3" wood screw	Shear	78 lbf	1.6	1	1	125 lbf
11	#8x3" wood screw	Withdrawal	82 lb/in	1.6	1	1	131 lb/in

Pullout at ridge and matelines

$$P := h_r \cdot p_{hr} \cdot 16in = 64.32 \cdot lbf$$

$$p := P \div 16in = 48.24 \cdot plf$$

Uplift at each rafter

$$U := 175lbf$$

$$u := U \div 16in = 131.25 \cdot plf$$

$$U2 := \frac{1}{2} \cdot 21.5ft \cdot |p_{vg}| \cdot 16in = 250.78 \cdot lbf$$

$$u2 := U2 \div 16in = 188.09 \cdot plf$$

$$U3 := 4ft \cdot |-51.4psf| \cdot 16in = 274.13 \cdot lbf$$

Rafter connections

Sloped Rafter

At Exterior Walls

Number of #8x3" toe-screws

$$n := \text{ceil} \left(\frac{U}{C_7 \cdot 1.5in} \right) = 2$$

OR Simpson H2.5

$$\text{if}(U \leq 365lbf, "Ok", "Not Ok") = "Ok"$$

At Mid-span Knee Wall

Number of 0.131x3-1/2" toe-nails - rafter to top plate

$$n := \text{ceil} \left(\frac{U2}{C_2 \cdot 2in} \right) = 6$$

At Ridge

Number of 0.131x3-1/2" toe-nails - rafter to rim

$$n := 6$$

$$\text{if} \left(\frac{P}{n \cdot C_2 \cdot 2in} + \frac{U}{n \cdot C_1} \leq 1, "Ok", "Not Ok" \right) = "Ok"$$



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Flat Roof

Number of 0.131x3-1/2" toe-nails - 2x10 rafter to rim $n := \max\left(4, \text{ceil}\left(\frac{U}{C_1}\right)\right) = 4$

Spacing of 0.131x3-1/2" toe-nails - rim to top plate $s := \min\left(6\text{in}, \text{in-floor}\left(\frac{C_2 \cdot 1.5\text{in}}{u\text{-in}}\right)\right) = 3\text{in}$

Fastening of 2x4 rafter to 2x10 rafter

Place 2x4 runners at 4' o.c.
Simpson LTSTA9 @ 4'-0" o.c. max

$\text{if}\left(U_3 \leq 635\text{lb}\cdot\frac{6}{8}, \text{"Ok"}, \text{"Not Ok"}\right) = \text{"Ok"}$

Knee-Wall connection

At Mid-span

Number of 0.131x3-1/2" toe-nails - stud to top and bottom plate $n := \text{ceil}\left(\frac{U_2}{C_2 \cdot 2\text{in}}\right) = 6$

Spacing of 0.131x3-1/2" nails - bottom plate to beam $s := \min\left(6\text{in}, \text{in-floor}\left(\frac{C_2 \cdot 2\text{in}}{u_2\text{-in}}\right)\right) = 2\text{in}$

Roof Diaphragm

1/2" Plywood Sheathing with 15ga staples at 4" edge & 8" field spacing

Aspect Ratio Check	1.12	<	3	OK
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Roof Diaphragm $\text{unit_shear} := \frac{5010\text{lb}\cdot\text{ft}}{34\text{ft}} = 147.35\cdot\text{plf}$

Capacity of Roof Diaphragm $C := \frac{1}{2} \cdot 505\text{plf} \cdot 0.92 = 232.3\cdot\text{plf}$



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5. Stud Properties

Framing Member

2x6

SPF #2

Stud spacing

s := 16in

Reference Design Values		Repetitive Use Factor C_r	Size Factor C_F	Load Duration Factor C_D	Buckling Stiffness Factor C_t	Adjusted Design Values
Bending	$F_b = 875$ psi	1.15	1.3	1.6	1	= 2093 psi
Tension	$F_t = 450$ psi	1	1.3	1.6	1	= 936 psi
Compression	$F_c = 1150$ psi	1	1.1	1.15	1	= 1454.75 psi
Modulus of Elasticity	$E = 1400000$ psi	1	1	1	1	= 1400000 psi
Min. Modulus of Elasticity	$E_{min} = 510000$ psi	1	1	1	1.27	= 646329.3 psi
Stud Spacing	s = 16 in o.c.					
Buckling Length Coeff.	$k_e = 1$					
Effective Length of Stud	$l_e = 8$ ft					

Distributive Load on Ext. Wall

$$w := \frac{1}{2} W_{max} \cdot \text{Proof}$$

Load Combination	Load
1	300 plf
2	233 plf
3	325 plf
4	-127 plf
Design	325 plf

Compressive Force on Stud

$$P := w_{wall} \cdot \text{plf} \cdot s = 433.3 \text{ lbf}$$

Wind Force on Stud

$$w := p_{cw} \cdot s = 36.3 \cdot \text{plf}$$

Allowable Deflection

$$\Delta := l_e \div 240 = 0.4 \cdot \text{in}$$

Applied Moment

$$M := \frac{1}{8} w \cdot l_e^2 = 290.36 \cdot \text{lbf} \cdot \text{ft}$$

Column Stability Factor

$$C_p = 0.59$$

Re-Adjusted Compression

$$F'_c := F_c \cdot C_p = 851.41 \text{ psi}$$

Compressive Capacity of Stud

$$P_{2x6} := F'_c \cdot A = 7024.17 \text{ lbf}$$

Applied Stresses	
f_b	= 461 psi
f_c	= 53 psi

Slenderness Ratio	17.45	OK
Bending & Axial Comp.	0.23	OK
Deflection	0.08 in	OK



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Interior Stud Capacity

Framing Member

2x4

SPF #2

Reference Design Values		Repetitive Use Factor C_r	Size Factor C_F	Load Duration Factor C_D	Buckling Stiffness Factor C_t	Adjusted Design Values
Bending	$F_b = 875$ psi	1.15	1.5	1.6	1	= 2415 psi
Tension	$F_t = 450$ psi	1	1.5	1.6	1	= 1080 psi
Compression	$F_c = 1150$ psi	1	1.15	1.15	1	= 1520.875 psi
Modulus of Elasticity	$E = 1400000$ psi	1	1	1	1	= 1400000 psi
Min. Modulus of Elasticity	$E_{min} = 510000$ psi	1	1	1	1.27	= 646329.3 psi

Column Stability Factor

$$C_p = 0.35$$

Re-Adjusted Compression

$$F'_c := F_c \cdot C_p = 528.57 \text{ psi}$$

Compressive Capacity of Stud

$$P_{2x4} := F'_c \cdot A = 2774.97 \text{ lbf}$$



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6. Framing Members

Rafter

Minimum 2x6 SPF#2 @ 16" o.c.

Floor Joist - Module A

Span

$$L := W_{\max} - 6\text{in} = 14.5\text{ft}$$

Spacing

$$s := 12\text{in}$$

Allowable Deflection	Δ	= 0.73 in	L/240
Allowable live load deflection	Δ_L	= 0.48 in	L/360

Loads

$$w := s \cdot p_{\text{floor}_1} = 67\text{-plf}$$

$$w_L := s \cdot LL_f = 50\text{-plf}$$

Moment

$$M := \frac{1}{8} w \cdot L^2 = 1760.84\text{-lbf}\cdot\text{ft}$$

Maximum Shear

$$V := \frac{1}{2} w \cdot L = 485.75\text{ lbf}$$

Required Stiffness

$$K := \max\left(\frac{5 \cdot w \cdot L^4}{384 \cdot \Delta}, \frac{5 \cdot w_L \cdot L^4}{384 \cdot \Delta_L}\right) = 714.52\text{-kip}\cdot\text{ft}^2$$

Framing Member

2x10 SPF #2

Reference Design Values		Repetitive Use Factor C_r	Size Factor C_F	Load Duration Factor C_D	Adjusted Design Values
Bending	$F_b = 875\text{ psi}$	1.15	1.1	1	= 1106.88 psi
Shear	$F_v = 135\text{ psi}$	1	1	1	= 135 psi
Modulus of Elasticity	$E = 1400000\text{ psi}$	1	1	1	= 1400000 psi

Applied Stresses		Property Check
Bending	$f_b = 988\text{ psi}$	OK
Shear	$f_v = 53\text{ psi}$	OK
Member Stiffness	$K = 961.84\text{ kip}\cdot\text{ft}^2$	OK



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Floor Joist - Modules B & C

Span $L := W_{m3} - 6in = 12.96 \text{ ft}$

Spacing $s := 16in$

Allowable Deflection	$\Delta = 0.65 \text{ in}$	L/240
Allowable live load deflection	$\Delta_L = 0.43 \text{ in}$	L/360

Loads $w := s \cdot P_{\text{floor}_1} = 89.33 \cdot \text{plf}$

$w_L := s \cdot LL_f = 66.67 \cdot \text{plf}$

Moment $M := \frac{1}{8} w \cdot L^2 = 1874.99 \cdot \text{lb-ft}$

Maximum Shear $V := \frac{1}{2} w \cdot L = 578.79 \text{ lbf}$

Required Stiffness $K := \max\left(\frac{5 \cdot w \cdot L^4}{384 \cdot \Delta}, \frac{5 \cdot w_L \cdot L^4}{384 \cdot \Delta_L}\right) = 679.93 \cdot \text{kip-ft}^2$

Framing Member

Reference Design Values		Repetitive Use Factor C_r	Size Factor C_F	Load Duration Factor C_D	Adjusted Design Values
Bending	$F_b = 875 \text{ psi}$	1.15	1.1	1	= 1106.88 psi
Shear	$F_v = 135 \text{ psi}$	1	1	1	= 135 psi
Modulus of Elasticity	$E = 1400000 \text{ psi}$	1	1	1	= 1400000 psi

Applied Stresses		Property Check
Bending	$f_b = 1052 \text{ psi}$	OK
Shear	$f_v = 63 \text{ psi}$	OK
Member Stiffness	$K = 961.84 \text{ kip-ft}^2$	OK



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7. Beam Design

Beam 1

Span of Beam

$L := 3.75\text{ft}$

Allowable Deflection	$\Delta = 0.19\text{ in}$	L/240
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Loads

$w := \frac{1}{2} \cdot 20.33\text{ft} \cdot p_{\text{roof}}$

Load Case	Distributive Load
1	407 plf
2	316 plf
3	440 plf
4	-172 plf
Design	440 plf
Uplift	-172 plf

Moment in Beam

$M := \frac{1}{8} w \cdot L^2 = 0.77\text{ kip}\cdot\text{ft}$

Maximum Shear in Beam

$V := \frac{1}{2} w \cdot L = 825.85\text{ lbf}$

Required Stiffness

$K := \frac{5 \cdot w \cdot L^4}{384 \cdot \Delta} = 72.58\text{ kip}\cdot\text{ft}^2$

Beam Reaction

$R := V = 825.85\text{ lbf}$

Framing Member

2x10 SPF #2

Reference Design Values		Size Factor C_F	Load Duration Factor C_D	Adjusted Design Values
Bending	$F_b = 875\text{ psi}$	1.1	1.25	= 1203.13 psi
Shear	$F_v = 135\text{ psi}$	1	1.25	= 168.75 psi
Modulus of Elasticity	$E = 1400000\text{ psi}$	1	1	= 1400000.00 psi

Applied Stresses	
Bending	$f_b = 434\text{ psi}$
Shear	$f_v = 89\text{ psi}$
Required Moment of Inertia	$I_{rq} = 7.47\text{ in}^4$

Minimum (2) Framing Members

$U := \frac{1}{2} L \cdot u = -322.17\text{ lbf}$

Simpson ST2122 each end of beam to stud

Number of Framing Members	= 1
Number of 2x4 Studs	= 1
Number of 2x6 Studs	= 1



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Beam 2

Span of Beam

$L := 5.75\text{ft}$

Allowable Deflection	$\Delta = 0.29\text{ in}$	$L/240$
----------------------	---------------------------	---------

Loads

$w := \frac{1}{2} 21.83\text{ft} \cdot p_{\text{roof}}$

Load Case	Distributive Load
1	437 plf
2	340 plf
3	473 plf
4	-185 plf
Design	473 plf
Uplift	-185 plf

Moment in Beam

$M := 1.33\text{kip} \cdot \text{ft}$

Maximum Shear in Beam

$V := 1400\text{lbf}$

Required Stiffness

$K := 100\text{kip} \cdot \text{ft}^2$

Beam Reaction

$R := V = 1400\text{lbf}$

Framing Member

2x10 SPF #2

Reference Design Values		Size Factor C_F	Load Duration Factor C_D	Adjusted Design Values
Bending	$F_b = 875\text{ psi}$	1.1	1.25	= 1203.13 psi
Shear	$F_v = 135\text{ psi}$	1	1.25	= 168.75 psi
Modulus of Elasticity	$E = 1400000\text{ psi}$	1	1	= 1400000.00 psi

Applied Stresses	
Bending	$f_b = 746\text{ psi}$
Shear	$f_v = 151\text{ psi}$
Required Moment of Inertia	$I_{rq} = 10.29\text{ in}^4$

Minimum (2) Framing Members

$U = 1087\text{ lbf}$

Simpson ST2122 at each beam support

Number of Framing Members	= 1
Number of 2x4 Studs	= 1
Number of 2x6 Studs	= 1



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Beam 3

Span of Beam

$$L := 12\text{ft}$$

Allowable Deflection	$\Delta = 0.60\text{ in}$	$L/240$
----------------------	---------------------------	---------

Loads

$$w := \left(\frac{1}{2} 10\text{ft} + 2\text{ft}\right) \cdot p_{\text{roof}}$$

Load Case	Distributive Load
1	280 plf
2	218 plf
3	303 plf
4	-118 plf
Design	303 plf
Uplift	-118 plf

Moment in Beam

$$M := \frac{1}{8} w \cdot L^2 = 5.46\text{ kip}\cdot\text{ft}$$

Maximum Shear in Beam

$$V := \frac{1}{2} w \cdot L = 1819.87\text{ lbf}$$

Required Stiffness

$$K := \frac{5 \cdot w \cdot L^4}{384 \cdot \Delta} = 1637.88\text{ kip}\cdot\text{ft}^2$$

Beam Reaction

$$R := V = 1819.87\text{ lbf}$$

Framing Member

1.5x9.25 2.0E LVL

Reference Design Values		Size Factor C_F	Load Duration Factor C_D	Adjusted Design Values
Bending	$F_b = 2750\text{ psi}$	1.03	1.25	$= 3540.63\text{ psi}$
Shear	$F_v = 285\text{ psi}$	1	1.25	$= 356.25\text{ psi}$
Modulus of Elasticity	$E = 2000000\text{ psi}$	1	1	$= 2000000.00\text{ psi}$

Applied Stresses	
Bending	$f_b = 3063\text{ psi}$
Shear	$f_v = 197\text{ psi}$
Required Moment of Inertia	$I_{rq} = 117.93\text{ in}^4$

Minimum (2) Framing Members

$$U := \frac{1}{2} L \cdot u = -709.95\text{ lbf}$$

Simpson ST2122 each end of beam to stud

Number of Framing Members	= 2
Number of 2x4 Studs	= 1
Number of 2x6 Studs	= 1



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Beam 4

Span of Beam

$$L := 9.5\text{ft}$$

Allowable Deflection	$\Delta = 0.48\text{ in}$	$L/240$
----------------------	---------------------------	---------

Loads

$$w := \frac{1}{2} W_{m3} \text{ Proof}$$

Load Case	Distributive Load
1	269 plf
2	209 plf
3	292 plf
4	-114 plf
Design	292 plf
Uplift	-114 plf

Moment in Beam

$$M := \frac{1}{8} w \cdot L^2 = 3.29 \cdot \text{kip} \cdot \text{ft}$$

Maximum Shear in Beam

$$V := \frac{1}{2} w \cdot L = 1384.95 \text{ lbf}$$

Required Stiffness

$$K := \frac{5 \cdot w \cdot L^4}{384 \cdot \Delta} = 781.2 \cdot \text{kip} \cdot \text{ft}^2$$

Beam Reaction

$$R := V = 1384.95 \text{ lbf}$$

Framing Member

2x10 SPF #2

Reference Design Values		Size Factor C_F	Load Duration Factor C_D	Adjusted Design Values
Bending	$F_b = 875 \text{ psi}$	1.1	1.25	$= 1203.13 \text{ psi}$
Shear	$F_v = 135 \text{ psi}$	1	1.25	$= 168.75 \text{ psi}$
Modulus of Elasticity	$E = 1400000 \text{ psi}$	1	1	$= 1400000.00 \text{ psi}$

Applied Stresses	
Bending	$f_b = 1845 \text{ psi}$
Shear	$f_v = 150 \text{ psi}$
Required Moment of Inertia	$I_{rq} = 80.35 \text{ in}^4$

Minimum (2) Framing Members

$$U := \frac{1}{2} L \cdot u = -540.28 \text{ lbf}$$

Simpson ST2122 each end of beam to stud

Number of Framing Members	= 2
Number of 2x4 Studs	= 1
Number of 2x6 Studs	= 1



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8. Header Design Chart

Load on header

$$w_{\text{wall}} := \frac{1}{2} W_{\text{max}} \cdot \text{Proof}_5 = 324.98 \cdot \text{plf}$$

Number of Members Required in 1st Floor Header							
Maximum Span	2x6 SPF #2	2x8 SPF #2	2x10 SPF #2	2x12 SPF #2	1.5"x7.25" LVL	1.5"x9.25" LVL	1.5"x11.25" LVL
3 ft	1	1	1	1	1	1	1
6 ft	3	2	1	1	1	1	1
9 ft	N/A	N/A	3	2	2	1	1
12 ft	N/A	N/A	N/A	3	3	2	1

REPRODUCTION



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9. Rim Joist Design

Rim Joist - RJ

Span of Beam

L := 7ft

Allowable Deflection	$\Delta = 0.35 \text{ in}$	L/240
----------------------	----------------------------	-------

Loads

$$w := \frac{1}{2} W_{m2} \cdot (P_{\text{roof}} + P_{\text{floor}}) + h_1 \cdot P_{\text{wall}}$$

Load Case	Distributive Load
1	769 plf
2	390 plf
3	710 plf
4	5 plf
Design	790 plf
Uplift	5 plf

Moment in Beam

$$M := \frac{1}{10} w \cdot L^2 = 3.87 \text{ kip}\cdot\text{ft}$$

Maximum Shear in Beam

$$V := \frac{5}{8} w \cdot L = 3457.34 \text{ lbf}$$

Required Stiffness

$$K := \frac{5 \cdot w \cdot L^4}{384 \cdot \Delta} = 847.05 \text{ kip}\cdot\text{ft}^2$$

Beam Reaction

$$R := 2V = 6914.69 \text{ lbf}$$

Framing Member

2x10 SPF #2

Reference Design Values		Size Factor C _F	Load Duration Factor C _D	Adjusted Design Values
Bending	F _b = 875 psi	1.1	1.25	= 1203.13 psi
Shear	F _v = 135 psi	1	1.25	= 168.75 psi
Modulus of Elasticity	E = 1400000 psi	1	1	= 1400000.00 psi

Applied Stresses	
Bending	f _b = 2172 psi
Shear	f _v = 374 psi
Required Moment of Inertia	I _{req} = 87.13 in ⁴

Number of Framing Members	= 3
Number of 2x4 Studs	= 3
Number of 2x6 Studs	= 1



**Solar Decathlon House
Norfolk, Virginia
Haven Custom Homes**

By: Jamie MacDonnell
3/16/2011
BCEI Project #: 11-91-0007
Page: 20 of 20

10. Loads Transferred to Foundation

Exterior Walls

$$\frac{1}{2} W_{\max} \cdot p_{\text{floor}_1} + \left(h_1 + \frac{1}{2} h_r \right) \cdot p_{\text{wall}_1} = 618.35 \text{ plf}$$

$$\left(\frac{1}{2} 8.75\text{ft} + 2\text{ft} \right) \cdot p_{\text{roof}_3} + (h_1 + D) \cdot p_{\text{wall}_3} = 371.65 \text{ plf}$$

$$\frac{1}{2} W_{m2} \cdot p_{\text{floor}_1} + \left(\frac{1}{2} W_{m2} + 2\text{ft} \right) \cdot p_{\text{roof}_1} + (h_1 + D) \cdot p_{\text{wall}_1} = 864.23 \text{ plf}$$

$$\frac{1}{2} W_{m3} \cdot p_{\text{floor}_1} + \left(\frac{1}{2} W_{m3} + 2\text{ft} \right) \cdot p_{\text{roof}_1} + (h_1 + D) \cdot p_{\text{wall}_1} = 895.42 \text{ plf}$$

$$(h_1 + D) \cdot p_{\text{wall}_1} = 95.42 \text{ plf}$$

$$\left(\frac{1}{2} 9.75\text{ft} + 2\text{ft} \right) \cdot p_{\text{roof}_3} + (h_1 + D) \cdot p_{\text{wall}_3} = 393.31 \text{ plf}$$

Matelines & Interior Walls

$$\frac{1}{2} 20.58\text{ft} \cdot p_{\text{roof}_3} + s \cdot p_{\text{floor}_3} = 518.53 \text{ plf}$$

$$\frac{1}{2} W_{\max} \cdot p_{\text{floor}_1} + h_1 \cdot p_{\text{wall}_1} = 582.5 \text{ plf}$$

$$\frac{1}{2} (W_{m2} + W_{m3}) \cdot (p_{\text{floor}_1} + p_{\text{roof}_1}) + h_1 \cdot p_{\text{wall}_1} = 1488.82 \text{ plf}$$

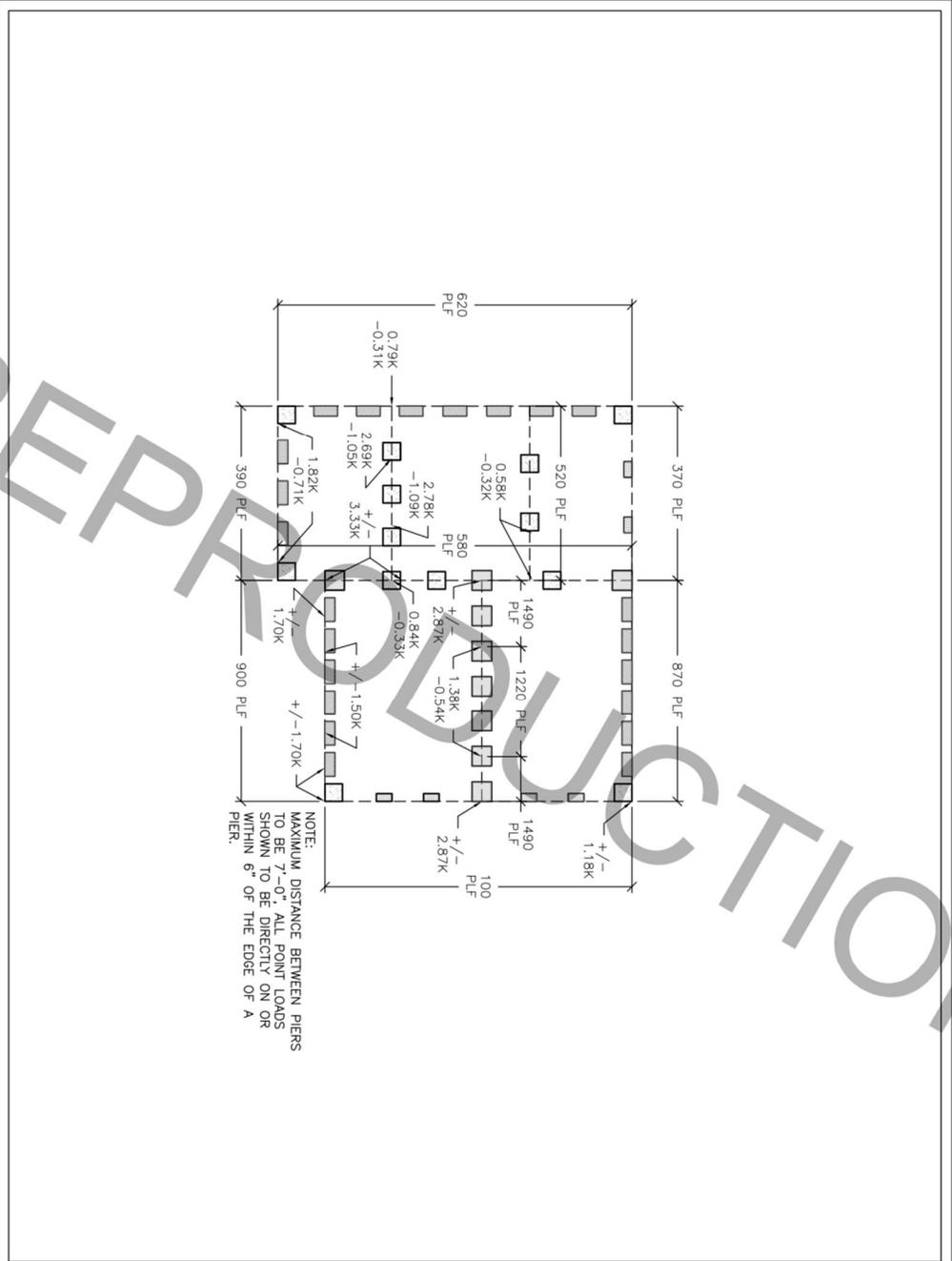
$$\frac{1}{2} W_{m2} \cdot (p_{\text{floor}_1} + p_{\text{roof}_1}) + h_1 \cdot p_{\text{wall}_1} + \frac{1}{2} W_{m3} \cdot p_{\text{floor}_1} = 1219.66 \text{ plf}$$

Appendix A

Beam and Shear Wall Locations

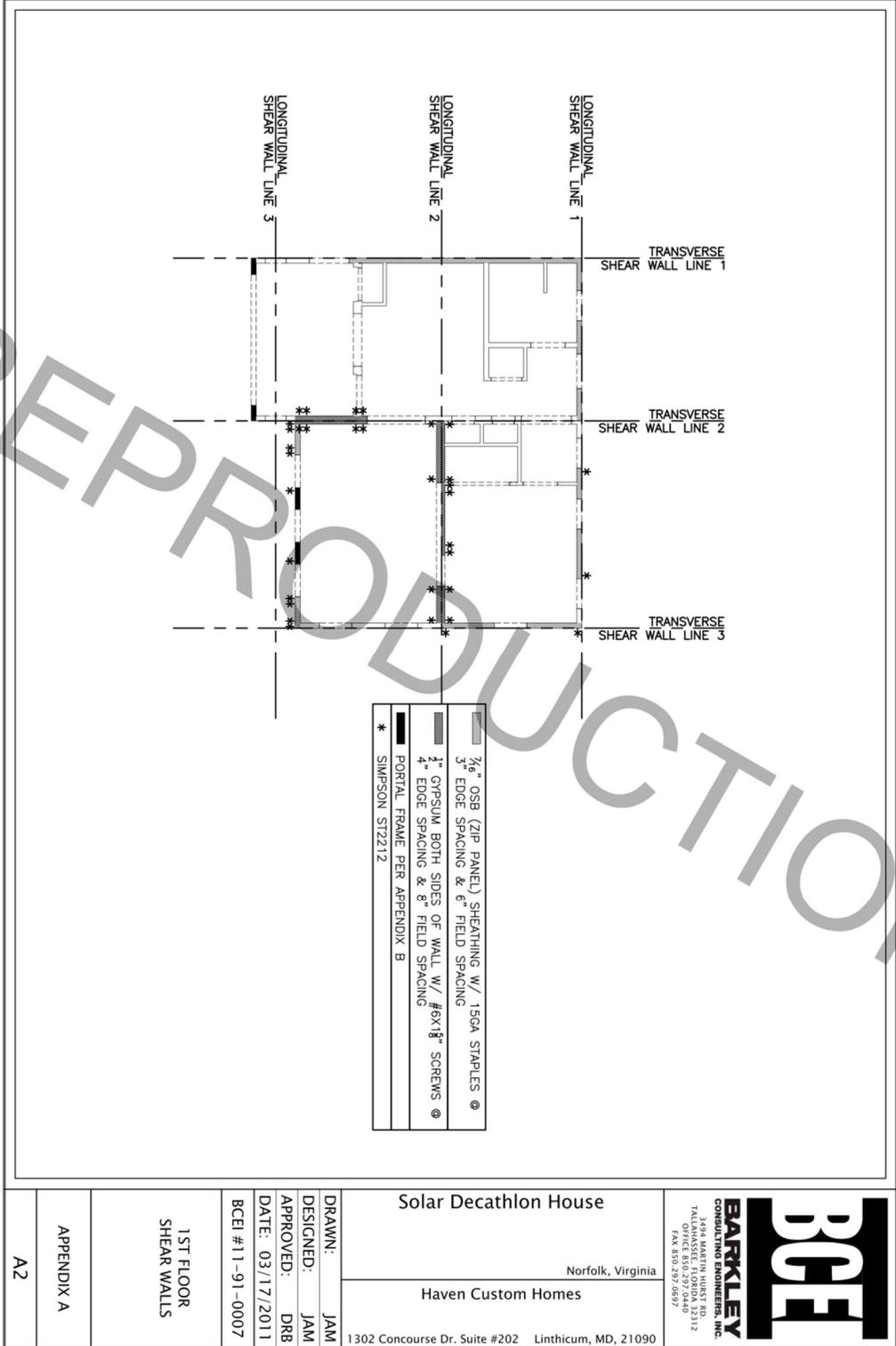
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	<p>DRAWN: JAM</p> <p>DESIGNED: JAM</p> <p>APPROVED: DRB</p> <p>DATE: 03/17/2011</p> <p>BCEI # 11-91-0007</p>	<p>FOUNDATION LOADS & 1ST FLOOR BEAM PLAN</p> <p>APPENDIX A</p> <p>A1</p>

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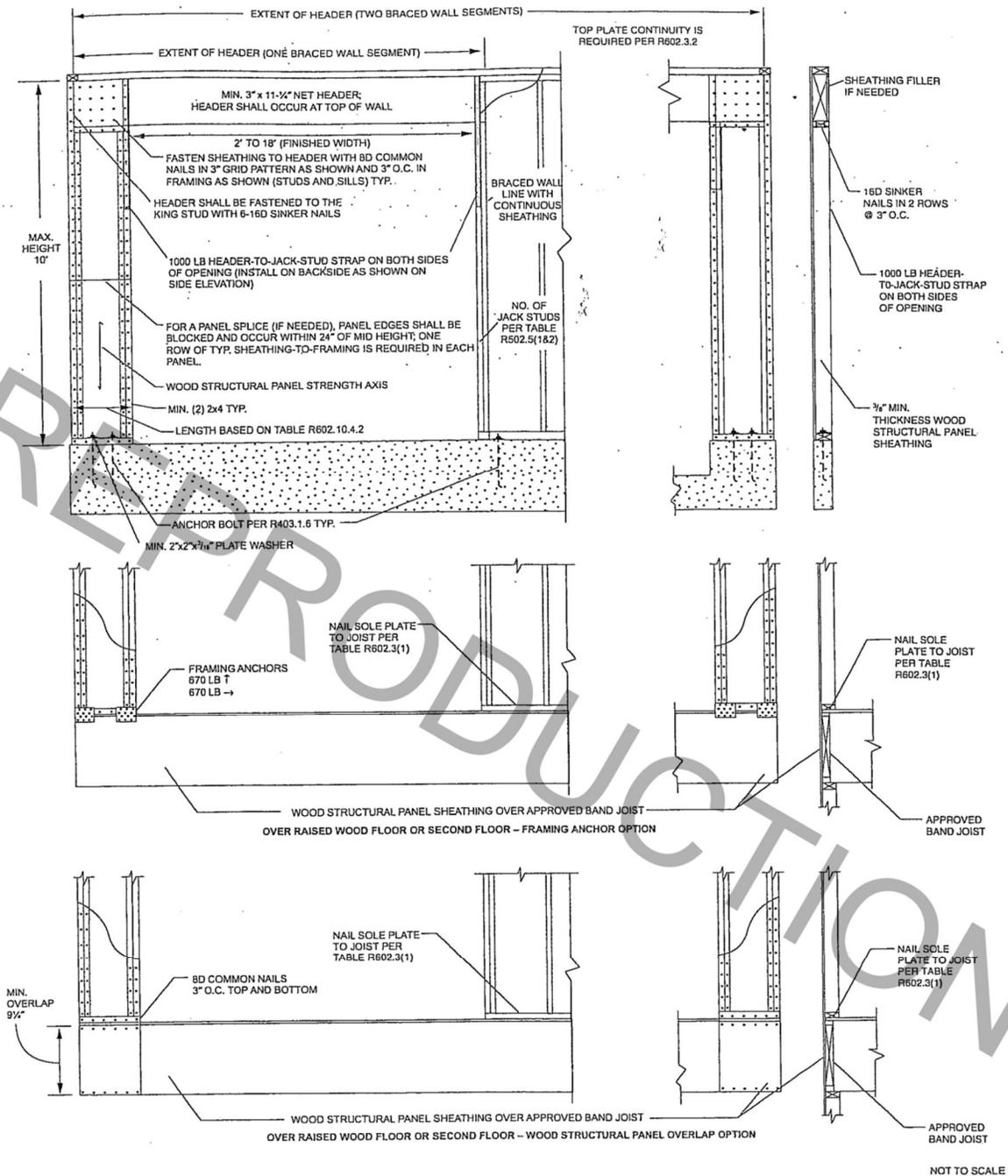


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APPROVED:	DRB	
DATE:	03/17/2011	
BCEI #	11-91-0007	
1ST FLOOR SHEAR WALLS		
APPENDIX A		
A2		

Appendix B

Portal Frame Details

REPRODUCTION



1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 pound force = 4.448 N.

FIGURE R602.10.4.1.1
METHOD CS-PF: CONTINUOUS PORTAL FRAME PANEL CONSTRUCTION

2009 INTERNATIONAL RESIDENTIAL CODE®

Appendix C

International Building Code
Seismic, Snow & Wind Load Maps

REPRODUCTION

BUILDING PLANNING

- - NORFOLK, VIRGINIA

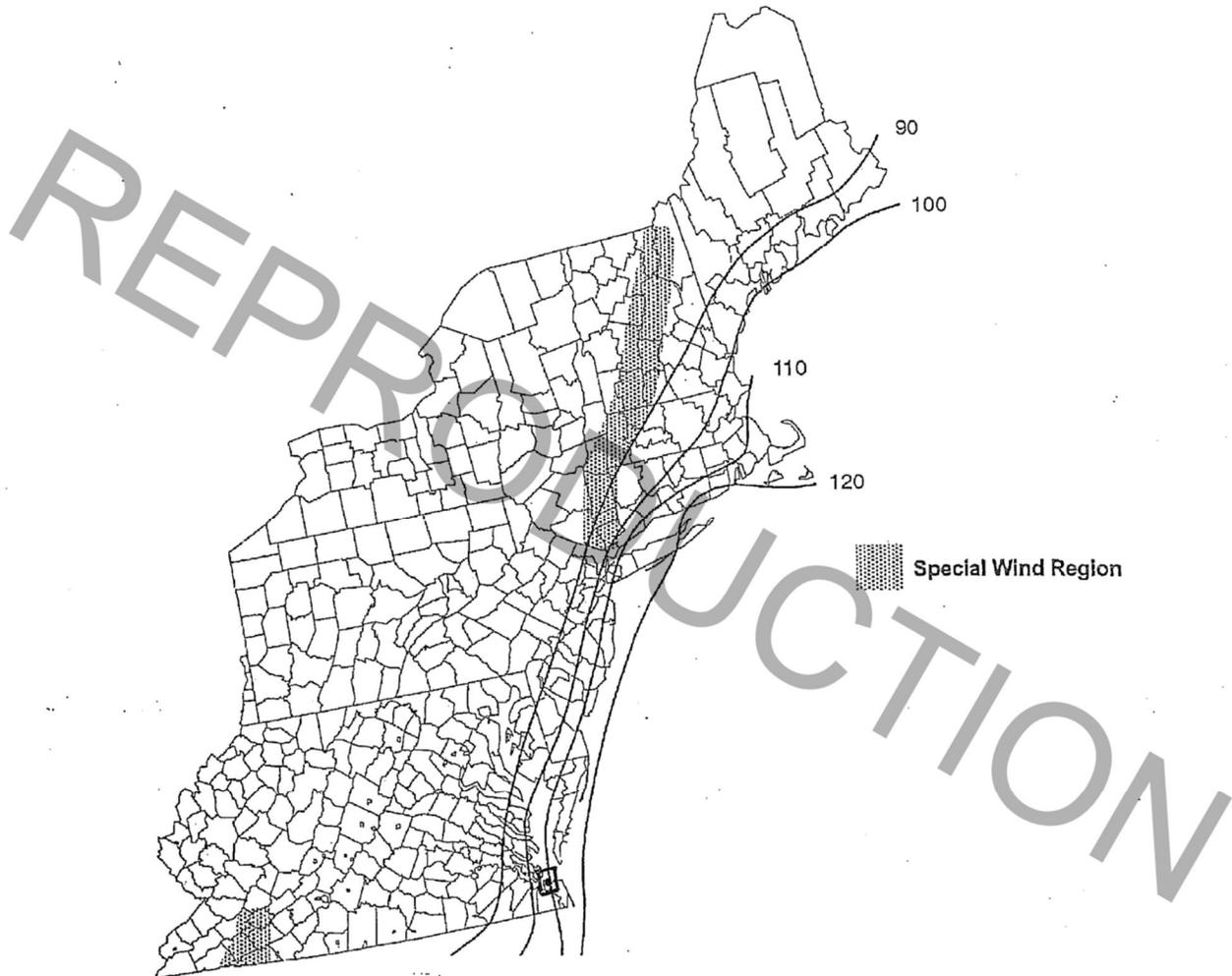


FIGURE R301.2(4)—continued
BASIC WIND SPEEDS FOR 50-YEAR MEAN RECURRENCE INTERVAL

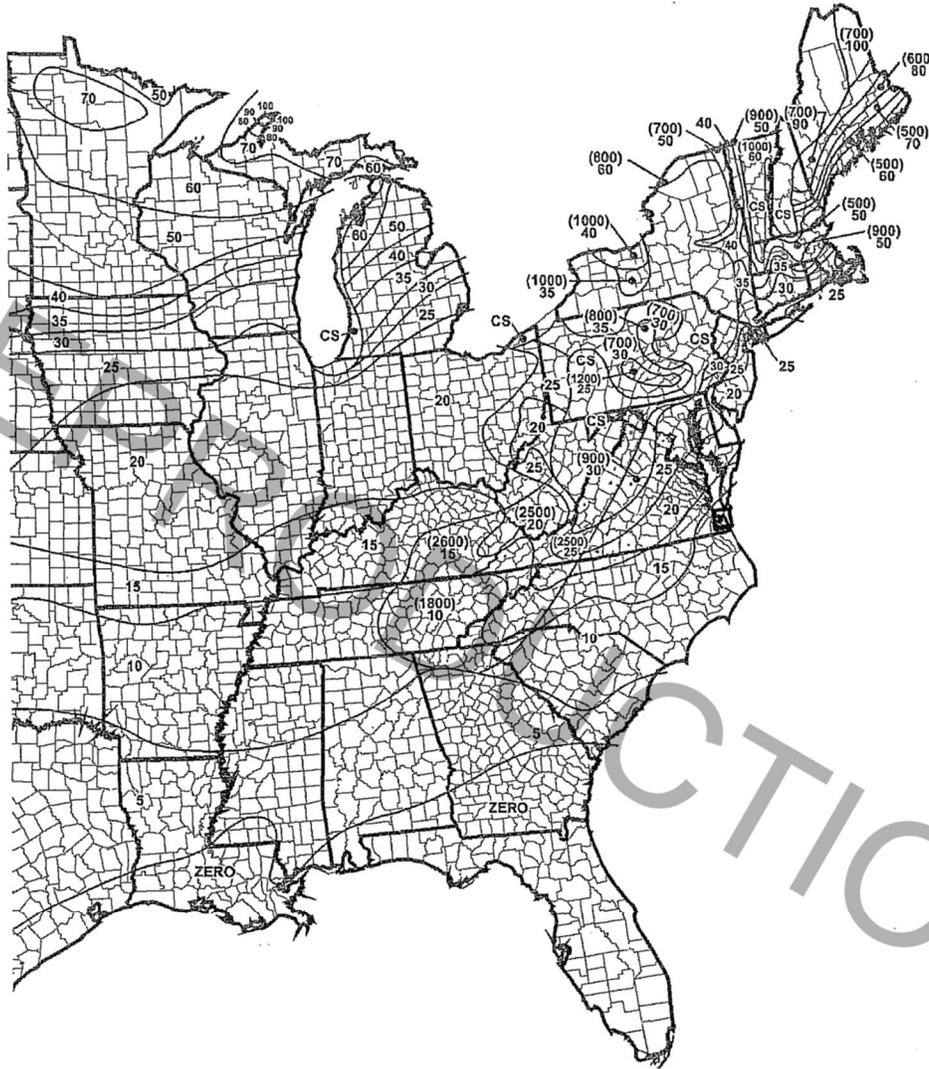
(continued)

For SI: 1 foot = 304.8 mm, 1 mile per hour = 0.447 m/s.

- Values are nominal design 3-second gust wind speeds in miles per hour at 33 feet above ground for Exposure C category.
- Linear interpolation between wind contours is permitted.
- Islands and coastal areas outside the last contour shall use the last wind speed contour of the coastal area.
- Mountainous terrain, gorges, ocean promontories and special wind regions shall be examined for unusual wind conditions.

BUILDING PLANNING

• - NORFOLK, VIRGINIA



For SI: 1 foot = 304.8 mm, 1 pound per square foot = 0.0479 kPa.

FIGURE R301.2(5)—continued
GROUND SNOW LOADS, P_g , FOR THE UNITED STATES (lb/ft^2)

BUILDING PLANNING

- - NORFOLK, VIRGINIA

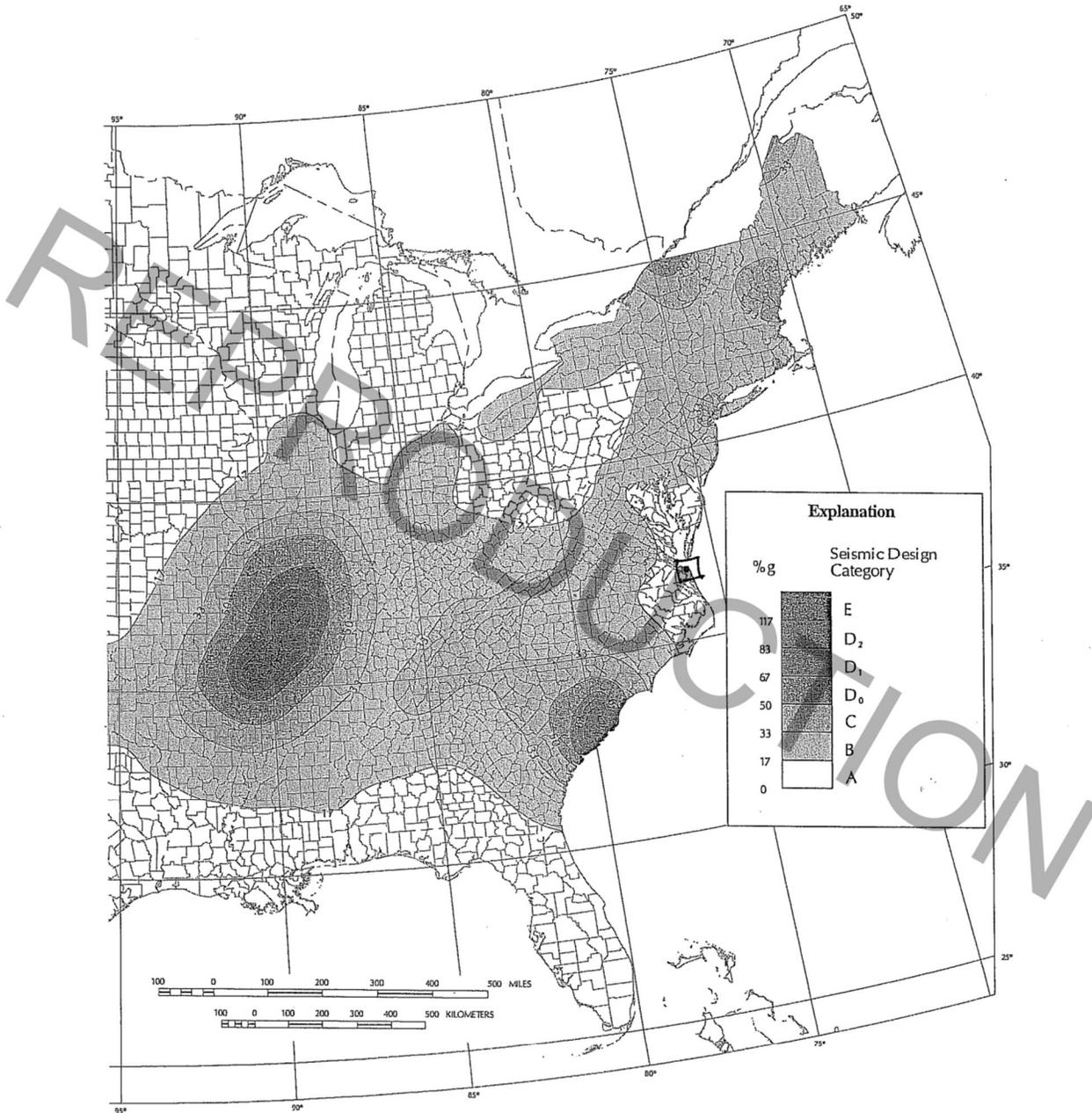


FIGURE R301.2(2)—continued
SEISMIC DESIGN CATEGORIES—SITE CLASS D

Appendix D

Strapping Details

REPRODUCTION

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7/16" OSB (ZIP) SHEATHING
FASTENED AS PER PLANS
2x6 EXTERIOR STUD WALL
@ 16" O.C.

FASTEN SHEATHING TO RIM JOIST
W/ (2) ROWS 15GA STAPLES @ 4" O.C.
(PLANT INSTALLED BY HAVEN)

FLOOR RIM JOIST
@ 16" O.C.

MODULE TO FOUNDATION
CONNECTION BY OTHERS
FOUNDATION BY OTHERS

7/16" OSB (ZIP) SHEATHING
FASTENED AS PER PLANS
2x6 EXTERIOR STUD WALL
@ 16" O.C.

FASTEN SHEATHING TO RIM JOIST
W/ (2) ROWS 15GA STAPLES @ 4" O.C.
(PLANT INSTALLED BY HAVEN)

FLOOR RIM JOIST
@ 16" O.C.

MODULE TO FOUNDATION
CONNECTION BY OTHERS
FOUNDATION BY OTHERS

8" BAND 7/16" OSB W/ (2) ROWS
15GA STAPLES @ 4" O.C. TO BOTH
RIM JOIST AND SILL PLATE
(FIELD INSTALLED BY OTHERS)

MODULE TO FOUNDATION
CONNECTION BY OTHERS
FOUNDATION BY OTHERS

7/16" OSB (ZIP) SHEATHING
FASTENED AS PER PLANS
2x6 EXTERIOR STUD WALL
@ 16" O.C.

SIMPSON STRAP AS PER PLANS
NOTE: EITHER DOUBLE STUD
OR PROVIDE BLOCKING AT
STRAP LOCATIONS. PROVIDE
BLOCKING, IF NECESSARY.
(PLANT INSTALLED BY HAVEN)

FLOOR RIM JOIST
@ 16" O.C.

MODULE TO FOUNDATION
CONNECTION BY OTHERS
FOUNDATION BY OTHERS

7/16" OSB (ZIP) SHEATHING
FASTENED AS PER PLANS
2x6 EXTERIOR STUD WALL
@ 16" O.C.

FASTENED AS PER PLANS
2x6 EXTERIOR STUD WALL
@ 16" O.C.

2x10 BLOCKING AT STRAP
LOCATIONS W/ (8) 10d
TOE-NAILS EACH SIDE
SIMPSON STRAP AS PER PLANS
(PLANT INSTALLED BY HAVEN)

FLOOR RIM JOIST
@ 16" O.C.

NOTE: MINIMUM DOUBLE RIM
AT STRAP LOCATIONS. PROVIDE
BLOCKING IF NECESSARY.

MODULE TO FOUNDATION
CONNECTION BY OTHERS
FOUNDATION BY OTHERS

DOUBLE STUD
@ STRAP
LOCATIONS
IN FIELD OF
BLOCKING

A FIRST FLOOR STEPPING DETAIL (TYP.)

D-1
Scale: 1/4" = 1'-0"

B FIRST FLOOR HOLD DOWN ANCHOR DETAIL (TYP.)

D-1
Scale: 1/4" = 1'-0"

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APPROVED:	DRB	
DATE:	03/17/2011	
BCEI # 11-91-0007		
APPENDIX D		
D1		

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C SECOND FLOOR STRAPPING DETAIL (TYP.)

D SECOND FLOOR HOLD DOWN ANCHOR DETAIL (TYP.)

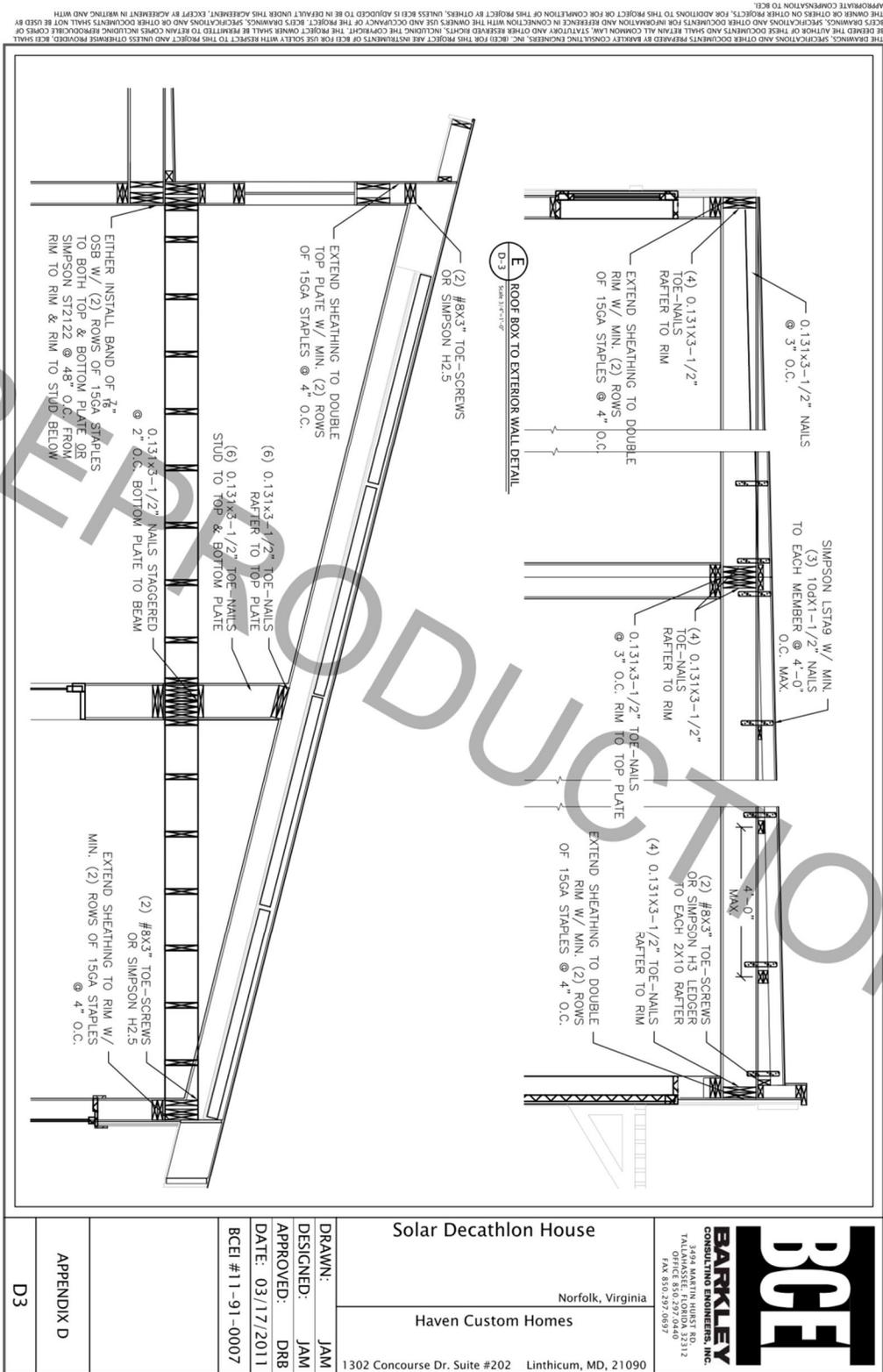
Solar Decathlon House
Norfolk, Virginia
Haven Custom Homes
1302 Concourse Dr. Suite #202 Linthicum, MD, 21090

DRAWN:	JAM
DESIGNED:	JAM
APPROVED:	DRB
DATE:	03/17/2011
BCEI #	11-91-0007

BARKLEY CONSULTING ENGINEERS, INC.
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APPENDIX D

D2



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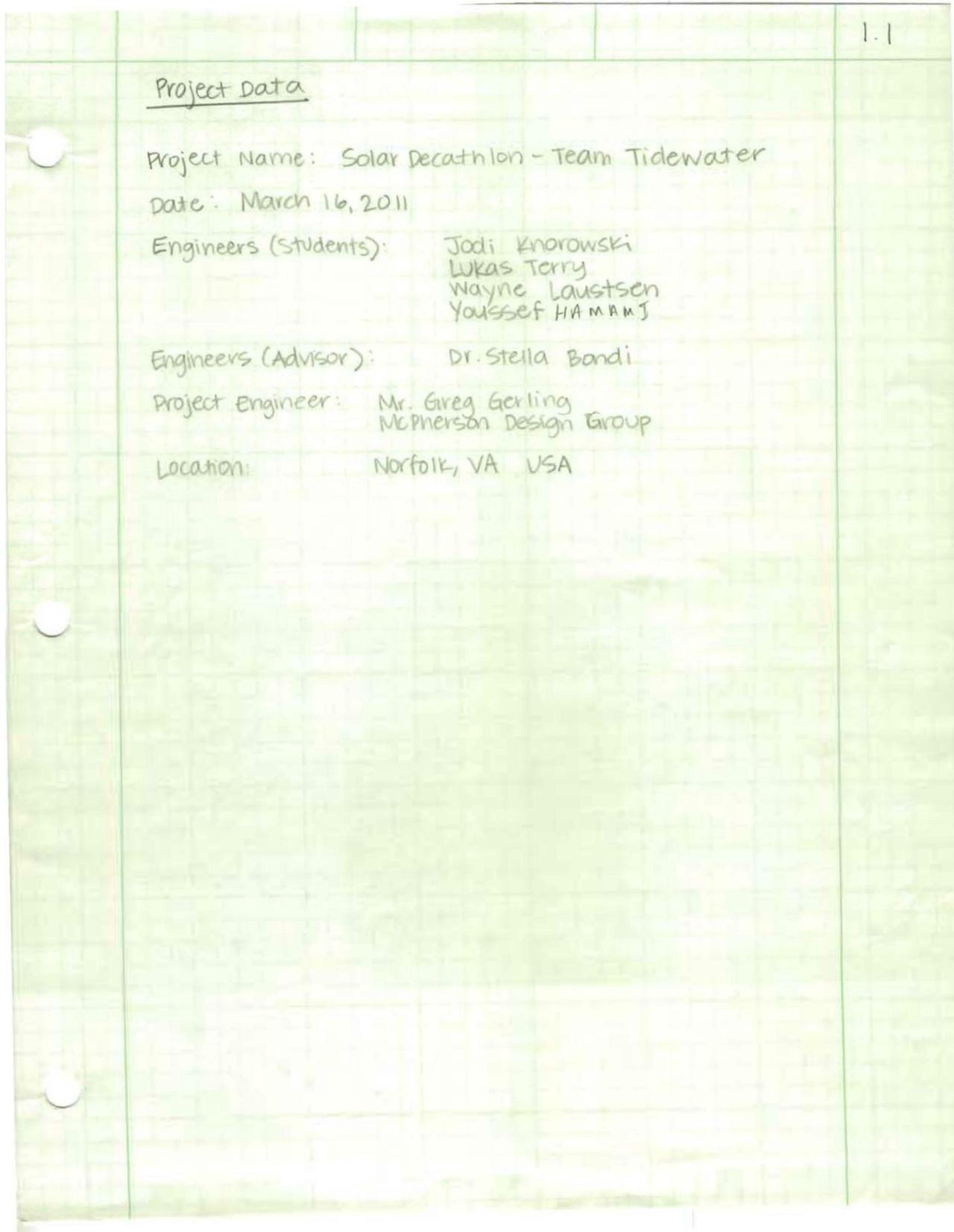
Site Construction Calculations

The following 68 pages are a reproduction of the stamped and sealed structural calculations submitted for the site construction.

Table of Contents:

1. Project Data	1.1
2. Design Criteria	2.1-2.3
3. Design Loads & Load combinations	3.1 - 3.3
4. Serviceability criteria	4.1
5. Wind Loads & Overturning	5.1-5.17
6. Design of Foundation	6.1 - 6.8
7. Design of Deck	7.1-7.4
8. Design of Ramp	8.1
9. Design of Railings	9.1
10. Design of Pergala & Utility core	10.1 - 10.8
11. Design of Photovoltaic & Solar Thermal	11.1-11.3
12. Design of Planters	12.1-12.2
13. Design of Rainwater Tank & Compressor	13.1





Section 5. Structural

The structural drawings and calculations shall be stamped by a qualified, licensed design professional. Obtaining the stamp is the responsibility of the teams, not the organizers. The organizers will submit stamped structural drawings and calculations to the National Park Service for final approval. It is strongly recommended that teams involve a qualified, licensed professional throughout the design process because he or she could require structural design changes that could affect other aspects of the house. In addition to meeting applicable IRC requirements, special attention must be given to the structural design challenges unique to the Solar Decathlon. These challenges include, but are not limited to, the following:

- a. Increased live loads because of public access to houses
- b. Necessity for tie-downs because of the lack of a permanent foundation (tie-downs must not penetrate more than 18 in. (45.7 cm) into the competition site topsoil)
- c. Use of low-impact footings to protect the competition site grass via concentration of loading
- d. Unique wind-loading conditions because of roof-mounted solar systems
- e. Increased dead loads because of unusual mechanical and electrical equipment.

5-1. Prescriptive Requirements

Structural systems shall be designed in accordance with the appropriate prescriptive provisions of the IRC (see alternate materials provisions in IRC Section 104.11 and Sec. CC2.6). For structural framing, a one-line structural plan view drawing is required at a minimum. Successive plan sheets shall be provided and shall include foundation footings, floor framing, wall locations, and roof framing. All structural components shall be listed including sizes, species and grade, orientation of the structural components, and repetitive spacing (on-center distances). Include details on connections between joists and beams, floor systems and foundations, walls and floors, rafters and beams, etc. Specify proprietary hangers or other mechanical connections (IRC, Sec. R301.1).

5-2. Design Loads

The following minimum loads must be used in the structural design:

- a. Wind: 60 mph (26.8 m/s) (3-second gust), exposure category C (if tie-downs are not used, you must show that there is no overturning, uplifting, or sliding with a safety factor of 2)
- b. Railings: 200 lb (890 N) concentrated load applied in any direction at any point at the top of the rail
- c. Interior floor, decks, ramps: 50 psf (2.39 kPa) live load
- d. Roof: 20 psf (0.958 kPa) live load
- e. Soil: 1,500 psf (71.8 kPa) maximum load-bearing pressure on top of the soil and 1,000 psf (47.9 kPa) minimum for house foundations to mitigate grass impact
- f. Additional structural design requirements at the post-event house location (to be determined by the licensed professional of record).

Structural plans shall indicate the design live loads [e.g., 40 psf (1.92 kPa) floors, 100 psf (4.79 kPa) means of egress components (ramps), 20 psf (0.958 kPa) snow roof live load] and the location, size, and weight of special loads such as liquid storage tanks and mass or trombe walls.

5-3. Exterior Construction

Structural plans shall include design details for any exterior appurtenances such as decks, stairs, ramps, awnings, canopies, and roof projections (IRC, Sec. R301.1). Deck structural framing shall include full details for house ledger connections, joist to beam connections, and beam to column/footing connections.

5-4. Specific Point Loads

Provide wind-analysis calculations for point-load connections demonstrating the components' abilities to withstand 60 mph (26.8 m/s), exposure category C wind conditions. Provide point-load connection details for all solar panel connections to demonstrate that the connections will resist uplift (IRC, Sec. R301.1).

5-5. Foundation

Provide a foundation plan for temporary setup on the competition site. Plans shall include location and size of all pad footings and required tie-down anchors (e.g., type, number, and installation configuration) to prevent wind uplift or overturning (IRC, Sec. R401.1 and R401.2). Please provide consideration for sloping or variable site conditions. The surface of each assigned site on the competition site may vary up to 18 in. (45.7 cm) depending upon location.

a. General Requirements

All houses, decks, and other structures shall be provided with foundations sufficient to safely transmit gravity, lateral, and uplift loads. For purposes of design, the presumptive soil bearing capacity shall be 1,500 psf (71.8 kPa). Design wind speed shall be 60 mph (26.8 m/s) (3-second gust) with a C exposure. The design winds have been reduced to accommodate the season and short duration of the Washington, D.C. event and to acknowledge mandatory evacuation when anticipated winds are expected to exceed 50 mph (22.4 m/s). Higher design values shall be used when required by the local jurisdiction regulating the final location of the structure following the Washington, D.C. exhibit.

b. Pad and Spread Footing Leveling

The surface of Solar Decathlon lots may vary up to 18 in. (45.7 cm) across the lot. Foundations should be designed to accommodate site variations without relying on imported fill materials for anything other than leveling the surface for complete pad contact. Any imported fill materials must be demonstrated to transmit all required loads. The surface of the National Mall must be protected from contamination by fill materials via geo-textile fabric or other approved barriers. All fill materials shall be retained by approved methods to prevent displacement by water or wind erosion.

c. Uplift Design

Uplift design may employ uplift anchorage, dead-load analysis, or a combination of both. Anchorage embedment in the National Mall is limited to an 18 in. (45.7 cm) depth. Teams are encouraged to configure their structures to take advantage of dead loads to resist uplift, overturning, and sliding. All designs shall be supported by calculations demonstrating the efficacy of the system. Foundation designs and calculations **shall be approved** prior to placement of the structure on the National Mall.

d. National Mall Surface Damage Mitigation

In an effort to reduce the damage to the grass surfaces on the National Mall, the following design criteria shall be employed:

- (i). House and Other Structures with Walls and Roofs Foundation – 1,000 psf (47.9 kPa) minimum footing load [1,500 psf (71.8 kPa) maximum]
- (ii). Deck and Ramp Foundations – 250 psf (12.0 kPa) minimum pad footing [1,500 psf (71.8 kPa) maximum]
- (iii). Water Tank – Must be elevated above the ground by 3.5 inches minimum. 1,000 psf (47.9 kPa) minimum elevated footing (tank assumed to be at full capacity) [1,500 psf (71.8 kPa) maximum].

5-6. Alternate Materials

Alternate materials are permitted as follows.

- a. Engineered lumber (e.g., TJIs, LPis, and BCIs) pursuant to specific manufacturer's design data. The product selected must carry a current ICC Evaluation Services report. See <http://www.icc-es.org/>.
- b. Structurally insulated panel systems pursuant to specific manufacturer's design data. The product selected must carry a current ICC Evaluation Services report. Also be advised that foam plastics must be thermally isolated from the interior of the dwelling (see Section 3-6 for more details).
- c. Engineered trusses (floor or roof) must be designed in accordance with IRC Sections R502.11 or R802.10 as appropriate. Individual truss reports shall be provided for review and shall bear the seal of a registered design professional (IRC, Sec. R104.11).
- d. Other alternate materials may be permitted if approved pursuant to approval by written request under IRC Section 104.11. It is the responsibility of the applicant to provide adequate proof to document the

alternate as meeting the intent of the prescriptive code requirements. The organizers reserve the right to deny any alternate for failure to clearly demonstrate code equivalence.

e. Phase-change materials included within building components must be identified on the plans. Specifications for the material composition must be provided with any available fire-performance testing data. Be advised that phase-change embedment in gypsum board or interior wall or ceiling finishes may affect the ability of these materials to pass required fire tests.

f. Unlisted electrical components intended to be used must be fully disclosed no later than 12 months prior to the start of the competition on the mall. Such unlisted components will be limited to 60 volts. Such components shall be fully described in a written proposal format with competent technical substantiation provided. The proposal is subject to approval by the event organizers subject to stipulated minimum testing to ensure safe operation during the public event.

5-7. Structural Steel

Provide structural details for load-carrying structural steel assemblies. Include welded or bolted connections within the assembly and where attached to other structures (IRC, Sec. R301.1.3).

REPRODUCTION

Design Loads

All Dead Loads found using *Design of Wood Structures, 6th Edition* Authored by
Donald Breyer, Kenneth Fridley, Kelly Cobeen, and David Pollock

A Roof Dead Load

Flat Roof	2x10" Joists @ 16" oc	2.4	psf
	2x4" Built Up @ 16" oc	0.9	psf
	Roofing Membrane	1	psf
	Plywood Sheathing (0.5")	1.5	psf
	Gypson Wallboard (0.5")	2.5	psf
	4" Spray Foam Insulation	0.8	psf
	6" Batte Insulation	3	psf
	Miscellaneous	1	psf
	TOTAL	13.1	psf
Sloped Roof	2x6" Joists @ 16" oc	2.4	psf
	Standing Seam Metal Roof	1.3	psf
	Plywood Sheathing (0.5")	1.5	psf
	Gypson Wallboard (0.5")	2.5	psf
	6" Spray Foam Insulation	1.2	psf
	Photovoltaic Cells	2.4	psf
	Solar Thermal Collector	4	psf
	Miscellaneous	1	psf
	TOTAL	16.3	psf

B Floor Dead Load

Typical	2x10" Joists @ 16" oc	2.4	psf
	Plywood Sheathing (1")	3	psf
	Finsihed Floor (1")		psf
	10" Batte Insulation	5	psf
	Miscellaneous	1	psf
	TOTAL	11.4	psf
Sunspace	2x8" Joists @ 12" oc	2.5	psf
	Plywood Sheathing (1")	3	psf
	Finsihed Floor (1")		psf
	8" Batte Insulation	4	psf
	Miscellaneous	1	psf
	TOTAL	10.5	psf

C Wall Dead Load

2x4 Interior	2x4" Studs @ 16" oc	0.9	psf
	Gypson Wallboard (0.5")	2.5	psf
	TOTAL	3.4	psf

3.2

2x6 Interior	2x6" Studs @ 16" oc	1.4	psf		
	Gypson Wallboard (0.5")	2.5	psf		
	TOTAL	3.9	psf		
2x6 Exterior	2x6" Studs @ 16" oc	1.4	psf		
	Gypson Wallboard (0.5")	2.5	psf		
	Plywood Sheathing (0.5")	1.5	psf		
	6" Spray Foam Insulation	1.2	psf		
	TOTAL	6.6	psf		
2x10 Exterior	2x10" Studs @ 16" oc	2.4	psf		
	Gypson Wallboard (0.5")	2.5	psf		
	Plywood Sheathing (0.5")	1.5	psf		
	10" Spray Foam Insulation	2	psf		
	TOTAL	8.4	psf		
D Deck Dead Load	2x10" Joists @ 16" oc	2.4	psf		
	Decking		psf		
	TOTAL	2.4	psf		
E Windows (Approximate)	Model #	Quantity	Weight	Total	
	144 x 88.5	1	1500	1500	lbs
	145 x 31	1	450	450	lbs
	23 x 85	2	200	400	lbs
	33 x 35 1/8	4	100	400	lbs
	36 x 73	6	250	1500	lbs
	58 x 84	1	350	350	lbs
				4600	
F Roof Live Load	20		psf		
G Snow Ground Load	10		psf		
H Floor Live Loads	50		psf		
I Wind Load	100		mph		
J Ramps	100		psf		
K Railings (Point Load at any point)	200		lb		

3.3

Load Combinations

Allowable Stress Design (ASD)

Dead + Live

4.1

Serviceability criteria

1. Deflection

For FLOOR Members (Deck)

$$\Delta_{max} = \Delta/360 \text{ (in)}$$

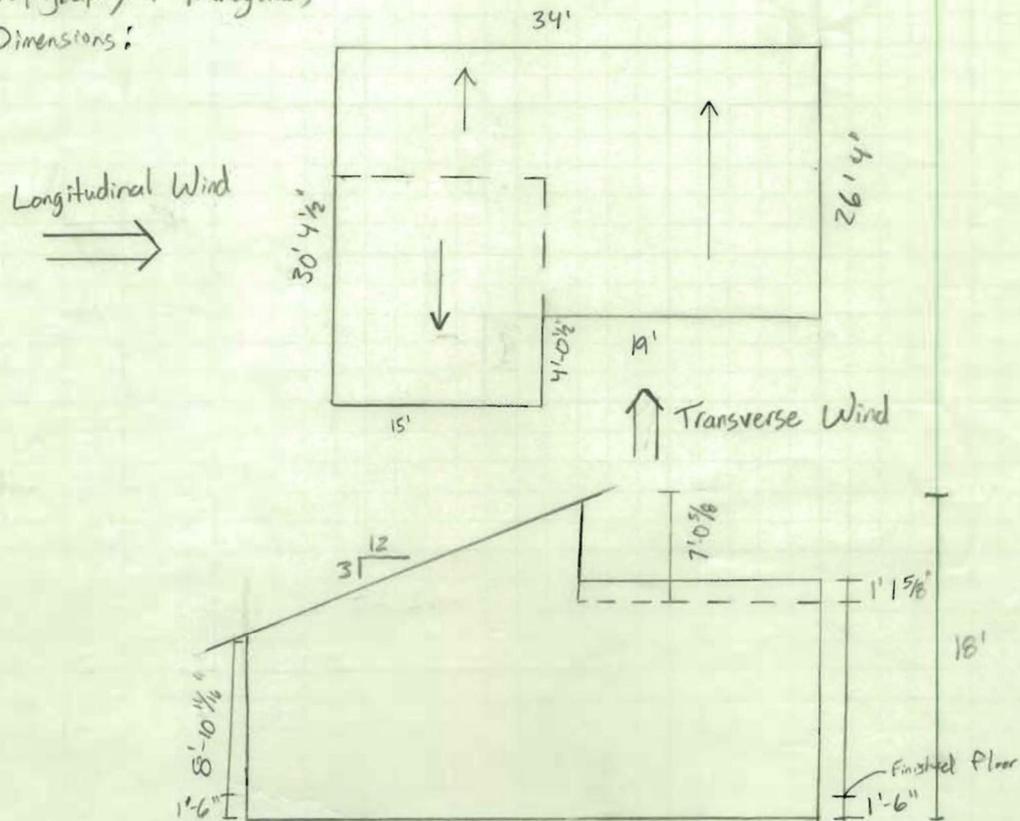
5-1

Wind Analysis - Using ASCE-07 Method 2 - MFRS

Location: Norfolk, VA

Topography: Homogeneous

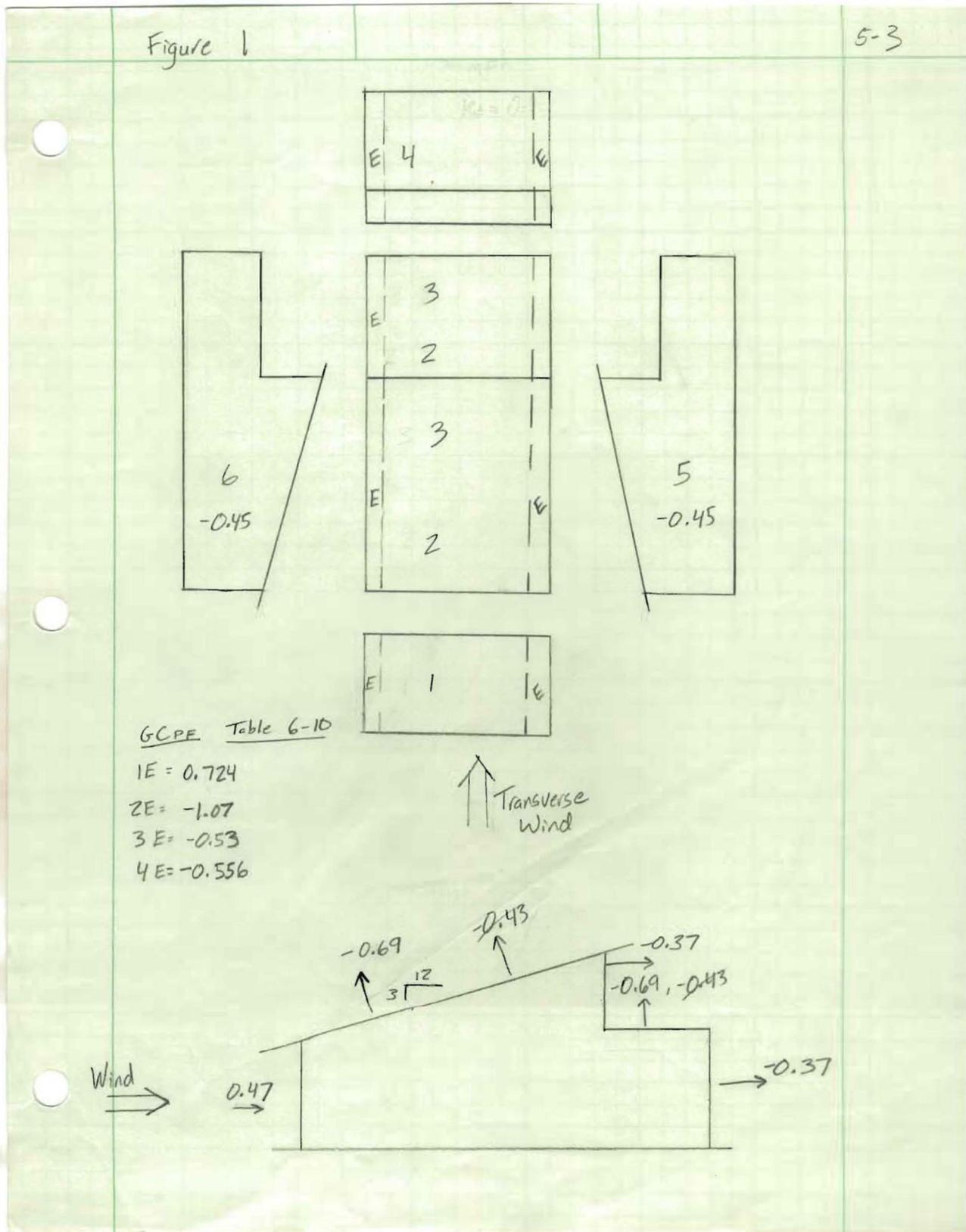
Dimensions:

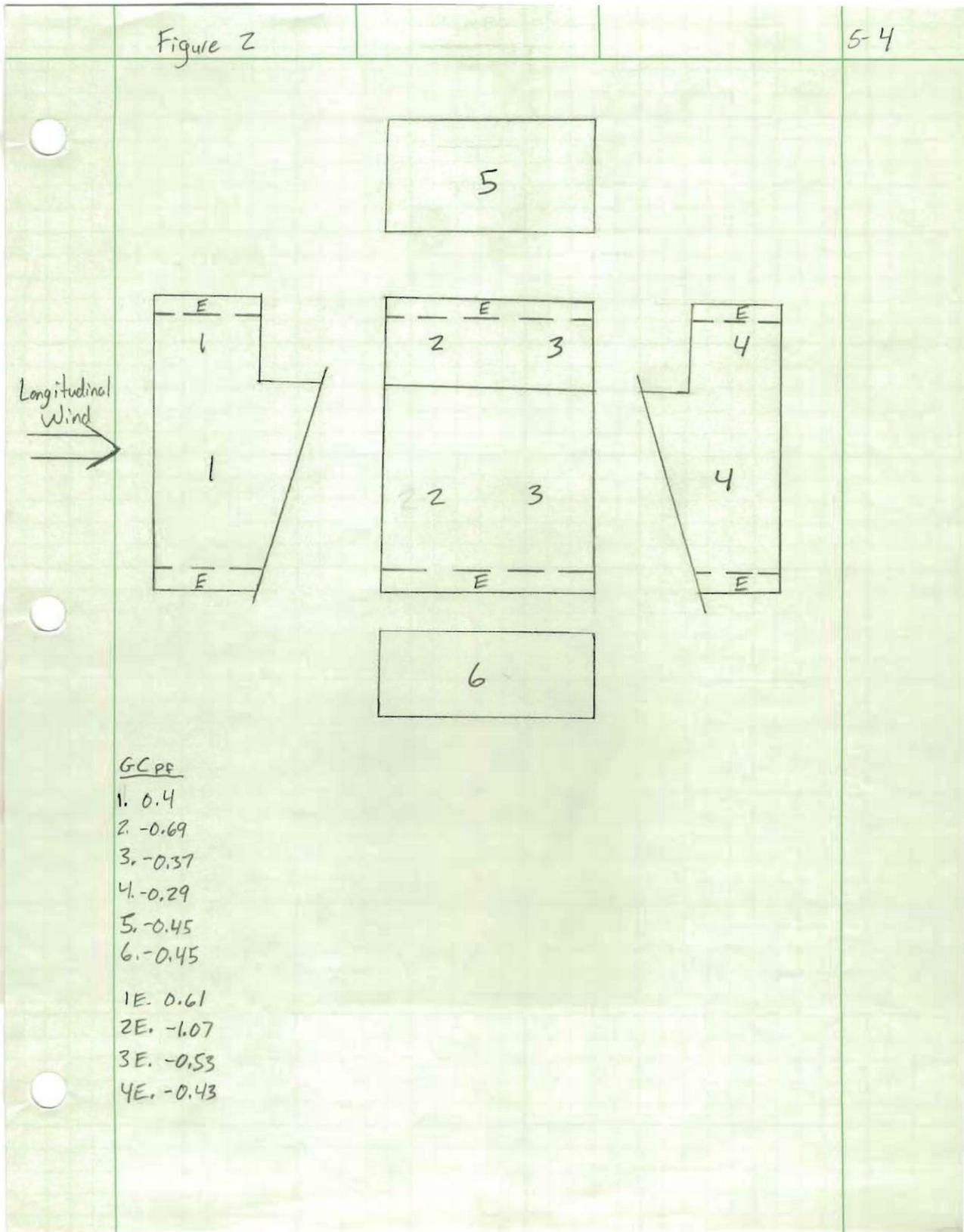


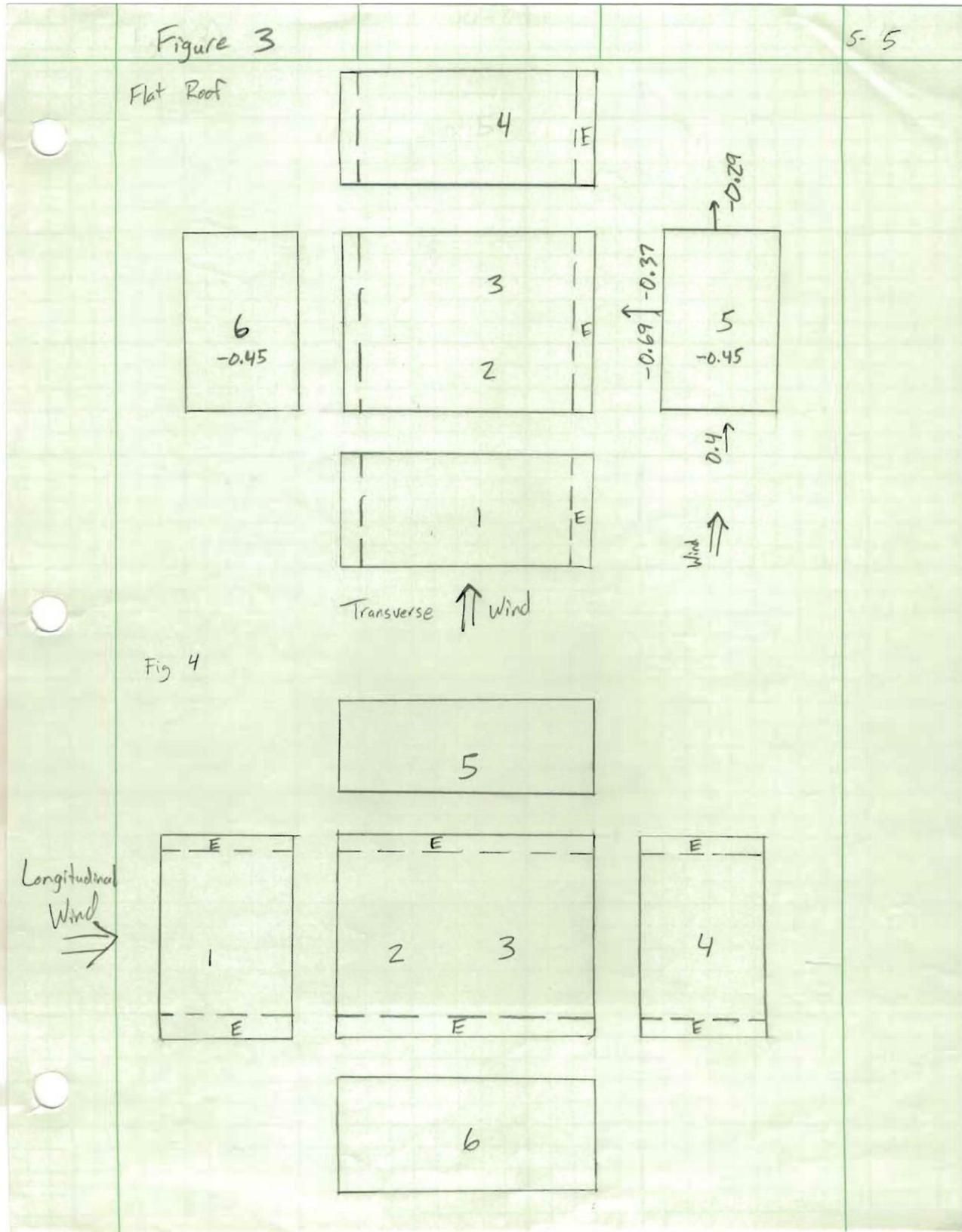
Framing: Typical Timber Construction

- Wall studs @ 16" o/c
- Wall and Roof panels are 4' x 8'

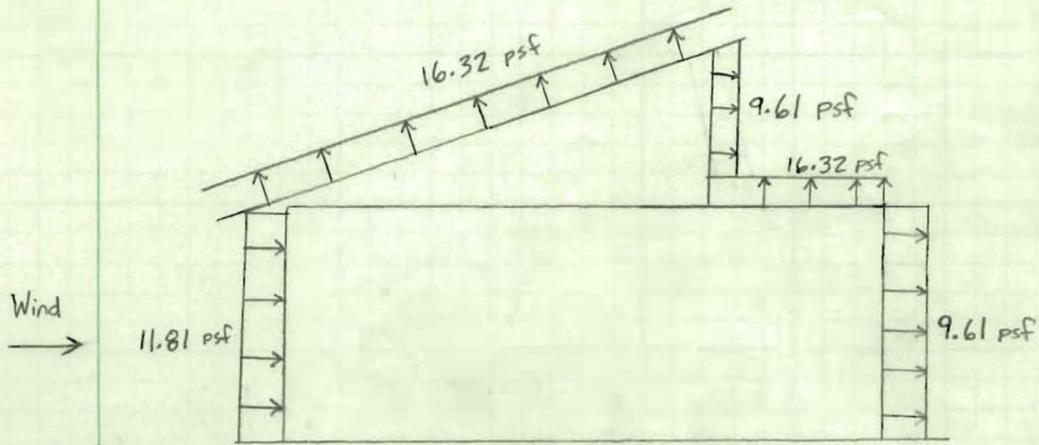
			5-2
	<u>Design Procedure</u>		
1.	Basic Wind Speed $V = 100$ mph		Fig. 6-1
2.	Wind Directionality Factor $K_d = 0.85$		T. 6-4
3.	Importance Factor $I = 1.0$ Building Classification: Category II, Residential		T 6-1
4.	Exposure Category = B		
5.	Velocity Pressure Exposure Coefficients		T, 6-3
	<u>Sloped Roof</u>	<u>Flat Roof</u>	
	<u>C+C Case 1</u>	<u>C+C Case 1</u>	
	$Z = 18'$ $K_z = 0.7$	$Z = 12'$ $K_z = 0.7$	
	<u>MWFRS Case 2</u>	<u>MWFRS Case 2</u>	
	$Z = 18'$ $K_z = 0.6$	$Z = 12'$ $K_z = 0.57$	
6.	Topographic Factor $K_{zt} = 1.0$		Sec. 6.5.7
7.	Gust Factor G can be taken as 0.85 per 6.5.8.1		
8.	Enclosure Classification = Enclosed		S. 6.5.9
9.	Internal Pressure Coefficient $G C_{pi} = \pm 0.18$ for enclosed buildings		F. 6-5



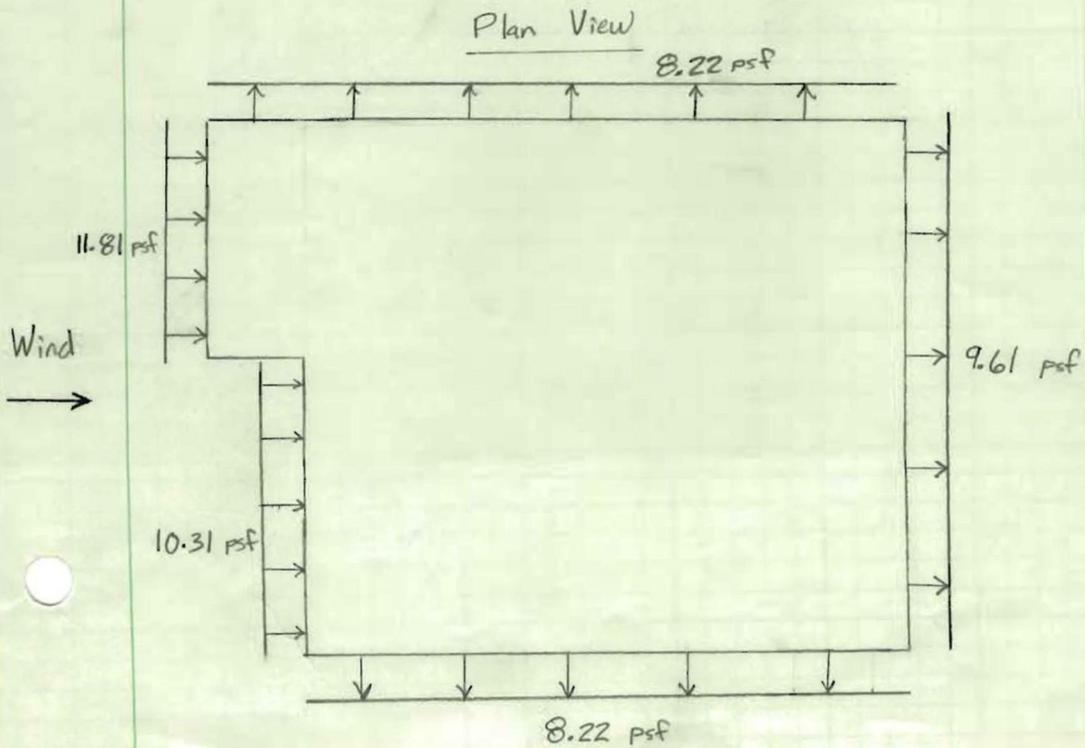




5-6

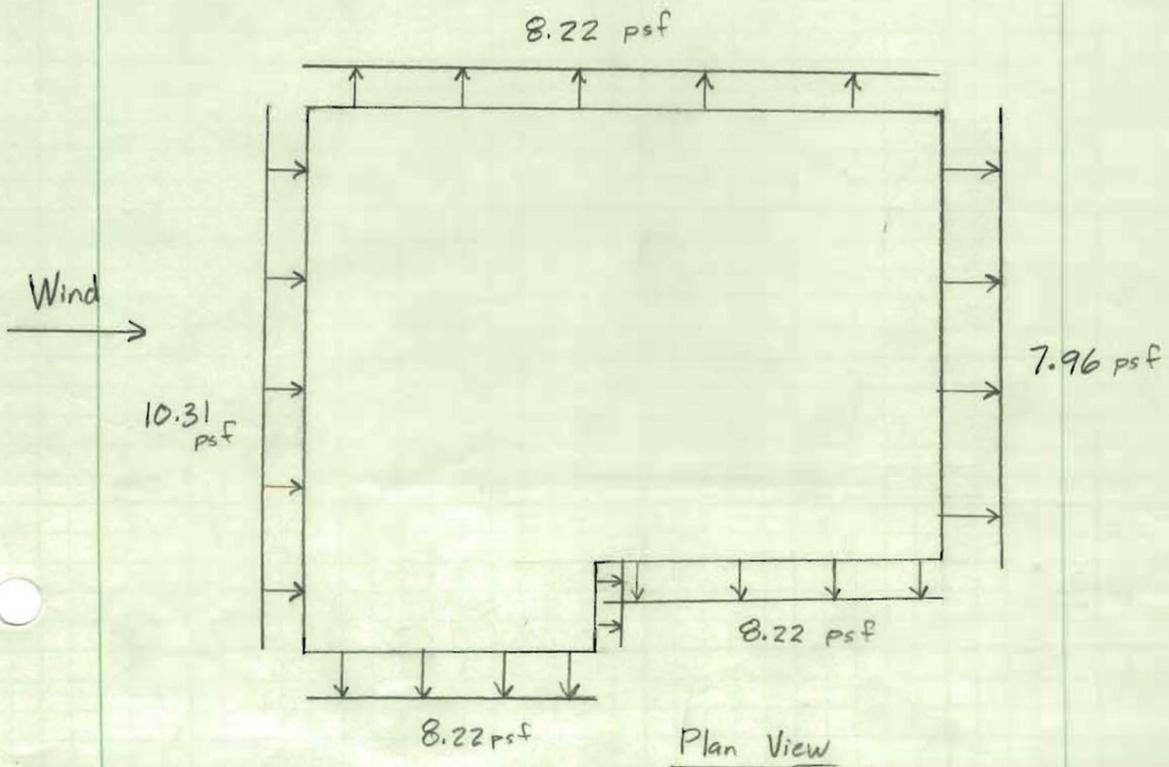
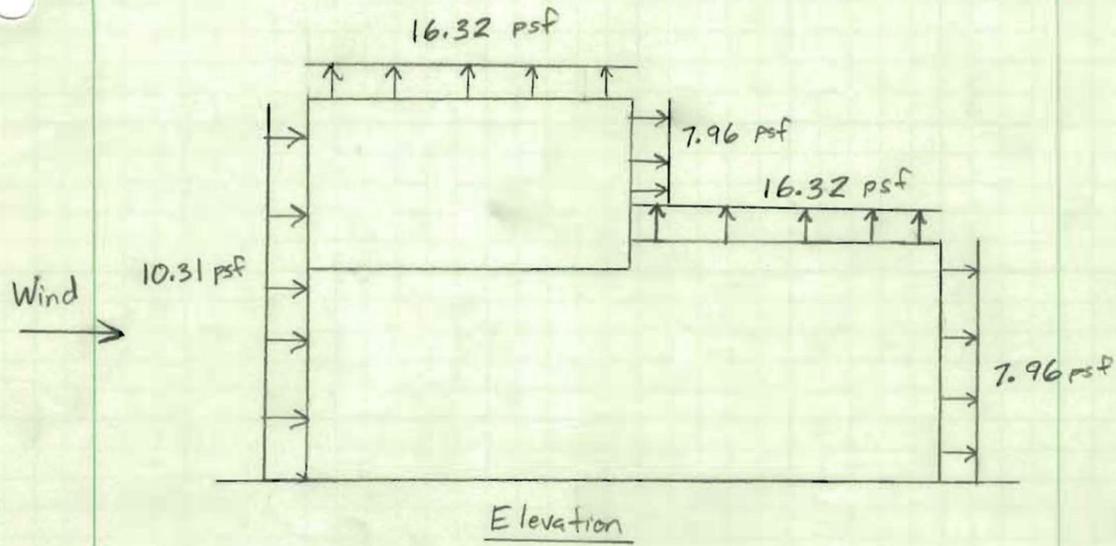


Elevation View



Plan View

5-7



Low-Rise Building Pressure

5.8

- 1 Basic Wind Speed V 100
- 2 Wind Direction Factor Kd 0.85
- 3 Importance Factor I 1
- 4 Exposure Category B
- 5 Velocity Pressure Exposure Coefficients

	Height (FT)	Kz	
		Case 1	Case 2
Case 1 applies to Components and Cladding	0-15	0.7	0.57
	18	0.7	0.6
Case 2 applies to MWFRS	20	0.7	0.62

- 6 Topographic Factor Kzt 1
- 7 Gust Factor G 0.85
- 8 Enclosure Classification= Enclosed
- 9 Velocity Pressure qz 13.056 psf
- 10 Internal Pressure Coefficients GCpi -0.18 0.18
- 11 External Pressure Coefficients GCpf

Fig 1
Transverse Wind

	GCpf	P -	P +
1	0.47	8.4864	3.78624
2	-0.69	-6.65856	-11.3587
3			
4	-0.37	-2.48064	-7.1808
5	-0.45	-3.52512	-8.22528
6	-0.45	-3.52512	-8.22528
1E	0.724	11.80262	7.102464
2E	-1.07	-11.6198	-16.32
3E			
4E	-0.556	-4.90906	-9.60922

Fig 2
Longitudinal Wind

	GCpf	P -	P +
1	0.4	7.57248	2.87232
2	-0.69	-6.65856	-11.3587
3			
4	0.29	6.13632	1.43616
5	-0.45	-3.52512	-8.22528
6	-0.45	-3.52512	-8.22528
1E	0.61	10.31424	5.61408
2E	-1.07	-11.6198	-16.32
3E			
4E	-0.43	-3.264	-7.96416

5.9

Fig 3
Transverse Wind

	GCpf	P -	P +
1	0.4	7.57248	2.87232
2	-0.69	-6.65856	-11.3587
3			
4	-0.29	-1.43616	-6.13632
5	-0.45	-3.52512	-8.22528
6	-0.45	-3.52512	-8.22528
1E	0.61	10.31424	5.61408
2E	-1.07	-11.6198	-16.32
3E			
4E	-0.43	-3.264	-7.96416

Fig 4
Longitudinal Wind

	GCpf	P -	P +
1	0.4	7.57248	2.87232
2	-0.69	-6.65856	-11.3587
3			
4	0.29	6.13632	1.43616
5	-0.45	-3.52512	-8.22528
6	-0.45	-3.52512	-8.22528
1E	0.61	10.31424	5.61408
2E	-1.07	-11.6198	-16.32
3E			
4E	-0.43	-3.264	-7.96416

REPRODUCTION

Low-Rise Building Pressure

5.10

- 1 Basic Wind Speed V 60
- 2 Wind Direction Factor Kd 0.85
- 3 Importance Factor I 1
- 4 Exposure Category B
- 5 Velocity Pressure Exposure Coefficients

	Height (FT)	Kz	
		Case 1	Case 2
Case 1 applies to Components and Cladding	0-15	0.7	0.57
	18	0.7	0.6
Case 2 applies to MWFRS	20	0.7	0.62

- 6 Topographic Factor Kzt 1
- 7 Gust Factor G 0.85
- 8 Enclosure Classification= Enclosed
- 9 Velocity Pressure qz 4.70016 psf
- 10 Internal Pressure Coefficients GCpi -0.18 0.18
- 11 External Pressure Coefficients GCpf

Fig 1
Transverse Wind

	GCpf	P -	P +
1	0.47	3.055104	1.363046
2	-0.69	-2.39708	-4.08914
3			
4	-0.37	-0.89303	-2.58509
5	-0.45	-1.26904	-2.9611
6	-0.45	-1.26904	-2.9611
1E	0.724	4.248945	2.556887
2E	-1.07	-4.18314	-5.8752
3E			
4E	-0.556	-1.76726	-3.45932

Fig 2
Longitudinal Wind

5.11

	GCpf	P -	P +
1	0.4	2.726093	1.034035
2	-0.69	-2.39708	-4.08914
3			
4	0.29	2.209075	0.517018
5	-0.45	-1.26904	-2.9611
6	-0.45	-1.26904	-2.9611
1E	0.61	3.713126	2.021069
2E	-1.07	-4.18314	-5.8752
3E			
4E	-0.43	-1.17504	-2.8671

Fig 3
Transverse Wind

	GCpf	P -	P +
1	0.4	2.726093	1.034035
2	-0.69	-2.39708	-4.08914
3			
4	-0.29	-0.51702	-2.20908
5	-0.45	-1.26904	-2.9611
6	-0.45	-1.26904	-2.9611
1E	0.61	3.713126	2.021069
2E	-1.07	-4.18314	-5.8752
3E			
4E	-0.43	-1.17504	-2.8671

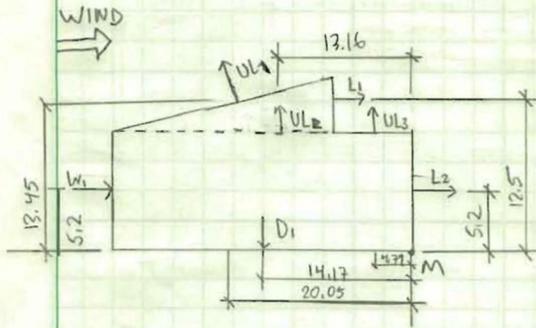
Fig 4
Longitudinal Wind

	GCpf	P -	P +
1	0.4	2.726093	1.034035
2	-0.69	-2.39708	-4.08914
3			
4	0.29	2.209075	0.517018
5	-0.45	-1.26904	-2.9611
6	-0.45	-1.26904	-2.9611
1E	0.61	3.713126	2.021069
2E	-1.07	-4.18314	-5.8752
3E			
4E	-0.43	-1.17504	-2.8671

OVERTURNING

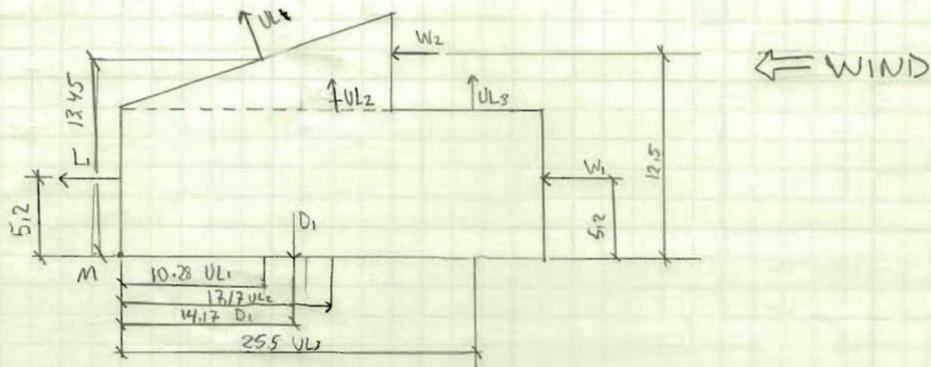
5.12

CASE 1 WIND NORTH TO SOUTH



See calcs on pg
5.14-5.15 (100mph)
5.16-5.17 (60mph)

CASE 2 WIND SOUTH TO NORTH



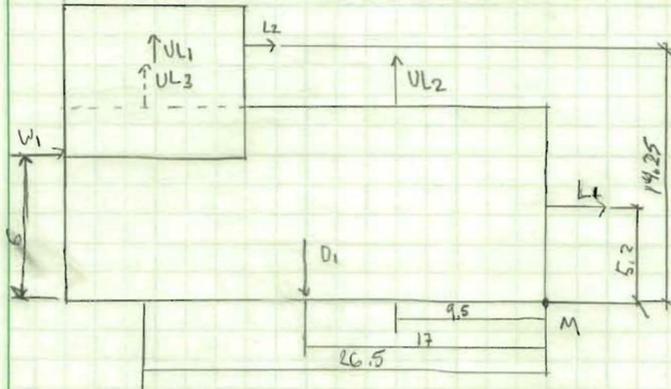
See calcs on pg
5.14-5.15 (100mph)
5.16-5.17 (60mph)

OVERTURNING

5.13

CASE 3 WIND WEST TO EAST

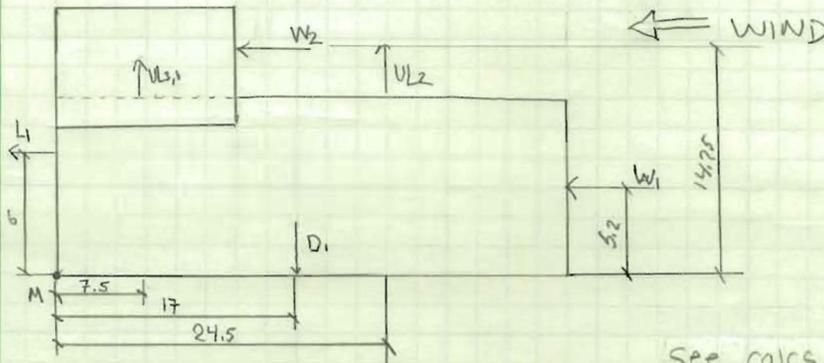
→ WIND



See calcs on pg:

CASE 4 WIND EAST TO WEST

5.14-5.15 (100mph)
5.16-5.17 (60mph)



See calcs on pg

5.14-5.15 (100mph)
5.16-5.17 (60mph)

OVERTURNING

100 MHP

CASE 1

WIND NORTH TO SOUTH

5.14

	PSF	AREA	LBS	X	Y	MOMENT ARM (ft)	x	y
W1	11.81	323.50	3820.54			5.2		
UL1	20.00	420.75	8415.00	1842.89	8165.07		13.34	20.05
UL2	16.32	500.26	8164.24			13.16		
UL3	16.32	136.88	2233.80			4.79		
L1	9.61	102.00	980.22			12.5		
L2	9.61	340.00	3267.40			5.20		
D1			47382.87			14.17		

Moment	355545.18
Moment Dead	671273.12
F.S.	1.8880107

CASE 2

WIND SOUTH TO NORTH

	PSF	AREA	LBS	X	Y	MOMENT ARM (ft)	X	Y
W1	11.81	340	4015.40			5.2		
W2	11.81	102	1204.62			12.5		
UL1	20	420.75	8415.00	1842.89	8165.07		10.28	13.45
UL2	16.32	500.26	8164.24			17.17		
UL3	16.32	136.88	2233.88			25.5		
L1	9.61	323.5	3108.84			4.2		
D1			47382.87			14.17		

Moment	374904.08
Moment Dead	671415.27
F.S.	1.79

CASE 3

WIND WEST TO EAST

5.15

	PSF	AREA	LBS	MOMENT ARM (ft)
W1	10.31	364.43	3757.27	6.00
UL1	20.00	420.75	8415.00	26.50
UL2	16.32	500.26	8164.24	9.50
UL3	16.32	136.88	2233.88	26.50
L1	7.96	261.35	2080.35	5.20
L2	7.96	60.68	483.01	14.25
D1			47382.87	17.00

Moment	400000.04
Moment Dead	805508.79
F.S.	2.01

CASE 4

WIND EAST TO WEST

	PSF	AREA	LBS	MOMENT ARM (ft)
W1	10.31	261.35	2694.5185	5.2
W2	10.31	60.68	625.6108	14.25
UL1	20	420.75	8415	7.5
UL2	16.32	500.26	8164.2432	24.5
UL3	16.32	136.88	2233.8816	7.5
L1	7.96	364.43	2900.8628	6
D1			47382.87	17

Moment	320222.2
Moment Dead	805508.79
F.S.	2.5154683

OVERTURNING

5.16

60 MHP

CASE 1

WIND NORTH TO SOUTH

	PSF	AREA	LBS	X	Y	MOMENT ARM (ft)	x	y
W1	4.24	323.50	1371.64			5.2		
UL1	10.00	420.75	4207.50	921.44	4082.54		13.34	20.05
UL2	5.88	500.26	2939.03			13.16		
UL3	5.88	136.88	804.83			4.79		
L1	3.45	102.00	351.90			12.5		
L2	3.45	340.00	1173.00			5.20		
D1			47382.87			14.17		

Moment	154310.51
Moment Dead	671273.12
F.S.	4.35

CASE 2

WIND SOUTH TO NORTH

	PSF	AREA	LBS	X	Y	MOMENT ARM (ft)	X	Y
W1	4.24	340	1441.60			5.2		
W2	4.24	102	432.48			12.5		
UL1	10	420.75	4207.50	921.44	4082.54		10.28	13.45
UL2	5.88	500.26	2941.53			17.17		
UL3	5.88	136.88	804.85			25.5		
L1	3.45	323.5	1116.08			4.2		
D1			47382.87			14.17		

Moment	153002.23
Moment Dead	671415.27
F.S.	4.39

CASE 3

5.17

WIND WEST TO EAST

	PSF	AREA	LBS	MOMENT ARM (ft)
W1	3.70	364.43	1348.39	6.00
UL1	10.00	420.75	4207.50	26.50
UL2	5.87	500.26	2936.53	9.50
UL3	5.87	136.88	803.49	26.50
L1	2.86	261.35	747.46	5.20
L2	2.86	60.68	173.54	14.25
D1			47382.87	17.00

Moment	175138.27
Moment Dead	805508.79
F.S.	4.60

CASE 4

WIND EAST TO WEST

	PSF	AREA	LBS	MOMENT ARM (ft)
W1	3.7	261.35	966.995	5.2
W2	3.7	60.68	224.516	14.25
UL1	10	420.75	4207.5	7.5
UL2	5.87	500.26	2936.5262	24.5
UL3	5.87	136.88	803.4856	7.5
L1	2.86	364.43	1042.2698	6
D1			47382.87	17

Moment	124008.63
Moment Dead	805508.79
F.S.	6.4955866

6.1

Foundation

See spreadsheet on page 6.4 for allowable loads on various size footings designed to 1500 psf.

Method:

The loads along each wall of the house will be calculated by combining the dead & live loads of the roof, floor, & walls within the tributary area of a given wall. This load will be found as a single weight. Based on the allowable loads for each footing (designed for a 1500 psf max bearing pressure) the number of footings needed along the wall section will be found.

Dead loads in PSF are found in "Design Loads" pg 3.1-3.2

Below labels the walls, roof, & floors. These values correspond to the dead loads in LBS for each wall, floor, & roof area found in spreadsheet on pg. 6.5-6.6

Walls:

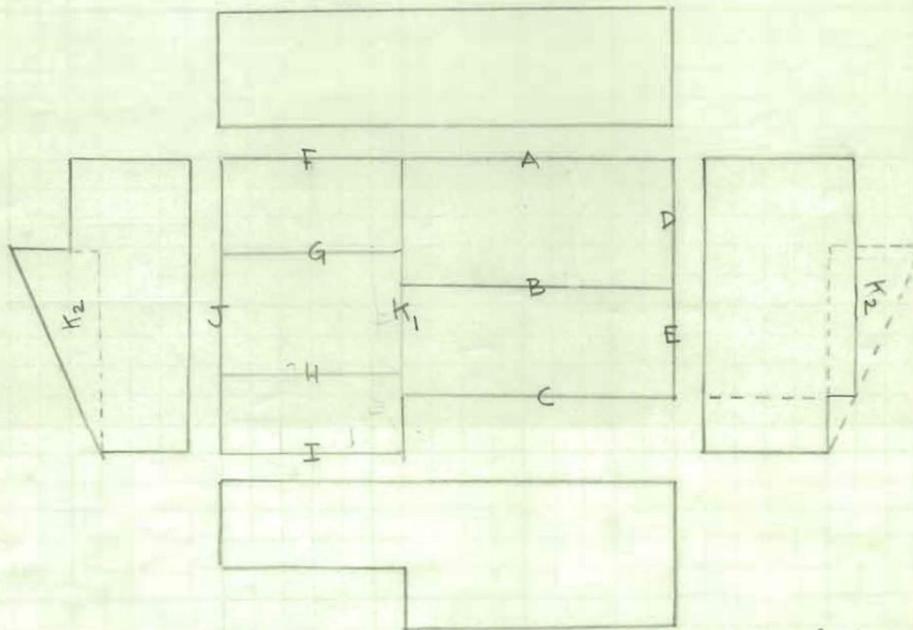


FIG 6-1

6.2

Floors

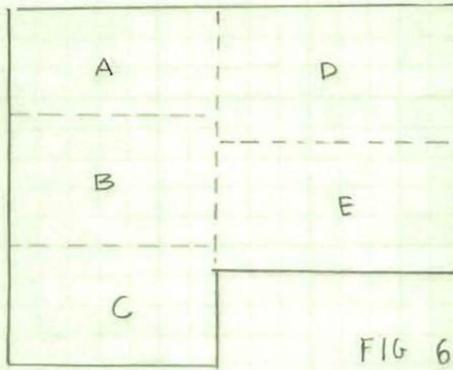


FIG 6.2

Roof

Sloped

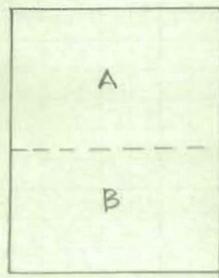


FIG. 6.3 A

Flat

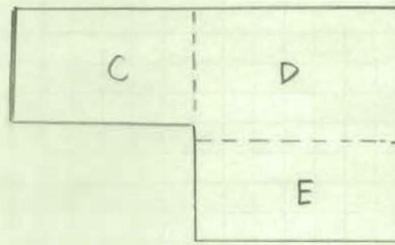


FIG 6.3B

6.3

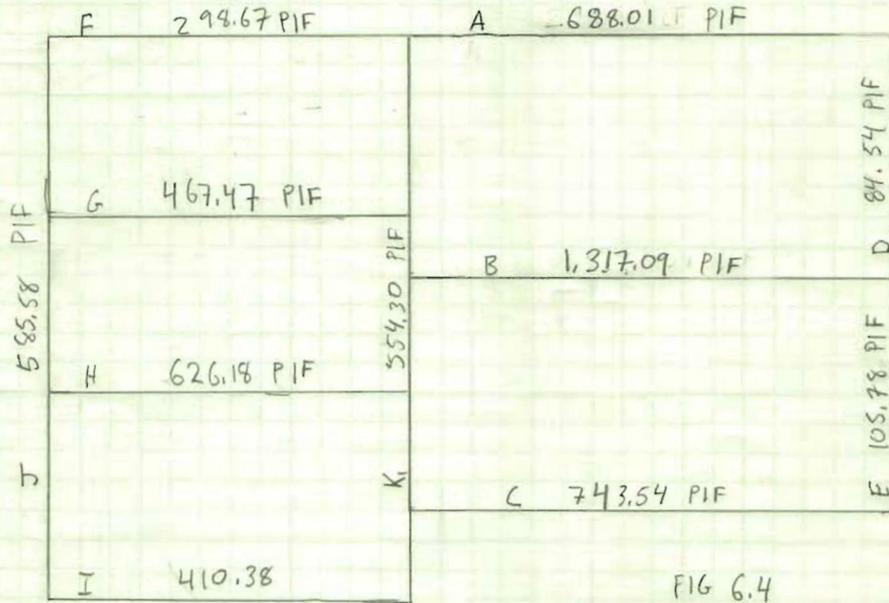


FIG 6.4

Allowable Loads on Footings

6.4

q _{all} =	1500	psf
--------------------	------	-----

16 X 16

b =	1.333333	ft
d =	1.333333	ft
P =	2666.667	lb

20 X 20

b =	1.666667	ft
d =	1.666667	ft
P =	4166.667	lb

10 X 24

b =	0.833333	ft
d =	2	ft
P =	2500	lb

8 X 16

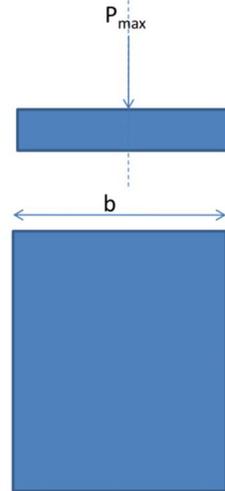
b =	0.666667	ft
d =	1.333333	ft
P =	1333.333	lb

12 X 12

b =	1	ft
d =	1	ft
P =	1500	

$$q = \frac{P}{A}$$

$$\Rightarrow P = q \times A$$



REPRODUCTION

6.5

Wall (Top of Parapet to Finished Floor)

	Width (ft)	Height (ft)	Area (SF)	Dead (PSF)	Windows (lbs)	Load (lbs)
A	19	10	190	6.6	300	1554
B	19	10	190	7.3	0	1387
C	19	10	190	6.6	750	2004
D	12.875	10	128.75	6.6	250	1099.75
E	13.46	10	132.6	6.6	500	1375.16
F	15	10	150	6.6	100	1090
G	15	15.5	232.5	3.9	450	1356.75
H	15	11.16	167.4	8.4	350	1756.16
I	15	8.9	133.5	6.6	1500	2381.1
J	30.375	10	303.75	6.6	0	2004.75
K1	30.375	9	273.375	3.9	0	1066.1625
K2	10.25	5.92	60.68	6.6	0	800.976
Total						17,875.81

SEE FIG 6.1

Floor (Wall to Wall)

	Width (ft)	Length (ft)	Area (SF)	Dead (PSF)	Load (lbs)	Live Load	Load (lbs)
A	15	9.125	136.875	11.4	1560.375	50	6843.75
B	15	11.33	169.95	11.4	1937.43	50	8497.5
C	15	9.58	143.7	35.5	5101.35	50	7185
D	12.83	19	243.77	11.4	2778.978	50	12188.5
E	13.5	19	256.5	11.4	2924.1	50	12825
Total					14,302.23		

SEE FIG 6.2

Roof (Sloped and Flat)

	Width (ft)	Length (ft)	Area (SF)	Dead (PSF)	Load (lbs)	Live Load	Load (lbs)
A	16.5	11.32	186.78	16.3	3044.514	20	3735.6
B	16.5	14.18	233.97	16.3	3813.711	20	4679.4
C	15	9.125	136.875	13.1	1793.0625	20	2737.5
D	12.83	19	243.77	13.1	3193.387	20	4875.4
E	13.5	19	256.5	13.1	3360.15	20	5130
Total					15,204.82		

SEE FIG 6.3

6.6

Total Weight of House 47,382.87 lbs

Wall, Roof, & Floor D + L

	PLF
A	688.01
B	1,317.09
C	743.35
D	84.54
E	105.78
F	298.67
G	467.47
H	626.18
I	410.38
J	585.58
K1	554.30

SEE FIG 6.4

REPRODUCTION

Allowable Footing Size for each wall

6.7

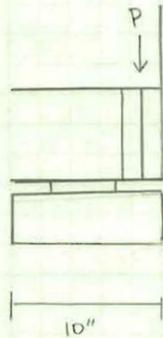
WALL	PLF	LBS	MIN AREA SF	MAX AREA SF	10X24	16 x 16	8 x 16	20 x 20
A	688.01	13072	8.71	13.072	5.2	4.9	9.8	3.1
B	1,317.09	25024	16.68	25.024	10.0	9.4	18.8	6.0
C	743.35	14123	9.42	14.123	5.6	5.3	10.6	3.4
D	84.54	1099	0.73	1.099	0.4	0.4	0.8	0.3
E	105.78	1375	0.92	1.375	0.6	0.5	1.0	0.3
F	298.67	4480	2.99	4.48	1.8	1.7	3.4	1.1
G	467.47	7012	4.67	7.012	2.8	2.6	5.3	1.7
H	626.18	9392	6.26	9.392	3.8	3.5	7.0	2.3
I	410.38	6155	4.10	6.155	2.5	2.3	4.6	1.5
J	585.58	17567	11.71	17.567	7.0	6.6	13.2	4.2
K1	554.30	16628	11.09	16.628	6.7	6.2	12.5	4.0

MAX LOAD	
10 x 24	2500
16 x 16	2666.66
8 x 16	1333.33
12 x 12	1500
20 x 20	4166.607

REPRODUCED

6.8

Check cantilever of FDN



2x10

$$A = 13.88 \text{ in}^2$$

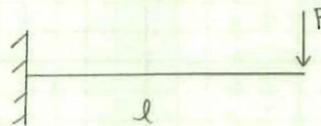
$$S_x = 21.39 \text{ in}^3$$

$$\text{Max wall load (lb/ft)} = 750 \text{ lb/ft}$$

(from pg. 6.7)

$$\text{Trib Area} = 16''$$

$$P = 750 \text{ lb/ft} (1.33 \text{ ft}) = 1000 \text{ lb}$$



$$l = \frac{10''}{2} - 1\frac{1}{2}'' = 3.5''$$

$$V_{\text{max}} = P = 1000 \text{ lb}$$

$$M_{\text{max}} = Pl = 3500 \text{ lb-in}$$

$$\tau = P/A = 72.05 \text{ psi}$$

$$\sigma = M/S_x = 163.63 \text{ psi}$$

OK

∴ The floor joists are capable of acting as a cantilever for the wall in such a way that the footings can be loaded in the middle for optimal loading capacity.

7.1

Analysis of Deck

Live Load = 50 psf
 Dead Load = 10 psf
 2x10 Joists @ 16" o.c. = 2.4 psf
 Decking ≈ 5 psf
 Miscellaneous = 3 psf
 ≈ 10 psf

Total load = D + L = 60 psf

→ Check longest Joist

Section Properties

L = 8.25'
 trib area = 16" = 1/3'
 w = load (trib area) = 80 lb/ft

2x10
 A = 13.88 in²
 S_x = 21.39 in³
 I_x = 98.93 in⁴

V_{max} = wL/2 = 330 lbs
 M_{max} = wL²/8 = 680.625 lb-ft = 8167.5 lb-in
 τ = V/A = 23.78 psi
 σ = M/S_x = 381.84 psi

$$\Delta = \frac{5wL^4}{384EI} = \frac{5(80)(99")^4}{384(1,600,000)(98.93)} = 0.0526"$$

Allowable: (No 2 So Pine)

$$F'_b = F_b C_D C_M C_t C_L C_F C_{fu} C_i C_r = 1207.5 \text{ psi} > 381 \text{ psi} \quad \boxed{\text{OK}}$$

$$F'_v = F_v C_D C_M C_t C_i = 175 \text{ psi} > 24 \text{ psi} \quad \boxed{\text{OK}}$$

F_b = 1050 psi

F_v = 175 psi

C_D = 1.0

C_M = 1.0

C_t = 1.0

C_L = 1.0

C_F = 1.0

C_{fu} = 1.0

C_i = 1.0

C_r = 1.15

E = 1,600,000 psi

$$\Delta_{allow} = \frac{L}{360} = \frac{0.275'}{360} \geq 0.0526" \quad \boxed{\text{OK}}$$

7.2

→ Check Longest Girder

$$L = 8'8"$$

$$\text{trib area} = 8.25' / 2 = 4.125'$$

$$w = 60 \text{ psf} (4.125') = 247.5 \text{ lb/ft}$$

$$V_{\text{max}} = wL/2 = 1072.5 \text{ lbs}$$

$$M_{\text{max}} = wL^2/8 = 2323.75 \text{ lb-ft} = 27,885 \text{ lb-in}$$

$$\tau = V/A = 77.23 \text{ psi}$$

$$\sigma = M/S_x = 651.82 \text{ psi} \quad \boxed{\text{OK}}$$

$$C_r = 1.0 \therefore F_b = 1050 \text{ psi}$$

$$S_x = 2(21.39) = 42.78 \quad (2 \text{ } 2 \times 10" \text{ make up the girder})$$

7.3

Check Fire Suppression Tank / Planter / Bench on Deck

Find Weight of water tank

Volume: $250 \text{ gal } (0.133 \text{ ft}^3/\text{gal}) = 33.325 \text{ ft}^3$
 Density of water: 62.4 lb/ft^3
 Weight = 2079.48 lbs.

Check Bearing of Tank

Minimum Required Area = $2079.48 \text{ lbs } \left(\frac{\text{sf}}{1500 \text{ lbs}} \right) = 1.386 \text{ sf}$

Given:

2x6 at 2.66' span
 $A = (1\frac{1}{2}'' \times 2.66') = 0.33 \text{ sf}$

Required # of 2x6: $\frac{1.386 \text{ sf}}{0.33 \text{ sf}} = 4.158 = 5 \text{ joists}$

Length of Tank = 5.5'

Joists in 5.5' @ 16" o.c. = $\frac{5.5'}{1.33'} = 4.125 \leq 4.158$ NG

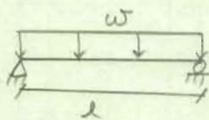
@ 12" o.c. = $\frac{5.5'}{1'} = 5.5 \geq 4.158$ OK

Find Weight of Soil

Volume: $2'6'' \times 2'8'' \times 8' = 5333 \text{ cf}$
 Density = 100 lb/cf
 Weight = 5333.33 lb

Check False Floor

load = $5333.33 \text{ lb} / (8' \times 2'8'') = 250 \text{ lb/ft}^2$
 trib area = $16''$
 $w = (250 \text{ lb/ft}^2) (16'') = 333.33 \text{ lb/ft}$



$l = 2'8''$

$V = w l / 2 = 444.44 \text{ lbs}$

$M = w l^2 / 8 = 296.296 \text{ lb-ft} = 3555.55 \text{ lb-in}$

2x6
 $A = 8.25 \text{ in}^2$
 $S_x = 7.583 \text{ in}^3$

$\sigma = V/A = 53.87 \text{ psi}$

$\sigma = M/S_x = 468.88 \text{ psi}$

OK
OK

Check Bearing from planter

Min required Area = $5333.33 \text{ lb } \left(\frac{\text{sf}}{1500 \text{ lb}} \right) = 3.55 \text{ sf}$

Given: 2(2x4) at 8' span

$A = 2(3\frac{1}{2}'' \times 8') = 4.66 \text{ sf} \geq 3.55 \text{ sf}$ OK

7.4

Check Bench. → Joists are 2x6 @ 16" o.c.

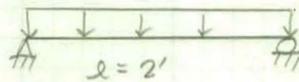
Live Load = 50 psf

Dead load = 2x6 @ 16" o.c. = 1.4 psf

Load = 51.4 psf

Trib Area = 16"

$w = 51.4 \text{ psf} (16") = 68.5 \text{ lb/ft}$



$$V = wL/2 = 68.5 \text{ lb}$$

$$M = wL^2/8 = 34.25 \text{ lb-ft} = 411 \text{ lb-in}$$

$$\tau = 8.3 \text{ psi}$$

$$\sigma = 54.2 \text{ psi}$$

OK

2x6

$$A = 8.25 \text{ in}^2$$

$$S_x = 7.583 \text{ in}^3$$

Check Bearing of Load

$$\text{Area of Bench} = 2' \times 6' = 12 \text{ sf}$$

$$\text{Weight} = 51.4 \text{ psf} (12 \text{ sf}) = 616.8 \text{ lb}$$

$$\text{Req. Min Area} = 616.8 \text{ lb} \left(\frac{\text{sf}}{1500 \text{ lb}} \right) = 0.4112 \text{ sf}$$

Given 1. (2x4) @ 6' span

$$A = (3\frac{1}{2}') (6') = 1.75 \text{ sf} > 0.4112 \text{ sf} \quad \text{OK}$$

Ramp Design 8.1

$SF = (23' \times 5') = 115 \text{ SF}$
 $Load = 50 \text{ psf} \times 2.5 = 125 \text{ lb/ft}$

$W = 125 \text{ lb/ft} (23')$
 $P = 2875 \text{ lbs}$
 Allowable Bearing = 1500 psf
 $\frac{2875}{1500} = 1.9 \text{ SF/per edge}$
 2 2x10 @ 11.8' span

$(\frac{1.5''}{12})(11.8')(2) = 2.95 \text{ SF} \quad \boxed{\text{OK}}$

9.1

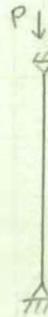
Check Railings

Section Properties - 4x6" Column

$$A = 19.25 \text{ in}^2$$

$$S_y = 11.23 \text{ in}^3 \text{ (worse case)}$$

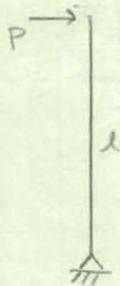
Point Load applied in compression



$$P = 200 \text{ lb}$$

$$\sigma_{\text{axial}} = P/A = 10.39 \text{ psi} \quad \boxed{\text{GBI}}$$

Point Load applied laterally



$$P = 200 \text{ lb}$$

$$l = 3'6"$$

$$M = P \cdot l = 700 \text{ lb-ft} = 8400 \text{ lb-in}$$

$$\sigma_{\text{bending}} = M/S_x = 747.99 \text{ psi} \quad \boxed{\text{GBI}}$$

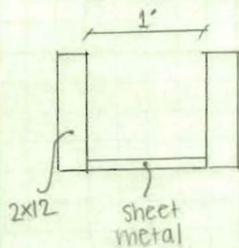
$$\tau = P/A = 10.39 \text{ psi} \quad \boxed{\text{GBI}}$$

10.1

Utility Core $\frac{1}{3}$ Pergola

The loads from the pergola are transferred to the utility core and to the house. The pergola is made of 2x12 Cypress rafters and 3 builtup planters made of two 2x12 spaced 1 ft apart and stainless steel sheet metal across the bottom.

→ Find the loads of the planters $\frac{1}{3}$ check structure



Weight of 2x12:

$$\text{Volume} = 1\frac{1}{2} \times 11\frac{1}{4} \times 12' = 1.406 \text{ ft}^3$$

$$\text{Density} = 32 \text{ lb/ft}^3$$

$$\text{Weight} = 45 \text{ lbs}$$

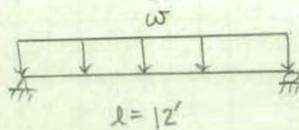
Weight of Soil:

$$\text{Volume} = 1' \times 1' \times 12' = 12 \text{ ft}^3$$

$$\text{Density} = 100 \text{ lb/ft}^3$$

$$\text{Weight} = 1200 \text{ lbs}$$

$$\therefore w = (1200 \text{ lbs} + 45 \text{ lbs}) / 12' = 103.75 \text{ lb/ft}$$



$$V = \frac{wL}{2} = 622.5 \text{ lb}$$

$$M = \frac{wL^2}{8} = 1867.5 \text{ lb-ft} = 22410 \text{ lb-in}$$

$$\tau = \frac{V}{A} = 18.44 \text{ psi}$$

$$\sigma = \frac{M}{S_x} = 354.14 \text{ psi}$$

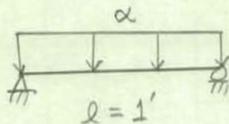
OK

$$A = 2(1\frac{1}{2} \times 11\frac{1}{4}) = 33.75 \text{ in}^2$$

$$S_x = 2\left(\frac{bd^2}{6}\right) = 2(31.64) = 63.28 \text{ in}^3$$

→ Determine minimum thickness of sheet metal

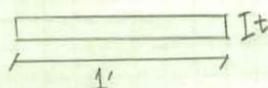
Assume $\sigma_y = 30 \text{ ksi}$ and $\tau_y = 0.6(30 \text{ ksi}) = 18 \text{ ksi}$



Consider the cross-section of the planter as a simply supported beam made of sheet metal.

$$\alpha = 1200 \text{ lbs} \div 12' = 100 \text{ lbs/ft}$$

Cross-section of sheet metal:



$$V_{\text{max}} = \frac{\alpha l}{2} = 50 \text{ lb}$$

$$M_{\text{max}} = \frac{\alpha l^2}{8} = 12.5 \text{ lb-ft} = 150 \text{ lb-in}$$

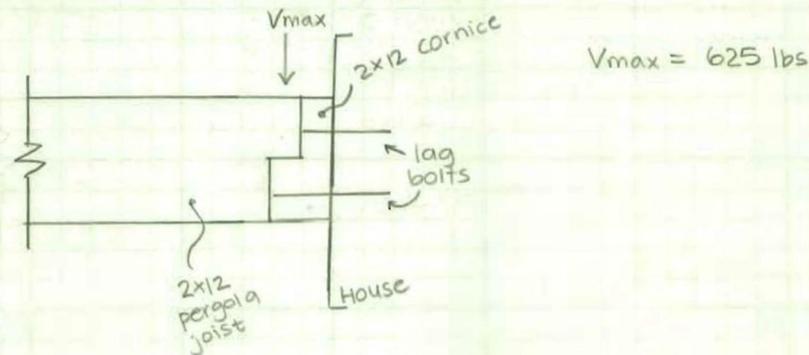
$$\sigma = \frac{M}{S_x} \Rightarrow 30 \text{ ksi} \geq \frac{150 \text{ lb-in}}{(12)(t^3)/6} \Rightarrow t \geq 0.6 \text{ in} \quad \text{*governs}$$

$$\tau = \frac{V}{A} \Rightarrow 18 \text{ ksi} \geq \frac{50 \text{ lb}}{(12)(t)} \Rightarrow t \geq 0.00023 \text{ in}$$

\therefore sheet metal must be $\frac{5}{8}$ " stainless steel with $\sigma_y = 30 \text{ ksi}$

10.2

→ Check load of pergola into house



Assume notch is equal in both 2x12

$$\therefore A = \frac{1}{2} (2 \times 12) = \frac{1}{2} (16.88) = 8.44 \text{ in}^2$$

Each planter is made of 2x12. Assume each carries an equal amount of shear load.

$$\therefore P = V_{\max} / 2 = 312.5 \text{ lbs}$$

$$\tau = \frac{P}{A} = \frac{312.5 \text{ lbs}}{8.44 \text{ in}^2} = 37.03 \text{ psi} \quad \boxed{\text{OK}}$$

$\sigma = 0$ because there is no moment at this connection.

→ Determine bolt size of lag bolts into house.

Bolt Length = 5" to penetrate to stud

Try Grade 2 bolt with $\frac{3}{8}$ " thickness

$$A = \pi \left(\frac{3/8 \div 2}{2} \right)^2 = 0.11 \text{ in}^2$$

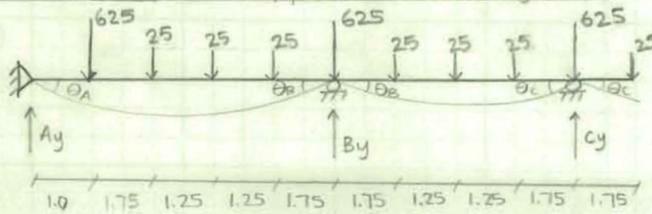
$$\tau = \frac{V_{\max}}{A} = \frac{625}{0.11} = 5658.84 \text{ psi}$$

$$\sigma_y = 36,000 \text{ psi} > 5658.84 \text{ psi} \quad \boxed{\text{OK}}$$

\therefore Any $\frac{3}{8}$ " bolt GR2 or higher will work with length of 5".

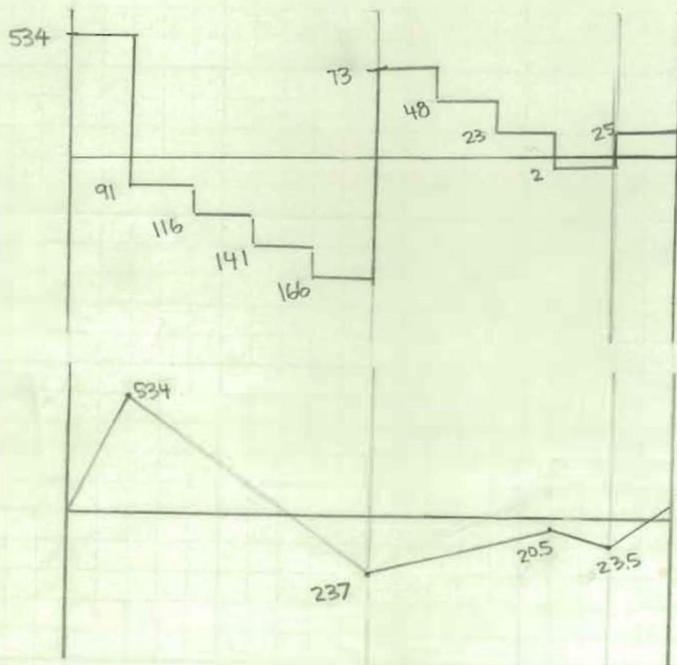
10.3

Check loads into supports on Utility Core



$A_y = 534$
 $B_y = 864$
 $C_y = 653$

* Determined Using STAAD PRO 8.7 (See Sheets 10.3A - 10.3N)



Shear (lb)

Moment (lb-in)

Max Shear = 534 lb
Max Moment = 534 lb-ft = 6408 lb-in

Section Properties - 2x8

$A = 10.875 \text{ in}^2$
 $S_x = 13.141 \text{ in}^3$

$\tau = V/A = 49.10 \text{ psi}$ OK
 $\sigma = M/S_x = 487.63 \text{ psi}$ OK

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10.3A

```
*****
*
*          STAAD.Pro V8i SELECTseries1          *
*          Version  20.07.06.35                 *
*          Proprietary Program of              *
*          Bentley Systems, Inc.               *
*          Date=    MAR 21, 2011                *
*          Time=    22: 8:18                   *
*
*          USER ID:  odu                       *
*****
```

```
1. STAAD PLANE
INPUT FILE: Structure1.STD
2. START JOB INFORMATION
3. ENGINEER DATE 21-MAR-11
4. END JOB INFORMATION
5. INPUT WIDTH 79
6. UNIT FEET POUND
7. JOINT COORDINATES
8. 1 0 0 0; 2 1 0 0; 3 2.75 0 0; 4 4 0 0; 5 5.25 0 0; 6 7 0 0; 7 8.75 0 0
9. 8 10 0 0; 9 11.25 0 0; 10 13 0 0; 11 14.25 0 0
10. MEMBER INCIDENCES
11. 1 1 2; 2 2 3; 3 3 4; 4 4 5; 5 5 6; 6 6 7; 7 7 8; 8 8 9; 9 9 10
12. 10 10 11
13. DEFINE MATERIAL START
14. ISOTROPIC CONCRETE
15. E 4.536E+008
16. POISSON 0.17
17. DENSITY 150.336
18. ALPHA 5E-006
19. DAMP 0.05
20. END DEFINE MATERIAL
21. MEMBER PROPERTY
22. 1 TO 10 PRIS YD 0.5 ZD 0.5
23. CONSTANTS
24. MATERIAL CONCRETE ALL
25. SUPPORTS
26. 1 PINNED
27. 6 10 FIXED BUT FX FZ MX MY MZ
28. LOAD 1 LOADTYPE NONE TITLE LOAD CASE 1
29. JOINT LOAD
30. 2 6 10 FY -625
31. 3 TO 5 7 TO 9 11 FY -25
32. PERFORM ANALYSIS PRINT ALL
```

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STAAD PLANE

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10.3B

PROBLEM STATISTICS

NUMBER OF JOINTS/MEMBER+ELEMENTS/SUPPORTS = 11/ 10/ 3

SOLVER USED IS THE OUT-OF-CORE BASIC SOLVER

ORIGINAL/FINAL BAND-WIDTH= 1/ 1/ 6 DOF
TOTAL PRIMARY LOAD CASES = 1, TOTAL DEGREES OF FREEDOM = 29
SIZE OF STIFFNESS MATRIX = 1 DOUBLE KILO-WORDS
REQRD/AVAIL. DISK SPACE = 12.0/ 167874.0 MB

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10.3C

LOADING 1 LOADTYPE NONE TITLE LOAD CASE 1

JOINT LOAD - UNIT POUN FEET

JOINT	FORCE-X	FORCE-Y	FORCE-Z	MOM-X	MOM-Y	MOM-Z
2	0.00	-625.00	0.00	0.00	0.00	0.00
6	0.00	-625.00	0.00	0.00	0.00	0.00
10	0.00	-625.00	0.00	0.00	0.00	0.00
3	0.00	-25.00	0.00	0.00	0.00	0.00
4	0.00	-25.00	0.00	0.00	0.00	0.00
5	0.00	-25.00	0.00	0.00	0.00	0.00
7	0.00	-25.00	0.00	0.00	0.00	0.00
8	0.00	-25.00	0.00	0.00	0.00	0.00
9	0.00	-25.00	0.00	0.00	0.00	0.00
11	0.00	-25.00	0.00	0.00	0.00	0.00

FOR LOADING - 1

APPLIED JOINT EQUIVALENT LOADS

JOINT	FORCE-X	FORCE-Y	FORCE-Z	MOM-X	MOM-Y	MOM-Z
2	0.00000E+00	-6.25000E+02	0.00000E+00	0.00000E+00	0.00000E+00	0.00000E+00
3	0.00000E+00	-2.50000E+01	0.00000E+00	0.00000E+00	0.00000E+00	0.00000E+00
4	0.00000E+00	-2.50000E+01	0.00000E+00	0.00000E+00	0.00000E+00	0.00000E+00
5	0.00000E+00	-2.50000E+01	0.00000E+00	0.00000E+00	0.00000E+00	0.00000E+00
6	0.00000E+00	-6.25000E+02	0.00000E+00	0.00000E+00	0.00000E+00	0.00000E+00
7	0.00000E+00	-2.50000E+01	0.00000E+00	0.00000E+00	0.00000E+00	0.00000E+00
8	0.00000E+00	-2.50000E+01	0.00000E+00	0.00000E+00	0.00000E+00	0.00000E+00
9	0.00000E+00	-2.50000E+01	0.00000E+00	0.00000E+00	0.00000E+00	0.00000E+00
10	0.00000E+00	-6.25000E+02	0.00000E+00	0.00000E+00	0.00000E+00	0.00000E+00
11	0.00000E+00	-2.50000E+01	0.00000E+00	0.00000E+00	0.00000E+00	0.00000E+00

STATIC LOAD/REACTION/EQUILIBRIUM SUMMARY FOR CASE NO. 1
LOADTYPE NONE TITLE LOAD CASE 1

CENTER OF FORCE BASED ON Y FORCES ONLY (FEET).
(FORCES IN NON-GLOBAL DIRECTIONS WILL INVALIDATE RESULTS)

X = 0.708841485E+01
Y = 0.000000000E+00
Z = 0.000000000E+00

***TOTAL APPLIED LOAD (POUN FEET) SUMMARY (LOADING 1)

SUMMATION FORCE-X = 0.00
SUMMATION FORCE-Y = -2050.00
SUMMATION FORCE-Z = 0.00

SUMMATION OF MOMENTS AROUND THE ORIGIN-
MX= 0.00 MY= 0.00 MZ= -14531.25

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10.3D

***TOTAL REACTION LOAD(POUN FEET) SUMMARY (LOADING 1)

SUMMATION FORCE-X = 0.00
 SUMMATION FORCE-Y = 2050.00
 SUMMATION FORCE-Z = 0.00

SUMMATION OF MOMENTS AROUND THE ORIGIN-

MX= 0.00 MY= 0.00 MZ= 14531.25

MAXIMUM DISPLACEMENTS (INCH /RADIANS) (LOADING 1)

MAXIMUMS AT NODE
 X = 0.00000E+00 0
 Y = -8.63404E-03 3
 Z = 0.00000E+00 0
 RX= 0.00000E+00 0
 RY= 0.00000E+00 0
 RZ= -4.57048E-04 1

EXTERNAL AND INTERNAL JOINT LOAD SUMMARY (POUN FEET)-

JT	EXT FX/ INT FX	EXT FY/ INT FY	EXT FZ/ INT FZ	EXT MX/ INT MX	EXT MY/ INT MY	EXT MZ/ INT MZ	
							SUPPORT=1
1	0.00 0.00	0.00 -533.52	0.00 0.00	0.00 0.00	0.00 0.00	0.00 0.00	111110
6	0.00 0.00	-625.00 -238.84	0.00 0.00	0.00 0.00	0.00 0.00	0.00 0.00	011110
10	0.00 0.00	-625.00 -27.64	0.00 0.00	0.00 0.00	0.00 0.00	0.00 0.00	011110

***** END OF DATA FROM INTERNAL STORAGE *****

33. PRINT ALL

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10.3E

JOINT COORDINATES

COORDINATES ARE FEET UNIT

JOINT	X	Y	Z
1	0.000	0.000	0.000
2	1.000	0.000	0.000
3	2.750	0.000	0.000
4	4.000	0.000	0.000
5	5.250	0.000	0.000
6	7.000	0.000	0.000
7	8.750	0.000	0.000
8	10.000	0.000	0.000
9	11.250	0.000	0.000
10	13.000	0.000	0.000
11	14.250	0.000	0.000

REPRODUCTION

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10.3F

MEMBER INFORMATION

MEMBER	START JOINT	END JOINT	LENGTH (FEET)	BETA (DEG)	RELEASES
1	1	2	1.000	0.00	
2	2	3	1.750	0.00	
3	3	4	1.250	0.00	
4	4	5	1.250	0.00	
5	5	6	1.750	0.00	
6	6	7	1.750	0.00	
7	7	8	1.250	0.00	
8	8	9	1.250	0.00	
9	9	10	1.750	0.00	
10	10	11	1.250	0.00	

REPRODUCTION

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10.3G

MATERIAL PROPERTIES.

ALL UNITS ARE - POUN FEET

MATERIAL

KIND	E	POIS	DENS	ALPHA	DAMP	G
CONCRETE						
1D	4.53600E+08	0.170	1.50336E+02	5.00000E-06	0.050	1.93846E+08

REPRODUCTION

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10.13H

MATERIAL PROPERTIES.

ALL UNITS ARE - POUN FEET

MEMBER	E	G	DEN	ALPHA
1	453600000.0	193846160.0	150.33598328	0.00000500
2	453600000.0	193846160.0	150.33598328	0.00000500
3	453600000.0	193846160.0	150.33598328	0.00000500
4	453600000.0	193846160.0	150.33598328	0.00000500
5	453600000.0	193846160.0	150.33598328	0.00000500
6	453600000.0	193846160.0	150.33598328	0.00000500
7	453600000.0	193846160.0	150.33598328	0.00000500
8	453600000.0	193846160.0	150.33598328	0.00000500
9	453600000.0	193846160.0	150.33598328	0.00000500
10	453600000.0	193846160.0	150.33598328	0.00000500

REPRODUCTION

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10.3I

MEMBER PROPERTIES. UNIT - INCH

MEMB	PROFILE	AX/ AY	IZ/ AZ	IY/ SZ	IX/ SY
1	PRISMATIC	36.00	108.00	108.00	182.52
		30.60	30.60	36.00	36.00
2	PRISMATIC	36.00	108.00	108.00	182.52
		30.60	30.60	36.00	36.00
3	PRISMATIC	36.00	108.00	108.00	182.52
		30.60	30.60	36.00	36.00
4	PRISMATIC	36.00	108.00	108.00	182.52
		30.60	30.60	36.00	36.00
5	PRISMATIC	36.00	108.00	108.00	182.52
		30.60	30.60	36.00	36.00
6	PRISMATIC	36.00	108.00	108.00	182.52
		30.60	30.60	36.00	36.00
7	PRISMATIC	36.00	108.00	108.00	182.52
		30.60	30.60	36.00	36.00
8	PRISMATIC	36.00	108.00	108.00	182.52
		30.60	30.60	36.00	36.00
9	PRISMATIC	36.00	108.00	108.00	182.52
		30.60	30.60	36.00	36.00
10	PRISMATIC	36.00	108.00	108.00	182.52
		30.60	30.60	36.00	36.00

SUPPORT INFORMATION (1=FIXED, 0=RELEASED)

UNITS FOR SPRING CONSTANTS ARE POUN FEET DEGREES

JOINT	FORCE-X/ KFY	FORCE-Y/ KFY	FORCE-Z/ KFZ	MOM-X/ KMX	MOM-Y/ KMY	MOM-Z/ KMZ
1	1	1	1	1	1	0
	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
6	0	1	1	1	1	0
	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
10	0	1	1	1	1	0
	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00

***** END OF DATA FROM INTERNAL STORAGE *****

34. PRINT ANALYSIS RESULTS

Monday, March 21, 2011, 10:11 PM

STAAD PLANE

-- PAGE NO. 10

10.3J

JOINT DISPLACEMENT (INCH RADIANS) STRUCTURE TYPE = PLANE

JOINT	LOAD	X-TRANS	Y-TRANS	Z-TRANS	X-ROTAN	Y-ROTAN	Z-ROTAN
1	1	0.00000	0.00000	0.00000	0.00000	0.00000	-0.00046
2	1	0.00000	-0.00519	0.00000	0.00000	0.00000	-0.00034
3	1	0.00000	-0.00863	0.00000	0.00000	0.00000	-0.00001
4	1	0.00000	-0.00743	0.00000	0.00000	0.00000	0.00015
5	1	0.00000	-0.00444	0.00000	0.00000	0.00000	0.00022
6	1	0.00000	0.00000	0.00000	0.00000	0.00000	0.00015
7	1	0.00000	0.00166	0.00000	0.00000	0.00000	0.00002
8	1	0.00000	0.00162	0.00000	0.00000	0.00000	-0.00002
9	1	0.00000	0.00112	0.00000	0.00000	0.00000	-0.00004
10	1	0.00000	0.00000	0.00000	0.00000	0.00000	-0.00006
11	1	0.00000	-0.00105	0.00000	0.00000	0.00000	-0.00007

REPRODUCTION

Monday, March 21, 2011, 10:11 PM

STAAD PLANE

-- PAGE NO. 11

10.3K

SUPPORT REACTIONS -UNIT POUN FEET STRUCTURE TYPE = PLANE

JOINT	LOAD	FORCE-X	FORCE-Y	FORCE-Z	MOM-X	MOM-Y	MOM Z
1	1	0.00	533.52	0.00	0.00	0.00	0.00
6	1	0.00	863.84	0.00	0.00	0.00	0.00
10	1	0.00	652.64	0.00	0.00	0.00	0.00

REPRODUCTION

Monday, March 21, 2011, 10:11 PM

STAAD PLANE

-- PAGE NO. 12

10.3L

MEMBER END FORCES STRUCTURE TYPE = PLANE

ALL UNITS ARE -- POUN FEET (LOCAL)

MEMBER	LOAD	JT	AXIAL	SHEAR-Y	SHEAR-Z	TORSION	MOM-Y	MOM-Z
1	1	1	0.00	533.52	0.00	0.00	0.00	0.00
		2	0.00	-533.52	0.00	0.00	0.00	533.52
2	1	2	0.00	-91.48	0.00	0.00	0.00	-533.52
		3	0.00	91.48	0.00	0.00	0.00	373.42
3	1	3	0.00	-116.48	0.00	0.00	0.00	-373.42
		4	0.00	116.48	0.00	0.00	0.00	227.81
4	1	4	0.00	-141.48	0.00	0.00	0.00	-227.81
		5	0.00	141.48	0.00	0.00	0.00	50.96
5	1	5	0.00	-166.48	0.00	0.00	0.00	-50.96
		6	0.00	166.48	0.00	0.00	0.00	-240.39
6	1	6	0.00	72.36	0.00	0.00	0.00	240.39
		7	0.00	-72.36	0.00	0.00	0.00	-113.76
7	1	7	0.00	47.36	0.00	0.00	0.00	113.76
		8	0.00	-47.36	0.00	0.00	0.00	-54.57
8	1	8	0.00	22.36	0.00	0.00	0.00	54.57
		9	0.00	-22.36	0.00	0.00	0.00	-26.62
9	1	9	0.00	-2.64	0.00	0.00	0.00	26.62
		10	0.00	2.64	0.00	0.00	0.00	-31.25
10	1	10	0.00	25.00	0.00	0.00	0.00	31.25
		11	0.00	-25.00	0.00	0.00	0.00	0.00

***** END OF LATEST ANALYSIS RESULT *****

35. FINISH

Monday, March 21, 2011, 10:11 PM

STAAD PLANE

-- PAGE NO. 13

10.3M

***** END OF THE STAAD.Pro RUN *****

**** DATE= MAR 21,2011 TIME= 22: 8:18 ****

* For questions on STAAD.Pro, please contact *
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* *

REPRODUCTION

Monday, March 21, 2011, 10:11 PM

STAAD PLANE

-- PAGE NO. 14

10.3N

REPRODUCTION

10.4

Check 4x4 Cypress columns supporting pergola at reaction points B & C on pg 10.3.



$P = 864 \text{ lb}$ (worst case)

$A = 12.25 \text{ in}^2$
 $S_x = 7.146 \text{ in}^3$
 $l_e = 4.5'$
 $d = 3\frac{1}{2}"$
 $l_e/d = 15.43" \leq 50 \text{ OK}$
 $E_{min} = 470,000$
 $E'_{min} = 470,000$

$F_c' = F_c C_D C_M C_E C_F C_i C_p$
 $F_c = 900 \text{ psi (NO.2)}$
 $C_D = 0.9$
 $C_M = 1.0$
 $C_E = 1.0$
 $C_F = 1.15$
 $C_i = 1.0$
 $C_p = 0.999$
 $C_T = 1.0$

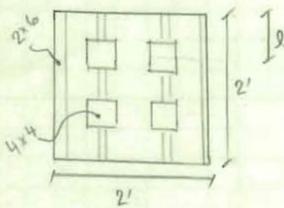
$F_c^* = 931.5$
 $F_{cE} = 0.882 E'_{min} / (l_e/d)^2 =$
 $\beta = F_{cE} / F_c^* = 1741.1436$
 $C = 0.8$
 $C_p = \frac{1+\beta}{2C} - \sqrt{\left(\frac{1+\beta}{2C}\right)^2 - \frac{\beta}{C}}$
 $C_p = 1088.84 - 1087.84$
 $C_p = 0.999$

$F_c' = 922.185 \text{ psi}$ $\sigma_{axial} = P/A = 70.53 \text{ psi}$

$922.185 > 70.53 \text{ psi}$ OK

Check Bottom support

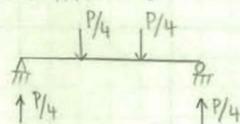
① Plan View



$l = 8"$

Each column carries $P/4 \text{ lbs} = 216 \text{ lbs}$

check the 2x6



$M_{max} = P/4 (l)$
 $= 1728 \text{ lb-in}$

$V_{max} = P/4 = 216 \text{ lbs}$

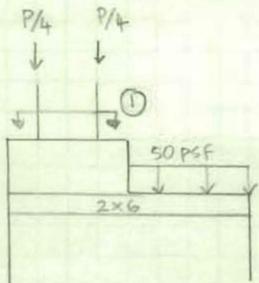
$A = 8.25 \text{ in}^2$
 $S_x = 7.563 \text{ in}^3$

$\tau = V/A = 26.18 \text{ psi}$
 $\sigma = M/S_x = 228.48 \text{ psi}$

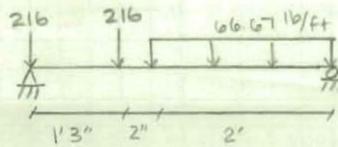
OK

10.5

Check Built in Bench



$$w = 50 \text{ psf} (1.33 \text{ ft o.c.}) = 66.67 \text{ lb/ft}$$



$$\Sigma F_y = 216 + 216 + 66.67(2) = A_y + B_y$$

$$A_y + B_y = 565.34 \text{ lbs}$$

$$\Sigma M_A = 216(1'3'') + 66.67(2)(2'5'') - B_y(3'5'')$$

$$B_y = 173.33$$

$$A_y = 392.01$$

$$V_{\max} = 173.33 \text{ lbs}$$

$$M_{\max} = 220 \text{ lb-ft}$$

$$= 2640 \text{ lb-in}$$

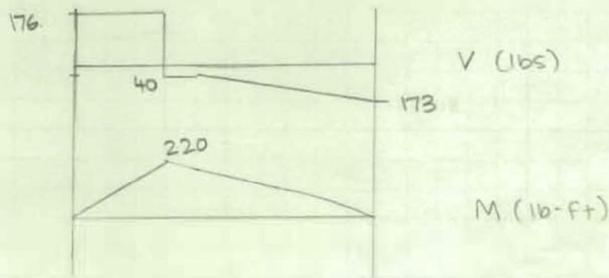
$$A = 8.25 \text{ in}^2$$

$$S_x = 7.563 \text{ in}^3$$

$$\tau = 21.01 \text{ psi}$$

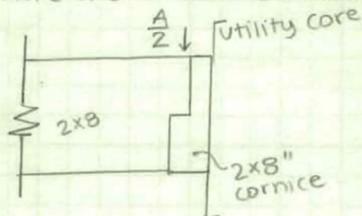
$$\sigma = 348.84 \text{ psi}$$

OK



→ Check loads from pergola to utility core at reaction point A from pg. 10.3

There are 2 2x8 so assume each carries $\frac{1}{2}$ the load.



$$A = \frac{1}{2}(10.88 \text{ in}^2) = 5.44 \text{ in}^2$$

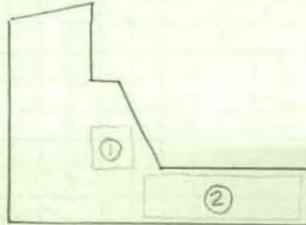
$$P = A/2 = 534/2 = 267 \text{ lbs}$$

$$\tau = P/A = 49.08 \text{ psi}$$

OK

1D.6

check Water Tanks inside the Utility Core



Volume (gal)	60	500
Volume (ft ³)	8	66.67
Density H ₂ O	62.4	62.4
Weight	500	4160

→ For tank ②

$$\text{Min req area} = 4160 \text{ lbs} \left(\frac{\text{sf}}{1500 \text{ lb}} \right) = 2.77 \text{ sf}$$

Given:

$$2 \times 6 \text{ @ } 16'' \text{ o.c. for } 2'10'' \text{ span}$$

$$A = (1\frac{1}{2} \times 2'10'') = 0.354 \text{ sf}$$

$$\text{Req joists} = \frac{2.77 \text{ sf}}{0.354 \text{ sf}} = 7.82 \text{ joists}$$

$$\text{For } 11' \text{ span @ } 16'' \text{ o.c. } \Rightarrow \frac{11'}{16''} = 8.25 \text{ joists } > 7.82 \text{ joists}$$

OK

→ For tank ①

$$\text{Min req area} = 500 \text{ lbs} \left(\frac{\text{sf}}{1500 \text{ lb}} \right) = 0.33 \text{ sf}$$

Given 4 (2x4) columns

$$4 (1\frac{1}{2} \times 3\frac{1}{2}) = 0.146 \text{ sf} \quad \text{NG}$$

$$8 (1\frac{1}{2} \times 3\frac{1}{2}) = 0.292 \text{ sf} \quad \text{NG}$$

$$4 (1\frac{1}{2} \times 5\frac{1}{2}) = 0.229 \text{ sf} \quad \text{NG}$$

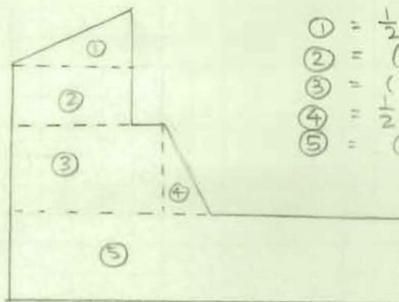
$$8 (1\frac{1}{2} \times 5\frac{1}{2}) = 0.458 \text{ sf} \quad \text{OK}$$

∴ support with
8 2x6 columns.

10.7

Dead Load of Utility Core

- 2x6 @ 16" o.c. = 1.4 psf
- 2x4 @ 16" o.c. = 0.9 psf
- Plywood (1/2") = 1.5 psf
- Siding (1/2") = 1.5 psf
- 4x4 column = 3 lb/ft
- Roofing (Metal) = 3 psf ??



- ① = $\frac{1}{2}(3'9'')(1'2'') = 2.1875 \text{ ft}^2$
- ② = $(3'9'')(2'9'') = 10.3125 \text{ ft}^2$
- ③ = $(5'3'')(5'2'') = 27.125 \text{ ft}^2$
- ④ = $\frac{1}{2}(5'2'')(1'5'') = 3.66 \text{ ft}^2$
- ⑤ = $(3'6'')(17'11'') = 62.71 \text{ ft}^2$

Depth = 3'4"

Walls

- 2x4 + Plywood + Siding = 3.9 psf
- (E/W) $A_1 = 106 \text{ ft}^2 \times 2 = 212 \text{ ft}^2$
- (South) $A_2 = (3'4'')(11'5'') = 38 \text{ ft}^2$
- (North) $A_3 = (3'4'')(4'11'' + 3'11'' + 4'0'') = 42.78 \text{ ft}^2$
- $A = 292.78 \text{ ft}^2$

Ⓐ Load = $3.9(292.78) = 1141.84 \text{ lbs}$

Roof

- Metal Roof = 3 psf
- Area = $(4'5'')(3'4'') = 14.72 \text{ ft}^2$

Ⓑ Load = 44 lbs

Floors

- 2x6 + Plywood = 2.9 psf
- $A = (17'11'')(3'4'')(2) = 120 \text{ ft}^2$

Ⓒ Load = 348 lbs

Columns

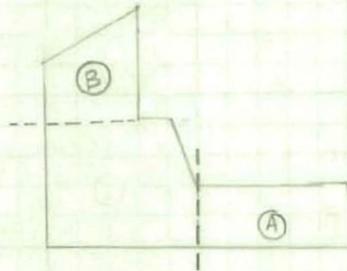
- columns - 3 lb/ft
- Length - 4'8" × 8 columns
- Load = 112 lbs

Total Dead Load = 1645.84 lbs

10.8

Check Bearing Capacity

Dead Load = 1645.84 lbs



(A) Add weight of bench (pg 10.5) and reaction loads B & C (pg. 10.3)

(B) Add reaction load A (pg 10.3) and the reaction of 3 (2x12) pergola joists (@ 45/2 lb each)

<p>(A) 50 psf (2')(2') = 200 lbs By = 864 lbs Cy = 653 lbs</p>	}	1720 lbs
<p>(B) Ay = 534 lb 2x12 = 70 lb</p>	}	605 lb
		2325 lbs

From pg 10.7 → Dead Load = 1650 lbs
From pg 10.8 → Load = $\frac{2325 \text{ lbs}}{3975 \text{ lbs}}$

Min req Area = $3975 \text{ lbs} \left(\frac{\text{sf}}{1500 \text{ lb}} \right) = 2.65 \text{ sf}$

Given:

(2) 2x4 along length of 17'10"

$2(3\frac{1}{2}'' \times 17'10'') = 10.4 \text{ sf} \geq 2.65 \text{ sf}$ OK

11.1

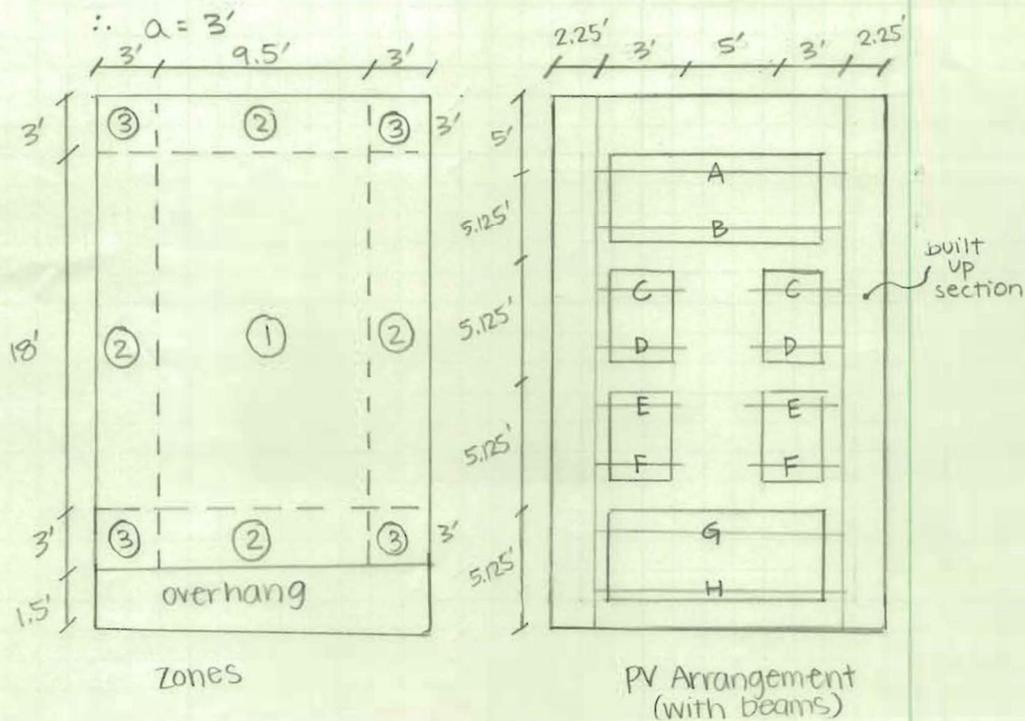
Photovoltaic Uplift Load on Sloped Roof

Using SolarMount™ Code-Compliant Installation Manual 227.3 the point uplift loads & down force loads at each connection are found. These loads are based on what zone the connection is in on the roof.

Below is a sketch showing the zones on the sloped roof → Gable Roof where $\theta = 14^\circ$

Find a:

$$\begin{aligned} 10\% \text{ of least horizontal dimension} &= 0.10 (15.5') = 1.55' \\ 0.4h &= 0.4 (15') = 6' \\ \text{Must be } \geq 4\% \text{ of least horiz dim} &= 0.04 (15.5') = 0.62' \\ \text{Must be } \geq 3' & \end{aligned}$$



Determine the length of each beam that lies in each zone. Use appropriate uplift point load to correspond to the number of connections to the roof in each zone. Convert these uplift values into a PSF value depending on the footprint of the PV array.

→ See spreadsheet for calcs.

PV Loading

		Roof				NOTES
		Zone 1	Zone 2	Zone 3	Overhang	
P_{net30} (psf)	Uplift	-16.5	-28.7	-42.4	-33.5	Effective Area = 10 sf
	Downforce	10.4	10.4	10.4	10.4	Wind Loads = 100 mph Exposure B, h = 15'
	λ	1	1	1	1	Topographical Factor
	K_{zt}	1	1	1	1	Importance Factor
	I	1	1	1	1	
	P_{netv} Up (psf)	-16.5	-28.7	-42.4	-33.5	$P_{net} = P_{net30} * \lambda * K_{zt} * I$
	P_{netv} Down (psf)	10.4	10.4	10.4	10.4	
	Dead (psf)	2.4	2.4	2.4	2.4	Given Weight of PV
	Snow (psf)	10	10	10	10	Norfolk Building Code
P_{Downv} Down force (psf)	Case 1	12.4	12.4	12.4	12.4	Dead + Snow
	Case 2	12.8	12.8	12.8	12.8	Dead + P_{net} Down
	Case 3	17.7	17.7	17.7	17.7	Dead + 0.75 Snow + 0.75 P_{net} Down
	Max	17.7	17.7	17.7	17.7	Max of 3 Cases
P_{Upv} Uplift (psf)	-15.06	-27.26	-40.96	-32.06	0.6 Dead + P_{net} Up	
	B (ft)	5.183	5.183	5.183	5.183	PV Module Length
	w, Downforce (plf)	45.873	45.873	45.873	45.873	$P_{Down} * B / 2$
	w, Uplift (plf)	-39.031	-70.649	-106.155	-83.089	$P_{Up} * B / 2$
	L (ft)	1	1	1	1	Given for attachment to metal roof
	R Down (lbs)	45.873	45.873	45.873	45.873	$P_{Down} * L * B / 2$
	R Up (lbs)	-39.031	-70.649	-106.155	-83.089	$P_{Up} * L * B / 2$
	R max (lbs)	45.873	70.649	106.155	83.089	Max of R up or R down
	Thread Depth (in)	0.149	0.230	0.346	0.271	Using No2 Southern Pine, $R_{max}/307$

Convert Rmax into a PSF uplift load on the roof

		Beam *	A	B	C	D	E	F	G	H	
Length (ft) & Num of Connections**	Zone 1	9	9	6	6	6	6	0	0		
	Zone 2	2	2	4	4	4	4	9	0		
	Zone 3	0	0	0	0	0	0	2	0		
	Overhang	0	0	0	0	0	0	0	0	11	
Load (lbs)	Zone 1	351.27	351.27	234.18	234.18	234.18	234.18	0.00	0.00		
	Zone 2	141.30	141.30	282.60	282.60	282.60	282.60	635.84	0.00		
	Zone 3	0.00	0.00	0.00	0.00	0.00	0.00	212.31	0.00		
	Overhang	0.00	0.00	0.00	0.00	0.00	0.00	0.00	913.98		
Total			492.57	492.57	516.78	516.78	516.78	516.78	848.15	913.98	4814.38
Area of PV Footprint (ft ²)			225.5								
Uplift on Roof (psf)			21.34982								

* See attached sketch for labeling of Beams

** Because the spacing of connections is at 1', then the length of the beam is equivalent to the number of connections for that beam in each zone

11.3

Solar Thermal Loading

Dry Weight (lbs)	153
Capacity (gal)	1.22
Conversion ft ³ /gal	0.133
Density of Water (pcf)	62.4
Total Wet Weight (lbs)	163.150
Length of Module (in)	121.187
Number of Connections (@12")	10.099
Load per Connection (lbs)	16.155
Width of Module (in)	47.187
Area of Module (ft ²)	39.711
Uplift on Roof (psf)	4.108

Total Uplift Force

PV	21.349817	psf
Solar Thermal	4.108	psf
Total Uplift Force	25.458	psf

REPRODUCTION

12.1

Planters

A Greywater Planters

Weight of soil:

$$\text{Volume: } 3/4'' \times 2'1'' \times 7'10'' = 54.4 \text{ CF}$$

$$\text{Density: } 100 \text{ lb/CF}$$

$$\text{Weight: } 5439.8 \text{ lb}$$

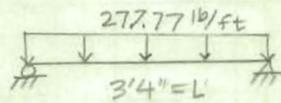
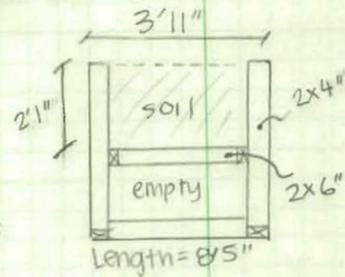
$$\text{Bearing Area: } (3/4'' \times 7'10'') = 26.11 \text{ CF}$$

Check False Floor

$$\text{Dead Load} = 5439.8 \text{ lb} / 26.11 \text{ CF} = 208 \text{ lb/CF}$$

$$\text{Trib Area} = 16''$$

$$\text{Linear Load on Joist} = 277.77 \text{ lb/ft}$$



$$V_{\text{max}} = WL/2 = 462.96 \text{ lb}$$

$$M_{\text{max}} = WL^2/8 = 385.8 \text{ lb-ft} \\ = 4629.62 \text{ lb-in}$$

$$\tau = V/A = 56.12 \text{ psi}$$

$$\sigma = M/S_x = 610.53 \text{ psi}$$

2x6

$$A = 8.25 \text{ in}^2$$

$$S_x = 7.583 \text{ in}^3$$

Find Allowables: No 2 So Pine

$$F_b = 1500 \text{ psi}$$

$$F_v = 175 \text{ psi}$$

$$C_p = 0.9 \text{ - Dead Load}$$

$$C_m = 1.0$$

$$C_t = 1.0$$

$$C_L = 1.0$$

$$C_F = 1.0$$

$$C_{fu} = 1.0$$

$$C_i = 1.0$$

$$C_r = 1.15$$

$$F_b' = F_b C_D C_M C_t C_L C_F C_{fu} C_i C_r = 1552.5 \text{ psi} \quad \boxed{\text{OK}}$$

$$F_v' = F_v C_D C_M C_t C_i = 157.5 \text{ psi} \quad \boxed{\text{OK}}$$

Check Bearing of planters

$$\text{Min Req. Area} = 5439.8 \text{ lb} \left(\frac{\text{sf}}{1500 \text{ lb}} \right) = 3.63 \text{ sf}$$

Given:

$$2(2 \times 4'') \text{ spanning } 8'5''$$

$$A = 2(3/2'' \times 8'5'') = 4.91 \text{ sf} \geq 3.63 \text{ sf} \quad \underline{\text{OK}}$$

12.2

ⓑ Southern Planters

Weight of Soil:

(worst case)
Volume = $2'6" \times 2'4" \times 8'8" = 50.55 \text{ ft}^3$

Density = 100 psf

Weight = 5,055.56 lbs

There is NO false floor in these planters. All bearing load is transferred directly to the ground through 2x6 @ 16" oc joists.

Min required area = $5,055.56 \text{ lbs} \left(\frac{\text{sf}}{1500 \text{ lbs}} \right) = 3.37 \text{ sf}$

Given:

ⓐ 2x6 along length of planter

ⓑ 2x6 @ 16" oc with span of 2'4"

Area of ⓐ = $1\frac{1}{2} \times 8'8" = 1.083 \text{ sf}$

Area of ⓑ = $1\frac{1}{2} \times 2'4" = 0.292 \text{ sf}$

Arequired = $2(A_{\text{ⓐ}}) + \# \text{ of joists } (A_{\text{ⓑ}})$

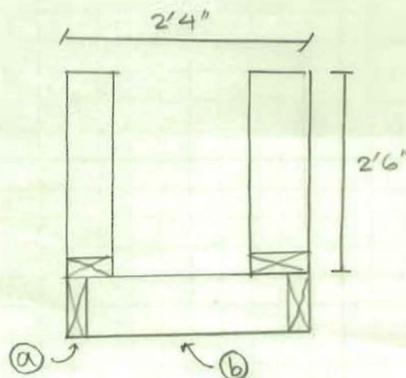
$3.37 = 2(1.083) + \# \text{ of joists } (0.292)$

of joists = 4.121

At a length of 8'8" with 16" spacing of joists, there will be

$\frac{8'8"}{16"} = 6.5 \text{ joists} > 4.121 \text{ joists}$

ok



Depth = 8'8" (Worst Case)

13.1

Check Rainwater Tank Bearing Load

Volume : 1,100 gal
 Conversion : 1,100 (0.133 ft³/gal) = 146.3 ft³
 Density of Water = 62.4 lb/ft³
 Weight = 9129.12

Minimum Req. Area = $9129.12 \left(\frac{\text{sf}}{1500 \text{ lbs}} \right) = 6.086 \text{ sf}$

Given Area

2x6" with span of 8'

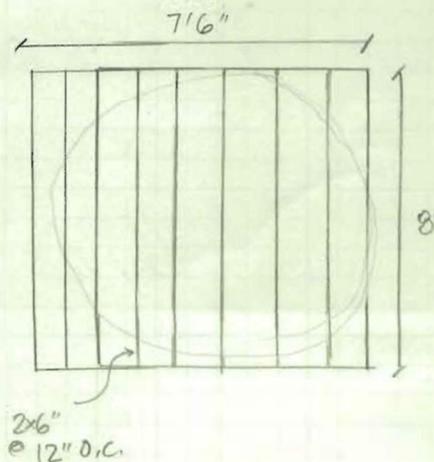
$1\frac{1}{2}'' \times 8' = 1 \text{ sf}$

Required 2x6 to meet area req.

$\frac{6.086 \text{ sf}}{1 \text{ sf}} = 6.086 \text{ joists}$

∴ Space joists at 12" o.c. over 7'6" length

$\frac{7'6''}{12''} = 7.5 \text{ joists} \geq 4 \text{ joists } \boxed{\text{OK}}$



Adjacent
HVAC compressor

Good by
comparison
to rainwater
collection
tank.

Detailed Water Budget

FUNCTION	WATER USE (GALLONS)	CALCULATIONS		NOTES
		GAL	EVENTS	
Hot Water Draws	240	15	16	
Water Vaporization	4	1	4	
Dishwasher	14.5	2.9	5	
Clothes Washer	105.6	13.2	8	
Vegetation	0			
Fire Protection	250			Organizer estimate for upper limit of demand
Thermal Storage Tanks	50			Hot Water Storage Tank for Solar Drainback System
Testing	32.1			One test run of each appliance plus HW and Cooking
Initial Systems Fill	11.4			Includes drainback reservoir
Solar Thermal Collectors	5			1 AET AE-40 collector, 4' x 10'
Aesthetic Purpose	0			Not Applicable
Radiant Flooring	0			Not Applicable
Safety Factor	71.26			10%
WATER REQUIRED	783.86	gallons		

Summary of Unlisted Electrical Components

All electrical components used in the design of Team Tidewater Virginia's Solar Decathlon house, Unit 6, shall carry an approved agency's listing per Section 6.7 of the Solar Decathlon Building Code.

Summary of Reconfigurable Features

Unit 6 includes the following reconfigurable features:

- The motorized window system for the north and south walls of the sunspace, used to invite or control solar heat gain in the house, depending on the season.
 - In cold months, the southern window is raised, while the northern window is lowered. This creates a sunspace, which adds heat to the house both directly and via natural convection through the open window to the kitchen.
 - In hot months, the northern window is closed, while the southern window is opened. This transforms the sunspace into a deep shaded porch, enticing residents out in the summer to interact with the neighbors as they enjoy a respite from the heat.
 - Sheet A-311 shows the window/wall section.

- A sliding shelving unit which controls circulation between the bedroom and living room.
 - When closed, the unit is integrated into a built-in entertainment center, and conceals the passage into the bedroom.
 - When opened the unit slides to the East, providing access to the bedroom.
 - The unit can moved from either room, and has a positive locking mechanism to ensure privacy.
 - The shelving unit can be seen in elevation in Sheet A-216, Drawing 2.

Interconnection Application Form

Team Tidewater Virginia, Lot #103

PV Systems

Module Manufacturer	Short Description of Array	DC Rating of Array (sum of the DC ratings)
Sanyo	2 branches, 6 panels per branch. Fixed array.	2.65KW
Bosch	1 string of 6 modules. Fixed array.	1.38 kW

Total DC power of all arrays is 4.1 kW (in tenths)

INVERTERS

Inverter Manufacturer	Model Number	Voltage	Rating (kVA or KW)	Quantity
Opti-Solar	GT-3000	450	3.0KW	1
Opti-Solar	GT-2000	450	2.0 kW	1

Total AC power of all inverters is 5 kW (in whole numbers)

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. (Example: B3/E-201)

1. One-Line Electrical schematic – the loads do not have to be detailed: A1/E-601,
2. Calculations of service/feeder net computer load and neutral load (NEC 220): B6, A6-7/E-601
3. Plan view of the lot showing the house, decks, ramps, tour paths, the service point and the distribution panel or load center: Figure 1

Provide the Team's "Electrical Engineer" contact in the "Team Officer Contact Info" database on the Yahoo Group as required per Rule 3-2.

Please see the "SD2011_Microgrid_Interconnection_Process_v1" file located the Files/Rules/Team Interconnection Process section of the Yahoo Group for more details on the interconnection process.

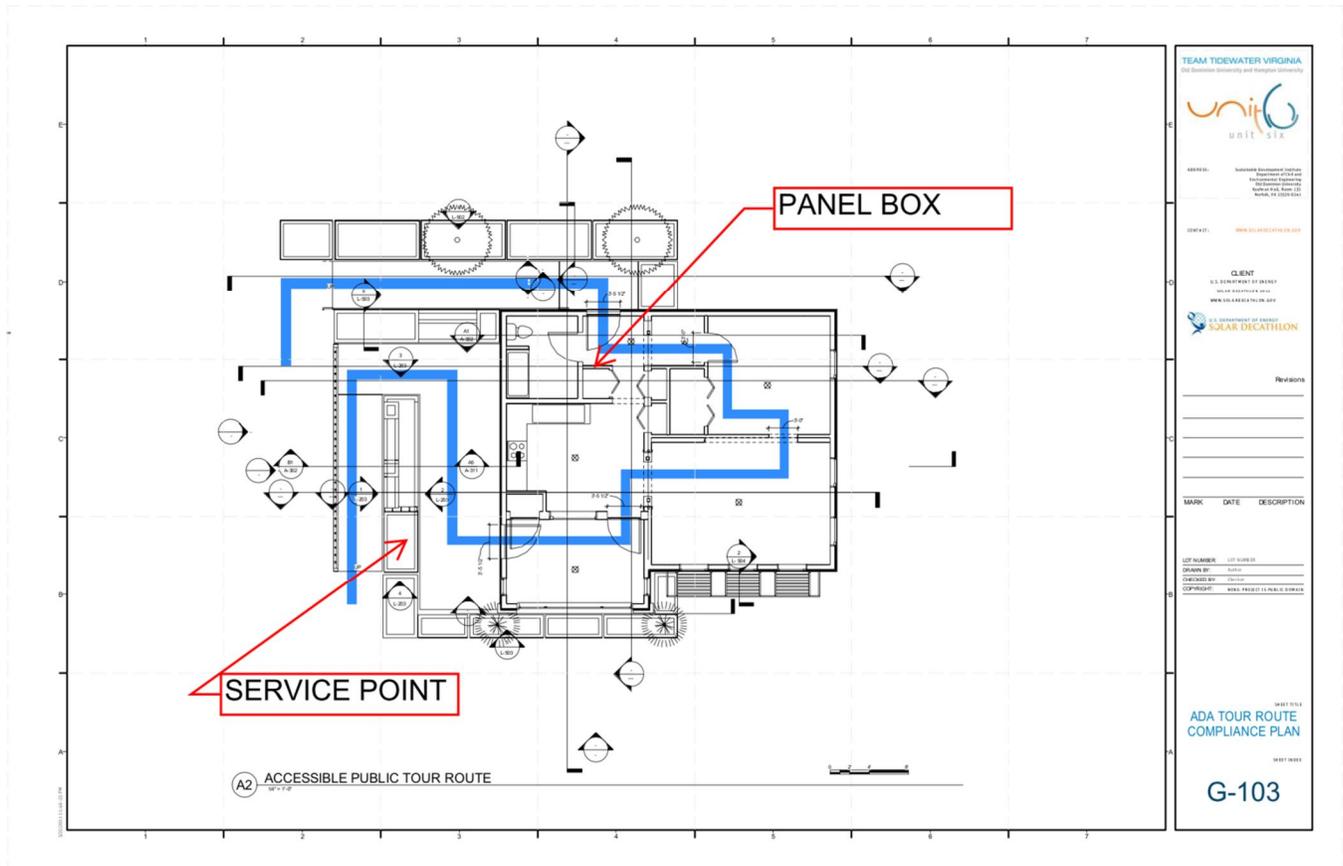


Figure 1 Drawing showing Panel Box, Service Point, and House, Decks, Tour Route

Energy Analysis Results and Discussion

A REM/Rate model of Unit6 was used to test the annualized performance of the house as designed and to examine alternatives in an effort to optimize cost-effective performance. Since the house design was modified repeatedly in response to the results of the energy model, the results presented here do not perfectly match the house as shown in the construction documents. However, it is the team's opinion that it represents an adequate estimate of the annual energy performance of the house when set in Norfolk, VA, facing South as designed.

Energy modeling requires many assumptions about the house occupants' behavior. Team Tidewater Virginia's approach to this is consistent with the Department of Energy's efforts to reduce consumption through efficiency and changed patterns of use. We have used typical lighting usage hours from the DOE Energy Information Administration's 1996 publication "Residential Lighting: Use and Potential Savings," average values for the various rooms; power for the light fixtures assumes either CFL or LED lamps. Appliances are a significant portion of the typical residential electrical load, but are very difficult to model accurately, since the per-use energy consumption is not published by most manufacturers. We estimated per-use energy consumption based on Energy Star baseline data acquired from the DOE's appliance energy savings calculators. These calculators are in Excel format and include a second worksheet which shows the underlying energy consumption assumptions. Since the appliances we specify are significantly more efficient than the Energy Star standard, we view the appliance consumption values as a conservative estimate. The number of uses per week was based on the two-person household for which the house is designed: 2 loads of laundry, 3 dishwasher loads, occasional cooking. In order to save capital costs, the design aims to provide net-zero housing at a moderate level of consumption. Occupants who chose to purchase 72" televisions and leave them on for many hours or to wash 6 loads of laundry each week will find the house underpowered and will have to pay for the additional consumption.

Heating and cooling loads are a major portion of the energy load for most North American houses. The REM/Rate model takes detailed input on the building envelope and calculates a whole house heat loss coefficient. It then uses the climate information for the permanent location of the house and the efficiency rating of the HVAC equipment to calculate annual energy consumption to meet that load. In the model of Unit6, the insulation levels were modified repeatedly in response to both model results and to constructability concerns as the design developed. The results shown here have the house slightly better insulated than the final constructed version is likely to be, and a slightly positive energy consumption over the course of a year: Estimated \$4 of energy use annually. This suggests an increase in insulation or in power supply may be appropriate in order to achieve net zero, however REM/Rate is known to underestimate sunspace thermal performance compared to other residential energy modeling programs, and a central part of the Unit6 design is a convertible sunspace. It is likely that the sunspace will contribute more to winter heating than is modeled, and since the sunspace becomes an open porch in warm months, it will not have a deleterious effect on cooling loads. With the addition of BioPCM phase change material to the sunspace in favor of concrete flooring, the release of stored heat from the sunspace will be timed optimally for when it is needed: at the point at which the

room begins to drop below 73 degrees F. This will again improve the thermal performance of the sunspace compared to the modeled result. The PCM used has a latent heat of fusion of 209J/g, which means that with 65kg of PCM in the floor the space can store 13,000 Btu at room temperature, approximately half of the anticipated daily heat flow into the space in winter from solar radiation. With the addition of an extra 1.4 kW PV array, Unit6 will perform at better than net zero energy on an annual basis in Norfolk, VA. The following pages show key elements of the input summary and the primary output charts from the REM/Rate model for Unit6 of 03-08-2011, without the additional array. The input summaries show the cavity and stud thermal resistances, the air barrier and wall/ceiling/floor coverings, and the calculated conductivity and area for the given surface, which are all based on the input data from the BIM and specifications. The REM/Rate model also takes inputs including appliances specs and usage rates, lighting profiles, HVAC equipment specs, solar collection equipment, and location. It accesses a large library of climate files to find the appropriate heating and cooling loads and solar irradiation values. Then it calculates the annualized performance of the building. Information provided includes a comparison with a standard code-compliant new house, for HERS rating purposes. For the Solar Decathlon, the estimated annual loads and power generation values were more useful to us. The charts reproduced here show the estimated electrical energy consumption for the house. Power generation is shown as negative consumption, and the overall annual cost of power used by the house is \$4, about 40 kW at current Virginia rates.

Team Tidewater has chosen to install energy optimizing control systems for lights, HVAC, and motorized windows. The first two options are relatively easy to assess on a cost-benefit basis, however energy savings associated with control systems are very difficult to quantify since they depend on occupant habits. Intuitively, controls which ensure that lights are not left on when spaces are unoccupied or when daylight levels are sufficient must have a significant impact on electrical usage. These controls are relatively inexpensive so will almost certainly be incorporated into the house. However, we cannot make a reliable estimate of savings associated with it, so these savings will not be modeled.

REM/Rate Model Report Data

The following 9 pages show key input data summaries and the output charts from the March 8, 2011 REM/Rate model of Unit6.

BUILDING FILE REPORT

Solar_Decathlon_drawings&spec_3-02-11.blg

Page 3

Frame Floor: Solar Decathlon*****

Information From Quick Fill Screen:

Continous Insulation R-Value	0.0
Cavity Insulation R-Value	40.0
Cavity Insulation Thickness (in.)	9.3
Cavity Insulation Grade	1.0
Joist Size (w x h, in)	1.5 x 9.3
Joist Spacing (in oc)	16.0
Framing Factor - (defined)	0.1000
Floor Covering	HARDWOOD

Note:

Layers	Paths		
	Cavity	Framing	Grade
Inside Air Film	0.920	0.920	0.920
Floor covering	0.680	0.680	0.680
Subfloor	0.820	0.820	0.820
Cavity ins	40.000	0.000	0.000
Continuous ins	0.000	0.000	0.000
Framing	0.000	11.625	0.000
	0.000	0.000	0.000
Outside Air Film	0.920	0.920	0.920
Total R-Value	43.340	14.965	3.340
U-Value	0.023	0.067	0.299
Relative Area	0.900	0.100	0.000
UA	0.021	0.007	0.000

Total Component UA: 0.027

Total Component Area: 1.0

Component Uo: 0.027

Above-Grade Wall:	1	2	3
Name	North	North Cathedral	East
Library Type	solar dec. ext wall*****	solar dec. ext wall*****	solar dec. ext wall*****
Gross Area(sq ft)	272.66	95.30	211.33
Exterior Color	Medium	Medium	Medium
Location	Cond -> ambient	Cond -> ambient	Cond -> ambient
Uo Value	0.045	0.045	0.045

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Page 4

Above-Grade Wall:	4	5	6
Name	East Cathedral	West to Sunspace	West to outside
Library Type	solar dec. ext wall*****	solar dec. ext wall*****	solar dec. ext wall*****
Gross Area(sq ft)	121.20	39.33	169.00
Exterior Color	Medium	Medium	Medium
Location	Cond -> ambient	Cond -> garage	Cond -> ambient
Uo Value	0.045	0.045	0.045
Above-Grade Wall:	7	8	9
Name	West Cathedral	South to Outside	South to Sunspace
Library Type	solar dec. ext wall*****	solar dec. ext wall*****	solar dec. ext wall*****
Gross Area(sq ft)	121.20	152.00	112.42
Exterior Color	Medium	Medium	Medium
Location	Cond -> ambient	Cond -> ambient	Cond -> garage
Uo Value	0.045	0.045	0.045

BUILDING FILE REPORT

Solar_Decathlon_drawings&spec_3-02-11.blg

Page 5

Above-Grade Wall: solar dec. ext wall*****

Information From Quick Fill Screen:

Standard Wood Frame

Continuous Insulation (R-Value)	0.0
Frame Cavity Insulation (R-Value)	27.0
Frame Cavity Insulation Thickness (in)	5.5
Frame Cavity Insulation Grade	1
Stud Size (w x d, in)	1.5 x 5.5
Stud Spacing (in o.c.)	16.0
Framing Factor - (defined)	0.1400
Gypsum Thickness (in)	0.5

Note:

Layers	Paths		
	Cavity	Framing	Grade
Inside Air Film	0.680	0.680	0.680
Gyp board	0.450	0.450	0.450
Air Gap/Frm	0.000	0.000	0.000
Cavity ins/Frm	27.000	6.875	1.030
Continuous ins	0.000	0.000	0.000
Ext Finish	0.940	0.940	0.940
	0.000	0.000	0.000
Outside Air Film	0.170	0.170	0.170
Total R-Value	29.240	9.115	3.270
U-Value	0.034	0.110	0.306
Relative Area	0.860	0.140	0.000
UA	0.029	0.015	0.000

Total Component UA: 0.045

Total Component Area: 1.0

Component Uo: 0.045

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Page 6

Window Information:	1	2	3
Name	South to outside	South to sunspace	North
Library Type	Triple - Vinyl 19.6*****	Triple - Vinyl*****	Triple - Vinyl*****
U-Value	0.190	0.142	0.142
SHGC	0.600	0.470	0.470
Area(sq ft)	45.28	35.00	21.00
Orientation	South	South	North
Overhang Depth	2.6	0.0	0.0
Overhang To Top	1.2	0.0	0.0
Overhang To Bottom	6.9	0.0	0.0
Interior Winter Shading	0.85	0.85	0.85
Interior Summer Shading	0.50	0.50	0.50
Adjacent Winter Shading	None	None	None
Adjacent Summer Shading	None	None	None
Wall Assignment	AGWall 8	AGWall 9	AGWall 1

Window Information:	4	5
Name	North cathedral	East
Library Type	Triple - Vinyl*****	Triple - Vinyl*****
U-Value	0.142	0.142
SHGC	0.470	0.470
Area(sq ft)	37.50	45.30
Orientation	North	East
Overhang Depth	0.0	0.0
Overhang To Top	0.0	0.0
Overhang To Bottom	0.0	0.0
Interior Winter Shading	0.85	0.85
Interior Summer Shading	0.50	0.50
Adjacent Winter Shading	None	None
Adjacent Summer Shading	None	None
Wall Assignment	AGWall 2	AGWall 3

Window: Triple - Vinyl 19.6*****

U-Value: 0.190
 Solar Heat Gain Coefficient: 0.600
 Note:

Window: Triple - Vinyl*****

U-Value: 0.142
 Solar Heat Gain Coefficient: 0.470
 Note:

BUILDING FILE REPORT

Solar_Decathlon_drawings&spec_3-02-11.blg

Page 7

Door Information:	1	2
Name	North - Front	South - Sunspace
Opaque Area(sq ft)	25.6	25.6
Library Type	Solar Decathlon	Solar Decathlon
Wall Assignment	AGWall 1	AGWall 5
Uo Value	0.126	0.126

Door: Solar Decathlon

R-Value of Opaque Area: 7.0
 Storm Door: No
 Note:

Roof Information:	1	2
Name	Flat Ceiling	Cathedral Ceiling
Library Type	Solar Decathlon Ceil0*****0*****	Solar Decathlon Ceil0*****0*****
Gross Area(sq ft)	573.00	407.00
Color	Dark	Dark
Radiant Barrier	No	No
Type(Attic)	Attic	Attic
Uo Value	0.033	0.033

BUILDING FILE REPORT

Solar_Decathlon_drawings&spec_3-02-11.blg

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Ceiling: Solar Decathlon Ceil0***0*******

Information From Quick Fill Screen:

Continous Insulation (R-Value)	0.0
Cavity Insulation (R-Value)	40.0
Cavity Insulation Thickness (in)	5.5
Cavity Insulation Grade	1
Gypsum Thickness (in)	0.500
Bottom Chord/Rafter Size(w x h, in)	1.5 x 5.5
Bottom Chord/Rafter Spacing (in o.c.)	16.0
Framing Factor - (defined)	0.1000
Ceiling Type	Attic

Note:

Layers	Paths		
	Framing	Cavity	Grade
Inside Air Film	0.610	0.610	0.610
Gyp board	0.450	0.450	0.450
Cavity Ins/Frm	6.875	40.000	0.000
Continuous ins	0.000	0.000	0.000
	0.000	0.000	0.000
	0.000	0.000	0.000
	0.000	0.000	0.000
Outside Air Film	0.610	0.610	0.610
Total R-Value	8.545	41.670	1.670
U-Value	0.117	0.024	0.599
Relative Area	0.100	0.900	0.000
UA	0.012	0.022	0.000

Total Component UA: 0.033

Total Component Area: 1.0

Component Uo: 0.033

Mechanical Equipment: General

Number of Mechanical Systems:	3
Heating SetPoint(F):	71.00
Heating Setback Thermostat:	Present
Cooling SetPoint(F):	76.00
Cooling Setup Thermostat:	Present

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Page 9

ASHP: 12k 10seer 8.9hspf O***0*******

Fuel Type:	Electric
Heating Seasonal Efficiency:	8.90 HSPF
Compressor Heating Output Capacity at 17F (kBtuh):	11.0
Compressor Heating Output Capacity at 47F (kBtuh):	12.0
Electric Resistance Backup Capacity (kW):	5
Cooling Output Capacity (kBtuh):	18.0
Cooling Seasonal Efficiency:	18.00 SEER
Desuperheater:	No
Note:	
Location:	Conditioned area
Performance Adjustment:	100
% Heating Load Served:	53
% Cooling Load Served:	50
Number Of Units:	1

ASHP: 9k 10seer 8.9hspf O***0*******

Fuel Type:	Electric
Heating Seasonal Efficiency:	8.90 HSPF
Compressor Heating Output Capacity at 17F (kBtuh):	5.5
Compressor Heating Output Capacity at 47F (kBtuh):	9.0
Electric Resistance Backup Capacity (kW):	5
Cooling Output Capacity (kBtuh):	18.0
Cooling Seasonal Efficiency:	18.00 SEER
Desuperheater:	No
Note:	
Location:	Conditioned area
Performance Adjustment:	100
% Heating Load Served:	47
% Cooling Load Served:	50
Number Of Units:	1

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Page 10

Water Heating Equipment: Demand-Elec

Water Heater Type: Instant water heater
 Fuel Type: Electric
 Energy Factor: 1.00
 Recovery Efficiency: 0.00
 Water Tank Size (gallons): 0
 Extra Tank Insulation (R-Value): 0.0
 Note:
 Location: Conditioned area
 Percent Load Served: 100
 Performance Adjustment: 100
 Number Of Units: 1

Duct System Information:

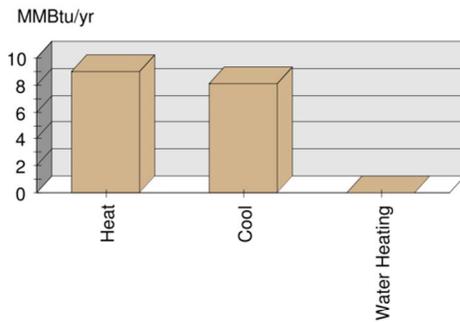
Name: Ductwork
 Heating System: 12k 10seer 8.9hspf O*****0*****
 Cooling System: 12k 10seer 8.9hspf O*****0*****
 Supply Area(sq ft): 129.7
 Return Area(sq ft): 24.0
 # of Registers: 1
Duct Leakage
 Qualitative Assessment - Not Applicable
 Total Duct Leakage: 0.00 CFM @ 25 Pascals
 Supply Duct Leakage - Not Applicable
 Return Duct Leakage - Not Applicable
 Duct Tightness Test: Postconstruction Test

Duct Information:	1	2
Type	Supply	Return
Percent Area	100.0	100.0
R-Value	0.0	0.0
Location	Conditioned space	Conditioned space

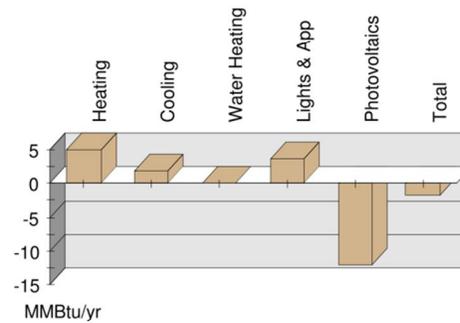
PERFORMANCE SUMMARY

Date:	March 08, 2011	Rating No.:
Building Name:		Rating Org.:
Owner's Name:		Phone No.:
Property:		Rater's Name:
Address:		Rater's No.:
Builder's Name:		
Weather Site:	Norfolk, VA	Rating Type:
File Name:	Solar_Decathlon_drawings&spec_3-02-11.blg	Rating Date:

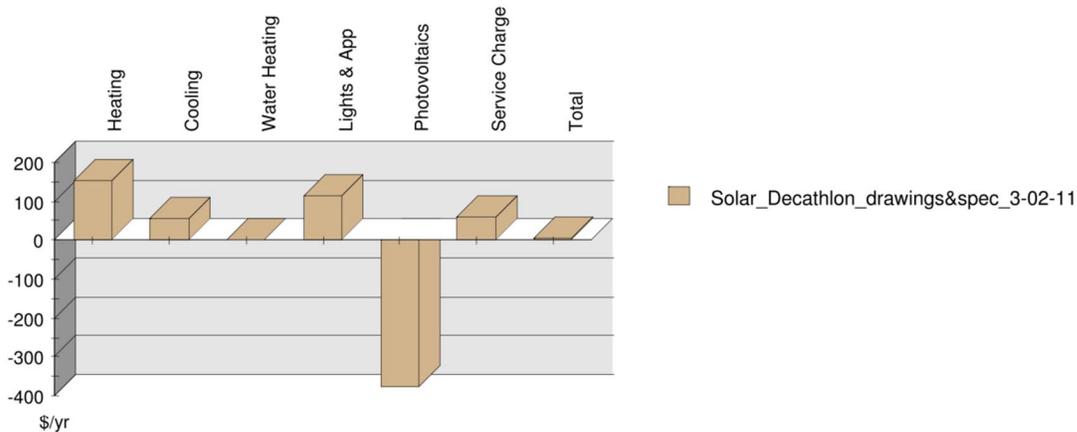
Annual Load



Annual Consumption



Annual Energy Cost



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This information does not constitute any warranty of energy cost or savings.
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Construction Specifications

Division 01 - General Requirements

01 00 00 General Requirements

Division 02 - Existing Conditions

Division 03 - Concrete

Division 04 - Masonry

Division 05 - Metals

05 50 00 Metal Fabrications

Division 06 - Wood, Plastics, and Composites

06 10 00 Rough Carpentry

06 15 00 Wood Decking

06 17 53 Shop-Fabricated Wood Trusses

06 20 00 Finish Carpentry

06 61 00 Fiberglass-Reinforced Plastic (FRP) Fabrications

Division 07 - Thermal and Moisture Protection

07 21 00 Thermal Insulation

07 21 16 Blanket Insulation

07 21 19 Foamed-In-Place Insulation

07 26 00 Vapor Retarder

07 41 13 Metal Roof

07 46 00 Siding

07 46 23 Wood Siding

07 54 50 Thermoplastic Polyolefin (TPO) Membrane Roofing

07 62 00 Sheet Metal Flashing and Trim

Division 08 - Openings

08 14 16 Flush Wood Doors

08 35 13 Folding Doors

08 55 00 Doors and Windows

08 71 00 Door Hardware

Division 09 - Finishes

09 21 16 Gypsum Board Assemblies

09 30 00 Tiling

09 62 23 Bamboo Flooring

09 90 00 Painting and Coating

Division 10 - Specialties

10 28 00 Toilet and Bath and Laundry Accessories

Division 11 - Equipment

11 31 00 Residential Appliances

Division 12 - Furnishings

12 35 30 Residential Casework

Division 13 - Special Construction

13 42 00 Building Modules

- Division 14 – Conveying Equipment
- Division 21 – Fire Suppression
 - 21 05 00 Fire Suppression
 - 21 41 00 Storage Tanks for Fire Suppression
- Division 22 – Plumbing
 - 22 05 00 Common Work Results for Plumbing
 - 22 07 19 Plumbing Piping Insulation
 - 22 10 00 Plumbing Piping and Pumps
 - 22 30 00 Plumbing Equipment
 - 22 40 00 Plumbing Fixtures
- Division 23 – Heating, Ventilating, and Air-Conditioning (HVAC)
 - 23 07 00 HVAC Insulation
 - 23 23 00 Refrigerant Piping
 - 23 30 00 HVAC Air Distribution
 - 23 31 00 HVAC Ducts
 - 23 56 13 Heating Solar Collectors
 - 23 81 26 Split-System Air Conditioners
- Division 25 – Integrated Automation
- Division 26 – Electrical
 - 26 05 00 Common Work Results for Electrical
 - 26 05 19 Low Voltage Electrical Power Conductors and Cables
 - 26 05 26 Grounding and Bonding for Electrical Systems
 - 26 05 33 Raceways and Boxes for Electrical Systems
 - 26 09 23 Lighting Control Devices
 - 26 24 16 Panel Boards
 - 26 27 26 Wiring Devices
 - 26 31 00 Photovoltaic Collectors
 - 26 50 00 Lighting
 - 26 51 00 Interior Lighting
 - 26 56 00 Exterior Lighting
- Division 27 – Communications
- Division 28 – Electronic Safety and Security
 - 28 16 00 Intrusion Detection
 - 28 31 00 Fire Detection and Alarm
- Division 31 – Earthwork
 - 316616 Temporary Foundations
- Division 32 – Exterior Improvements
 - 32 94 00 Plant Accessories
- Division 33 – Utilities
- Division 34 – Transportation
- Division 40 – Process Integration
- Division 48 – Electrical Power Generation

SECTION 01 00 00

GENERAL REQUIREMENTS

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Summary:
 - 1. Contract description.
 - 2. Work by Owner.
 - 3. Contractor's use of premises.
 - 4. Future work.
 - 5. Specification conventions.

- B. Price and Payment Procedures:
 - 1. Cash allowances.
 - 2. Contingency allowances.
 - 3. Testing and inspection allowances.
 - 4. Schedule of values.
 - 5. Applications for payment.
 - 6. Change procedures.
 - 7. Unit prices.
 - 8. Alternates.

- C. Administrative Requirements:
 - 1. Coordination.
 - 2. Field engineering.
 - 3. Meetings.
 - 4. Progress meetings.
 - 5. Equipment electrical characteristics and components.
 - 6. Cutting and patching.

- D. Submittals:
 - 1. Submittal procedures.
 - 2. Construction progress schedules.
 - 3. Proposed products list.
 - 4. Product data.
 - 5. Shop drawings.
 - 6. Samples.
 - 7. Manufacturer's instructions.
 - 8. Manufacturer's certificates.

- E. Quality Requirements:
 - 1. Quality control.
 - 2. Tolerances.

3. References.
 4. Labeling.
 5. Mock-ups.
 6. Testing and inspection laboratory services.
 7. Manufacturer's field services and reports.
 8. Examination.
 9. Preparation.
- F. Temporary Facilities and Controls:
1. Temporary electricity.
 2. Temporary lighting for construction purposes.
 3. Temporary heating and cooling.
 4. Temporary ventilation.
 5. Telephone and facsimile service.
 6. Temporary water service.
 7. Temporary sanitary facilities.
 8. Field offices and sheds.
 9. Access roads.
 10. Parking.
 11. Progress cleaning and waste removal.
 12. Project identification.
 13. Fire prevention facilities.
 14. Barriers and fencing.
 15. Enclosures.
 16. Protection of installed work.
 17. Security.
 18. Water control.
 19. Pollution and environmental control.
 20. Removal of utilities, facilities, and controls.
- G. Product Requirements:
1. Products.
 2. Delivery, handling, storage, and protection.
 3. Product options.
 4. Substitutions.
- H. Execution Requirements:
1. Closeout procedures.
 2. Final cleaning.
 3. Starting of systems.
 4. Demonstration and instructions.
 5. Testing, adjusting and balancing.
 6. Protecting installed construction.
 7. Project record documents.
 8. Operation and maintenance data.
 9. Spare parts and maintenance materials.
 10. Warranties.

1.2 CONTRACT DESCRIPTION

- A. Work of the Project includes construction of Unit Six, a single family dwelling for Team Tidewater, Virginia.
- B. Perform Work of Contract under a [stipulated sum] [fixed cost] [cost plus a percentage fee] [_____] contract with Owner in accordance with Conditions of Contract.

1.3 WORK BY OWNER

- A. Owner has awarded contracts for supply and installation of [all components to construct Unit Six] which will commence on June 01, 2011. Work under these contracts will include: [_____].
- B. Items noted as NIC (Not in Contract), movable cabinets, furnishings, minor equipment, appliances and electronics will be furnished and installed by Owner after Substantial Completion.

1.4 CONTRACTOR'S USE OF PREMISES

- A. Limit use of premises to allow:
 - 1. Owner occupancy.
 - 2. Work by others and work by Owner.
 - 3. Work sequence to allow [_____].
 - 4. Use of premises by private Owner and approved Contractors.

1.5 FUTURE WORK

- A. Project is designed for future design research.
- B. Provide fixed foundation for future installation of permanent placement of Unit Six at location TBD.

1.6 SPECIFICATION CONVENTIONS

- A. These specifications are written in imperative mood and streamlined form. This imperative language is directed to the Contractor, unless specifically noted otherwise. The words "shall be" are included by inference where a colon (:) is used within sentences or phrases.

1.7 CASH ALLOWANCES

- A. Costs Included in Allowances: Cost of Product to Contractor or subcontractor, less applicable trade discounts; delivery to site and applicable taxes.
- B. Costs Not Included in Allowances But Included in Contract Sum/Price: Product delivery to site and handling at the site, including unloading, uncrating, and storage; protection of Products from elements and from damage and labor for installation and finishing.
- C. Difference in cost will be adjusted by Change Order.

D. Allowances Schedule:

1. Section [_____-_____]: Allow stipulated sum of \$[_____] for purchase and delivery of [_____].
2. Section [_____-_____]: Allow stipulated sum of \$[_____] for purchase, delivery, and installation of [_____].

1.8 CONTINGENCY ALLOWANCES

- A. Include in the Contract, stipulated amount of \$250,000.00 for use upon Owner's instruction.
- B. Contractor's costs for Products, delivery, installation, labor, insurance, payroll, taxes, bonding, equipment rental, overhead and profit are included in Change Orders authorizing expenditure of funds from this Contingency Allowance.

1.9 TESTING AND INSPECTION ALLOWANCES

- A. Testing and Inspection Allowances: Include in the Contract, sum of \$0.00 for payment of testing and inspection services.
- B. Costs Included in Allowance: Cost of engaging testing or inspection firm, execution of tests or inspection, and reporting of results.
- C. Costs Not Included in Allowance:
 1. Incidental labor and facilities required to assist testing or inspection firm.
 2. Costs of re-testing upon failure of previous tests as determined by Architect/Engineer.
- D. Costs will be drawn from testing and inspection allowances by Change Order.
- E. Reports will be submitted by independent firm to Architect/Engineer, Contractor, and authority having jurisdiction, in Norfolk, Virginia indicating observations and results of tests and indicating compliance or non-compliance with Contract Documents.
 1. Submit final report indicating correction of Work previously reported as non-compliant.
- F. Agency Reports: After each test, promptly submit two physical copies of report to Architect/Engineer, Contractor, and authority having jurisdiction. When requested by Architect/Engineer, provide interpretation of test results. Include the following:
 1. Date issued.
 2. Project title and number.
 3. Name of inspector.
 4. Date and time of sampling or inspection.
 5. Identification of product and specifications section.
 6. Location in Project.
 7. Type of inspection or test.
 8. Date of test.
 9. Results of tests.
 10. Conformance with Contract Documents.

1.10 SCHEDULE OF VALUES

- A. Submit schedule on AIA Form G703.
- B. Submit Schedule of Values in duplicate within 15 days after date of Owner-Contractor Agreement.

1.11 APPLICATIONS FOR PAYMENT

- A. Submit three physical copies of each application on AIA Form G702 and G703.
- B. Content and Format: Utilize Schedule of Values for listing items in Application for Payment.
- C. Payment Period: Monthly.

1.12 CHANGE PROCEDURES

- A. Stipulated Sum/Price Change Order: Based on Proposal Request and Contractor's request for Change Order as approved by Architect/Engineer.
- B. Change Order Forms: AIA G701.
- C. Unit Price Change Order: For pre-determined unit prices and quantities, Change Order will be executed on fixed unit price basis. For unit costs or quantities of units of work which are not pre-determined, execute Work under Construction Change Directive. Changes in Contract Sum/Price or Contract Time will be computed as specified for Time and Material Force Account Change Order.

1.13 UNIT PRICES

- A. Architect/Engineer will take measurements and compute quantities accordingly. Provide and assist in taking of measurements.
- B. Unit Price Schedule:
 - 1. [Item: [_____]; Section [_____].]
 - 2. [Item: [_____]; Section [_____].]
 - 3. [Item: [_____]; Section [_____].]

1.14 COORDINATION

- A. Coordinate scheduling, submittals, and Work of various sections of specifications to ensure efficient and orderly sequence of installation of interdependent construction elements.
- B. Verify utility requirement characteristics of operating equipment are compatible with building utilities.

- C. Coordinate space requirements and installation of mechanical and electrical work indicated diagrammatically on Drawings. Follow routing shown for pipes, ducts, and conduit, as closely as practicable.
- D. In finished areas, conceal pipes, ducts, and wiring within construction.

1.15 FIELD ENGINEERING

- A. [Owner will] [Employ [Land Surveyor] [experienced instrument technician] to] locate reference datum and protect survey control and reference points.
- B. Establish elevations, lines, and levels and certify elevations and locations of the Work conform with Contract Documents.
- C. Verify field measurements are as indicated on shop drawings or as instructed by manufacturer.

1.16 [PRECONSTRUCTION] [SITE MOBILIZATION] [PREINSTALLATION] MEETINGS

- A. [Owner] [Architect/Engineer] will schedule [preconstruction] [site mobilization] meeting after [Notice of Award] [_____] for affected parties.
- B. When required in individual specification section, convene preinstallation meeting at [Project site] [_____] prior to commencing work of section.

1.17 PROGRESS MEETINGS

- A. Schedule and administer meetings throughout progress of the Work at maximum [monthly] [bi-monthly] [_____] intervals.
- B. Preside at meetings, record minutes, and distribute copies within [two] [_____] days to those affected by decisions made.

1.18 CUTTING AND PATCHING

- A. Employ [original] [skilled and experienced] installer to perform cutting and patching new Work; restore Work with new Products.
- B. [Submit written] request in advance of cutting or altering structural or building enclosure elements.
- C. Execute cutting, fitting, and patching [including excavation and fill,] to complete Work, and to:
 1. Fit several parts together, to integrate with other Work.
 2. Uncover Work to install or correct ill-timed Work.
 3. Remove and replace defective and non-conforming Work.
 4. Remove samples of installed Work for testing.
 5. Provide openings in elements of Work for penetrations of mechanical and electrical Work.

- D. Cut masonry and concrete materials using masonry saw or core drill. Restore Work with new Products in accordance with requirements of Contract Documents.
- E. Fit Work tight to adjacent elements. Maintain integrity of wall, ceiling, or floor construction; completely seal voids.
- F. Fit Work tight to pipes, sleeves, ducts, conduit, and other penetrations through surfaces.
- G. Refinish surfaces to match adjacent finishes.

1.19 SUBMITTAL PROCEDURES

- A. Submittal form to identify Project, Contractor, subcontractor or supplier; and pertinent Contract Document references.
- B. Apply Contractor's stamp, signed or initialed, certifying that review, verification of Products required, field dimensions, adjacent construction Work, and coordination of information is in accordance with requirements of the Work and Contract Documents.
- C. Identify variations from Contract Documents and Product or system limitations which may be detrimental to successful performance of completed Work.
- D. Revise and resubmit submittals as required; identify changes made since previous submittal.

1.20 CONSTRUCTION PROGRESS SCHEDULES

- A. Submit initial progress schedule in duplicate within [15] [20] [_____] days after date [of Owner-Contractor Agreement] [established in Notice to Proceed] for Architect/Engineer review.
- B. Submit revised schedules with [each] [_____] Application for Payment, identifying changes since previous version. Indicate estimated percentage of completion for each item of Work at each submission.
- C. Submit [horizontal bar] [_____] chart with separate line for each [major section of Work or operation] [section of Work], identifying first work day of each week.

1.21 PROPOSED PRODUCTS LIST

- A. Within [15] [_____] days after date of [Owner-Contractor Agreement] [Notice to Proceed], submit list of major Products proposed for use, with name of manufacturer, trade name, and model number of each product.

1.22 PRODUCT DATA

- A. Product Data:
 - 1. Submitted to Architect/Engineer for review for limited purpose of checking for conformance with information given and design concept expressed in Contract Documents.

2. After review, provide copies and distribute in accordance with SUBMITTAL PROCEDURES article and for record documents purposes as specified.

- B. Submit number of copies which Contractor requires, plus [two] [_____] copies which will be retained by Architect/Engineer.
- C. Mark each copy to identify applicable products, models, options, and other data. Supplement manufacturer's standard data to provide information unique to this project.

1.23 SHOP DRAWINGS

- A. Shop Drawings:
 1. Submitted to Architect/Engineer for review for limited purpose of checking for conformance with information given and design concept expressed in Contract Documents.
 2. After review, provide copies and distribute in accordance with SUBMITTAL PROCEDURES article and for record documents purposes as specified.
- B. When required by individual specification sections, provide shop drawings signed and sealed by professional engineer responsible for designing components shown on shop drawings.
 1. Include signed and sealed calculations to support design.
 2. Submit drawings and calculations in form suitable for submission to and approval by authorities having jurisdiction.
 3. Make revisions and provide additional information when required by authorities having jurisdiction.
- C. Submit in form of one reproducible transparency [and [one] [_____] opaque reproduction].

***** [OR] *****

- D. Submit number of opaque reproductions Contractor requires, plus [two] [_____] copies which will be retained by Architect/Engineer.

1.24 SAMPLES

- A. Samples for Review:
 1. Submitted to Architect/Engineer for review for limited purpose of checking for conformance with information given and design concept expressed in Contract Documents.
 2. After review, provide copies and distribute in accordance with SUBMITTAL PROCEDURES article and for record documents purposes as specified.
- B. Samples For Selection:
 1. Submitted to Architect/Engineer for aesthetic, color, or finish selection.
 2. Submit samples of finishes [from full range of manufacturer's standard colors,] [in custom colors selected,] textures, and patterns for Architect/Engineer selection.
 3. After review, provide copies and distribute in accordance with SUBMITTAL PROCEDURES article and for record documents purposes as specified.

- C. Submit samples to illustrate functional and aesthetic characteristics of Product.
- D. Submit samples of finishes [from full range of manufacturer's standard colors] [in custom colors selected], textures, and patterns for Architect/Engineer's selection.

1.25 MANUFACTURER'S INSTRUCTIONS

- A. When specified in individual specification sections, submit manufacturer printed instructions for delivery, storage, assembly, installation, [start-up,] adjusting, and finishing, in quantities specified for Product Data.

1.26 MANUFACTURER'S CERTIFICATES

- A. When specified in individual specification sections, submit certifications by manufacturer to Architect/Engineer, in quantities specified for Product Data.
- B. Indicate material or Product conforms to or exceeds specified requirements. Submit supporting reference data, affidavits, and certifications as appropriate.

1.27 QUALITY CONTROL

- A. Monitor quality control over suppliers, manufacturers, Products, services, site conditions, and workmanship, to produce Work of specified quality.
- B. Comply with manufacturer's instructions.
- C. Comply with specified standards as minimum quality for the Work except when more stringent tolerances, codes, or specified requirements indicate higher standards or more precise workmanship.

1.28 TOLERANCES

- A. Monitor fabrication and installation tolerance control of installed Products over suppliers, manufacturers, Products, site conditions, and workmanship, to produce acceptable Work. Do not permit tolerances to accumulate.
- B. Comply fully with manufacturer's tolerances.

1.29 REFERENCES

- A. Conform to reference standards by date of issue current as of date of Contract Documents.
- B. When specified reference standard conflict with Contract Documents, request clarification from Architect/Engineer before proceeding.

1.30 LABELING

- A. Attach label from agency approved by authority having jurisdiction for products, assemblies, and systems required to be labeled by [_____] [applicable] code.
- B. Label Information: Include manufacturer's or fabricator's identification, approved agency identification, and the following information, as applicable, on each label.
 - 1. Model number.
 - 2. Serial number.
 - 3. Performance characteristics.

1.31 MOCK-UPS

- A. Tests will be performed under provisions identified in this section and identified in respective product specification sections.
- B. Accepted mock-ups are representative of quality required for the Work.
- C. Where mock-up has been accepted by Architect/Engineer and is specified in product specification sections to be removed; remove mock-up and clear area when directed to do so.

1.32 TESTING AND INSPECTION LABORATORY SERVICES

- A. Owner will appoint, employ, and pay for specified services of independent firm to perform testing and inspection.

***** [OR] *****

- B. Owner will appoint and employ services of independent firm to perform testing and inspection. Pay for services from specified Cash Allowance.
- C. Independent firm will perform tests, inspections, and other services as required.
- D. Cooperate with independent firm; furnish samples as requested.
- E. Re-testing required because of non-conformance to specified requirements will be charged to Contractor.

1.33 MANUFACTURER'S FIELD SERVICES AND REPORTS

- A. When specified in individual specification sections, require material or Product suppliers or manufacturers to furnish qualified staff personnel to observe site conditions and to initiate instructions when necessary.
- B. Report observations and site decisions or instructions that are supplemental or contrary to manufacturer's written instructions.

1.34 EXAMINATION

- A. Verify existing site conditions and substrate surfaces are acceptable for subsequent Work. Beginning new Work means acceptance of existing conditions.
- B. Verify utility services are available, of correct characteristics, and in correct location.

1.35 PREPARATION

- A. Clean substrate surfaces prior to applying next material or substance.
- B. Apply manufacturer required or recommended substrate primer, sealer, or conditioner prior to applying new material or substance in contact or bond.

1.36 TEMPORARY ELECTRICITY

- A. [[Owner will pay] [Pay] cost of electricity used.] [Provide separate metering and [pay cost of electricity used.] [reimburse Owner for cost of electricity used.]]
- B. Provide temporary electricity and power outlets for construction operations, connections, branch wiring, distribution boxes, and flexible power cords as required. Do not disrupt Owner's need for continuous service.

1.37 TEMPORARY LIGHTING FOR CONSTRUCTION PURPOSES

- A. Provide and maintain temporary lighting for construction operations.
- B. Provide branch wiring from power source to distribution boxes with lighting conductors, pigtails, and lamps as required.
- C. Permanent building lighting may [not] be utilized during construction. [Repair, clean, and replace lamps at end of construction.]

1.38 TEMPORARY HEATING AND COOLING

- A. [Provide heating and cooling devices] [Utilize Owner's existing heating and cooling plant, extend and supplement with temporary units] and heat and cool as needed to maintain specified conditions for construction operations.
- B. [[Owner will pay] [Pay] cost of energy used.] [Provide separate metering and [pay cost of energy used.] [reimburse Owner for cost of energy used.]]
- C. [Provide and pay for operation, maintenance, and regular replacement of filters and worn or consumed parts.]
- D. Maintain minimum ambient temperature of [50] [_____] degrees F in areas where construction is in progress, unless indicated otherwise in specifications.

1.39 TEMPORARY VENTILATION

- A. Ventilate enclosed areas to assist cure of materials, to dissipate humidity, and to prevent accumulation of dust, fumes, vapors, or gases.
- B. [Utilize existing ventilation equipment. Extend and supplement equipment with temporary fan units as required to maintain clean air for construction operations.]

1.40 TELEPHONE AND FACSIMILE SERVICE

- A. Provide, maintain and pay for telephone [and telephone facsimile] service to field office at time of project mobilization. Allow Architect/Engineer incidental use.

1.41 TEMPORARY WATER SERVICE

- A. [Provide, maintain and pay for suitable quality water service required.] [Connect to existing water source] for construction operations.

1.42 TEMPORARY SANITARY FACILITIES

- A. Provide and maintain required facilities and enclosures. [Existing] [New] facilities may [not] be used.
- B. Maintain in clean and sanitary condition.

1.43 FIELD OFFICES AND SHEDS

- A. Office: Weather tight, with lighting, electrical outlets, heating, [cooling] [and] [ventilating] equipment, and equipped with sturdy furniture [and drawing display table].
- B. [Provide space for Project meetings, with table and chairs to accommodate [6] [_____] persons.]

1.44 ACCESS ROADS

- A. Construct and maintain temporary roads accessing public thoroughfares to serve construction area.
- B. [Designated] existing on-site roads [may] [shall not] be used for construction traffic.

1.45 PARKING

- A. [Arrange for] [Provide] [Construct] temporary parking areas to accommodate construction personnel.

1.46 PROGRESS CLEANING AND WASTE REMOVAL

- A. Collect and maintain areas free of waste materials, debris, and rubbish. Maintain site in clean and orderly condition.

1.47 PROJECT IDENTIFICATION

- A. Provide [[8 foot wide x 6 foot high] [____x____]] project sign of exterior grade plywood and wood frame construction, painted, to Architect/Engineer's design and colors.
- B. Erect on site at location [indicated.] [established by Architect/Engineer.]

1.48 FIRE PREVENTION FACILITIES

- A. Prohibit smoking within buildings under construction. Designate area on site where smoking is permitted. Provide approved ashtrays in designated smoking areas.
- B. Establish fire watch for cutting and welding and other hazardous operations capable of starting fires. Maintain fire watch before, during, and after hazardous operations until threat of fire does not exist.
- C. Portable Fire Extinguishers: NFPA 10; 10 pound capacity, 4A-60B: C UL rating.
 - 1. Provide one fire extinguisher at each stair on each floor of buildings under construction.
 - 2. Provide minimum one fire extinguisher in every construction trailer and storage shed.
 - 3. Provide minimum one fire extinguisher on roof during roofing operations using heat producing equipment.

1.49 BARRIERS AND FENCING

- A. Provide [barriers] [fencing] to prevent unauthorized entry to construction areas and to protect existing facilities and adjacent properties from damage.
- B. Construction: [Contractor's option.] [Commercial grade chain link fence.] [Solid wood fence, painted.]
- C. Provide [6] [_____] foot high fence around construction site; equip with vehicular [and pedestrian] gates with locks.

1.50 ENCLOSURES

- A. Provide temporary [insulated] weather tight closures to exterior openings to permit acceptable working conditions and protection of the Work.
- B. Provide temporary roofing as specified in Section [_____].

- C. Provide temporary partitions [and ceilings] as indicated on Drawings to separate work areas from Owner occupied areas, to prevent penetration of dust and moisture into Owner occupied areas, and to prevent damage to existing materials and equipment.

- D. [Paint surfaces exposed to view from Owner occupied areas.] [_____].

1.51 PROTECTION OF INSTALLED WORK

- A. Protect installed Work and provide special protection where specified in individual specification sections.
- B. Prohibit traffic or storage upon waterproofed or roofed surfaces.

1.52 SECURITY

- A. Provide security and facilities to protect Work [and existing facilities,] and Owner's operations from unauthorized entry, vandalism, or theft.

1.53 WATER CONTROL

- A. Maintain excavations free of water. Provide, operate, and maintain pumping equipment.
- B. Provide erosion control.

1.54 POLLUTION AND ENVIRONMENTAL CONTROL

- A. Provide methods, means, and facilities to prevent contamination of soil, water, and atmosphere from discharge of noxious, toxic substances, and pollutants produced by construction operations.
- B. Provide dust control, erosion and sediment control, noise control, pest control and rodent control to allow for proper execution of the Work.
- C. Comply with pollution and environmental control requirements of [Conservation Commission Document No.____.] [_____].

1.55 REMOVAL OF UTILITIES, FACILITIES, AND CONTROLS

- A. Remove temporary utilities, equipment, facilities, materials, prior to [Substantial Completion] [Final Application for Payment] review.
- B. Remove underground installations to minimum depth of [2] [_____] feet. [Grade site as indicated on Drawings.]
- C. Clean and repair damage caused by installation or use of temporary work.
- D. Restore existing facilities used during construction to original condition. Restore permanent facilities used during construction to specified condition.

1.56 PRODUCTS

- A. Products: Means new material, machinery, components, equipment, fixtures, and systems forming the Work, but does not include machinery and equipment used for preparation, fabrication, conveying and erection of the Work. [Products may also include existing materials or components specifically identified for reuse.]
- B. Do not use materials and equipment removed from existing premises, except as specifically identified or allowed by the Contract Documents.
- C. Provide interchangeable components of same manufacture for components being replaced.

1.57 DELIVERY, HANDLING, STORAGE, AND PROTECTION

- A. Deliver, handle, store, and protect Products in accordance with manufacturer's instructions.

1.58 PRODUCT OPTIONS

- A. Products Specified by Reference Standards or by Description Only: Any Product meeting those standards or description.
- B. Products Specified by Naming One or More Manufacturers: Products of manufacturers named and meeting specifications, no options or substitutions allowed.
- C. Products Specified by Naming One or More Manufacturers with Provision for Substitutions: Submit request for substitution for manufacturers not named.

1.59 SUBSTITUTIONS

- A. Architect/Engineer will consider requests for Substitutions only within [15] [_____] days after date [of Owner-Contractor Agreement.] [established in Notice to Proceed.]

1.60 CLOSEOUT PROCEDURES

- A. Submit written certification Contract Documents have been reviewed, Work has been inspected, and Work is complete in accordance with Contract Documents and ready for Architect/Engineer's inspection.
- B. Submit final Application for Payment identifying total adjusted Contract Sum/Price, previous payments, and amount remaining due.

1.61 FINAL CLEANING

- A. Execute final cleaning prior to final inspection.
- B. Clean interior and exterior surfaces exposed to view. Vacuum carpeted and soft surfaces.

- C. Clean debris from site, roofs, gutters, downspouts, and drainage systems.
- D. [Clean] [Replace] filters of operating equipment.
- E. Remove waste and surplus materials, rubbish, and construction facilities from site.

1.62 STARTING OF SYSTEMS

- A. Provide [seven] [_____] days notification prior to start-up of each item.
- B. Ensure each piece of equipment or system is ready for operation.
- C. Execute start-up under supervision of responsible persons in accordance with manufacturer's instructions.
- D. Submit written report stating equipment or system has been properly installed and is functioning correctly.

1.63 DEMONSTRATION AND INSTRUCTIONS

- A. Demonstrate operation and maintenance of Products to Owner's personnel [two weeks] [_____] prior to date of [Substantial Completion.] [final review.]
- B. For equipment or systems requiring seasonal operation, perform demonstration for other season within [six] [_____] months.
- C. Demonstrate start-up, operation, control, adjustment, trouble-shooting, servicing, maintenance, and shutdown of each item of equipment at [scheduled] [agreed-upon] [_____] times, at [equipment] [designated] location.

1.64 TESTING, ADJUSTING, AND BALANCING

- A. Adjust operating products and equipment to ensure smooth and unhindered operation.
- B. Owner will appoint, employ, and pay for services of independent firm to perform testing, adjusting, and balancing.

***** [OR] *****

- C. Owner will appoint and employ services of independent firm to perform testing, adjusting, and balancing. Pay for services from Cash Allowance specified in this section.
- D. Reports will be submitted by independent firm to Architect/Engineer indicating observations and results of tests and indicating compliance or non-compliance with specified requirements and with requirements of Contract Documents.
- E. Cooperate with independent firm; furnish assistance as requested.

- F. Re-testing required because of non-conformance to specified requirements will be charged to Contractor.

1.65 PROTECTING INSTALLED CONSTRUCTION

- A. Provide temporary and removable protection for installed products. Control activity in immediate work area to prevent damage.
- B. Protect finished floors, stairs, and other surfaces from traffic, dirt, wear, damage, or movement of heavy objects, by protecting with durable sheet materials.
- C. Prohibit traffic or storage upon waterproofed or roofed surfaces. When traffic or activity is necessary, obtain recommendations for protection from waterproofing or roofing material manufacturer.
- D. Prohibit traffic from landscaped areas.

1.66 PROJECT RECORD DOCUMENTS

- A. Maintain on site one set of Contract Documents to be utilized for record documents.
- B. Record actual revisions to the Work. Record information concurrent with construction progress.
- C. Specifications: Legibly mark and record at each Product section description of actual Products installed.
- D. Record Documents and Shop Drawings: Legibly mark each item to record actual construction.
- E. Submit documents to Architect/Engineer [with claim for final Application for Payment.] [_____.]

1.67 OPERATION AND MAINTENANCE DATA

- A. Submit [two] [_____] sets prior to final inspection, bound in 8-1/2 x 11 inch text pages, [three D side ring] [capacity expansion] [_____] binders with durable [plastic] [cloth] covers.
- B. Prepare binder cover with printed title "OPERATION AND MAINTENANCE INSTRUCTIONS" and title of project.
- C. Internally subdivide binder contents with permanent page dividers, logically organized, with tab titles legibly printed under reinforced laminated plastic tabs.
- D. Contents:
 1. Part 1: Directory, listing names, addresses, and telephone numbers of Architect/Engineer, Contractor, subcontractors, and major equipment suppliers.
 2. Part 2: Operation and maintenance instructions, arranged by system.
 3. Part 3: Project documents and certificates.

1.68 SPARE PARTS AND MAINTENANCE MATERIALS

- A. Provide Products, spare parts, maintenance and extra materials in quantities specified in individual specification sections.
- B. Deliver to [Project site] [and place in location as directed by [Architect/Engineer] [Owner]] [_____];obtain receipt prior to final payment.

1.69 WARRANTIES

- A. Provide [duplicate] notarized copies.
- B. Execute and assemble transferable warranty documents from subcontractors, suppliers, and manufacturers.
- C. Submit prior to final Application for Payment.

PART 2 PRODUCTS

Not Used.

PART 3 EXECUTION

Not Used.

END OF SECTION

SECTION 05 50 00

METAL FABRICATIONS

PART 1 GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Shop fabricated metal fasteners.
 - 2. Sheet metal fabrications.
 - 3. Metal hardware.
 - 4. Metal hand railing.
- B. Related Sections:
 - 1. Section 06 10 00: Rough Carpentry
 - 2. Section 06 15 00: Wood Decking
 - 3. Section 06 20 00: Finish Carpentry

1.2 SUBMITTALS

- A. Refer to Section 01 00 00 – General Requirements for Submittal Procedures
- B. Product Data: Submit technical data for each distinct product specified.

PART 2 PRODUCTS

2.1 FASTENERS

- A. Bolts: ASTM A307; Grade A.
 - 1. 3/8 inch Lag Bolt. Zinc Plated Steel, pre drilled.
 - 2. 3/4 inch – 10 x 7 inch. Zinc Plated Steel. Coarse hex bolts.
 - 3. 3/8 inch – 16 x 4 inch. Zinc Plated Steel. Coarse thread carriage bolts.
- B. Nuts: ASTM A563 heavy hex type.
 - 1. Finish: Zinc Plated Steel.
- C. Washers: ASTM F436; Type 1.
 - 1. Finish: Zinc Plated Steel.
- D. Screws: ASTM A307; Grade A. #10 Wood Screws. Lengths vary. Pre Drilled.
- E. Nails: Stainless Steel, varying lengths.

2.2 METAL HARDWARE

- A. Corner Brace: 12 gauge steel corner brace.

2.3 FINISHES

- A. Clean surfaces of rust, scale, grease, and foreign matter prior to finishing.
- B. Shop prime items with two coats. Do not prime surfaces in direct contact with concrete or where field welding is required.
- C. Galvanizing for Fasteners, Connectors, and Anchors:
 - 1. Hot-Dipped Galvanizing: ASTM A153/A153M.
 - 2. Mechanical Galvanizing: ASTM B695; Class 50 minimum.

2.4 METAL HANDRAILING

- A. Manufacturer: HDI Railing Systems
 - 1. Model: inox Guardrail
 - 2. Material: Wood top rail; stainless infill rails.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify field conditions are acceptable and are ready to receive Work.

3.2 PREPARATION

- A. Make provisions for erection stresses. Install temporary bracing to maintain alignment, until permanent bracing and attachments are installed.

3.3 INSTALLATION

- A. Install items plumb and level, accurately fitted, free from distortion or defects.
- B. Provide for erection loads and provide temporary bracing to maintain indicated alignment until completion of erection and installation of permanent attachments.
- C. Install components indicated on Drawings.

END OF SECTION

SECTION 06 10 00

ROUGH CARPENTRY

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes:

1. Structural floor, wall, and roof framing with dimension lumber.
2. Built-up structural beams and columns.
3. Structural floor, wall, and roof sheathing
4. Wood furring, grounding, and connections.
5. Miscellaneous framing and sheathing: telephone and electrical panel back boards; concealed wood blocking for support of toilet and bath accessories, wall cabinets, and wood trim.

B. Related Sections:

1. Section 31 66 16: Temporary Foundations.
2. Section 06 15 00: Wood Decking.
3. Section 06 17 53: Shop Fabricated Wood Trusses.
4. Section 06 20 00: Finish Carpentry.
5. Section 05 50 00: Metal Fabrications.

1.2 SUBMITTALS

- A. Refer to Section 01 00 00 – General Requirements for Submittal Procedures
- B. Product Data: Submit technical data for each distinct product specified.
- C. Manufacturer's Certificate: Certify lumber meets or exceeds specified requirements.

1.3 QUALITY ASSURANCE

A. Perform Work in accordance with the following:

1. Lumber Grading Agency: Certified by DOC PS 20.
2. Lumber: Southern Pine #2
3. Wood Structural Panels: DOC PS 1 or DOC PS 2.

B. Surface Burning Characteristics:

1. Fire Retardant Treated Materials: Maximum 25/450 flame spread/smoke developed index when tested in accordance with ASTM E84.

- C. Apply label from agency approved by authority having jurisdiction to identify each preservative treated material.

PART 2 - PRODUCTS

2.1 LUMBER MATERIALS

- A. Lumber Grading Rules: SPIB: Southern Pine Inspection Bureau
- B. All lumber to be Sustainable Forestry Initiative certified.
- C. Beam Framing: Southern Pine species, #2 grade, 2 x 10 size classification, 19 percent maximum moisture content.
- D. Joist Framing: Southern Pine species, #2 grade, 2 x 10 floor Joists, 2 x 10 Ceiling Joists, 19 percent maximum moisture content.
- E. Rafter Framing: Southern Pine species, #2 grade, 2 x 12 and 2 x 6 size classification where indicated, 19 percent maximum moisture content.
- F. Non-structural Light Framing: Southern Pine species, #2 grade, 2 x 4 size classification, 19 percent maximum moisture content.
- G. Studding: Southern Pine species, #2 grade, 2 x 6, 2 x 4, and 2 x 10 size classification where indicated, 19 percent maximum moisture content.
- H. Miscellaneous Framing: Southern Pine species, 19 percent maximum moisture content.

2.2 SHEATHING MATERIALS

- A. Wood Structural Panel Roof Sheathing: EWA Rated Sheathing; Structural I, Zip system Roof sheathing ERS 1473.
- B. Structural Wall Sheathing: ANSI A208.1 Structural I, Zip system wall sheathing ERS 1474.
- C. Gypsum Board Wall Sheathing: ASTM C1177, 5/8 inch thick, 1/2 inch thick.
- D. Wood Structural Panel Floor Sheathing: EWA Rated Sheathing, Structural 1, Oriented Strand Board, Plywood.
- E. Wood sheathing ignition barrier. 1/4 inch thick exterior grade plywood sheathing.

2.3 SHEATHING AND UNDERLAYMENT LOCATIONS

- A. Sloped Roof Sheathing: 1/2 inch thick Zip system roof sheathing ERS 1473, 48 x 96 inch sized sheets, square edges.
- B. Flat Roof Sheathing: 1/2 inch thick Zip system roof sheathing ESR 1473, 48 x 96 inch sized sheets, square edges.

C. Floor Sheathing: One 7/16 inch thick OSB and one 1/2 inch thick plywood, 48 x 96 inch sized sheets, square edges, alternating direction between layers.

D. Wall Sheathing: 7/16 inch thick Zip system wall sheathing ESR 1474, 48 x 96 inch sized sheets, square edges.

2.4 FIREBLOCKING AND DRAFTSTOPPING

A. Fire blocking: Solid lumber nominal 2 inches thick.

B. Draft stopping: Gypsum board.

1. Gypsum board, 1/2 inch thick.

2.5 ACCESSORIES

A. Fasteners and Anchors:

1. Fasteners: ASTM A153/A153M, hot dipped galvanized steel for high humidity and treated wood locations, unfinished steel elsewhere.
2. Nails and Staples: ASTM F1667.
3. Screws: Bugle head, hardened steel, power driven type, length three times thickness of sheathing.

B. Anchors: No anchors necessary in temporary location.

C. Structural Framing Connectors:

1. Joist Hangers: Hot dipped galvanized steel, sized to suit framing conditions, manufactured by Simpson Strong Tie.
2. Hurricane Ties: Hot dipped galvanized steel, sized to suit framing conditions, manufactured by Simpson Strong Tie.
3. Structural Straps: Hot dipped galvanized steel, sized to suit framing conditions, manufactured by Simpson Strong Tie.

D. Subfloor Glue: Waterproof of water base, air cure type, cartridge dispensed.

1. Adhesives: Maximum volatile organic compound content in accordance with SCAQMD Rule 1168.
2. Aerosol Adhesives: Maximum volatile organic compound content in accordance with GS-36.

E. Building Paper: No building paper necessary as Zip system panels built in Precipitek™ moisture resistive barrier

F. Sheathing Tape: Zip system tape flashing tape ESR 2227

2.6 FACTORY WOOD TREATMENT

- A. Wood Preservative (Pressure Treatment): Factory applied pressure treated preservative, AWWA U1, Commodity Specification A-Sawn Products or F-Wood Composites using water-borne preservative, in accordance with the National Design Specifications for Wood Construction.
- B. Moisture Content After Treatment:
 - 1. Lumber: Maximum 19 percent.
 - 2. Structural Panels: Maximum 15 percent.

PART 3 - EXECUTION

3.1 WOOD FRAMING, GENERAL

- A. Install framing members level and plumb, in correct position, of size and spaced as indicated.
- B. Fasten framing in accordance with the Uniform Statewide Building code of Virginia.
- C. Make provisions for erection loads, and for sufficient temporary bracing to maintain structure safe, plumb, and in alignment until completion of erection and installation of permanent bracing.
- D. Place horizontal members, crown side up.
- E. Do not splice structural members between supports.
- F. Space short studs over and under opening to stud spacing.
- G. Construct and install joist headers as indicated.
- H. Bridge floor and ceiling joists in excess of 8 feet span at mid-span. Fit solid blocking at ends of rafters where needed.
- I. Construct corners and partitions with three (3) or more studs. Provide miscellaneous blocking and framing as shown, to support facing materials, fixtures, specialty items, and trim.
- J. Frame openings with multiple studs and headers. Provide nailed header members of thickness equal to width of studs. Set headers on support of jack studs.
 - 1. For non load bearing partitions, provide single jack studs with headers not less than 4 inch nominal depth for openings 36 inches and less in width, and not less than 6 inch nominal depth for wider openings.
 - 2. For load bearing walls, provide double jack studs for all openings. Provide headers of depth as indicated on Contract documents.

- K. Curb roof openings as indicated.
- L. Coordinate curb installation with installation of roofing vapor retardant, parapet construction, and photovoltaic installation.

3.2 FLOOR JOIST FRAMING

- A. General: Install floor joist with crown edge up and support ends of each member on metal joist hanger installed into joist header.
- B. Frame floor joists as indicated on contract documents.
- C. Do not notch in any part of joists. Do not bore holes larger than 1/3 depth of joist; do not locate holes closer than 2 inches from top or bottom.
- D. Provide solid blocking of 2 inch nominal thickness by depth of joist at mid-span of joists.
- E. Under interior partitions, provide double joists or greater directly under partition wall. Coordinate with structural prints or structural engineer.

3.3 RAFTER AND CEILING JOIST FRAMING

- A. Ceiling Joists: Install ceiling joists with crown edge up and complying with requirements specified above for floor joists.
- B. Rafters: Notch to fit exterior wall plates and toe nail to plate. Use metal framing clips on each rafter at each supporting wall. Install rafter headers at exterior ends.
- C. Rafter ties shall be provided from each roof framing member to exterior and interior supporting studs.

3.4 SHEATHING

- A. Install gypsum sheathing in accordance with ASTM C1280.
- B. Fasten sheathing in accordance with the Uniform Statewide Building code of Virginia.
- C. Secure roof sheathing with longer edge (strength axis) perpendicular to framing members and with ends staggered and sheet ends over bearing.
- D. Secure wall sheathing with long dimension perpendicular to wall studs, with ends over firm bearing and staggered.
- E. Place sheathing tape along all joints overlapping where necessary.

- F. Secure 7/16 inch sub-floor sheathing with longer edge perpendicular to floor framing and with end joints staggered and sheet ends over bearing. Attach with sub-floor glue and screws. Secure second 1/2 inch layer plywood perpendicular to first layer of floor sheathing.
- G. Install wall plywood first row level with bottom of joist headers. Install second row level with top of parapet. Finish sheathing wall in center. Nail to framing and space panels 1/8" at edges and ends.
- H. Place building paper between floor underlayment and subflooring.
- I. Install flooring underlayment after dust and dirt generating activities have ceased and prior to application of finished flooring. Apply perpendicular to subflooring, stagger joints of underlayment. Secure with screw type fasteners.
- J. Install telephone and electrical panel back boards with plywood sheathing material where required. Size back boards 12 inches beyond size of electrical panel.

3.5 FIREBLOCKING AND DRAFTSTOPPING

- A. Install fire blocking to cut off concealed draft openings.

3.6 SITE APPLIED WOOD TREATMENT

- A. Brush apply two coats of preservative treatment on wood in contact with cementitious materials.
- B. Allow preservative to dry prior to erecting members.

3.7 TOLERANCES

- A. Section 01 00 00 - General Requirements: Tolerances.
- B. Framing Members: 1/8 inch from indicated position, maximum.
- C. Surface Flatness of Floor: 1/4 inch in 30 feet maximum.

END OF SECTION

SECTION 06 15 00

WOOD DECKING

PART 1 GENERAL

1.1 SUMMARY

- A. Section includes softwood lumber structural wood decking and preservative treatment of wood.

1.2 SUBMITTALS

- A. Refer to Section 01 00 00 – General Requirements for Submittal Procedures.
- B. Product Data: Submit technical data on wood preservative materials.
- C. Shop Drawings: Indicate deck framing system, bearing details, and framed openings.

1.3 QUALITY ASSURANCE

- A. Perform Work in accordance with the following:
 - 1. Lumber Grading Agency: Certified by DOC PS 20.
 - 2. Lumber: DOC PS 20.
- B. Perform Work in accordance with AITC A190.1.
- C. Surface Burning Characteristics:
 - 1. Fire Retardant Treated Materials: Maximum 25/450 flame spread/smoke developed index when tested in accordance with ASTM E84.
- D. Apply label from agency approved by authority having jurisdiction to identify each preservative treated material.

1.4 QUALIFICATIONS

- A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years documented experience.
- B. Design decking under direct supervision of Professional Engineer experienced in design of this Work and licensed in State of Virginia.

PART 2 PRODUCTS

2.1 WOOD DECKING

- A. Manufacturers:

1. Generic treated lumber decking. Milled and ripped to sizes as indicated.

2.2 MATERIALS

- A. Lumber Grading Rules: SPIB – Southern Pine Inspection Bureau.
- B. Lumber Decking: Southern Pine species, #2 grade, 5/4 inch x 3 inch, 5/4 inch x 7 inch size classification, 19 percent maximum moisture content.

2.3 ACCESSORIES

- A. Exterior Grade Fasteners and Anchors:
 1. Screws: Bugle head, hardened steel, power driven type, length three times thickness of decking.
- B. Sealer: Thompsons water seal or equivalent sealer.

2.4 WOOD TREATMENT

- A. Wood Preservative (Pressure Treatment): Factory applied pressure treated preservative, AWWA U1, Commodity Specification A-Sawn Products or F-Wood Composites using water-borne preservative, in accordance with the National Design Specifications for Wood Construction.
- B. Wood Preservative (Surface Application): Colored, manufactured by Thompsons water seal.

2.5 SOURCE QUALITY CONTROL

- A. Section 01 00 00 - Quality Requirements: Testing, inspection and analysis requirements.
- B. Inspect Work performed at fabricator's facility to verify conformance to Contract Documents.
- C. When fabricator is approved by authority having jurisdiction, submit certificate of compliance indicating Work performed at fabricator's facility conforms to Contract Documents.
 1. Specified shop inspections are not required for Work performed by approved fabricator.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify support framing is ready to receive decking.

3.2 PREPARATION

- A. Coordinate placement of support items.

3.3 SITE APPLIED WOOD TREATMENT

- A. Brush apply two coats of preservative treatment on wood.
- B. Treat site-sawn cuts. Apply preservative to site-sawn cuts in accordance with AWPA M4.
- C. Allow preservative to dry prior to erecting members.

3.4 INSTALLATION - LUMBER DECKING

- A. Install decking perpendicular to framing members, with ends staggered, over firm bearing.
- B. Secure with fasteners.
- C. Maintain decking joint space of 1/16 inch maximum.
- D. Cut decking to accommodate roof drain and flange.

3.5 ERECTION TOLERANCES

- A. Surface Flatness of Decking without Load: 1/4 inch in 30 feet maximum.

END OF SECTION

SECTION 06 17 53

SHOP-FABRICATED WOOD TRUSSES

PART 1 GENERAL

1.1 SUMMARY

- A. Section includes shop fabricated wood trusses for roof framing; bridging, bracing, and anchorage.

1.2 SYSTEM DESCRIPTION

- A. Minimum Truss Opening To Accommodate Mechanical Ducts: 6 inch x 8 inch.

1.3 SUBMITTALS

- A. Refer to Section 01 00 00 – General Requirements for Submittal Procedures.
- B. Product Data: Provide truss configurations, bearing and anchor details, bridging and bracing.
- C. Shop Drawings: Indicate sizes and spacing of trusses and associated components, web and chord sizes, plate sizes, fastener descriptions, and spacing.

1.4 QUALITY ASSURANCE

- A. Perform Work in accordance with the following:
 - 1. Lumber Grading Agency: Certified by DOC PS 20.
 - 2. Wood Structural Panel Grading Agency: Certified by EWA - The Engineered Wood Association.
 - 3. Lumber: Southern Pine #2.
 - 4. Wood Structural Panels: DOC PS 1 or DOC PS 2.
- B. Truss Design, Fabrication, and Installation: In accordance with TPI 1.
- C. Surface Burning Characteristics:
 - 1. Fire Retardant Treated Materials: Maximum 25/450 flame spread/smoke developed index when tested in accordance with ASTM E84.
- D. Manufacturer: Company specializing in manufacturing Products specified in this section with minimum three years documented experience.
- E. Design trusses under direct supervision of Professional Engineer experienced in design of this work and licensed.

PART 2 PRODUCTS

2.1 WOOD TRUSSES

2.2 MATERIALS

- A. Lumber Grading Rules: SPIB: Southern Pine Inspection Bureau.
- B. Truss Bridging: Type, size and spacing recommended by truss manufacturer.

2.3 ACCESSORIES

- A. Wood Blocking: In accordance with Section 06 10 00.
- B. Fasteners and Anchors:
 - 1. Fasteners: ASTM A153/A153M, hot dipped steel for high humidity and treated wood locations, unfinished steel elsewhere.
 - 2. Nails and Staples: ASTM F1667.
- C. Bearing Plates: Simpson Strong Tie truss hangers.

2.4 FABRICATION

- A. Fabricate trusses to achieve structural requirements specified.
- B. Frame special sized openings in web framing as detailed.

2.5 WOOD TREATMENT

- A. Moisture Content After Treatment:
 - 1. Lumber: Maximum 19 percent.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify supports and openings are ready to receive trusses.

3.2 PREPARATION

- A. Coordinate placement of support items.

3.3 ERECTION

- A. Set members level and plumb, in correct position.

- B. Make provisions for erection loads, and for sufficient temporary bracing to maintain structure plumb, and in indicated alignment until completion of erection and installation of permanent bracing.
- C. Do not field cut or alter structural members without approval of Architect/Engineer.
- D. Place headers and supports to frame openings.
- E. Frame openings between trusses with lumber in accordance with Section 06 10 00.
- F. Coordinate placement of sheathing with work of this section.
- G. After erection, touch-up damaged surfaces with primer consistent with shop coat.

3.4 ERECTION TOLERANCES

- A. Framing Members: 1/4 inch maximum, from indicated position.

END OF SECTION

SECTION 06 20 00

FINISH CARPENTRY

PART 1 GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Exterior Finish Carpentry:
 - a. Standing and running trim.
 - b. Ramps
 - c. Handrails
 - d. Decking.
 - e. Sunshades.
 - f. Pergola.
 - 2. Interior Finish Carpentry:
 - a. Standing and running trim.
 - b. Door frames.
 - c. Shelving.
 - d. Clothes rods.
 - e. Interior Casework

1.2 SUBMITTALS

- A. Product Data:
 - 1. Submit data on fire retardant treatment materials and application instructions.
 - 2. Submit data on preservative treatment materials and application instructions.
 - 3. Submit data on plastic finish carpentry products.
 - 4. Submit data on attachment hardware, finish hardware, and specific design casework.
- B. Shop Drawings:
 - 1. Indicate materials, component profiles, fastening methods, jointing details, finishes, and accessories.
- C. Samples:
 - 1. Submit two 6 x 6 inch size samples illustrating wood grain and specified finish.

1.3 QUALITY ASSURANCE

- A. Perform work in accordance with Custom Grade.
- B. Surface Burning Characteristics: Maximum 25/450 flame spread/smoke developed index when tested in accordance with ASTM E84.

PART 2 PRODUCTS

2.1 EXTERIOR FINISH CARPENTRY

- A. Manufacturer and Product List:
 - 1. Hardwood Manufacturers Southern Cypress Manufacturer Association.
 - 2. Substitutions permitted.
- B. Exterior Running Trim: Cypress.
 - 1. Cornice Trim: Sizes 2 X 12 nominal wood
 - 2. String Course: Sizes 2 X 3 nominal wood
- C. Exterior Standing Trim Battens: Southern Yellow Pine
 - 1. Kiln-dried after treatment
 - 2. Profile: Sizes and profiles as indicated on Drawings.
- D. Exterior Decking: Treated Southern Yellow Pine
 - 1. Profile: Sizes and profiles as indicated on Drawings.
- E. Sunshade: Cypress
 - 1. Profile: Sizes and profiles as indicated on Drawings.
- F. Pergola: Cypress
 - 1. Profile: Sizes and profiles as indicated on Drawings.
- G. Performance / Design Criteria:
 - 1. Design handrails stairs, pergola, and sunshade under direct supervision of licensed professional.

2.2 INTERIOR FINISH CARPENTRY

- A. Interior Standing and Running Trim: Poplar lumber.
 - 1. Profile: Sizes and profiles as indicated on Drawings.
- B. Interior Door Frames: Poplar lumber.
 - 1. Profile: Sizes and profiles as indicated on Drawings.
- C. Shelving: MDO plywood.
 - 1. Profile: Sizes and profiles as indicated on Drawings.
- D. Interior Clothes Rod: Pine lumber.
 - 1. Profile: Sizes and profiles as indicated on Drawings.

2.3 EXTERIOR MATERIALS

- A. Exterior Softwood Lumber: Cyprus species.
 - 1. Cut: Plain sawn.

2. Finger Jointing: Permitted with waterproof adhesives.

B. Lumber Moisture Content Range: 10-15 percent.

2.4 INTERIOR MATERIALS

A. Interior Hardwood Lumber: Poplar species.

1. Cut: Plain sawn.
2. Finger Jointing: Permitted.

B. Lumber Moisture Content Range: 10 percent.

2.5 WOOD TREATMENT

A. Fire Retardant Treatment: Chemically treated and pressure impregnated, having flame spread of 25 or less when tested in accordance with ASTM E 84 and showing no evidence of significant progressive combustion when test is continued for an additional 20 minute period, Exterior Type.

B. Wood Preservative Pressure Treatment: WDMA I.S.4

C. Provide identification on fire retardant treated material.

D. Deliver fire retardant treated materials cut to required sizes. Minimize field cutting.

E. Moisture Content after Treatment: Redried.

1. Lumber: As specified for exterior and interior lumber.
2. Plywood: Maximum 15 percent.

2.6 FABRICATION

A. Fabricate finish carpentry to AWI AWS Section 6 Custom Premium Grade.

B. Fabricate handrails, balustrades, pergola, and sunshade to AWI AWS Section 7 Custom Grade.

2.7 FINISHES

A. Sand work smooth and set exposed nails and screws.

B. Apply wood filler in exposed nail and screw indentations.

C. On items to receive transparent finishes, use wood filler matching surrounding surfaces and of types recommended for applied finishes.

D. Stain, seal, and varnish exposed to view surfaces.

E. Seal internal surfaces and semi-concealed surfaces.

F. Prime paint surfaces in contact with cementitious materials.

2.8 ACCESSORIES

A. Fasteners and Anchors:

1. Fasteners: ASTM A153/A153M, hot dipped galvanized steel for high humidity and treated wood locations, unfinished steel elsewhere.
2. Nails and Staples: ASTM F1667.

B. Contact Adhesives: Water Base type.

C. Wall Adhesive: Cartridge type, compatible with wall substrate, capable of achieving durable bond.

D. Primer: Acrylic primer sealant type.

E. Wood Filler: Solvent base, tinted to match surface finish color.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify field conditions are acceptable and are ready to receive work.

3.2 PREPARATION

A. Prime paint surfaces of wood items and assemblies to be in contact with cementitious materials.

B. Prime paint surfaces of exterior wood items and assemblies.

3.3 INSTALLATION

A. Install work in accordance with AWI AWS Section 6 and Custom] Grade and manufacturer's instructions.

B. Set and secure materials and components in place, plumb and level.

C. Install trim with screws

D. Install prefinished paneling with screws

E. Install hardware supplied by Section 08 71 00.

F. Site Applied Wood Treatment:

1. Brush apply one coat of preservative treatment on wood in contact with cementitious materials

2. Treat site-sawn cuts. Apply preservative to site-sawn cuts in accordance with WDMA I.S.4.
3. Allow preservative to dry prior to erecting members.

G. Preparation For Finish:

1. Sand work smooth and set exposed fasteners. Apply wood filler in exposed fastener indentations.

3.4 ATTACHMENTS

A. Exterior Finish Carpentry:

1. Brackets, Finials, and Pediments: Clear fir, prepare for paint finish.
2. Handrails Cyprus: Prepare for stained and sealed finish.
3. Soffits and Facias: Cyprus, prepare for paint finish.

B. Interior Finish Carpentry:

1. Window Sills: Plastic laminate finish.
2. Balustrades, and Handrails: Clear fir, prepare for stained finish.
3. Moldings, Bases, Casings, and Miscellaneous Trim: Clear Cyprus, prepare for paint finish.

END OF SECTION

SECTION 06 261 00

FIBERGLASS REINFORCED PLASTIC (FRP) FABRICATIONS – PULTRUDED PEDESTRIAN GRATING

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:

1. Porch flooring as tile substrate and structural housing for phase-change material.

PART 2 PRODUCTS

2.1 PORCH FLOORING

A. Manufacturer and Product List:

1. Fibergrate.
2. Size: 4 feet by 12 feet by 1 inch high.
3. Mesh: 2 inch square.
4. Fire spread rating ≤ 25 .
5. Substitutions not permitted..

PART 3 EXECUTION

3.1 EXAMINATION

- ###### A. Verify field conditions are acceptable and are ready to receive work.

3.2 PREPARATION

- ###### A. Clean area where grate is to be installed.
- ###### B. Ensure subfloor under grate is strong and sufficiently rigid to install tile without cracking.

3.3 INSTALLATION

- ###### A. Apply construction adhesive suitable for FRP and substrate material to underside of grate.
- ###### B. Position grate on substrate. Fasten to substrate with screws, minimum 16 inches on center.
- ###### C. Allow adhesive to cure before installing phase-change material, tile backer board, thinset and tile.

END OF SECTION

07 21 00

THERMAL INSULATION

PART 1 GENERAL

1.1 SUMMARY

- A. Section includes board thermal insulation on low-slope roof; batt thermal insulation in ceilings and walls; cellulose thermal insulation in ceilings and walls. Also includes Phase Change Material mats suitable for wall, ceiling, or floor application.

1.2 SYSTEM DESCRIPTION

- A. System performance to provide continuity of thermal barrier at building enclosure elements in conjunction with vapor barrier materials in Section 07 26 00.

1.3 SUBMITTALS

- A. Product Data: Submit manufacturer's product data including thermal performance of materials.

1.4 QUALITY ASSURANCE

- A. Furnish and label cellulose dense pack insulation in accordance with CPSC 16 CFR 1209 and CPSC 16 CFR 1404.
- B. Insulation Installed in Concealed Locations Surface Burning Characteristics:
 - 1. Foam Plastic Insulation: Maximum 75/450 flame spread/smoke developed index when tested in accordance with ASTM E84.
 - 2. Cellulose Dense Pack Insulation: 450 smoke developed index when tested in accordance with ASTM E84.
- C. Insulation Installed in Exposed Locations Surface Burning Characteristics:
 - 1. Cellulose Dense pack Insulation: 450 smoke developed index when tested in accordance with ASTM E84.
 - 2. Other Insulation Materials: 25/450 flame spread/smoke developed index when tested in accordance with ASTM E84.
- D. Apply label from agency approved by authority having jurisdiction to identify each foam plastic insulation board.

PART 2 PRODUCTS

2.1 BUILDING INSULATION

- A. Manufacturers:
1. Johns Manville - Polyisocyanurate Insulation.
 2. Knauff – ECOBatt Fiberglass Batt Insulation.
 3. Substitutions: Permitted.

2.2 PHASE-CHANGE MATERIAL

- A. Manufacturers:
1. PhaseChangeEnergy.com – BioPCM mats, 1lb/sq ft loading, 73F melt point.

2.3 COMPONENTS

- A. Rigid Polyisocyanurate Insulation conforming to the following:
1. Board Thickness: 1 inch thick.
 2. Thermal Resistance: R of 6.5.
 3. Board Edges: Square edges.

2.4 ACCESSORIES

- A. Adhesive: Type recommended by insulation manufacturer for application.
- B. Sheet Vapor Retarder: As specified in Section 07 26 00. Black polyethylene film 5 mil thick.
- C. Tape: Bright aluminum self-adhering type, mesh reinforced, 2 inch.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify substrate, adjacent materials, and insulation boards are dry and ready to receive insulation and adhesive.

3.2 INSTALLATION

- A. Blown Insulation:
1. Drill 2 inch diameter insulation access ports for floor system to permit equipment access.
 2. Place insulation pneumatically, tight in stud joist spaces
 3. Place insulation against baffles. Do not impede natural attic ventilation to soffit.

4. Place against and behind mechanical and electrical services within plane of insulation.
5. Completely fill intended spaces. Leave no gaps or voids.
6. Repair and reseal insulation access ports. Refinish to match disturbed work.

END OF SECTION

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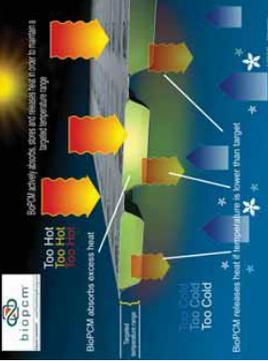


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BioPCM™ phase change material

BiPCM™ Mils	Unit	23/73°F	55 biq. ft.	1 biq. ft.	2 biq. ft.	55 biq. ft.	1 biq. ft.	2 biq. ft.
Thickness	mil	14	14	14	14	14	14	14
Weight per square foot	lb	0.77	1.32	2.68	0.76	1.31	2.68	
Total unit thickness	in	-.25-.35	-.4-.6	1	-.25-.35	-.4-.6	1	
Dimensions	mm/in	419.1/16.5	419.1/16.5	419.1/16.5	419.1/16.5	419.1/16.5	419.1/16.5	419.1/16.5

Energy Store values-Other temperature ranges are available

PCM loading	%	75%	75%	75%	74%	75%
Melt point	°C/F	23/73	23/73	23/73	23/81	23/81
Latent heat storage capacity	J/g >	209	209	209	219	219
Boiling point	°C	>248.9	>248.9	>248.9	>248.9	>248.9

Other temperature ranges are available. The melting range of the PCM is dependent on the application. The BiPCM™ product name and phase "Beyond Insulation" are registered trademarks.



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Dr. Rusty Suttphin,
 Poll Scientist and
 Director of Energy
 Research at the
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BiopCM™ helps the planet and your pocketbook by reducing energy usage and CO₂ emissions.

BiopCM™: A Smart Response To Climate Change

Imagine a product so smart it actively wants to conserve energy and improve your home's energy efficiency. It's not a pipe dream. It's BiopCM™. We all know traditional insulation works as a simple barrier that slows the transfer of heat. That's a good start, but scientists at Phase Change Energy Solutions have gone Beyond Insulation™ to develop phase change material technology that absorbs and releases excess heat as needed. The result? Buildings that want to stay at the prescribed temperature throughout the day, consuming less energy and keeping room temperatures more constant. In tests conducted by a major public utility, 25 to 30% energy savings were achieved. The product is earth-friendly, easy to install and can even be used to retrofit existing buildings. This is high performance insulation that offers a smart response to climate change. This is BiopCM™.

BiopCM™ increases the comfort, safety and efficiency of buildings in several ways:

- reduces indoor temperature fluctuation
- reduces need for heating and cooling
- reduces greenhouse gas emissions
- improves safety and reduces fire risk
- reduces overall energy use
- shifts energy usage away from peak demand when energy can be most expensive

BiopCM™: A Critical Difference

Years of study by independent laboratories have proven the effectiveness of phase change material (PCM). However, most pcm is petroleum-based which tends to cause undue fire risks and is subject to volatile oil price and environmental impact. BiopCM™ uses a patented manufacturing method that enables low-cost bio-based materials to achieve similar energy savings performance without the downside of petroleum-based PCM.

Innovative Design, Simple Installation

BiopCM™ is encapsulated in flame retardant, super-engineered polyfilm. BiopCM™ can be easily cut to fit around wall sockets, door frames and framing studs. BiopCM™ is placed along the interior wall directly behind standard plasterboard. Attic installation is a simple way to instantly gain energy savings.

This innovative design allows builders to creatively install BiopCM™ in entirely new construction, retrofit buildings and temporary structures. This flexibility allows construction professionals taking advantage of BiopCM's energy storage properties.

BiopCM™ is a high-performance building insulation that improves energy efficiency. Use in new construction or retrofit existing buildings to "go green" today.



BiopCM™ helps reduce energy use, improve comfort, and reduce carbon footprint. It's earth-friendly. With BiopCM™, you can afford to do your part to help protect the planet.

BiopCM™ can be used in both new construction and for retrofitting existing structures. That's high-performance, smart building technology ready to help you "go green" quickly and easily.

Fire Suppression: Turning Past Challenges into Future Opportunity

Phase Change Energy Solutions added a unique fire suppression element to BiopCM™ that actually works to help extinguish fire should it occur in your home or workplace.

Proof of Performance: Third Party Testing Confirms Energy Savings

Energy savings from BiopCM™ enables smaller, more efficient heating and cooling units to be installed. Some climates can completely eliminate air conditioning. Third party public utility testing confirms up to 30% overall energy savings when BiopCM™ is installed. Direct savings are realized by reduced electric bills and lower heating and cooling costs.

BiopCM™: A Closer Look At Fire Suppression
A major advantage of BiopCM™ is the fact that it not only saves you precious monetary resources year after year, but it also adds an additional layer of security to any structure. Our built-in fire suppressant layer acts as a shield to extinguish most small fires and adds critical extra minutes to allow occupants of the structure to escape larger more dangerous fires.

This single factor can mean the difference between life and death because the smoke index of any fire is often the leading factor in terms of safety. In independent third-party testing, our BiopCM™ received extremely high scores in reducing the amount of smoke released into the space and gives the occupants greater visual and breathing capacity.



BiopCM™ is manufactured with water-soluble fire retard. The fire suppression element is designed to provide peace of mind as well. The fire testing photo above shows the condition of wood construction walls after a period of 21 minutes.



BiopCM™ is versatile in that lends itself to many applications. Regardless of its use, BiopCM™ will greatly benefit the user through lower energy usage.

BiopCM™: A Versatile, Green Energy Solution

- Traditional Homes
- Modular Homes
- Commercial Box Stores
- Warehouse Space
- Offices and Schools
- Churches/Synagogues
- Restaurants
- Unconditioned Light Industrial Space
- Military Facilities- Fixed and Mobile
- Poultry/Agricultural Industry
- Remote Telecommunication Enclosures
- Thermal Transport

Product applications



SECTION 07 21 16

BLANKET INSULATION

PART 1 GENERAL

1.1 SUMMARY

- A. Section includes batt insulation in exterior wall and floor construction; and batt insulation for filling crevices in exterior wall and roof.
- B. Related Sections:
 - 1. Section 07 21 00 – Rigid Insulation.
 - 2. Section 07 21 19 – Foamed-In Place Insulation.

1.2 REFERENCES

- A. ASTM International:
 - 1. ASTM C665 - Standard Specification for Mineral-Fiber Blanket Thermal Insulation for Light Frame Construction and Manufactured Housing.
 - 2. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials.
 - 3. ASTM E96/E96M - Standard Test Methods for Water Vapor Transmission of Materials.

1.3 SYSTEM DESCRIPTION

- A. Materials of This Section: Provide continuity of thermal barrier at building enclosure elements in conjunction with thermal insulating materials in Section 07 21 00.

1.4 PERFORMANCE REQUIREMENTS

- A. Vapor Retarder Permanence: Maximum 1 perm when tested in accordance with ASTM E96/E96M, water method.

1.5 QUALITY ASSURANCE

- A. Insulation Installed in Concealed Locations Surface Burning Characteristics:
 - 1. Batt Insulation: Maximum 25/450 flame spread/smoke developed index when tested in accordance with ASTM E84.
- B. Insulation Installed in Exposed Locations Surface Burning Characteristics: Maximum 25/450 flame spread/smoke developed index when tested in accordance with ASTM E84.

PART 2 PRODUCTS

2.1 BATT INSULATION

- A. Manufacturers:
1. Johns Manville
 2. Knauff
 3. Substitutions: Permitted.

2.2 COMPONENTS

- A. Batt Insulation: ASTM C665; preformed glass fiber roll; conforming to the following:
1. Thermal Resistance: R of 3.7/inch
 2. Batt Roll Size: 15x93 inch.
 3. Facing: Faced on one side with asphalt treated Kraft paper.
- B. Nails or Staples: Steel wire; galvanized; type and size to suit application.
- C. Tape: Bright aluminum self-adhering type 2 inch wide.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify substrate, adjacent materials, and insulation are dry and ready to receive insulation.

3.2 INSTALLATION

- A. Install in exterior walls spaces without gaps or voids. Do not compress insulation.
- B. Trim insulation neatly to fit spaces. Insulate miscellaneous gaps and voids.
- C. Fit insulation tight in spaces and tight to exterior side of mechanical and electrical services within plane of insulation.
- D. Nail facing flanges in place at maximum 6 inches oc.
- E. Tape seal butt ends, lapped flanges, and tears or cuts in membrane.
- F. Tape seal tears or cuts in vapor retarder.
- G. Extend vapor retarder tight to full perimeter of adjacent window and door frames and other items interrupting plane of membrane. Tape seal in place.

END OF SECTION

SECTION 07 21 19

FOAMED-IN-PLACE INSULATION

PART 1 GENERAL

1.1 SUMMARY

- A. Section includes foamed-in-place insulation in exterior framed walls, at exterior wall crevices requiring thermal seal, and in roof structure in between ceiling joists; and foamed-in-place insulation at junctions of dissimilar wall and roof materials to achieve thermal and air seal, with protective cover. Also includes foamed-in-place insulation in utility core used for air sealing and weather-proofing.
- B. Related Sections:
 - 1. Section 07 26 00 - Vapor Retarders.
 - 2. Section 07 21 00 Thermal Insulation.

1.2 REFERENCES

- A. ASTM International:
 - 1. ASTM C177 - Standard Test Method for Steady-State Heat Flux Measurements and Thermal Transmission Properties by Means of the Guarded-Hot-Plate Apparatus.
 - 2. ASTM C1029 - Standard Specification for Spray-Applied Rigid Cellular Polyurethane Thermal Insulation.
 - 3. ASTM D1621 - Standard Test Method for Compressive Properties of Rigid Cellular Plastics.
 - 4. ASTM D1622 - Standard Test Method for Apparent Density of Rigid Cellular Plastics.
 - 5. ASTM D2482 - Standard Test Method for Surface Strength of Paper (Wax Pick Method).
 - 6. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials.
 - 7. ASTM E96/E96M - Standard Test Methods for Water Vapor Transmission of Materials.

1.3 PERFORMANCE REQUIREMENTS

- A. Conform to USBC code for flame and smoke, concealment, and over coat requirements.

1.4 SUBMITTALS

- A. Product Data: Submit product description, insulation properties, and preparation requirements.
- B. Manufacturer's Installation Instructions: Submit special procedures, perimeter conditions requiring special attention, and instructions..

1.5 QUALITY ASSURANCE

- A. Insulation Installed in Concealed Locations Surface Burning Characteristics:

1. Foam Plastic Insulation: Maximum 75/450 flame spread/smoke developed index when tested in accordance with ASTM E84.
2. Overcoat: Maximum 25/450 flame spread/smoke developed index when tested in accordance with ASTM E84.

- B. Apply label from agency approved by authority having jurisdiction to identify each foam plastic component.

1.6 QUALIFICATIONS

- A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years documented experience, and with service facilities within 100 miles of project.
- B. Installer: Company specializing in performing Work of this section with minimum three years documented experience approved by manufacturer.

1.7 PRE-INSTALLATION MEETINGS

- A. Convene minimum one week prior to commencing work of this section.

1.8 ENVIRONMENTAL REQUIREMENTS

- A. Do not install insulation when ambient temperature is lower than 70 degrees F.

PART 2 PRODUCTS

2.1 COMPONENTS

- A. Insulation: ASTM C1029, Type III polyurethane, Closed Cell Spray Foam with zero ozone-depleting blowing agent.
- B. Primer: As required by insulation manufacturer.
 1. Interior Flat and Non-Flat Paints: Maximum volatile organic compound content in accordance with GS-11.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify Work within construction spaces or crevices are complete prior to insulation application.
- B. Verify surfaces are clean, dry, and free of matter capable of inhibiting insulation [or overcoat] adhesion.

3.2 PREPARATION

- A. Mask and protect adjacent surfaces from over spray or dusting.

3.3 INSTALLATION

- A. Apply insulation by spray method, to uniform monolithic density without voids.
- B. Apply to minimum cured thickness of 1 inch under floor and in utility core, 2 inches in walls, 3 inches in ceiling and 6 inches in sloped roof ceiling cavities.

3.4 FIELD QUALITY CONTROL

- C. Inspection will include verification of insulation and overcoat thickness.

3.4 PROTECTION OF INSTALLED CONSTRUCTION

- A. Do not permit subsequent construction Work to disturb applied insulation.

END OF SECTION

SECTION 07 26 00

VAPOR RETARDERS

PART 1 GENERAL

1.1 SUMMARY

- A. Section includes sheet and sealant materials for controlling vapor diffusion; materials to continue vapor retarder from wall to roof construction; and materials to continue vapor retarder from wall to windows and doors.

1.2 SYSTEM DESCRIPTION

- A. Materials and installation methods to provide continuity of vapor retarder:
 - 1. In conjunction with materials described in Section 07 21 00.
 - 2. To seal gaps between enclosure components and opening frames.
- B. Vapor Retarder Permeance: Maximum 1 perm when tested in accordance with ASTM E96/E96M, water method.

PART 2 PRODUCTS

2.1 VAPOR RETARDERS

- A. Manufacturers:
 - 1. Alumiseal Corp
 - 2. Substitutions: Not Permitted.

2.2 COMPONENTS

- A. Sheet Retarder Type 1 Clear polyethylene film for above grade application; 10mil thick.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify substrate materials are dry and clean. Remove loose or foreign matter impairing adhesion.

3.2 PREPARATION

- A. Coordinate with Work of other affected sections.
- B. Clean and prime substrate surfaces to receive adhesive.

3.3 INSTALLATION

- A. Secure sheet retarder to wall vapor retarder with tape.
- B. Lap sheet retarder to roof vapor retarder and seal with adhesive.
- C. Install sheet retarder between window and door frames and adjacent wall vapor retarder and seal with adhesive.
- D. Caulk with sealant to ensure complete seal.

END OF SECTION

SECTION 07 41 13

METAL ROOFING

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:

1. This section covers the pre-finished, pre-fabricated Architectural standing seam roof system. All metal trim, accessories, fasteners, insulation and sealants indicated on the drawings as part of this section.
2. Drawings and general provisions of the Contract, including general and Supplementary Conditions and Division 01 Specifications, apply to this section.

B. Related work specified elsewhere.

1. Section 07 62 00 Sheet Metal Flashing and Trim.

1.2 DEFINITIONS

A. Metal Roof Panel Assembly: Metal roof panels, attachment system components, miscellaneous metal framing, thermal, and accessories necessary for a complete weather tight roofing system.

B. References:

1. American Society for Testing and Materials (ASTM)
 - a. ASTM A 653: Steel Sheet, Zinc Coated by the Hot Dip Press
 - b. ASTM A 792: Steel Sheet, Aluminum-Zinc Alloy Coated by the Hot Dip Process
 - c. ASTM B 209: Aluminum-Zinc Alloy Sheet and Plate
2. Sheet Metal and Air Conditioning Contractors National Association (SMACNA)
 - a. SMACNA Architectural Sheet Metal manual 1993 edition
3. American Iron and Steel Institute (AISI)
 - a. AISI Cold Formed Steel Design Manual
4. Aluminum Association
 - a. Aluminum Design Manual
5. Metal Construction Association
6. Code References
 - a. ASCE, Minimum Loads for Buildings and Other Structures
 - b. BOCA National Building Codes
 - c. UBC Uniform Building Code
 - d. SBC Standard Building Code

1.3 SYSTEM DESCRIPTION

A. Material to comply with:

1. ASTM A 653: Steel Sheet, Zinc Coated by the Hot Dip Press
2. ASTM A 792: Steel Sheet, Aluminum-Zinc Alloy Coated by the Hot Dip Process

1.4 DESIGN REQUIREMENTS

- A. Low Slope Membrane Roof Edge Securement: Conform to SPRI ES-1 for wind speeds determined from applicable code.

1.5 SUBMITTALS

- A. Shop Drawings: Indicate conditions of interface with other materials. Indicate membrane layout and seam locations.
- B. Product Data: Submit characteristics on membrane materials, flashing materials, insulation, and vapor retarders.

1.6 QUALITY ASSURANCE

- A. Englert inc., 1200 Amboy Avenue, Perth Amboy, New Jersey 08861, products establish a minimum of quality required.
- B. Manufacturer and erector shall demonstrate experience of a minimum five years in this type of product.

1.7 ROOF SYSTEM PERFORMANCE TESTING

- A. General Performance: Metal roof panels shall comply with performance requirements without failure due to defective manufacture, fabrication, installation or other defects in construction.
- B. Roof System shall be designed to meet Standard Building Code Wind Load requirements.
- C. Panels to meet:
 - 1. Water Penetration: When tested per ASTM E-283/1680 and ASTM E-331/1646 there shall be no uncontrolled water penetration or air infiltration through the panel joints.
 - 2. UL 2218- Impact Resistance rated.

1.8 WARRANTIES

- A. Furnish detailed drawings showing profile and gauge of exterior sheets, location and type of fasteners, location, gauges, shape and method of attachment of all trim locations and types of sealants, and any other details as may be required for a weather-tight installation.
- B. Provide finish samples of all colors specified.
- C. Shop drawings: Show fabrication and installation layouts of metal roof panels, metal wall panels, or metal soffit panels, details of edge conditions, side-seams, panel profiles, corners, anchorages, trim, flashings, closures and accessories, and special details. Distinguish between factory and field-assembled work.

- D. Coordination Drawings: Roof plans, drawn to scale, on which the following are shown and coordinated with each other, base done input from installer of the items involved:
1. Roof panels and attachments
 2. Metal trusses, bracing and supports
 3. Roof-mounted items including snow guards and items mounted on roof curbs.

1.9 DELIVERY, STORAGE AND HANDLING

1. Ordering: Comply with manufacturer' ordering instruction and lead time requirements to avoid construction delays.
2. Deliver components, sheets, metal roof panels and other manufactured items so as not to be damaged or deformed. Package metal roof panels for protection during transportation and handling.
3. Unload, store and erect metal roof panels in a manner to prevent bending, warping, twisting and surface damage.
4. Stack metal roof panels on platforms or pallets, covered with suitable weathertight and ventilated covering. Store metal roof panels to ensure dryness. Do not store metal roof panels in contact with other materials that might cause staining, denting, or other surface damage.
5. Protect strippable protective coating on any metal coated product from exposure to sunlight and high humidity, except to the extent necessary for material installation.

1.10 PROJECT CONDITIONS

- A. Weather Limitations: proceed only when existing and forecasted weather conditions permit metal roof panel work to be performed.
- B. Field Measurements: Verify actual dimensions of construction contiguous with metal roof panels by field measurements before fabrication.

1.11 COORDINATION

- A. Coordinate sizes and locations of roof curbs, equipment supports and roof penetrations with actual equipment provided.
- B. Coordinate metal roof panels with rain drainage work, flashing, trim and construction of decks, parapet walls and other adjoin to work to provide a leak proof, secure and noncorrosive installation.

PART 2 PRODUCTS

2.1 PANEL DESIGN

- A. General: Provide factory-formed metal roof panels designed to be installed by lapping and interconnecting raised side edges of adjacent panels with joint type indicated and mechanically

attaching panels to supports using concealed clips in side laps. Include clips, cleats, pressure plates and accessories required for a weather tight installation.

- B. Roof panels shall be standing seam Snap-On Batten in 12" widths with 1 1/2" high seams.
- C. Panels to be produced Smooth-Factory Standard.
- D. Panels to be designed for attachment with concealed fastener clips, spaced as required by the manufacturer to provide for both positive and negative design loads, while allowing for the expansion and contraction of the entire roof system resulting from variations in temperature.
- E. Forming: use continuous end rolling method. No end laps on panels. No portable roll forming machines will be permitted on this project; no installer-owned or installer-rented machines will be permitted. It is the intent of the Architect to provide Factory-Manufactured panel systems only for this project.

2.2 MANUFACTURERS

- A. Manufacturers:
 1. Englert Inc.
 2. Substitutions: Not Permitted

2.3 MATERIALS AND FINISHES

- A. Preformed roofing panels shall be fabricated of 24 gauge steel
- B. Color shall be Charcoal
- C. Finish shall be Kynar 500 or Hylar 5000 Fluorocarbon coating with a top side film thickness of 0.70 to 0.90 mil over a 0.25 to 0.3 mil prime coat to provide a total dry film thickness of 0.95 to 1.25 mil, to meet AAMA 621. Bottom side shall be coated with a primer with a dry film thickness of 0.25 mil. Finish shall conform to all tests for adhesions, flexibility and longevity as specified by Kynar 500 or Hylar 5000 finish supplier.
- D. If strippable coating to be applied on the pre-finished panels to the top side to protect the finish during fabrication, shipping and handling, film shall be removed before installation.
- E. Trim: Trim shall be fabricated of the same material and finish to match the profile, and will be press broken in lengths of 10 to 12 feet. Trim shall be formed only by the manufacturer of their approved dealer. Trim to be erected in overlapped condition. Use lap strips only as indicated on drawings. Miter conditions shall be factory welded material to match the sheeting.
- F. Closures: use composition or metal profiled closures at the top of each elevation to close ends of the panels. Metal closures to be made in the same material and finish as face sheet.
- G. Fasteners: Fasteners shall be of type, material, size, corrosion resistance, holding power and other properties required to fasten miscellaneous framing members to substrates.

H. Substrate shall be ZIP System Roof Sheathing panels.

I. Roofing Underlayment

1. On all surfaces to be covered with roofing material, furnish and install a 40 mil "Peel & Stick membrane", required as outlined by metal panel manufacturer. Membrane to be a minimum of 40 mil thickness, smooth, non-granular, by one of the following manufacturers:
 - a. W.R Grace "Ice & water Shield"
 - b. Cetco Strongseal
 - c. Carlisle CCW WIP 300HT
 - d. Interwrap Titanium PSU
 - e. MFM Corp "Wind & Water Shield"
 - f. Polyguard Deck Guard HT of Polyglas HT
 - g. Tamko TW Tile and Metal Underlayment
2. Underlayment shall be laid in horizontal layers with joints lapped in the direction of flow a minimum of 6", and well secured along laps and at ends as necessary to properly hold the felt in place. All underlayment shall be preserved unbroken and whole.
3. Ice and Water Shield shall lap all hips and ridges at least 12" to form double thickness and shall be lapped 6" over the metal of any valley or built-in gutters and shall be installed as required by the Standing Seam Panel Manufacturer to attain the MINIMUM 20 Year Weather tightness Warranty.

J. Sealants

1. Provide two-part polysulfide class B non-sag type for vertical and horizontal joints or
2. one part polysulfide not containing pitch or phenolic extenders or
3. Exterior grade silicone sealant recommended by roofing manufacturer or
4. One part non-sag, gun grade exterior type polyurethane recommended by the roofing manufacturer.

2.4 FABRICATION

- A. Comply with dimensions, profile limitations, gauges and fabrication details shown and if not shown, provide manufacturer's standard product fabrication.
- B. Fabricate components of the system in factory, ready for field assembly.
- C. Fabricate components and assemble units to comply with fire performance requirements specified.
- D. Apply specified finishes in conformance with manufacturer's standard, and according to manufacturer's installation.

PART 3 EXECUTION

3.1 INSPECTION

- A. Examine alignment of structural steel and related supports, primary and secondary roof framing, solid roof sheathing, prior to installation.
- B. For the record, prepare written report, endorsed by installer, listing conditions detrimental to performance of the Work.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 FASTENERS

- A. Secure units to supports
- B. Place fasteners as indicated in manufacturer's standards.

3.3 INSTALLATION

- A. Panels should be installed plumb and true in a proper alignment and in relation to the structural framing. The erector must have at least five years successful experience with similar applications.
- B. Install metal panels, fasteners, trim and related sealants in accordance with approved shop drawings and as may be required for a weather tight installation.
- C. Remove all strippable coating and provide a dry-wipe down cleaning of the panels as they are erected.

3.4 DAMAGED MATERIAL

- A. Upon determination of responsibility, repair or replace damaged metal panels and trim to the satisfaction of the Architect and Owner.

END OF SECTION

SECTION 07 46 00

SIDING

PART 1 GENERAL

1.1 SUMMARY

- A. Section includes plywood sheet siding for walls, battens, related trim, flashings, accessories, and fastenings.

1.2 SUBMITTALS

- A. Product Data: Submit data indicating materials, component profiles, fastening methods, jointing details, sizes, surface texture, finishes, and accessories.
- B. Samples: Submit two samples 12" x 12" in size illustrating surface texture and color.

1.3 QUALITY ASSURANCE

- A. Plywood Grading: Certified by American Plywood Association.

1.4 WARRANTY

- A. Furnish five year manufacturer's warranty for wood siding, including deterioration of finish for factory prefinished products.

PART 2 PRODUCTS

2.1 SIDING

- A. Manufacturers:
 - 1. Olympic Panel Pre-Primed MDO 1/2".
 - 2. Substitutions: Not Permitted.
- B. Product Description: Furnish flat board plywood sheet siding.

2.2 COMPONENTS

- A. Softwood Plywood: Panel A smooth paintable Group 1 species face veneer; core material of lumber; APA Texture Medium Density Overlay.

2.3 ACCESSORIES

- A. Screws: Corrosion resistant non-staining,

1. Vinyl Siding Nails: Minimum 0.313 inch diameter head and 0.125 inch shank diameter; length required to penetrate support minimum 0.75 inch.
- B. Flashings: 28gage thick metal: Accessory Components: Vented soffits, soffit vents, facias starter strips trim and corner boards' battens; refer to finish carpentry.
- C. Prime Paint: Breathable latex base primer enamel.

2.4 FABRICATION

- A. Panel Siding:
 1. Sheet Size: 4 x 10 feet size sheet, 1/2 inch thick.
 2. Sheet Profile: Flush with batten joints Space joints 1/4 inch apart.
 3. Surface Texture: Sanded
 4. Batten Strip Profile: 1 1/2" x 1/2" rectangular.

PART 3 EXECUTION

3.1 INSTALLATION

- A. Nail panel siding at maximum 12 inches oc. Install sheets vertically, Miter external corners.
- B. Blind nail except on over trim.
- C. Install siding for natural watershed.
- D. Align level, and plumb. Locate cut board edges and ends over bearing.
- E. Install metal flashings at internal and external corners, sills, head of wall openings and.
- F. Install corner strips, closures, trim and battens.
- G. Install sealant to prevent weather penetration. Maintain neat appearance.
- H. Preparation For Site Finishing:
 1. Sand work smooth and set exposed nails and screws.
 2. Site Finishing: Specified in Section 09 90 00

END OF SECTION

SECTION 07 46 23

WOOD SIDING

PART 1 GENERAL

1.1 SUMMARY

- A. Section includes sheathing paper, wood siding for walls with, related trim, corner boards, flashings, accessories, and fastenings.
 - 1. Type of Siding: Flat board siding.
- B. Related Sections:
 - 1. Section 06 10 00 - Rough Carpentry: Sheathing paper.
 - 2. Section 06 20 00 - Finish Carpentry: Exterior wood trim at windows.
 - 3. Section 09 90 00 - Painting and Coating: Prime and finish painting. Stain and seal finish. Back prime siding.

1.2 REFERENCES

- A. American Hardboard Association:
 - 1. AHA A135.6 - Hardboard Siding.
- B. U. S Department of Commerce National Institute of Standards and Technology:
 - 1. DOC PS 1 - Construction and Industrial Plywood.
 - 2. DOC PS 2 - Performance Standard for Wood-Based Structural-Use Panels.
 - 3. DOC PS 20 - American Softwood Lumber Standard.
- C. Western Wood Products Association:
 - 1. WWPA G-5 - Western Lumber Grading Rules.

1.3 QUALITY ASSURANCE

- A. Perform Work in accordance with the following:
 - 1. Lumber Grading Agency: Certified by DOC PS 20.
 - 2. Wood Structural Panel Grading Agency: Certified by EWA - The Engineered Wood Association.
 - 3. Lumber: DOC PS 20.
 - 4. Wood Structural Panels: DOC PS 1 or DOC PS 2.

1.4 DELIVERY, STORAGE, AND HANDLING

- A. Store in ventilated areas with constant minimum temperature of 60 degrees F and maximum relative humidity of 55 percent.

1.5 WARRANTY

- A. Furnish five year manufacturer's warranty for wood siding, including deterioration of finish for factory prefinished products.

PART 2 PRODUCTS

2.1 WOOD SIDING

- A. Manufacturers:
 - 1. Gates Custom Milling
 - 2. Substitutions: Permitted. Product Description: Furnish shiplap cypress board siding, , maximum 10 percent moisture content.

2.2 ACCESSORIES

- A. Screws: Corrosion resistant type; non-staining, of size and strength to securely and rigidly retain the work; prefinished to match siding finish.
- B. Nails: Stainless steel.
- C. Building Paper: Cellulose fiber building paper; water repellent breathing type ASTM D226; Unperforated asphalt felt, 10 mils thick.
- D. Flashing: 26 gage thick galvanized steel 20 mil black polyethylene.
- E. Soffits: Same material and finish as siding; vented type.
- F. Accessory Components: Starter strips, trim, and corner boards of same material and finish as siding.
- G. Prime Paint: Breathable latex base primer enamel.

2.3 FABRICATION - BOARD SIDING

- A. Board Siding:
 - 1. Size: 1 inch thick, 6 inch high nominal board with 1/2 inch lap.
 - 2. Board Profile: Vertical Ship lap.
 - 3. Species: Cypress.
 - 4. Surface Texture: Sanded.

2.4 SHOP FINISHING

- A. Pre-finish Color: Cabot Bleaching Oil.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify framing, substrate surfaces, and wall openings are ready to receive work.

3.2 PREPARATION

- A. Preservative Treatment: Apply preservative treatment in accordance with AWWA.
 - 1. Verify materials do not exceed specified percent moisture content before applying wood preservative treatment.
 - 2. Brush apply one coat of preservative treatment to siding soffit, and related trim.
- B. Treat site-sawn ends of preservative treated and prime painted wood siding. Allow preservative and primer to cure prior to erecting materials.
- C. Prime paint surfaces in contact with cementitious materials.

3.3 INSTALLATION - BUILDING PAPER

- A. Building Paper: Install one layer of building paper horizontally on sheathed walls.
 - 1. Weather lap edges and ends minimum 2 inches.
 - 2. Stagger vertical joints.
 - 3. Nail in Place unless otherwise stated to screw at module locations. in place.

3.4 INSTALLATION - SIDING

- A. Manufactured Siding: Install siding, soffits and batten strips.
 - 1. Delay installation of materials until site pre-finishing and backing primer by Section 09 90 00 is complete and dry.
- B. Preparation for Site Finishing:
 - 1. Set exposed fasteners, fill set holes, sand smooth.
 - 2. Site Finishing: Specified in Section 09 90 00.

3.5 ERECTION TOLERANCES

- A. Maximum Variation From Plumb : 1/4 inch per 10 feet.
- B. Maximum Offset From Joint Alignment: 1/16 inch.

END OF SECTION

SECTION 07 54 50

THERMOPLASTIC POLYOLEFIN (TPO) MEMBRANE ROOFING

1 GENERAL

1.1 SECTION INCLUDES

- A. Thermoplastic Polyolefin Membrane Roofing.
- B. Membrane Flashings.
- C. Metal Flashings.
- D. Roof Insulation.

1.2 RELATED SECTIONS

- A. Section 03300 - Cast-In-Place Concrete: Structural concrete roof decks.
- B. Section 03510 - Cementitious Roof Deck.
- C. Section 03520 - Lightweight Concrete Roof Insulation.
- D. Section 05310 - Steel Roof Deck.
- E. Section 06100 - Rough Carpentry: Roof blocking installation and requirements.
- F. Section 07620 - Sheet Metal Flashing and Trim: Metal flashing and counter flashing installation and requirements.
- G. Section 07700 - Roof Specialties and Accessories: Roof hatches, expansion joints, pavers and other related roof accessories.
- H. Section 08600 - Skylights: Roof Windows and metal framed skylights.
- I. Section 15430 - Plumbing Specialties: roof drains, scuppers, gutters and downspout installation and requirements.

1.3 REFERENCES

- A. American Society of Civil Engineers (ASCE) - ASCE 7 - Minimum Design Loads for Buildings and Other Structures, Current Revision.
- B. ANSI/SPRI WD-1 "Wind Design Standard for Roofing Assemblies".

- C. ASTM International (ASTM):
 1. ASTM C 208 - Standard Specification for Cellulosic Fiber Insulating Board.
 2. ASTM C 578 - Standard Specification for Rigid, Cellular Polystyrene Thermal Insulation.
 3. ASTM C 1289 - Standard Specification for Faced Rigid Cellular Polyisocyanurate Thermal Insulation Board.
 4. ASTM D 41 - Standard Specification for Asphalt Primer Used in Roofing, Dampproofing, and Waterproofing.
 5. ASTM D 226 - Standard Specification for Asphalt-Saturated Organic Felt Used in Roofing and Waterproofing.
 6. ASTM D 312 - Standard Specification for Asphalt Used in Roofing.
 7. ASTM D 412 - Standard Test Methods for Vulcanized Rubber and Thermoplastic Elastomers-Tension.
 8. ASTM D 1079 - Standard Terminology Relating to Roofing, Waterproofing, and Bituminous Materials.
 9. ASTM D 2178 - Standard Specification for Asphalt Glass Felt Used in Roofing and Waterproofing.
 10. ASTM D 4263 - Standard Test Method for Indicating Moisture in Concrete by the Plastic Sheet Method.
 11. ASTM D 4491 - Standard Test Methods for Water Permeability of Geotextiles by Permittivity.
 12. ASTM D 4869 - Standard Specification for Asphalt-Saturated Organic Felt Underlayment Used in Steep Slope Roofing.
 13. ASTM D 6878 - Standard Specification for Thermoplastic Polyolefin Based Sheet Roofing.
 14. ASTM E 96 - Standard Test Methods for Water Vapor Transmission of Materials.
 - D. Factory Mutual (FM Global):
 1. Approval Guide.
 - a. Factory Mutual Standard 4470 - Approval Standard for Class 1 Roof Covers.
 - b. Loss Prevention Data Sheets 1-28, 1-29.
 - E. International Code Council (ICC):
 1. International Building Code (IBC).
 - F. National Roofing Contractors Association (NRCA) - Low Slope Roofing and Waterproofing Manual, Current Edition.
 - G. Sheet Metal and Air Conditioning Contractors National Association, Inc. (SMACNA) - Architectural Sheet Metal Manual.
 - H. Underwriters Laboratories (UL):
 1. TGFU R1306 - "Roofing Systems and Materials Guide".
 2. UL-790 - Standard Test Method for Fire Tests of Roof Coverings.
 - I. ANSI/ASHRAE/IESNA Standard 9.1 (2007): Energy Standard for Buildings Except Low-Rise Residential Buildings.
- 1.4 DESIGN CRITERIA
- A. Wind Uplift Performance:
 1. Roof system is designed to withstand wind uplift forces as calculated using the current revision of ASCE-7.
 2. Roof system is designed to achieve a FM 1-___ wind uplift rating.
 3. Roof system is designed to achieve ___-psf of uplift testing.

4. Carlisle offers a standard 55 mph wind speed warranty. Please contact Carlisle if a higher wind speed warranty is desired.
- B. Fire Resistance Performance:
 1. Roof system will achieve a UL Class A rating when tested in accordance with UL-790.
 2. Roof system will achieve a UL Class B rating when tested in accordance with UL-790.
 3. Roof system will achieve a UL Class C rating when tested in accordance with UL-790.
 - C. Thermal Performance: Roof system will achieve a minimum R value not less than ____.
 - D. Drainage: Provide a roof system with positive drainage where all standing water dissipates within 48 hours after precipitation ends.
 - E. Building Codes:
 1. Roof system will meet the requirements of all federal, state and local code bodies having jurisdiction.

1.5 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. Detail Drawings:
 1. Submit approved plan, section, elevation or isometric drawings which detail the appropriate methods for all flashing conditions found on the project.
 2. Coordinate approved drawings with locations found on the Contract Drawings.
- D. Selection Samples: For each finish product specified, two complete sets of chips representing manufacturer's full range of available colors, membranes, and thicknesses.
- E. Verification Samples: For each finish product specified, two samples, minimum size 4 inches (100 mm) square representing actual product, color, and patterns.

1.6 QUALITY ASSURANCE

- A. Manufacturer Qualifications: All primary products specified in this section will be supplied by a single manufacturer with a minimum of fifteen (15) years experience.
- B. Installer Qualifications:
 1. All products listed in this section are to be installed by a single installer with a minimum of five (5) years demonstrated experience in installing products of the same type and scope as specified.
 2. Installer must be capable of extending the Manufacturer's Labor and Materials guarantee.
 3. Installer must be capable of extending the Manufacturer's No Dollar Limit guarantee.
- C. Mock-Up: Provide a mock-up for evaluation of surface preparation, installation techniques and workmanship.
 1. Finish areas designated by Architect.
 2. Do not proceed with remaining work until workmanship, color, and sheen are approved by Architect.

3. Refinish mock-up area as required to produce acceptable work.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Store products in manufacturer's unopened packaging until ready for installation.
- B. Store and dispose of hazardous materials, and materials contaminated by hazardous materials, in accordance with requirements of local authorities having jurisdiction.
- C. Material Safety Data Sheets (MSDS) must be on location at all times during the transportation, storage and application of materials.
- D. When loading materials onto the roof, the Authorized Roofing Applicator must comply with the requirements of the building owner to prevent overloading and possible disturbance to the building structure.

1.8 PROJECT CONDITIONS

- A. Proceed with roofing work only when weather conditions are in compliance with the manufacturer's recommended limitations, and when conditions will permit the work to proceed in accordance with the manufacturer's requirements and recommendations.
- B. Proceed with work so new roofing materials are not subject to construction traffic. When necessary, new roof sections shall be protected and inspected upon completion for possible damage.
- C. Provide protection, such as $\frac{3}{4}$ inch thick plywood, for all roof areas exposed to traffic during construction. Plywood must be smooth and free of fasteners and splinters.
- D. The surface on which the insulation or roofing membrane is to be applied shall be clean, smooth, dry, and free of projections or contaminants that would prevent proper application of or be incompatible with the new installation, such as fins, sharp edges, foreign materials, oil and grease.
- E. New roofing shall be complete and weather tight at the end of the work day.
- F. Contaminants such as grease, fats and oils shall not be allowed to come in direct contact with the roofing membrane.

1.9 WARRANTY

- A. At project closeout, provide to Owner or Owners Representative an executed copy of the manufacturer's Total System warranty, outlining its terms, conditions, and exclusions from coverage.
 1. Duration: 10 Years.
 2. Duration: 15 Years.
 3. Duration: 20 Years.
 4. Duration: 25 Years.
 5. Duration: 30 Years.
 6. Coverage to be extended to include accidental punctures in accordance with terms stated in the Warranty document.
 7. Coverage to be extended to include hail damage in accordance with terms stated in the Warranty document.
- B. When positioning membrane sheets, exercise care to locate all field splices away from low spots and out of drain sumps. All field splices should be shingled to prevent bucking of water.

2 PRODUCTS

2.1 MANUFACTURERS

- A. Acceptable Manufacturer: Carlisle SynTec , which is located at: P. O. Box 7000 ; Carlisle, PA 17013; Toll Free Tel: 800-4-SYNTEC; Tel: 717-245-7000; Email: [request info](mailto:requestinfo@carlisle-syntec.com) (Amanda.Lodge@syntec.carlisle.com); Web: www.carlisle-syntec.com
- B. Requests for substitutions will be considered in accordance with provisions of Section 01600.

2.2 SCOPE / APPLICATION

- A. Roof System: Provide a waterproof roof system, capable of withstanding uplift forces as specified in the Design Criteria article of this section.
1. Membrane Attachment: Mechanically Attached.
 2. Membrane Attachment: Fully Adhered.
 3. Membrane Attachment: Asphalt Adhered.
- B. Base Flashing: Provide a waterproof, fully adhered base flashing system at all penetrations, plane transitions and terminations.
- C. Insulation: Provide a roof insulation system beneath the finish membrane.
- D. Roof Garden Assembly:
1. Provide an Intensive planting system with a soil depth greater than 8 inches (204mm) with a variety of plants such as sod grass, annual or perennial flowers, shrubs and small trees. Structure must be capable of withstanding the additional dead loads as calculated by the Project Engineer which typically exceed 48 lbs per square foot.
 2. Provide an Extensive planting system with a soil depth of 4 inches to 8 inches (102 to 204 mm) where recommended plants include sedums, herbs, grasses and other vegetation which can grow in this depth of media. Structure must be capable of withstanding the additional dead loads as calculated by the Project Engineer which are typically between 24 to 48 lbs per square foot.
 - a. As an alternate to Ultra-Extensive or Extensive traditional, Carlisle Grid System may be used.
 3. Provide an Ultra-Extensive planting system with a soil depth less than 4 inches (102mm) ideally suited for areas that will receive little maintenance. Recommended plants include sedums, herbs and grasses. Structure must be capable of withstanding the additional dead loads as calculated by the Project Engineer which are typically less than 24 lbs per square foot.

2.3 MEMBRANE BASE SHEET

- A. Carlisle FR Base Sheet 1S: A non-asphaltic, resin-bound, fiberglass-reinforced mat, coated on one side with a mineral-filled fire-resistant coating (42" wide and 200' long). Designed for use as a suitable substrate for direct application of Mechanically Fastened Roofing Systems over decks requiring a fastened base sheet.
- B. Carlisle Modified Base Sheet: A tough, glass fiber, reinforced, SBS-modified asphalt, base sheet (nominal 39" wide by 50' long) that meets or exceeds the requirements for ASTM D 6163 Type I, Grade S for SBS-modified bituminous sheet materials using glass fiber reinforcement. Designed for use with the Sure-Weld AFX Roofing System.
- C. 725TR: A 40-mil thick composite consisting of 32-mil self-adhering rubberized asphalt membrane laminated to an 8-mil spun bonded polyester fabric which has a permeability rating (ASTM E-96) of 0.05

perms and is fully compatible with urethane based insulation adhesive. Available in rolls 36” wide by 75’ long (225 square feet).

2.4 INSULATION

- A. Polyisocyanurate HP-H: Rigid board with fiber reinforced facers on both sides, meeting or exceeding the requirements of ASTM C 1289. Carlisle HPH.
 - 1. Compressive Strength: 20 psi (138 kPa).
 - 2. Density: 2 lb per cubic foot (24 kg/cu m) minimum.

2.5 THERMOPLASTIC POLYOLEFIN (TPO) MEMBRANE

- A. Sure-Weld Membrane:
 - 1. Color: White.
 - 2. Color: Gray.
 - 3. Membrane Thickness: 60 mil nominal.
 - a. Thickness over Scrim: 0.020 inches (0.508mm).
 - b. Breaking Strength (ASTM D 751): 250 lbf/in (1.1 kN/m) minimum.
 - c. Tear Resistance (ASTM D 751): 55 lbf/in (245 N/m) minimum.
 - d. Elongation (ASTM D 751): 25 percent.
 - 4. Field Sheet Dimensions:
 - a. Width: 6 feet (1.8 m) maximum.
 - b. Width: 8 feet (2.4 m) maximum.
 - c. Width: 10 feet (3.05 m) maximum.
 - d. Width: 12 feet (3.65 m) maximum.
 - e. Length: 100 feet (30.5 m) maximum.

2.6 FLASHING ACCESSORIES

- A. Inside Corners: Pre-molded corner flashing for inside corners. 60 mil thickness. Color to match membrane. Special colors require custom fabrication process.
- B. Outside Corners: Injection molded corner used for flashing outside corners. 60 mil thickness. Color to match membrane. Special colors require custom fabrication process.
- C. TPO T-Joint Covers: Injection molded 60 mil thick TPO formed into a 4.5 inch (114mm) diameter circle used to seal step-offs at splice intersections. Color to match membrane. Special colors require custom fabrication process.
- D. TPO Curb Wrap Corners: Pre-fabricated corner flashings made from 45 mil thick reinforced Sure-Weld membrane. 6 inch (152mm) wide base flange and a 12 inch (305mm) overall height. Sizes available to fit curbs up to 6 foot by 6 foot (1828 x 1828 mm) in size. Color to match membrane. Gray, tan and special colors require custom fabrication process.
- E. Molded Pipe Seals: A pre-molded flashing and clamping ring used for pipe penetrations. Available for 0.75 inch to 8 inch (19 – 203.2mm) diameter pipes. Color to match membrane. Special colors not available.
- F. Split Pipe Seals: Pre-fabricated flashing consisting of 45 mil thick reinforced Sure-Weld Membrane for pipes 1 inch to 6 inch (25.4 – 152.4mm) in diameter. A split (cut) and overlapped tab is incorporated to allow the pipe seal to be opened and wrapped around the pipe when it is not possible to pull a standard pipe flashing over a round penetration. Gray, tan and special colors require custom order fabrication. Custom sizes available on a special order basis.

- G. TPO Square Tubing Wraps: Pre-fabricated flashings made of 45 mil thick reinforced Sure-Weld membrane for square tubing. A split (cut) and overlap tab are incorporated into these parts to allow the seals to be opened and wrapped around a square tubing penetration with an obstruction. Stock sizes include 3- inch, 4-inch, 5-inch and 6 inch (76, 102, 127, 152 mm) diameter square tubing. Gray, tan and special colors require custom order fabrication. Custom sizes available on a special order basis.
- H. TPO Molded Sealant Pockets:
1. A two-piece, interlocking injection molded, flexible pocket with a rigid polypropylene vertical wall and pre-formed deck flanges. Color to match membrane. Special colors not available.
 2. Used with Thermoplastic One-Part Pourable Sealer as specified in this section for waterproofing pipe clusters or other odd shaped penetrations. The removable built-in extensionlegs allow the oval pocket to adjust from 7.5 inches to 12 inches (191mm – 305mm) in length while maintaining a 6-inch width (152mm).
- I. Pre-Fabricated Sealant Pockets: A two-piece, pre-fabricated sealant pocket that utilizes reinforced TPO membrane and coated metal to form a rigid, oversized sealant pocket with a weldable horizontal deck flange. Color - White. Gray, tan and special colors require custom order fabrication. Custom sizes available on a special order basis.
1. 12 inch (305mm) - Total volume of 1.87 gallons.
 2. 16 inch (406mm) - Total volume of 2.77 gallons.
 3. 20 inch (508mm) - Total volume of 3.81 gallons.
- J. Sealant Pocket Extension Legs: Designed for use with the TPO Molded Sealant Pocket and the Pre-Fabricated Sealant Pocket to extend the length in increments of 10 inches (254mm). Fabricated from 45 mil thick reinforced TPO membrane and TPO coated metal. Can be used full length, cut to size for customized lengths or welded to each other for extra long applications. Color - White. Gray, tan and special colors require custom order fabrication.
- K. Pressure-Sensitive Cover Strip: A nominal 6 inch (152mm) wide by 40 mil thick non-reinforced TPO membrane laminated to nominal 35-mil thick cured synthetic rubber pressure-sensitive adhesive. Used in conjunction with TPO Primer to strip in flat metal flanges (i.e., drip edges or rows of fasteners and plates). Color to match membrane. Special colors not available.
- L. TPO Pressure-Sensitive RUSS:
1. 6 inch (152mm) RUSS: A nominal 6 inch (152mm) wide, 45 mil thick reinforced TPO membrane with nominal 3 inch (76mm) wide 35mil thick cured synthetic rubber pressure-sensitive adhesive laminated along one end. This product allows a continuous piece of membrane to be run up a parapet wall without fastener penetration through the field sheet at angle changes.
 2. 10 inch (254mm) RUSS: A nominal 10 inch (254mm) wide, 45 mil thick reinforced TPO membrane with nominal 3 inch (76mm) wide 35mil thick cured synthetic rubber pressure-sensitive adhesive laminated along both ends. The TPO 10-inch RUSS is used in place of narrow sheets to secure membrane in the perimeter roof area. The use of this product allows field membrane to be utilized over the entire roof area.
- M. Sure-Weld Heat Weldable Walkway Rolls: Superior tear, puncture and weather resistance and designed to protect Sure-Weld membrane in those areas exposed to repetitive foot traffic or other hazards. Walkway material may be heat welded to Sure-Weld membrane using an automated heat welder or hand held heat welder. Walkway Rolls are 34 inches (864mm) wide by 50 feet (15.2 m) long and are nominal 180 mils thick. Color – White, gray and tan.
- N. Non-Reinforced Flashing: Non-reinforced TPO flashing is a 60-mil thick non-reinforced TPO based membrane used for detail work where the use of pre-molded or pre-fabricated accessories are not

feasible. Color – White, gray and tan. Special colors require lead time and 5,000 square foot minimum.

2.7 CLEANERS, PRIMERS, ADHESIVES AND SEALANTS

- A. Sure-Weld Bonding Adhesive: A high-strength solvent-based contact adhesive used for bonding Sure-Weld membrane to various porous and non-porous substrates.
 - 1. Base: Synthetic Rubber.
 - 2. Color: Yellow.
 - 3. Solids: 20.0 percent.
 - 4. VOC: 670 grams/liter.
- B. Low VOC Bonding Adhesive: A high strength, solvent-based contact adhesive that allows bonding of Sure-Weld membrane to various porous and non-porous substrates. It is specially formulated using a blend of VOC exempt and non-exempt solvents to be in compliance with the state of California Clean Air Act of 1988 (updated in 1997) and as further regulated by California's Air Quality Control Districts listing VOC grams per liter limitations.
 - 1. Base: Synthetic Rubber.
 - 2. Color: Yellow.
 - 3. Solids: 20.3 percent.
 - 4. VOC: 250 grams/liter.
- C. FAST 100 or 100-LV Adhesive: A spray or extruded applied, two-component, polyurethane, low-rise expanding foam adhesive used to securely bond FleeceBACK membranes to a variety of substrates.
- D. FAST Dual Cartridge Adhesive: A two-component, polyurethane construction grade, low-rise expanding adhesive used to securely bond FleeceBACK membranes to a variety of substrates. The adhesive is extrusion applied 4 inch (102mm), 6 inch (152mm) or 12 inch (305mm) on center (depending on project conditions) using a portable applicator.
- E. FAST Adhesive Box Sets: A spray applied, two-component, polyurethane construction grade, low-rise expanding adhesive used to securely bond FleeceBACK membranes to a variety of substrates.
- F. FAST Bag in a Box: A two-component, polyurethane construction grade, low-rise expanding adhesive designed for bonding insulation to various substrates, packaged for use with the PaceCart 2.
- G. Aqua Base 120 Bonding Adhesive: a semi pressure-sensitive water based adhesive. Used as a one-sided, wet lay-in adhesive with Sure-Seal, Sure-White or Sure-Weld FleeceBACK 100 or 115 mil membranes or as a two-sided contact adhesive with non-fleece backed Sure-Weld TPO, Sure-Flex PVC, or Sure-Seal EPDM membranes. Adhesive is limited to 15 year warranty.
- H. Cut Edge Sealant: A medium solids content, free flowing polymeric material designed for sealing cut edges (exposed fabric) of Sure-Weld reinforced membrane.
- I. Water Cut-Off Mastic: A one-component, low viscosity, self wetting, Butyl blend mastic used as a compression sealing agent between membrane and applicable substrates.
- J. Low VOC Primer: Manufacturer's recommended low VOC primer.
- K. TPO Primer: Solvent-based product designed to prepare TPO membrane for improved adhesion to TPO surfaces prior to the application of pressure-sensitive products and sealant pockets.
- L. Universal Single-Ply Sealant: A 100 percent solids, solvent free, VOC free, one-part polyether sealant that provides a weather tight seal to a variety of building materials. It is used for general caulking such as

above termination bars and metal counter flashings and at scupper details.. Available in white only.

- M. Thermoplastic One-Part Sealant: Single component, moisture curing, elastomeric polyether sealant that is compatible with Carlisle's Thermoplastic membranes. Provides a flexible, durable and long lasting seal around hard-to-flash penetrations in Thermoplastic Roofing Systems.
- N. Carlisle Weathered Membrane Cleaner: Clear, solvent-based cleaner used to loosen and remove contaminants from the surface of exposed membrane.
- O. 702 Primer: A single component, solvent based, high tack primer used to provide maximum adhesion between Carlisle 725 Air & Vapor Barrier and an approved substrate. Applied by spray or long nap roller with a coverage rating ranging from approximately 250 square feet per gallon on smooth finishes (i.e., concrete) to 75 square feet per gallon on porous surfaces (i.e., DensDeck Prime gypsum board). Available in 5-gallon containers.
- P. Cav-Grip: A multi-purpose contact adhesive recommended for enhancing bond of CCW self-adhering sheet products and for bonding MiraDRAIN and board insulation to various substrates.

2.8 BITUMEN

- A. Hot Asphalt: Meets or exceeds requirements of ASTM D 312:
 1. Type: Type III
 2. Type: IV
 3. Type: SEBS
- B. Cut-Back Asphalt Primer: ASTM D 41 primer for structural concrete decks, existing smooth BUR, mineral surfaced cap sheet, or modified bitumen membranes prior to mopping.

2.9 FASTENING COMPONENTS

- A. HP Fastener: Threaded, coated (E-Coat) fastener for use with steel, wood plank or oriented strand board (OSB). For insulation fastening only on TPO Mechanically Fastened Roofing Systems.
- B. HP-X Fasteners: Heavy-duty #15 threaded fastener with a Phillips head for standard TPO seam fastening (Mechanically Fastened Roofing Systems) and where increased pullout resistance is necessary for steel and wood decks (Fully Adhered Roofing Systems).
- C. HP-Xtra Fasteners: An oversized diameter #21 steel threaded fastener used with HP Extra Polymer Seam Plates for membrane securement on Mechanically Fastened Roofing Systems.
- D. HD 14-10 Concrete Fastener: A #14 threaded fastener used for minimum 3,000 psi concrete decks.
- E. CD-10 Concrete Fastener: A hammer-driven, non-threaded E-Coat fastener for use with structural concrete decks rated 3,000 psi or greater.
- F. InsulFast Fasteners: Threaded, #12 fastener with a #3 Phillips head used with 3 inch (76mm) diameter Insulation Plates. For insulation attachment into steel or wood decks.
- G. Pre-Assembled ASAP Fasteners: InsulFast Fastener and pre-assembled 3 inch (76mm) diameter Plastic Insulation Plate for insulation attachment on adhered and mechanically-fastened roofing systems.
- H. HP-NTB Fastener: A non-penetrating, plastic fastener and plate for cementitious wood fiber and gypsum.

- I. Lite-Deck Fastener: An oversized diameter metal fastener and associated 3 inch diameter Lite-Deck metal plate for use on adhered roofing systems to attach insulation to dense gypsum decks, cementitious wood fiber and lightweight insulating concrete.
- J. HP Term Bar Nail-In: A 1 1/4 inch (32mm) long expansion anchor with threaded drive pin used for fastening Termination Bar or Seam Fastening Plates to concrete, brick or block walls.
- K. Base Sheet Fasteners And Plates:
 - 1. Carlisle Dual-Prong Fastener - A factory pre-assembled, 1.8 inch (46mm) long fastener consisting of a precision tube formed from galvanized (G-90) coated steel, a 2.7 inch (69mm) diameter disk formed from Galvalume (AX-55) coated steel and a locking staple of high tensile steel wire used to secure base sheets to fibrous cement, lightweight concrete and gypsum providing 70 lbs. of pullout resistance is achieved (40 lbs. Min.).
 - 2. Carlisle Metal Cap: For use on projects limited in height 30 feet (9.14 M) or 40 feet (12.2 M) depending on base sheet used, 1 inch (25mm) Carlisle Metal Cap in conjunction with a ring shank nail may be use to attach base sheets to wood plank, plywood or OSB decks per Carlisle's approved fastening pattern.
 - 3. Base Sheet fasteners and plates by others must be FM approved and the respective manufacturers' published recommendations for proper installation must be followed.
- L. Piranha Plates: A 2 3/8 inch (60mm) diameter metal barbed fastening plate used with Carlisle HP-X, CD-10 or HD 14-10 Fasteners for membrane securement. This plate can be used for insulation securement.
- M. Piranha Extra Plates: A 2 3/8 inch (60mm) diameter metal barbed fastening plate with an oversized hole for use with Carlisle HP-Xtra Fasteners for membrane securement.
- N. Seam Fastening Plates: A 2 inch (52mm) diameter metal plate used for insulation attachment on Mechanically Fastened Roofing Systems or membrane securement on Adhered Roofing Systems in conjunction with the appropriate Carlisle Fastener. Not for use on Sure-Weld systems.
- O. Insulation Fastening Plates: A nominal 3 inch (76mm) diameter metal plate used for insulation attachment in conjunction with the appropriate Carlisle Fastener.

2.10 EDGINGS AND TERMINATIONS

- A. SecurEdge 200: A snap-on edge system consisting of a 24 gauge galvanized metal water dam. Finish as noted on the Finish Schedule of the Contract Drawings.
- B. SecurEdge 300: A 24 gauge galvanized metal water dam. Finish as noted on the Finish Schedule of the Contract Drawings.
- C. SecurEdge 1000: A metal anchor bar fascia system consisting of a formed quarter hard 0.050 inch (1.25 mm) aluminum retainer bar, corrosion resistant fasteners and a 0.040 inch (1 mm) aluminum or 24 gauge steel snap-on fascia cover.
- D. SecurEdge 2000: An anchor bar roof edge fascia system consisting of 0.100 inch (2.5 mm) thick extruded aluminum bar, corrosion resistant stainless steel fasteners and snap-on fascia cover.
- E. SecurEdge 3000: A metal anchor bar fascia system consisting of a 20 gauge steel retainer bar, corrosion resistant fasteners and aluminum or 24 gauge steel snap-on fascia cover.
- F. Sure-Seal Drip Edge: A 22 gauge pre-punched 90-degree angle cleat and 12 foot (3658mm) long fascia sections. Kynar 500 or aluminum finish as noted on the Finish Schedule of the Contract Drawings.

- G. SecurEdge 200 Coping: An anchor cleat with pre-slotted holes, a concealed joint cover, and 10 or 12 foot sections of coping cap. Kynar 500 finish as noted on the Finish Schedule of the Contract Drawings.
- H. SecurEdge 300 Coping: An anchor cleat with pre-slotted holes, a concealed joint cover, and 10 or 12 foot sections of coping cap. Kynar 500 finish as noted on the Finish Schedule of the Contract Drawings.
- I. Sure-Seal Ballast Retaining Bar: A ballast retaining perimeter securement system comprised of a slotted extruded aluminum retention bar with integrated compression fastening strip.
- J. Sure-Weld Coated Metal: 4 foot by 10 foot coated metal sheets made from 24 gauge galvanized steel with a minimum .035 inch (0.9mm) thick non-reinforced Sure-Weld laminate. Sure-Weld membrane can be welded directly to the Sure-Weld Coated Metal in accordance with the manufacturer's detail. Color to match membrane.
- K. Sure -Seal Termination Bar: 1 inch (13 mm) wide, .098 inch (2.5mm) thick extruded aluminum bar pre-punched 6 inches (152 mm) on center with sealant ledge to support Lap Sealant.

3 EXECUTION

3.1 EXAMINATION

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

3.2 PREPARATION

- A. Clean surfaces thoroughly prior to installation.
- B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.
- C. Do not commence work until all other work trades have completed jobs that require them to traverse the deck on foot or with equipment.
- D. A vapor retarder / temporary roof (Carlisle 725 TR Air & Vapor Barrier/Temporary Roof) may be applied to protect the inside of the structure prior to the roof system installation.

3.3 INSULATION PLACEMENT

- A. Install insulation or membrane underlayment in multiple layers over the substrate with boards butted tightly together with no joints or gaps greater than 1/4 inch (6 mm). Stagger joints both horizontally and vertically if multiple layers are provided.
- B. Secure insulation to the substrate with the required mechanical fasteners or insulation adhesive in accordance with the manufacturer's current application guidelines.
- C. Do not install wet, damaged or warped insulation boards.
- D. Stagger joints in one direction unless joints are to be taped. Install insulation boards snug. Gaps between board joints shall not exceed 1/4 inch (6 mm). Fill all gaps in excess of 1/4 inch (6 mm) with same insulation material.

- E. Wood nailers must be at least 3 1/2 inches (89 mm) wide or 1 inch (25 mm) wider than adjacent metal flange. Thickness must equal that of insulation but not less than 1 inch (25 mm) thickness.
- F. Miter and fill the edges of the insulation boards at ridges, valleys and other changes in plane to prevent open joints or irregular surfaces. Avoid breaking or crushing of the insulation at the corners.
- G. Do not install any more insulation than will be completely waterproofed each day.

3.4 INSULATION ATTACHMENT

- A. Securely attach insulation to the roof deck for Adhered or Mechanically Fastened Roofing Systems. Attachment must have been successfully tested to meet or exceed the calculated uplift pressure required by the International Building Code (ASCE-7) or ANSI/SPRI WD-1.
- B. Enhance the perimeter and corner areas in accordance with the International Building Code (ASCE-7) or ANSI/SPRI WD-1.
- C. Install insulation layers, maximum 4 feet by 4 feet (1220 mm by 1220 mm) board size, in a full and uniform mopping of hot asphalt applied at the rate of 25 lb/square (1.2 kg/sm). Stagger the joints of additional layers in relation to the insulation joints in the layer(s) below by a minimum of 6 inches (152 mm).
- D. Install insulation layers, maximum 4 feet by 4 feet (1220 mm by 1220 mm), applied with adhesive, coverage rate as necessary to achieve the specified attachment and uplift rating. Press each board firmly into place after adhesive develops strings when touched, typically 1-1/2 to 2 minutes after adhesive was applied, and roll with a weighted roller. Add temporary weight and use relief cuts to ensure boards are well adhered. Stagger the joints of additional layers by a minimum of 6 inches (152 mm).

3.5 MEMBRANE PLACEMENT AND ATTACHMENT (Mechanically Attached)

- A. Unroll and position membrane without stretching. Allow the membrane to relax for approximately 1/2 hour prior to attachment. Provide and secure both perimeter and field membrane sheets in accordance with the manufacturer's most current specifications and details.
- B. Secure the membrane with the required Carlisle Fasteners and Plates centered over the pre-printed marks approximately 1-1/2 inches from the edge of the membrane sheet.
- C. Install adjoining membrane sheets in the same manner in accordance with the manufacturer's current application requirements.

3.6 SEAM WELDING

- A. Hot-air weld membrane using an Automatic Hot Air Welding Machine or Hot Air Hand Welder in accordance with the manufacturer's current guidelines. At all splice intersections, roll the seam with a silicone roller to ensure a continuous hot air welded seam.
- B. Overlay all splice intersections with Sure-Weld T-Joint Cover.
- C. Probe all seams once the hot air welds have thoroughly cooled (approximately 30 minutes).
- D. Repair all seam deficiencies the same day they are discovered.
- E. Apply Cut Edge Sealant on all cut edges of reinforced membrane (where the scrim reinforcement is

exposed) after seam probing is complete. Cut Edge Sealant is not required on vertical splices.

3.7 FLASHING

- A. Flashing of parapets, curbs, expansion joints and other parts of the roof must be performed using Sure-Weld reinforced membrane or prefabricated accessories. Sure-Weld non-reinforced membrane may be used for flashing pipe penetrations, Sealant Pockets, and scuppers, as well as inside and outside corners, when the use of pre-molded or prefabricated accessories is not feasible.
- B. Follow manufacturer's typical flashing procedures for all wall, curb, and penetration flashing including metal edging/coping and roof drain applications.

3.8 DAILY SEALS

- A. On phased roofing, when the completion of flashings and terminations is not achieved by the end of the work day, a daily seal must be performed to temporarily close the membrane to prevent water infiltration.
- B. Complete an acceptable membrane seal in accordance with the manufacturer's requirements.

3.9 CLEAN UP

- A. Perform daily clean-up to collect all wrappings, empty containers, paper, and other debris from the project site. Upon completion, all debris must be disposed of in a legally acceptable manner.
- B. Prior to the manufacturer's inspection for warranty, the applicator must perform a pre-inspection to review all work and to verify all flashing has been completed as well as the application of all caulking.

3.10 PROTECTION

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

END OF SECTION

SECTION 07 62 00

SHEET METAL FLASHING AND TRIM

PART 1 GENERAL

1.1 SUMMARY

- A. Section includes flashings, gutters and downspouts and fabricated sheet metal items.

1.2 SYSTEM DESCRIPTION

- A. Sheet Metal System: Conform to criteria of SMACNA "Architectural Sheet Metal Manual."
 - 1. Gutters: SMACNA Details as indicated on drawings.
 - 2. Downspouts: SMACNA Details as indicated on drawings.
 - 3. Flashings: SMACNA Details as indicated on drawings.
 - 4. Splash Pan: SMACNA Details as indicated on drawings.
 - 5. Roof Coping: SMACNA Details as indicated on drawings.
- B. Gutters and Downspouts: Size components for rainfall intensity determined by storm occurrence of 1 in 5 years in accordance with SMACNA recommendations.

1.3 SUBMITTALS

- A. Shop Drawings: Indicate material profile, jointing pattern, jointing details, fastening methods, flashings, termination, and installation details.

1.4 WARRANTY

- A. Furnish two year manufacturer warranty for finishes.

PART 2 PRODUCTS

2.1 SHEET METAL FLASHING AND TRIM

- A. Fabricators:
 - 1. Gutters. Englert Inc.
 - 2. Downspouts. Englert Inc.
 - 3. Splash Pan.
 - 4. Flashing.
 - 5. Roof Coping.
 - 6. Substitutions: Not Permitted.

- B. Product Description: Flashing and sheet metal; unfinished or prefinished, including gutters, downspouts, splash pans and roof copings.

2.2 COMPONENTS

- A. Seal joints watertight.
- B. Install snow guards as indicated on Drawings.

2.3 ACCESSORIES

- A. Fasteners: Galvanized steel
- B. Gutter and Downspout Anchorage Devices: recommended by fabricator.
- C. Gutter Supports: Brackets Downspout Supports: Brackets

2.4 FABRICATION

- A. Gutter Accessories: Profiled to suit gutters and downspouts.
- B. Gutters: Metal profile as indicated on Drawings.
 1. Manufacturer: Englert Inc
 2. Model: RainPro
 3. Color: Charcoal
- C. Downspouts: Aluminum 3 inch x 4 inch profile as indicated on Drawings.
 1. Manufacturer: Englert
- D. Roof Coping: profile as indicated on Drawings.
 1. Manufacturer: Englert Continuous Cleat Coping.
 2. 24 ga. Steel Color: Charcoal.
- E. Form components to shape indicated on Drawings, accurate in size, square, and free from distortion or defects. Form pieces in longest practical lengths.

2.5 SHOP FINISHING

- A. Class I Natural Anodized Finish: AAMA 611 Clear anodic coating not less than 0.7 mils thick.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify roof openings, curbs, pipes, sleeves, ducts, or vents through roof are solidly set, cant strips and reglets in place, and nailing strips located.
- B. Verify membrane termination and base flashings are in place, sealed, and secure.

3.2 PREPARATION

- A. Paint concealed metal surfaces and surfaces in contact with dissimilar metals with protective backing paint to minimum dry film thickness of 15 mil.

3.3 INSTALLATION

- A. Install starter and edge strips, and cleats.
- B. Install surface mounted reglets. Seal top of reglets with sealant. Insert flashings to form tight fit. Seal flashings into reglets with sealant.
- C. Secure flashings, gutters and downspouts in place using concealed fasteners.

END OF SECTION

SECTION 08 14 16

FLUSH WOOD DOORS

PART 1 GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Flush wood doors.
 - 2. Transom panels.
 - 3. Door louvers.
- B. Related Requirements:
 - 1. Section 06 20 00 - Finish Carpentry: Wood door frames.
 - 2. Section 08 71 00 - Door Hardware.
 - 3. Section 09 90 00 - Painting and Coating: Site finishing of wood doors.

1.2 REFERENCE STANDARDS

- A. American National Standards Institute:
 - 1. ANSI A135.4 - Basic Hardboard.
- B. ASTM International:
 - 1. ASTM C1048 - Standard Specification for Heat-Treated Flat Glass-Kind HS, Kind FT Coated and Uncoated Glass.
 - 2. ASTM E413 - Classification for Rating Sound Insulation.
- C. Architectural Woodwork Institute:
 - 1. AWI AWS - Architectural Woodwork Standards.
- D. Forest Stewardship Council:
 - 1. FSC Guidelines - Forest Stewardship Council Guidelines.
- E. Hardwood Plywood and Veneer Association:
 - 1. HPVA HP-1 - American National Standard for Hardwood and Decorative Plywood.
- F. National Fire Protection Association:
 - 1. NFPA 80 - Standard for Fire Doors, Fire Windows.
 - 2. NFPA 105 - Standard for the Installation of Smoke Door Assemblies and other Opening Protectives.
 - NFPA 252 - Standard Methods of Fire Tests of Door Assemblies.

- G. Wood Window and Door Manufacturers Association:
 - 1. WDMA I.S 1A - Architectural Wood Flush Doors.

1.3 COORDINATION

- A. Coordinate Work with door opening construction, door frame and door hardware installation.

1.4 SUBMITTALS

- A. Product Data:

- 1. Submit data for door core materials and construction.
- 2. Submit data for veneer species, type and characteristics.
- 3. Submit data for factory finishes.

- B. Shop Drawings:

- 1. Indicate door opening criteria, elevations, sizes, types, swings, undercuts required, special blocking for hardware and factory machining criteria.

- C. Samples:

- 1. Submit two samples of door construction, 3 x 3 inch in size cut from bottom corner of door.

- D. Manufacturers' Instructions: Submit special installation instructions.

- E. Qualification Statements:

- 1. Submit manufacturer experience qualifications.

1.5 QUALITY ASSURANCE

- A. Perform Work in accordance with AWI AWS Section 9, Custom Grade.

- B. Finish doors in accordance with AWI AWS Section 5 Custom.

- C. Maintain two copies of each document on site.

1.6 QUALIFICATIONS

- A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years experience.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Protect doors with resilient packaging. Do not store in damp or wet areas; or in areas where sunlight might bleach veneer. Seal top and bottom edges when stored more than one week.
- B. Accept doors on site in manufacturer's packaging. Inspect for damage.
 - 1. Break seal on site to permit ventilation.

1.8 WARRANTY

- A. Include coverage for de-lamination of veneer, warping beyond specified installation tolerances, defective materials, and telegraphing core construction.
- B. Interior Doors:
 - 1. Factory Finished Doors: Furnish manufacturer's life of installation warranty.
 - 2. Field Finished Doors: Furnish manufacturer's ten year warranty.

PART 2 PRODUCTS

2.1 FLUSH WOOD DOORS

- A. Manufacturer List:
 - 1. Interior Doors DirectModel#5000 Kinsman Collection1 3/8 x 6'-8" (80").
- B. Flush Interior Wood Doors: Solid core.
 - 1. Thickness: 1-3/4 inches
 - 2. Core: Solid Core.
 - 3. Face Construction: Seven ply.
 - 4. Performance Duty Level: Standard
 - 5. Quality Grade: Premium
- C. Transom Panels: Match doors.
 - 1. Face Veneer: Continuous match with door face.
- D. Performance / Design Criteria:
 - 1. Performance Duty Level: WDMA I.S. 1A.
 - 2. Sound Transmission Resistance: ASTM E413; minimum STC 35 for door and frame assemblies indicated as acoustically rated.

2.2 MATERIALS

- A. Door Cores: AWI AWS Section 9.

1. Solid Core, Non-Fire Rated:
 - a. Type: PC; Agrifiber.
2. Solid Core, Fire Rated: Neutral Pressure Standard.
 - a. Type FD; fire resistive composite.
3. Specialty Function: For locations and performance as indicated on Drawings.

B. Interior Door Faces:

1. Opaque Finished Faces: Close-grain hardwood veneer.
2. Transparent Finished Faces: Wood veneer.
 - a. Species: Poplar.
 - b. Veneer Cut: As specified by manufacturer.
 - c. Veneer Matching: Book matched
 - d. Face Matching: Pair matches multiple door leaves in single opening.
3. Plastic Laminate Finished Faces: High pressure decorative laminate.

- C. Hardboard: ANSI A135.4; type as specified for door faces; 1/8 inch thick.

2.3 FABRICATION

- A. Fabricate doors in accordance with AWI AWS Section 9 requirements.
- B. Furnish lock blocks at lock edge and top of door for closer for hardware reinforcement.
- C. Vertical Exposed Edge of Stiles: Wood veneer matching door facing
- D. Fit door edge trim to edge of stiles after applying veneer facing.
- E. Bond edge banding to cores.
- F. At exterior doors, furnish aluminum flashing at top and bottom rail for full thickness and width of door. Embed ends of flashing in sealant.
- G. Factory machine doors for finish hardware in accordance with hardware requirements and dimensions. Do not machine for surface hardware. Furnish solid blocking for through bolted hardware.
- H. Factory fit doors for frame opening dimensions identified on shop drawings.
- I. Cut and configure exterior door edge to receive recessed weather stripping devices.
- J. Provide edge clearances in accordance with AWI AWS Section 9.

2.4 FINISHES

- A. Finish work in accordance with AWI AWS Section 5; Premium Grade.

- B. Factories finish doors in accordance with approved sample. Architect/Engineer provided sample.
- C. Seal door top edge with clear sealer to match door facing.

2.5 ACCESSORIES

- A. Wood Door Louvers:
 - 1. Material and Finish: Match door face.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify opening sizes and tolerances are acceptable.
- B. Do not install doors in frame openings that are not plumb or are out-of-tolerance for size or alignment.

3.2 INSTALLATION

- A. Install doors in accordance with AWI AWS Section 9 and manufacturer's instructions.
- B. Field Fitting and Trimming:
 - 1. Trim non-rated door width by cutting equally on both jamb edges.
 - 2. Trim door height by cutting bottom edges to maximum of 3/4 inch.
 - a. Trim fire door height at bottom edge only, in accordance with fire rating requirements.
 - 3. Machine cut doors for hardware installation.
- C. Coordinate installation of doors with installation of frames specified in Section 08 71 00.
- D. Install door louvers plumb and level.
- E. Site finish doors in accordance with Section 09 90 00.

3.3 TOLERANCES

- A. Conform to AWI AWS Section 9 requirements for the following:
 - 1. Fit and clearance tolerances.
 - 2. Gaps.
 - 3. Flushness.
 - 4. Flatness.

5. Squareness.

3.4 ADJUSTING

- A. Adjust door for smooth and balanced door movement.
- B. Adjust door closer for full closure.

3.5 ATTACHMENTS

- A. Refer to Door and Frame Schedule appended to this section.

END OF SECTION

SECTION 08 35 13

FOLDING DOORS

PART 1 GENERAL

1.1 SUMMARY

- A. Section includes accordion folding non-acoustical doors, manually operated, with track and operating hardware.
- B. Related Sections:
 - 1. Section 06 20 00 - Finish Carpentry: Wood frame and perimeter trim.
 - 2. Section 08 71 00 - Door Hardware: Lock cylinders.

1.2 REFERENCES

- A. ASTM International:
 - 1. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials.
 - 2. ASTM F793 - Standard Classification of Wallcovering by Use Characteristics.
- B. Forest Stewardship Council:
 - 1. FSC Guidelines - Forest Stewardship Council Guidelines.
- C. National Fire Protection Association:
 - 1. NFPA 265 - Standard Methods of Fire Tests for Evaluating Room Fire Growth Contribution of Textile Coverings on Full Height Panels and Walls, Method B.
 - 2. NFPA 286 - Standard Methods of Fire Tests for Evaluating Room Fire Growth Contribution of Wall and Ceiling Interior Finish.

1.3 QUALITY ASSURANCE

- A. Sound Transmission Classification (STC): As specified, calculated in accordance with ASTM E413, based on tests performed in accordance with ASTM E90, on door size of 100 sq ft.
- B. Surface Burning Characteristics:
 - 1. Textile Wall Coverings: Comply with one of the following:
 - a. Maximum 25/450 flame spread/smoke developed index when tested in accordance with ASTM E84.

1.4 QUALIFICATIONS

- A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years documented experience.

- B. Installer: Company specializing in performing work of this section with minimum 3 years documented experience approved by manufacturer.

PART 2 PRODUCTS

2.1 ACCORDION FOLDING DOORS

- A. Non-Acoustical Accordion Folding Door Manufacturers:
 - 1. Interior Doors.com Inverted Arts & Crafts 3 Panel Raised Panel Bi-Fold #5555
 - 2. Substitutions: Not Permitted.
- B. Product Description: Accordion folding non-acoustical doors, manually operated, with track and operating hardware.

2.2 COMPONENTS

- A. Non-Acoustical Accordion Folding Door Construction:
 - 1. Panels: Nominal 4 inch to 5 inch wide, particleboard, continuously hinged.
 - 2. Finish: Wood veneer; color stained as directed.
 - 3. Connector Molding: Shaped moldings of same surface and color as panel finish.
 - 4. Trim: Jamb and meeting mullions; intermediate post.
- B. Track: Extruded aluminum; nominal 1-1/4 x 1-1/4 inches size; thickness and profile designed to support loads; furnish track connectors where track size exceeds manufacturer's standard size.
- C. Hardware: Latching door handles of stainless steel; keyed to building keying system.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify field measurements are as instructed by manufacturer.

3.2 INSTALLATION

- A. Fit and align door assembly level and plumb.

3.3 ADJUSTING

- A. Adjust door assembly to provide smooth operation from stacked to full open position.

END OF SECTION

SECTION 08 55 00

VINYL, WOOD, AND ALUMINUM CLAD CASEMENT WINDOWS AND DOORS

PART 1 GENERAL

1.1 SUMMARY

- A. Section includes
 - 1. Vinyl Casement Windows
 - 2. Glazing
 - 3. Accessories
 - 4. Entry Doors
 - 5. Glass Doors, Single, In Swing

- B. Related Sections:
 - 1. Section 06 20 00 - Finish Carpentry: Wood frame and perimeter trim.
 - 2. Section 08 71 00 - Door Hardware: Lock cylinders.

1.2 REFERENCES

- A. ASTM International:
 - 1. ASTM E36, Specification for Structural Steel.
 - 2. ASTM C1036, Specification for Flat Glass
 - 3. ASTM C1048, Specification for Heat Treated Flat Glass-Kind HS, Kind FT Coated and Uncoated Glass.
 - 4. ASTM D 4216, Specification for Rigid Poly (Vinyl Chloride)(PVC) and Related Plastic Building Products Compounds.
 - 5. ASTM E 90, Standard Test Method for Laboratory Measurement of Airbourne Sound Transmission Loss of Building Partitions.
 - 6. ASTM E 283, Test Method for Rate of Air Leakage through Exterior Windows, and Doors.
 - 7. ASTM E 330, Test Method for Structural Performance of Exterior Windows and Doors by Uniform Static Air Pressure Difference.
 - 8. ASTM E 413, Classification for Rating Sound Insulation.
 - 9. ASTM E 541 Test Method for Water Penetration of Exterior Windows and Doors by Cyclic Static Air Pressure Differential.
 - 10. ASTM E 773, Test Method for Seal Durability of Sealed Insulating Glass Units.
 - 11. ASTM E 774, Specification for Seal Durability of Sealed Insulating Glass Units.
 - 12. ASTM F 588, Test Methods for Resistance of Window Assemblies to Force Entry Excluding-Glazing.

- B. Consumer Product Safety Commission (CPSC):
 - 1. CPSC 16CFR-1201 Safety Standard for Architectural Glazing Materials

1.3 SYSTEM DESCRIPTION

- A. Performance Requirements: Vinyl, aluminum clad wood windows, and wood windows exceed the minimum performance requirements specified in AAMA/NWWDA 101/I.S. 2, DP 65, except where more stringent requirements are specified.
1. Air Infiltration: When tested in accordance with ASTM E 283 at a static pressure of 1.57 psf, total air infiltration to average less than or equal to 0.06 cfm per square foot of unit.
 2. Water Penetration: No water penetration beyond the interior face of window unit when tested in accordance with ASTM E 547 at a static pressure of 9.75 psf.
 3. Structural Performance: No glass breakage, damage to hardware, or permanent deformation (set) which would cause any malfunction or impair the operation of the unit, or residual deflection greater than 0.4% of span when tested in accordance with ASTM E 330 at a test pressure of 97.5 psf.
 4. Design Criteria: Design and size window components to withstand loads imposed by wind to a pressure of (refer to calculations) psf when measured in accordance with ASTM E 330. Limit deflection to L/175.
 5. Thermal Performance: Fenestration U-Factor: Fenestration Products shall be rated in accordance with NFRC 100-2002. U-Factors shall be as follows:

1.4 QUALITY ASSURANCE

- A. Sound Transmission Classification (STC): As specified, calculated in accordance with ASTM E413, based on tests performed in accordance with ASTM E90, on door size of 100 sq ft.
- B. Surface Burning Characteristics:
1. Textile Wall Coverings: Comply with one of the following:
 - a. Maximum 25/450 flame spread/smoke developed index when tested in accordance with ASTM E84.

1.5 QUALIFICATIONS

- A. Manufacturer Qualifications: Company having at least 60 years experience overall in the manufacture of window products and 30 years of experience with PVC windows. Factories located in Germany are ISO 9001 Certified, RAL Certified, IFT Rosenheim and NAMI certified. The product is also listed in the Florida Approved Product website. Upon request a reference list can be provided of at least 10 projects of similar scale and complexity successfully completed during the past three years. Installer: Company specializing in performing work of this section with minimum 3 years documented experience approved by manufacturer.
- B. Installer Qualifications: Company employees, certified and experienced in the installation of window products. Certifications and recent project details are available upon request.
- C. Safety Glazing: Comply with safety glazing requirements of CPSC 16CFR 1201. (Where required by code.)
- D. Insulating Glass Units: Provide insulating glass units manufactured and certification in compliance with ISO9001 standards.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. In addition to general delivery, storage and handling requirements comply with the following:
 1. Deliver materials to job site after inventory and inspection. Protect unpacked units from rubbing and transportation damage.
 2. Identify each carton with material name, project identification number and window position number.
 3. Store windows and doors and accessories off ground, under cover, protected from weather and construction activities.

1.7 PROJECT CONDITIONS

- A. Install windows and doors in strict accordance with safety and weather conditions specified by manufacturer's product literature.
- B. Use extra caution when temperature drops below 32 degrees F., and extreme care below 0 degrees F.

PART 2 PRODUCTS

2.1 Henselstone Casement Units

2.2 SIZES

- A. Triple Casement Windows #205
 1. Width Dimensions: 2'-11"
 2. Height Dimensions: 6'-0"
- B. Triple Casement Windows #204
 1. Width Dimensions: 2'-8"
 2. Height Dimensions: 2'-9 1/8"
- C. Triple Casement Windows #202
 1. Width Dimensions: 1'-10"
 2. Height Dimensions: 7'-0"
- D. Triple Casement Windows #206
 1. Width Dimensions: 12'-0"
 2. Height Dimensions: 2'-0"
- E. Triple Casement Windows #201
 1. Width Dimensions: 11'-4"
 2. Height Dimensions: 7'-0"
- F. Triple Casement Windows #203
 1. Width Dimensions: 5'-0"

2. Height Dimensions: 7'-0"

2.3 Henselstone Door Units

- A. Exterior Door Style #101/108
 - 1. Width Dimensions: 3'-5"
 - 2. Height Dimensions: 7'-6"
- B. Exterior Door Style #103
 - 1. Width Dimensions: 3'-5"
 - 2. Height Dimensions: 7'-6"
- C. Exterior Door Style #102
 - 1. Width Dimensions: 3'-5"
 - 2. Height Dimensions: 7'-6"

2.4 MATERIALS

- A. Vinyl: High Gloss Vinyl- A mark of superior quality, manufacturer's high gloss, color-stabilized, in house formula adds outstanding stain, fade, and chalking and impact resistance to vinyl's overall advantages.
 - 1. Highest Quality - 30 years of industry experience to ensure a product of the highest quality.
 - 2. Fusion Welded - Frame and Sash corners are miter cut and fusion welded to eliminate joints that may loosen or leak and provide protection from air and water penetration.
 - 3. Superior Performance and durability – The five-chambered design provides remarkable thermal performance. Dual weather seals provide a high level of resistance to air and water penetration. Steel bar reinforcement around the window and frame provides strength, security, secure hardware attachment, and superior wind load resistance.
 - 4. Versatile Design - This window is tailored to your specifications and can be made to incorporate grills and trim profiles to create a variety of architectural styles. Accessory profiles join window units, finish interior and exterior openings and adapt to different wall conditions.
 - 5. Operation and easy Cleaning-The windows have dual functions: the in-swing casement function is ideal for cleaning, making it easy to wash all surfaces from inside with just soap and water. These windows offer the best egress solution and have the highest security ratings. The hopper function allows controlled airflow in the room without drafts.
 - 6. Color: (RAL) 1100 colors and NCS shades of color are available for the outside of the windows. Textured wood vinyl surfaces available for inside and outside of windows.
 - 7. Dual seal system and drainage: All windows and doors have a seal on the interior and on the exterior with a drainage system between the seals. Drainage can be proved either to bottom (sill required) or front.
- B. Weather stripping:
 - 1. Venting Sash: Dual weather seals made with Ethylene propylene diene monomer (EPDM) lip sealing gaskets around the sash overlap ensure watertight seals, giving your home optimum protection from driving rain. EPDM has excellent resistance to weathering and good heat stability.

2. Stationary Sash and Stationary Picture Sash: Glass installed inside frame and sealed with tubular flexible vinyl.

2.5 GLAZING

- A. General: Insulating glass units comply with the Insulating Glass Certification Council as conforming to the requirements of IGCC Class CBA when tested in accordance with ASTM E 773 and E 774. Provide sealed units consisting of polysulphide primary seal, Butyl rubber secondary seal, and a moisture desiccant.
- B. Extra Therm Glass Low Emissivity, Argon Blended Filled Insulating Glass
 1. Therm Glass Low Emissivity, Air Filled Insulating Glass
ExtraTherm Glass Low Emissivity, Argon Blend Filled Insulating Glass
 - a. U-Factor: 0.260 Btu/h-ft²-F
 - b. Solar Heat Gain Coefficient (SHGC): 0.613
 - c. Shading coefficient for glazing system (center-of-glass) (SC): 0.705
 - d. Visible Transmittance of glazing layer (T_{vis}): 0.808
 - e. Relative Heat Gain 144 Btu/h-ft²
 - f. Glass conductivity: Keff 0.0187 Btu/h-ft²

2.6 HARDWARE

- A. Roto NT-Venting Casement Hardware
 1. Smooth Easy to operate hardware and a devise to prevent incorrect operation.
 2. Break-in reduction with all around safety locks and flared head locks.
 3. Three dimensionally adjustable barrel hinges either aluminum or stainless steel
- B. Window Handle and Operation
 1. Operator handle finishes: Roto hardware –Zinc easy grip style handle with vinyl coating color in stainless steel finish. Extruded aluminum; nominal 1-1/4 x 1-1/4 inches size; thickness and profile designed to support loads; furnish track connectors where track size exceeds manufacturer's standard size.
 2. Operator handle functions: TILT-TURN FUNCTION The operation of this handle to horizontal position allows for swing-in, door-like movement for cleaning and maximum ventilation; after closing, continuation of the handle movement to the vertical (up) position allows the sash to tilt-in at the top for indirect ventilation. The single handle operates a system of steel bars, which in turn activates adjustable cam locks located around the perimeter of the window, locking it tightly in a manner similar to a bank vault. Note: Lockable handles and electronic security components can be added for maximum security and controlled access.
 3. Sash Locks: Single actuation handle operates the window and controls all-around safety, flared head locks. Die cast zinc, galvanized steel link and engineered polymer components in a finish and appearance of top quality brass and stainless steel.

2.7 JOINING SYSTEMS

- A. Vinyl: Use manufacturers specifically designed vinyl extrusion with steel reinforcement pieces to attach multiple window frames.
 - 1. Fasteners: Corrosion resistant screws as provided by window manufacturer.
 - 2. Silicone Sealant: As recommended by window manufacturer.
 - 3. Vinyl Trim Strips: As recommended by window manufacturer for each joining method used.

2.8 ACCESSORIES

- A. Insect Screens: Provide venting sash with an insect screen, including attachment hardware. Fixed and removable screens with aluminum frames are available for outside mounting at all in-swing vents. Additionally, roll-up screens are available for either outside or inside mounting.
 - 1. Frames: 3/4" x 5/16" rolled aluminum frame Color: textured or smooth color to match windows.
 - 2. Insect Screen Cloth: 18 x 16 fiberglass mesh, charcoal (black) finish.
- B. Exterior Trim:
 - 1. Exterior Trim and Casing: Where indicated on Drawings attach to rigid vinyl channels. Color to match window framing. There are pieces intended to recreate the style of a particular period, whether it be baroque or art nouveau .
 - 2. Trim channels: Rigid vinyl extrusions supplied by window manufacturer for use on same product line.
- C. Remote Window Operator:
 - 1. Remote Window Operator: Provide electric window opener for remote operation of venting unit where indicated on Drawings. Electric opener system to consist of a 12-volt power operator, power supply (converting 120-volt AC to 12-volt DC), push button command center, and all necessary mounting hardware. Sash locks not operable on windows equipped with remote window operator.

2.9 FABRICATION

- A. Vinyl Products come primed and completely finished with Paint Treatment: Sash and frame members all finished in accordance with ISO9001 procedures and standards.

PART 3 EXECUTION

3.1 INSPECTION

- A. Inspect opening before installation is commenced.
 - 1. Verify wood frame walls are dry, clean, sound and well nailed, and/or glued, free of voids and without offsets at joints. Ensure that nail heads are driven flush with all surfaces in opening and within 3" of rough opening.

3.2 PREPARATION

- A. Obtain correct window for opening and all parts. Inspect window. Verify that window is not damaged and all parts are included before next step.
- B. B. Check hardware operation: Close and verify all-around operating latches.

3.3 JOINING SYSTEMS

- A. Assemble joining system where required for window combinations according to window and door manufacturer's instructions.
- B. Apply corrosion resistant coating to cut ends and field drilled holes in steel reinforcement member.
- C. Attach end brackets to rough opening as recommended by window manufacturer.

3.4 INSTALLATION

- A. Install window and door units, hardware, operators, accessories and other window components according to window manufacturer's installation instruction sheets.

3.5 INTERIOR FINISHING

- A. Extend vapor barrier around exterior face of window frame and attach to framing. Use expanding foam type insulation to seal windows airtight to frame and insulation package. Outdoors: illmod 600 Sealing Tape is used as the outermost seal between the window frame and the wall after installing the window. Afterwards, the outside is rendered up to the frame.

3.6 ACCESSORIES

- A. Insect Screens: Install screens according to window manufacturer's instructions.
- B. Handles: Install extension jambs according to window manufacturer's instructions.
- C. Remote Window Operator: Install remote window operator according to window manufacturer's instructions.

3.7 CLEANING

- A. Clean window and door surfaces to remove dirt. Use cleaning materials specifically recommended by window manufacturer.
- B. Remove debris from work site
- C. Leave window units in closed and locked position.

D. Protect interior and exterior of window units until structure is sealed from the weather.

3.8 SERVICE/MAINTENANCE

- A. Life expectancy and functionality of the hardware can be extended significantly if the adjustable moving parts are oiled annually.
- B. All exterior PVC surfaces have to be wiped annually with UV protecting liquid provided by Henselstone or equal
- C. Adjust door assembly to provide smooth operation from stacked to full open position.

END OF SECTION

SECTION 08 71 00

DOOR HARDWARE

PART 1 GENERAL

1.1 SUMMARY

- A. Section includes hardware for wood and vinyl doors, thresholds, weather-stripping, seals, and door gaskets.

1.2 SYSTEM DESCRIPTION

- A. Fire Rated Openings: Provide door hardware listed by UL or Warnock Hersey, or other testing laboratory approved by applicable authorities.
 - 1. Hardware: Tested in accordance with NFPA 252.

1.3 SUBMITTALS

- A. Refer to Section 01 00 00 – General Requirements for Submittal Procedures.
- B. Shop Drawings: Indicate locations and mounting heights of each type of hardware.
- C. Samples: Submit hinge, latchset, lockset, and closer, illustrating style, color, and finish.

1.4 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: Submit data on operating hardware, lubrication requirements, and inspection procedures related to preventative maintenance.

1.5 QUALITY ASSURANCE

- A. Perform Work in accordance with the following requirements:
 - 1. ANSI A156 series.
 - 2. NFPA 80 - Fire Doors and Windows.
 - 3. NFPA 101 - Life Safety Code.
- B. Furnish hardware marked and listed in BHMA Directory of Certified Products.
- C. Coordination: Coordinate work of this section with other directly affected sections requiring integral reinforcement for door hardware.

1.6 WARRANTY

- A. Furnish five year manufacturer warranty for door hardware.

1.7 MAINTENANCE SERVICE

- A. Provide service and maintenance services of door closers for one year from Date of Substantial Completion.
- B. Provide special wrenches and tools applicable to each different or special hardware component.

PART 2 PRODUCTS

2.1 DOOR HARDWARE

- A. Manufacturers:
 - 1. Hinge: Henselstone supplied
 - 2. Pivot: Henselstone supplied
 - 3. Latchset: Henselstone supplied
 - 4. Lockset: Henselstone supplied
 - 5. Closer: Henselstone supplied
 - 6. Weather-stripping: Henselstone supplied
 - 7. Seals: Henselstone supplied
 - 8. Door gaskets: Henselstone supplied
 - 9. Substitutions: Not Permitted.

2.2 COMPONENTS

- A. General Hardware Requirements: Where not specifically indicated, comply with applicable ANSI A156 standard for type of hardware required. Furnish each type of hardware with accessories as required for applications indicated and for complete, finished, operational doors.
 - 1. Templates: Furnish templates or physical hardware items to door and frame manufacturers sufficiently in advance to avoid delay in Work.
 - 2. Reinforcing Units: Furnished by door and frame manufacturers; coordinated by hardware supplier or hardware manufacturer.
 - 3. Fasteners: Furnish as recommended by hardware manufacturer and as required to secure hardware.
 - a. Finish: Match hardware item being fastened.
 - 4. Electrical Devices: Make provisions and coordinate requirements for electrical devices and connections for hardware.
- B. Hinges and Pivots: ANSI A156.1, full mortise type , template type, ANSI A156.7, complying with following general requirements unless otherwise scheduled.
 - 1. Widths: Sufficient to clear trim projection when door swings 180 degrees.
 - 2. Number: Furnish minimum three hinges to 90 inches high, four hinges to 120 inches high for each door leaf.
 - a. Fire Rated Doors to 86 inches High: Minimum three hinges.
 - b. Residential Hollow Core Interior Panel Wood Doors: Furnish minimum two hinges.

- C. Locksets and Latchsets: Furnish locksets compatible with specified cylinders. Furnish standard strikes with extended lips to protect trim from being marred by latch bolt.
 - 1. Mortise Locksets and Latchsets: ANSI A156.13, Series 1000, Grade 1 unless otherwise indicated.
 - 2. Bored (Cylindrical) Locksets and Latchsets: ANSI A156.2, Series 4000, Grade 1 unless otherwise indicated.
 - 3. Interconnected Locksets: ANSI A156.12, Series 5000, Grade 1 unless otherwise indicated.
 - 4. Auxiliary Locksets: ANSI A156.5, Grade 1, mortise dead locks unless otherwise indicated.
- D. Cylinders: ANSI A156.5, Grade 1, 6pin type removable cylinders
 - 1. Keying: As indicated by manufacturer.
- E. Closers: ANSI A156.4 concealed in door closers; full rack and pinion type with steel spring and non-freezing hydraulic fluid; closers required for fire rated doors unless otherwise indicated.
 - 1. Adjustability: Furnish controls for regulating closing, latching, speeds, and back checking.
 - 2. Arms: Type to suit individual condition; parallel-arm closers at reverse bevel doors and where doors can swing full 180 degrees.
 - 3. Location: Mount closers on inside of exterior doors, room side of interior doors typical; mount on pull side of other doors.
 - 4. Operating Pressure: Maximum operating pressure as follows.
 - a. Interior Doors: Maximum 5 pounds.
 - b. Exterior Doors: Maximum 10 pound.
 - c. Fire Rated Doors: As required for fire rating, maximum 15 pounds.
- F. Furnish as indicated in Schedule, with accessories as required for complete operational door installations.
 - 1. Kickplates Armor Plate ANSI A156.6, metal; height indicated in Schedule by 1 inch less than door width; stainless steel
 - 2. Weather stripping: Furnish continuous weather stripping at top and sides of exterior doors.
 - 3. Fire Rated Gaskets: Furnish continuous fire rated gaskets at top and sides of fire rated doors.
 - 4. Thresholds: Maximum 1/2 inch height; requirements to ensure accessibility for persons with disabilities.
 - 5. Floor Stops: ANSI A156.1 Grade 1 standard floor type with no visible screws; furnish with accessories as required for applications indicated.

2.3 ACCESSORIES

- A. Lock Trim: Furnish levers with as selected from manufacturer's full range of levers and roses.
- B. Through Bolts: Through bolts and grommet nuts are not permitted on door faces in occupied areas unless no alternative is possible.
 - 1. Through bolts not permitted on solid wood core doors.

2.4 FINISHING

- A. Finishes: ANSI A156.18; with following finishes except where otherwise indicated in Schedule at end of section.

1. Hinges and Pivots:
 - a. BHMA 630 and 626, stainless steel.
2. Typical Exterior Exposed and High Use Interior Door Hardware:
 - a. BHMA 613, stainless steel.
3. Typical Interior Door Hardware:
 - a. BHMA 613, stainless steel.
4. Typical Interior Bathroom Door Hardware:
 - a. BHMA 613, stainless steel.
5. Closers: Finish appearance to match door hardware on same face of door.
 - a. BHMA 600, primed for painting.
6. Thresholds:
 - a. BHMA 613, stainless steel.
7. Other Items: Provide manufacturer's standard finishes to match similar hardware types on same door, and maintain acceptable finish considering anticipated use and BHMA category of finish.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify doors and frames are ready to receive work and dimensions are as indicated.
- B. Verify electric power is available to power operated devices and is of correct characteristics.

3.2 INSTALLATION

- A. Coordinate mounting heights with door and frame manufacturers. Use templates provided by hardware item manufacturer.
- B. Mounting Heights from Finished Floor to Center Line of Hardware Item: Comply with manufacturer recommendations and applicable codes.

END OF SECTION

SECTION 09 21 16

GYP SUM BOARD ASSEMBLIES

PART 1 GENERAL

1.1 SUMMARY

- A. Section Includes:
1. Gypsum board and joint treatment.
 2. Predecorated gypsum board.
 3. Gypsum sheathing.
 4. Tile backer board.
 5. Acoustic insulation.
 6. Textured finishes.

1.2 QUALITY ASSURANCE

- A. Perform Work in accordance with ASTM C840. GA-201 - Gypsum Board for Walls and Ceilings.
- B. Furnish framing materials in accordance with SSMA - Product Technical Information.
- C. Fire Rated Wall Construction: 1 rating in conjunction with Section 06 10 00 Tested Rating: Determined in accordance with ASTM E119.
- D. Surface Burning Characteristics:
1. Textile Wall Coverings: Comply with one of the following:
 - a. Maximum 25/450 flame spread/smoke developed index when tested in accordance with ASTM E84.

PART 2 PRODUCTS

2.1 GYP SUM BOARD ASSEMBLIES

- A. Manufacturer List:
1. CertainTeed
 2. No substitutions permitted.
- B. Performance / Design Criteria:
1. Acoustic Attenuation for [Identified] Interior Partitions: 35 STC in accordance with ASTM E90.
 2. Seismic Loads: Design and size components to withstand seismic loads and sway displacement as calculated according to ASCE 7 and applicable codes.

2.2 COMPONENTS

- A. Gypsum Board Materials: ASTM C1396/C1396M ; Type X fire resistant where indicated on Drawings.
 - 1. Standard Gypsum Board: ½ thick, maximum available length in place; ends square cut, tapered and beveled edges.
 - 2. Moisture Resistant Gypsum Board: ½ thick, maximum available length in place; ends square tapered and beveled edges.
- B. Tile Backer Boards:
 - 1. Fiber Cement Tile Backer Board: ASTM C1288; 1/4 inch thick; mold resistant.

2.3 ACCESSORIES

- A. Gypsum Board Accessories: ASTM C1047; metal and paper combination; corner beads, edge trim, and expansion joints.
 - 1. Metal Accessories: Galvanized steel.
 - 2. Plastic Accessories: PVC plastic.
 - 3. Edge Trim: Type L bead.
- B. Joint Materials: GA-216, reinforcing tape, joint compound, and water.
- C. Fasteners: GA-216; length to suit application.
- D. Gypsum Board Screws: ASTM C1002; length to suit application.
 - 1. Screws for Wood Framing: Type W.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify site conditions are ready to receive work.

3.2 INSTALLATION

- A. Gypsum Board:
 - 1. Install gypsum board in accordance with GA-216.
 - 2. Fasten gypsum board to furring or framing with screws. Staples may only be used when securing first layer of double layer applications.
 - 3. Place control joints consistent with lines of building spaces as directed by Architect/Engineer.
 - 4. Place corner beads at external corners. Use longest practical length. Place edge trim where gypsum board abuts dissimilar materials.
 - 5. Seal cut edges and holes in moisture resistant gypsum board with sealant.
- B. Joint Treatment:

1. Finish in accordance with GA-214 3.

END OF SECTION

SECTION 09 30 00

TILING

PART 1 GENERAL

1.1 SUMMARY

- A. Section includes ceramic, ceramic mosaic tile for interior floor and wall applications; cementitious backer board as tile substrate; and thresholds at door openings.

1.2 SUBMITTALS

- A. Refer to Section 01 00 00 – General Requirements for Submittal Procedures.
- B. Shop Drawings: Indicate patterned applications and thresholds.
- C. Product Data: Submit instructions for using grouts and adhesives.
- D. Samples: Submit mounted tile and grout on two 48 inch plywood panels, size illustrating pattern, color variations, and grout joint size variations.

1.3 CLOSEOUT

- A. Operation and Maintenance Data: Submit recommended cleaning methods, cleaning materials, stain removal methods, and polishes and waxes.

1.4 QUALITY ASSURANCE

- A. Perform Work in accordance with TCA Handbook and ANSI A108.1 Series/A118.1 Series.
- B. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years documented experience.
- C. Installer: Company specializing in performing Work of this section with minimum three documented experience approved by manufacturer.

1.5 ENVIRONMENTAL REQUIREMENTS

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

PART 2 PRODUCTS

2.1 TILE

A. Manufacturers:

1. Bathroom Floor Tile: Ceramic Tile – Fondovalle Le Pietre Naturali 13x13 African Blue Tile
2. Sunspace: Porcelain Tile – International Tile Vintage Wood Porcelain Flooring
3. Substitutions: Not permitted.

2.2 COMPONENTS

A. Base: Same as floor tile.

1. Length: 16'
2. Height: 4"
3. Top Edge: Beveled
4. Moisture Absorption: TBD percent.
5. Surface Finish: Porcelain.
6. Color: Gray.

B. Mortar Materials:

1. Mortar Bed Materials: ANSI A108.1A Portland cement, sand, and water; proportioned in accordance with International Building code.
2. Mortar Bond Coat Materials:
 - a. Dry-Set Portland Cement type: ANSI A118.1.
 - b. Latex-Portland Cement type: ANSI A118.4.

C. Grout Materials:

1. Standard Grout: Commercial Portland cement type as specified in ANSI A118.6; Raven color as selected.
2. Silicone Rubber Grout: Silicone sealant, moisture and mildew resistant type, complying with ANSI A118.6, TBD color as selected.
 - a. Interior Sealants and Sealant Primers: Maximum volatile organic compound content in accordance with SCAQMD Rule 1168.

D. Cementitious Backer Board: ANSI A118.9; High density, glass fiber reinforced, 5/16 inch thick; 2 inch wide coated glass fiber tape for joints and corners; manufactured by Durock.

E. Thresholds: Extruded aluminum with integral edge strip.

F. Tile Floor Edging: TBD.

PART 3 EXECUTION

3.1 EXAMINATION

- #### A. Verify surfaces are ready to receive work.

3.2 PREPARATION

- A. Install cementitious backer board. Tape joints and corners, cover with skim coat of thin-set mortar to feather edge.

3.3 INSTALLATION

- A. Install tile, thresholds, and grout in accordance with applicable requirements of ANSI A108.1 through A108.10, and TCA Handbook recommendations.
- B. Cut and fit tile to penetrations through tile, leaving sealant joint space. Form corners and bases neatly. Align floor, base and wall joints.
- C. Place tile joints uniform in width, subject to variance in tolerance allowed in tile size. Make joints watertight, without voids, cracks, excess mortar, or excess grout.
- D. Grout tile joints. Use standard grout unless otherwise indicated.
- E. Floors:
 - 1. Over wood substrates, install in accordance with TCA Handbook Method F142, with standard grout.
 - 2. Over FRP grate, position BioPCM mat inverted over grate such that PCM pockets are inserted into grate openings. Apply construction adhesive suitable for plastic and cementitious substrates to PCM backing, then install cementitious backer board, securing the backer board to the wooden subfloor beneath the FRP grate for added rigidity.
- F. Wall Tile:
 - 1. Over cementitious backer units install in accordance with TCA Handbook Method W244, using membrane at toilet rooms, kitchens.
 - 2. Over gypsum wallboard on wood or metal studs install in accordance with TCA Handbook Method W243, thin-set with dry-set or latex-Portland cement bond coat.

END OF SECTION

SECTION 09 62 23

BAMBOO FLOORING

PART 1 GENERAL

1.1 SUMMARY

- A. Section includes bamboo laminate flooring.

1.2 SUBMITTALS

- A. Refer to Section 01 00 00 – General Requirements for Submittal Procedures.
- B. Product Data: Submit manufacturer's product data.
- C. Samples:
 - 1. Submit manufacturer's complete set of color samples for initial selection.

1.3 QUALITY ASSURANCE

- A. Surface Burning Characteristics:
 - 1. Floor Finishes: Class II, minimum 0.22 watts/sq cm when tested in accordance with NFPA 253.

1.4 ENVIRONMENTAL REQUIREMENTS

- A. Maintain temperature in storage area between 55 degrees F and 90 degrees F.
- B. Store materials for not less than 48 hours prior to installation in area of installation at temperature of 70 degrees F to achieve temperature stability. Thereafter, maintain conditions above 55 degrees F.

PART 2 PRODUCTS

2.1 SHEET FLOORING

- A. Manufacturers:
 - 1. Morning Star, Quin Xiamen Strand Bamboo, Lumber Liquidators.
 - 2. Substitutions: Not Permitted.

2.2 RESILIENT BASE

- A. Manufacturers:
 - 1. Floor Base – Refer to Finish Carpentry 06 20 00

2. Substitutions: Not Permitted.

2.3 ACCESSORIES

- A. Subfloor Filler: Cementitious; type recommended by floor material manufacturer.
- B. Primers and Adhesives: Waterproof, types recommended by floor material manufacturer.
 - 1. Interior Adhesives: Maximum volatile organic compound content in accordance with SCAQMD Rule 1168.
- C. Moldings and Edge Strips: Base molding as indicated in finished carpentry section.
- D. Feature Strips: Same material as flooring, 1.5 - 2 inch wide.
- E. Sealer and Wax: Types recommended by floor material manufacturer.

PART 3 EXECUTION

3.1 PREPARATION

- A. Clean substrate.
- B. Fill minor low spots and other defects with sub-floor filler.
- C. Apply primer as required to prevent "bleed-thru" or interference with adhesion by substances that cannot be removed.

3.2 INSTALLATION

- A. Spread adhesive and set flooring in place. Press sheet flooring with 150 pound roller to attain full adhesion.

3.3 CLEANING

- A. Remove excess adhesive from surfaces without damage.

END OF SECTION

SECTION 09 90 00

PAINTING AND COATING

PART 1 GENERAL

1.1 SUMMARY

- A. Section includes surface preparation and field application of paints stains, varnishes, and other coatings.

1.2 SUBMITTALS

- A. Product Data: Submit data on finishing products.
- B. Refer to Section 01 00 00 – General Requirements for Submittal Procedures.
- C. Samples: Submit two paper chip samples, 3x3 inch in size illustrating range of colors available for each surface finishing product scheduled.

1.3 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: Submit maintenance and cleaning instructions.

1.4 QUALITY ASSURANCE

- A. Surface Burning Characteristics:
 - 1. Fire Retardant Finishes: Maximum 25/450 flame spread/smoke developed index when tested in accordance with ASTM E84.

1.5 ENVIRONMENTAL REQUIREMENTS

- A. Store and apply materials in environmental conditions required by manufacturer's instructions.

PART 2 PRODUCTS

2.1 PAINTS AND COATINGS

- A. Manufacturers:
 - 1. Benjamin Moore Natura Copley Gray Semi-Gloss (Exterior)
 - 2. Benjamin Moore Natura Antique White Flat
 - 3. Benjamin Moore Natura Big Bend Beige Eggshell
 - 4. Benjamin Moore Natura Mount Rushmore Rock Semi-gloss
 - 5. Stain Finish: Cabot Bleaching Oil
 - 6. Substitutions: Not Permitted.

2.2 COMPONENTS

- A. Coatings: Ready mixed except field catalyzed coatings of good flow and brushing properties, capable of drying or curing free of streaks or sags.
 - 1. Interior Flat and Non-Flat Paints: Zero volatile organic compound.
 - 2. Interior Anti-Corrosive Paints: Zero volatile organic compound.
- B. Accessory Materials: Linseed oil, shellac, turpentine, paint thinners and other materials required to achieve finishes specified.
 - 1. Interior Clear Wood Finishes: Maximum volatile organic compound content in accordance with SCAQMD Rule 1113.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify substrate conditions are ready to receive Work.
- B. Measure moisture content of porous surfaces using electronic moisture meter. Do not apply finishes unless moisture content is less than 15 percent.

3.2 PREPARATION

- A. Correct minor defects and clean surfaces affecting work of this section.
- B. Remove electrical plates, hardware, light fixture trim, escutcheons, and fittings prior to preparing surfaces or applying finishes.
- C. Gypsum Board Surfaces: Fill minor defects with filler compound. Spot prime defects after repair.
- D. Interior Wood Items Scheduled to Receive Stain finish:
- E. Exterior Wood Scheduled to Receive Transparent Finish: Remove dust, grit, and foreign matter; seal knots, pitch streaks, and sappy sections with sealer. Fill nail holes with tinted exterior caulking compound after sealer has been applied.

3.3 APPLICATION

- A. Sand wood and metal surfaces lightly between coats to achieve required finish.
- B. Where clear finishes are required, tint fillers to match wood.
- C. Prime concealed surfaces of exterior woodwork with primer paint.
- D. Prime concealed surfaces of interior wood surfaces scheduled to receive stain or varnish finish with gloss varnish reduced 25 percent with thinner.

E. Cleaning: As work proceeds, promptly remove finishes where spilled, splashed, or spattered.

3.4 SCHEDULE - EXTERIOR SURFACES

A. Wood - Transparent:

1. Two coats of stain.
2. One coat of sealer.
3. One coat of varnish satin

3.5 SCHEDULE - INTERIOR SURFACES

A. Wood - Transparent:

1. Two coats of stain.
2. One coat of sealer.
3. One coat of varnish satin

B. Plaster, Gypsum Board:

1. One coat of alkyd primer sealer.
2. Two coats latex
3. Benjamin Moore As Specified

3.6 SCHEDULE - COLORS

A. Exterior

1. Benjamin Moore Copley Gray

B. Sunspace

1. Benjamin Moore Antique White

C. Kitchen

1. Benjamin Moore (Above Picture Rail) Antique White
2. Benjamin Moore (Below Picture Rail) Big Bend Beige

D. Living Room

1. Benjamin Moore (Above Picture Rail) Antique White
2. Benjamin Moore (Below Picture Rail) Big Bend Beige

E. Bedroom

1. Benjamin Moore (Above Picture Rail) Antique White
2. Benjamin Moore (Below Picture Rail) Big Bend Beige

F. Flex Space.

1. Benjamin Moore (Below Picture Rail) Big Bend Beige

G. Bathroom

1. Benjamin Moore (Below Picture Rail) Big Bend Beige
- H. Work Space
1. Benjamin Moore (Below Picture Rail) Big Bend Beige
- I. Hallway
1. Benjamin Moore (Below Picture Rail) Big Bend Beige
- J. Interior Trim
1. Benjamin Moore Mount Rushmore Rock

END OF SECTION

SECTION 10 28 00

TOILET, BATH, AND LAUNDRY ACCESSORIES

PART 1 GENERAL

1.1 SUMMARY

- A. Section includes toilet and bath, laundry, shower, and washroom accessories.

1.2 SUBMITTALS

- A. Product Data: Submit data on accessories describing size, finish, details of function, attachment methods.
- B. Samples: Submit two samples of each accessory illustrating color and finish.
- C. Refer to Section 01 00 00 – General Requirements for Submittal Procedures.

PART 2 PRODUCTS

2.1 TOILET, BATH AND LAUNDRY ACCESSORIES

- A. Manufacturers:
 - 1. Towel Rack: Brushed Nickel
 - 2. Toilet Tissue Dispenser: Coralais Suite Brush Nickel
 - 3. Mirror: TBD
 - 4. Shower Curtain Rod: Brushed Nickel
 - 5. Waste Basket: Coralais Suite Brush Nickel
 - 6. Bathroom Vanity Allen & Roth 36" Item #145772
 - 7. Substitutions: Not Permitted.

2.2 COMPONENTS

- A. Products listed in Schedule are made by the indicated manufactures above.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify exact location of accessories for installation.

3.2 PREPARATION

- A. Deliver inserts and rough-in frames to site. Provide templates and rough-in measurements.

B. See Section (TBD) for installation of concealed anchors in walls.

3.3 INSTALLATION

A. Install plumb and level, securely and rigidly anchored to substrate.

B. Mounting Heights and Locations: As indicated on Drawings.

3.4 SCHEDULES

- A. Towel Rack
- B. Toilet Tissue Dispenser
- C. Waste Basket
- D. Mirror
- E. Shower Curtain Rod

END OF SECTION

SECTION 11 31 00

RESIDENTIAL APPLIANCES

PART 1 GENERAL

1.1 SUMMARY

- A. Section includes refrigerator, range, dishwasher, washer, dryer, microwave oven with exhaust, and kitchen appliance accessories.

1.2 SYSTEM DESCRIPTION

- A. Equipment: Conform to applicable code for UL approval in accordance with International Building Code Standards.

1.3 SUBMITTALS

- A. Product Data: Submit data on equipment, accessories, and maintenance.
- B. Manufacturer's Installation Instructions: Submit manufacturer's installation instructions.
- C. Refer to Section 01 00 00 – General Requirements for Submittal Procedures.

PART 2 PRODUCTS

2.1 RESIDENTIAL EQUIPMENT

- A. Manufacturers:
 1. ConServ Model CT380Z
 2. Frigidaire FPCS3085LF
 3. Fisher and Paykel DD24SCTX6V2
 4. Frigidaire FAFW4011LB
 5. Frigidaire FAQE7077KB
 6. Frigidaire FPBM189KF
 7. Substitutions: Not Permitted.

2.2 COMPONENTS

- A. Washer: Model FAFW4011L, free standing stackable type, variable water level control, dispenser for powder or liquid soap, dispenser for liquid softener, black as selected.
- B. Dryer: Model FAQE7077KB, electric free standing stackable type, interior light, removable lint screen, black color as selected.

- C. Refrigerator: Model CT380Z, 12 cubic feet capacity, free standing type, self defrosting, double door with freezer compartment below, stainless steel color as selected.
- D. Range: Model FPCS3085LF, electric free standing slide in type, four top burners, oven below with top and bottom elements, with two stainless steel racks, vision panel, timed convenience outlet, self cleaning, interior oven light, stainless steel color as selected
- E. Dishwasher: Model DD24SCTX6V2, under counter single drawer type, nine level wash cycles, one rubber coated pull out dish rack, one loose utensil bin, and stainless steel color as selected.
- F. Microwave Oven: Model FPBM189KF, Over-the-Range, interior space of 1.8 cu ft; with electronic timed cook, rotating glass platform, interior light, stainless steel color as selected.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify openings and utility services are ready to receive work and opening dimensions are as indicated on shop drawings.

3.2 INSTALLATION

- A. Set and adjust units level and plumb.
- B. Connect to utilities and make units operational.
- C. Activate units to confirm correct operation.
- D. Turn refrigerators on to moderate temperature setting and flush water line.

END OF SECTION



Tall Apartment Refrigerator



CT 380 Z - 12 cu. ft.
White
Stainless



Interior View

SPECIFICATIONS	
Model	CT 380 Z
Color	White, Stainless
Volume (cu. Ft.)	12
Fridge Volume (Gross/Net) cu. Ft.	8.05 / 7.91
Freezer Volume (Gross/Net) cu. Ft.	4.73 / 3.91
Unit Dimension HxWxD (inch)	79 x 23.6 x 23.6
Shipping Dimension HxWxD (inch)	81.2 x 26.2 x 26.2
Weight (Gross / Net) lbs	192 / 176
Qty / 40' HC Container	60
Defrost System	Cycle
Refrigerant	R134A
Compressors	2
Reversible Doors	✓
Leveling Feet	✓
Rear Casters	✓
Dairy Compartment with Transparent Lid	✓
Removable Door Racks	✓
Adjustable Glass Shelves	✓
Transparent Crisper	✓
Wine Rack	✓
Origin	Europe
Factory Warranty	1 Year Parts & Labor





Frigidaire Professional 1.8 Cu. Ft. Over-The-Range Microwave

Model: FPBM189KF

29-15/16" W x 17-1/16" H x 16-3/8" D

MSRP \$499.00



Stainless Steel

Specifications

Color: Stainless Steel

Capacity / Cavity Size (Cu. Ft.): 1.8

Watts (IEC-705 Test Procedure): 1,000

Installation Type: Over-the-Range

Oven Interior Color: White

Turntable (Diameter): 14"

Interior Light: Incandescent

Interior Light Wattage: 20

Control Panel Features

Controls: Bottom Controls

Electronic Controls Type: Membrane

Display Type: VFD

Display Color: Green

Touch Pads Controls (# Pads): 31

Electronic Clock: Yes in User Pref

Timer: MM:SS

Start: Yes with 30 sec add feature

Stop / Cancel: Yes

Turntable Off / On: Yes

Number pads 1 - 0: Yes

Power Levels: High / 1-9

Auto Mode Features

Auto Cook Options: 9 Options - Frozen

Breakfast/Scrambled Eggs/Hot Cereal/Soup/Chicken
and Rice/Meatloaf/Seafood Pasta/Vegetarian Medley

Melt / Soften Options: 4 Options - Melt Butter/Melt
Chocolate/Soften Ice Cream/Soften Cream Cheese

Snack Menu Options: 6 Options - Frozen MW
 Pizza/Hand Held Snacks (3 - 4 oz.)/Hand Held Snacks
 (5 - 6 oz.)/Hog Dogs/Frozen Kids Meals/Pizza
 Auto Reheat Options: 4 Options - Fresh Rolls/Frozen
 Rolls/Pasta/Beverage
 Auto Defrost Options: 6 Options - Ground
 Meat/Steaks-Chops-Fish/Chicken Pieces/Roast
 Pork/Casserole/Soup
 Keep Warm: Yes
 Popcorn Options: Yes

Sensor Modes Features

Sensor Cook Options: 5 Options - Frozen
 Entrees/Ground Meat/Rice/Fish-Seafood/Chicken
 Breast
 Snack: Yes
 Chicken Nuggets: Yes
 Baked Potatoes: Yes
 Sensor Reheat: Yes
 Veggie Options: Frozen Veggies
 User Preference - Custom Help Options: Yes
 Clock: Yes
 Child Lock: Yes
 Auto Start (Delayed Cooking): Yes
 Language (Eng./Fr./Sp.): Yes
 Weight (Lbs./Kg.): Yes
 Demo Mode: Yes
 Audible Signal On / Off / Adjustable: On/Off
 Cooking - Multiple Stages: No - (4 Stages)
 30-Minute Warm Hold: Yes
 Vent (High): Yes
 Vent (Low): Yes
 Vent (Off): Yes

Ventilation/Light System

Hood Fan Speeds / CFM Rating: 2 speeds - 150/350
 Vent (Hidden or Open): Hidden
 Ducted / Ductless Vent Installation: Yes
 Grease Filter (Dishwasher Safe): 2 - Yes
 Charcoal Filter: 2
 Cooktop Light: Incandescent
 Cooktop Light Wattage: 20 Watts
 Cooktop Light Bulbs (No.): 2
 Heat Deflector: Yes
 Auto-start Heat Sensor: Yes

Accessories

Removable Metal Rack: Included
 36" Filler Panel Kit (Stainless Steel): MWFILKTSS -
 Optional
 Exterior Finish: Real Stainless Steel

Oven Cavity Dimensions

Width: 22-17/32"

Depth: 14-31/32"

Height: 10-1/16"

Exterior Dimensions

Exterior Width: 29-15/16"

Exterior Depth: 16-3/8"

Exterior Height: 17-1/16"

Wall Cut-Out Width: 30"

Cut-Out Depth (Max.): 14"

Cut-Out Depth (Min.): 12"

Cut-Out Height (Max.): 17"

Cut-Out Height (Min.): 16-3/4"

UL/cUL Approval: Yes

CDRH Approval: Yes

Power Supply Connection Location: Right Top Rear

Voltage Rating: 120V / 60 Hz / 14.3A

Connected Load (kW Rating) @ 120 Volts: 1.65 kW

Amps @ 120V: 14.3

Product Weight: 61 lbs

Shipping Weight (approx.): 69 lbs

UPC: 0-12505-56026-2

Base_Model: FPBM189K

Size: 1.8 Cu. Ft.

Product Type: Over-the-Range

FRIGIDAIRE

affinity



Front Load Dryers

FAQE7077K W/B/R/N/A

7.0 Cu. Ft. Electric



Signature Features



Fits-More™ 7.0 Cu. Ft. Dryer

The largest capacity dryer in a standard size¹ lets you dry more at once.



DrySense™ Technology

Dries your clothes more precisely, reducing wrinkles.



Save Your Settings

Automatically saves your last dry setting so you can save time when doing laundry.



Express-Select™ Controls

Easily select options and cycles with the touch of a button.

Powerful Performance

- 7 Cycles Including -
 - Quick Cycle (Fast 25-minute dry cycle²)
 - Heavy Cycle
 - Ultra Delicates
- 12 Options
 - Shrink Guard Ultra
 - Extended Tumble Ultra
- 5 Temperature Selections Including -
 - Sanitize (NSF Certified in 3 Cycles)
- 4 Dryness Levels
- 3 Status Indicators
- Electronic Moisture Sensor
- 6 Auto Dry Cycles
- 6 Timed Dry Cycles
- Heater (4700W)

Performance-Driven Style

- TimeWise™ Technology
- Stainless Steel Drum

More Easy-To-Use Features

- Estimated Time Remaining
- Drying Rack
- SilentDesign™
- Interior Light

SpaceWise™ Design

- Reversible Door
- Optional 15" Largest Capacity³ Drawer Pedestals
 - Classic White - PN# APWD15W
 - Classic Black - PN# APWD15E
 - Classic Red - PN# APWD15R
 - Classic Blue - PN# APWD15N
 - Classic Silver - PN# APWD15A

NSF® International Certification



Capacities

Total Capacity 7.0 Cu Ft.

Overall Exterior Dimensions

Height 36"
Width 27"
Depth 29-3/4"

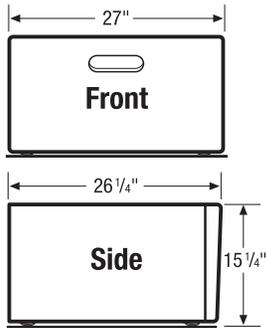
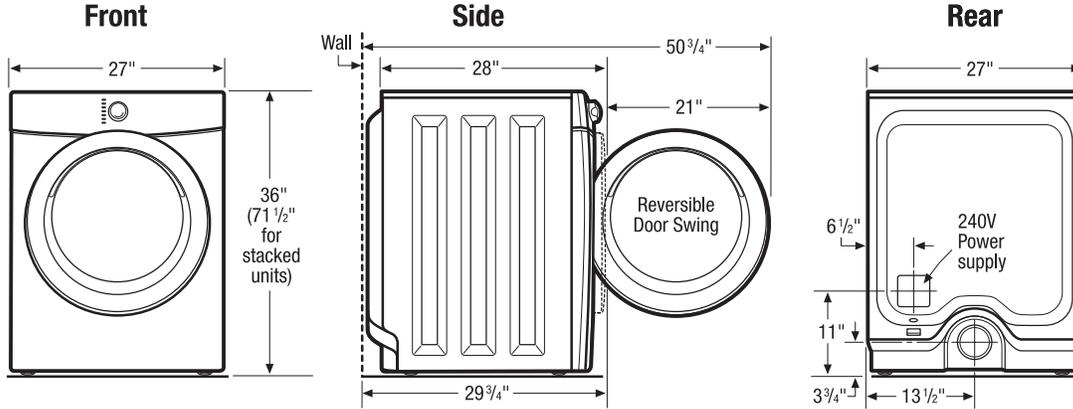
Available in:



¹Based on dryers 36" or less in height and 27" or less in width.

²Based on 8 lb. load/quick cycle selected for various load compositions.

³Based on manufacturer specifications.

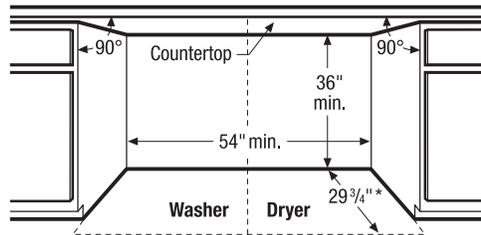


15" Drawer Pedestal Installation

Elevates dryer height to 51 1/4". For detailed pedestal installation, refer to instructions included with pedestal or on web. **Note:** Pedestal Installation requires modified utility hookup locations. For details, refer to Product Installation Guide on web.

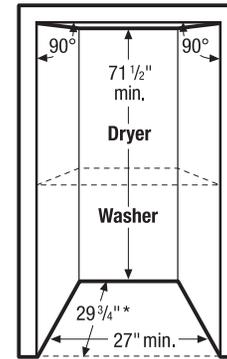
Built-In Installations

For built-in installations, NO minimum clearance required around sides or backs of units. For closet installation, allow additional 1" clearance between fronts of units and door. Location of plumbing, exhaust and utility hookups MUST be considered in built-in installations. For additional installation details, refer to Product Installation Guides on web.



Side-by-Side Units in Under-Counter Installation
Can be installed with standard countertop and/or cabinetry.

* To achieve minimal installation depth dimensions, dryer MUST be vented straight back. For installation with quick-turn 90° elbow, refer to Product Installation Guide on web for approximate clearances incurred with multi-directional exhausting options in freestanding, pedestal-mounted, or stacked installation.



Stacked Units in Recessed or Closet Installation

For detailed stacked installation, refer to instructions included with Stacking Kit or on web. **Note:** Stacked installation requires modified utility hookup locations for dryer. For details, refer to Product Installation Guide on web.

Front Load Dryer Specifications

- Product Shipping Weight (approx.) - 140 Lbs.
- An electrical supply with grounded three-prong receptacle is required.
- Voltage Rating - 240V/60 Hz/30 Amps
- Single phase 3- or 4-wire cable, 240 Volt, 60 Hertz AC only electrical supply with ground required on separate circuit fused on both sides of line. (Do not use same circuit as washer.)
- Connected Load (kW Rating) @ 240 Volts = 5.0kW
- Amps @ 240 Volts = 24 Amps
- Dryer MUST employ a 3-conductor NEMA 10-30 type SRDT or 4-conductor NEMA 14-30 type SRDT or ST (as required), rated at 240 volt AC minimum, 30 amp power supply cord marked for use with clothes dryers (not supplied).
- Grounding through neutral link prohibited in specific applications and certain locales, requiring use of 4-wire system. (For detailed electrical requirements, refer to Product Installation Guide on web.)
- Always consult local and national electric codes.
- Can be installed alone, with or without optional 15" Drawer Pedestal, or stacked above matching Frigidaire® Affinity Washer, which requires installation of optional Dryer Stacking Kit. (For installation details, refer to instructions included with optional pedestal or stacking kit or on web.)
- Can be built in with matching Frigidaire® Affinity Washer in under-counter, recessed or closet installation. (Refer to Built-In Installations on this page for cutout dimensions. For additional installation details, refer to Product Installation Guide on web.)
- Closet installation requires vented door with 2 unobstructed louvered openings, minimum 60 sq. in. each, located 3" from top and bottom

- of door. Full-length 120 sq. in. opening also acceptable. Allow additional 1" clearance between fronts of units and closed door.
- Do NOT install in area exposed to dripping water or outdoor weather conditions, or where gasoline or other flammables, including automobiles, are kept or stored.
- Floor MUST be solid with 1" maximum slope. Do NOT install on carpeted surface.
- Dryer MUST exhaust to outside of building, NOT into any concealed space.
- Exhaust installation requires minimum 4"-diameter rigid or flexible metal duct with approved vent hood having swing-out damper(s). Do NOT use flexible plastic or metal foil duct and use shortest run possible.
- Leveling legs supplied to level dryer properly and reduce excessive noise and vibration.

Note: For planning purposes only. Refer to Product Installation Guide on the web at frigidaire.com for detailed instructions.

Optional Accessories

- Dryer Stacking Kit - (PN# 134700600).
- 15" Classic White Drawer Pedestal - (PN# APWD15W).
- 15" Classic Black Drawer Pedestal - (PN# APWD15E).
- 15" Classic Red Drawer Pedestal - (PN# APWD15R).
- 15" Classic Blue Drawer Pedestal - (PN# APWD15N).
- 15" Classic Silver Drawer Pedestal - (PN# APWD15A).
- Mobile Home Installation Kit - (PN# 137067200).
- Drying Rack - (PN# 137067300).



Frigidaire Professional 30" Slide-In Induction Hybrid Range

Model: FPCS3085LF
30" W x 36-5/8" H x 28-5/16" D
MSRP \$2,699.00



Stainless Steel

Specifications

Product Code: FPCS3085LF
Product Type: Ranges
Power Type: Hybrid
Size: 30"
Installation Type: Slide-In
UPC Code: 0-57112-10463-8
Color: Stainless Steel

Certifications & Approvals

Sabbath Mode (Star-K® Certified): Yes
A.D.A. Compliant: Yes
Agency Approval: UL

Exterior Specifications

Control Panel Finish: Silver Grey with Stainless Steel
Overlay
Door Finish: Stainless Steel
Handle Color: Stainless Steel
Drawer Finish: Stainless Steel

Cooking Controls

Bake: Yes
Broil: Variable
Chicken Nugget Button: Yes
Convection: Bake, Roast, Broil
Convection Conversion: Yes
Keep Warm: Yes
Pizza Button: Yes
Quick Preheat: Yes
Self-Clean: 2, 3, 4 Hours
Interface: Membrane
Oven Light: Oven Light
Lockout: Yes
My Favorite: Yes
Add-a-Minute: Yes
Start Time: Multiple Functions
Timer: Yes

Cooktop Specifications

Cooking Surface: Black Ceramic Glass
Right Front: 10" - 2,500/3,400 Watts (Induction)
Right Rear: 6" - 1,500/1,900 Watts (Induction)
Left Front: 7" Bridge - 1,800/800 Watts
Left Rear: 7" - 1,800 Watts
Center: 100 Watts (Keep Warm)
Knob Type: Cast Metal
Hot-Surface Indicator Light: 4 (integrated in display)

Capacities

Oven 1 Capacity : 4.2
Drawer Capacity (Cu. Ft.): 1.6

Oven Specifications

Oven 1 Type: Main
Oven 1 Bake: 8 pass 2,500 Watts
Oven 1 Baking System: True Hidden
Oven 1 Broil : 8 pass 4,000 Watts
Oven 1 Broiling System: Variable (400°F to 550°F)
Oven 1 Convection: 500 Watts
Oven 1 Convection System: Dual Fan
Light Type: 2 Incandescent
Oven 1 Rack Configuration: 1 HD Handle, 1 HD Auto Rack, 1 Half Rack
Oven 1 Rack Positions: 4 positions
Oven 1 Interior Height: 16-1/2"
Oven 1 Interior Width: 24-1/8"
Oven 1 Interior Depth: 18-1/32"
Oven 1 Interior Color: Marlin Blue
Oven 1 Cleaning System: Self-Clean
Oven Window: Large

Warmer Drawer

Element (Watts): 450 Watts
Drawer Rack Configuration: 1 Half-Rack

Exterior Dimensions

Height : 36-5/8"
Width: 30"
Depth: 28-5/16"
Depth (with Door 90° Open): 45-1/2"

Electrical Specifications

Power Supply Connection Location: Left Rear Bottom
Voltage Rating: 240V / 208V, 60Hz
Connected Load (kW Rating) @ 240V: 14.3 / 11.7
Amps @ 240 Volts: 59.6 / 56.3
Minimum Circuit Required (Amps): 40A

General Specifications

Product Weight (lbs): 220
Shipping Weight (lbs): 245

Cut-Out Dimensions

Cut-Out Height: 35-7/8" - 36-5/8"

Cut-Out Width: 30-1/16"

Cut-Out Depth: 21-3/4" - 22-1/8"

Performance

Ultra-Efficient Kitchen: Yes



Frigidaire Affinity 4.0 Cu. Ft. Front Load Washer

Model: FAFW4011LB
 27" W x 36" H x 31" D
 MSRP \$649.00



Classic Black



Shown with Optional Pedestal

Specifications

Color: Classic Black
 Energy Star® Certified: Yes
 Agency Approval: UL/CUL

Colors/Capacity

Capacity (Cu. Ft.): 4.0
 Drum Material: Stainless Steel
 Delicates/Hand Wash: Yes
 Cabinet Color: White
 Console Color: White
 Console Location: Front

Washer Cycle Features

Timer Offs/Different Cycle Selections: 7
 Cycle Count: 7
 Heavy: Yes
 Bulky: Yes
 Water Level Adjustments: Automatic
 Normal: Yes
 Normal/Casual: Yes
 Delicates: Yes
 Rinse & Spin: Yes
 Spin Only: Yes
 Casual: Yes
 Cycle Status Lights: 5 - Door Lock, Sensing, Wash,
 Touch Pause to add a Garment
 Time Remaining Indicator: Yes - LED Segment

Specialty Cycles

Soil Level Selections: 3

Heavy Soil: Yes

Normal Soil: Yes

Light Soil: Yes

Washer Temperature Options

Automatic Temperature Control: Yes

Hot: Yes

Warm: Yes

Cool: Yes

Cold: Yes

Cold Clean: Yes

Wash Speeds (rpm): 33 / 47

Maximum Spin Speed (rpm): 1,100

Options / Modifiers

Energy Saver: Yes

Stain Clean: Yes

Clean Washer: Yes, Key Combination

Fresh Water Rinse: Yes

Cycle Signal (Volume Control): Yes

Dispensers

Detergent Dispenser: Yes

Bleach Dispenser: Yes

Fabric Softener Dispenser: Yes

Options

Sound Package: Silent Design

Delay Start: Yes

Time: Up to 10 Hours

Cycle Signal: Chime

Door Lock Light: Yes

Control Lock: Yes

Exterior Dimensions

Exterior Width: 27"

Exterior Depth: 31"

Exterior Height: 36"

Shipping Weight (approx.): 222 lbs

UPC: 0-12505-38272-7

SECTION 12 35 30

RESIDENTIAL CASEWORK

PART 1 GENERAL

1.1 SUMMARY

- A. Section includes shop fabricated residential cabinet units and counter tops.

1.2 SUBMITTALS

- A. Refer to Section 01 00 00 – General Requirements for Submittal Procedures.
- B. Shop Drawings: Indicate casework locations, scale plans, elevations, and clearances required.
- C. Product Data: Submit data on component profiles, sizes, assembly methods, and schedule of finishes.
- D. Samples: Submit two panels, 12x 12 inch in size illustrating cabinet and counter top finish.
- E. Samples: Submit hardware samples.

1.3 QUALITY ASSURANCE

- A. Perform Work in accordance with KCMA (Directory of Certified Cabinet Manufacturers) - Certification Program.

1.4 ENVIRONMENTAL REQUIREMENTS

- A. Install after interior temperature and humidity are controlled and stabilized.

PART 2 PRODUCTS

2.1 RESIDENTIAL CASEWORK

- A. Manufacturers:
 1. Merillat Cabinetry Model W3330.
 2. Merillat Cabinetry Model W2715.
 3. Merillat Cabinetry Model W3015.
 4. Merillat Cabinetry Model WBC2830.
 5. Merillat Cabinetry Model B36HDS
 6. Merillat Cabinetry Model BBC36/39L
 7. Merillat Cabinetry Model B12RHDS
 8. Merillat Cabinetry Model BDW272446

9. Caesarstone Countertop Style: Absolute Noir 6100
10. Substitutions: Not Permitted.

2.2 COMPONENTS

- A. Hardware: Manufacturer's standard.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify adequacy of backing and location of mechanical and electrical outlets.

3.2 PREPARATION

- A. Install supplementary support framing.

3.3 INSTALLATION

- A. Set and secure casework in place rigid, plumb, and level.
- B. Provide cutouts for plumbing fixtures, appliances, and other fixtures and fittings.
- C. Use fixture attachments at concealed locations for wall mounted components.
- D. Use concealed joint fasteners to align and secure adjoining cabinet units counter tops and kitchen backsplash.
- E. Carefully scribe casework against other building materials, leaving gaps of 1/32 inch maximum. Use filler strips not additional overlay trim for this purpose.
- F. Secure cabinet and counter bases to floor using appropriate anchorage.
- G. Adjust moving or operating parts to function smoothly and correctly.
- H. Install backsplashes and end splashes.

END OF SECTION

SECTION 13 42 00

BUILDING MODULES

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Fabrication of shell modules for inter-module connections for site assembly.
- B. Transportation and erection of modules on prepared foundation as indicated.
- C. Modules shall contain:
 - 1. Building Envelope consisting of floor roof and wall framing.
 - 2. Interior partitions and ceiling framing with gypsum board finish.
 - 3. Cabinetry, with countertops.
 - 4. Finish trim for interior doors and windows.
 - 5. Interior doors, with hardware and trim.
 - 6. Complete wiring for electrical per code.
 - 7. Complete piping and fixtures for plumbing systems.
- D. Related Requirements
 - 1. Division 06: Wood Plastics & Composites, Framing and Sheathing, Finish Carpentry,
 - 2. Division 07: Thermal & Moisture Protection: Insulation and Vapor Barriers
 - 3. Division 08: Openings: Interior doors and frames with hardware.
 - 4. Division 09: Finishes: Gypsum Board Ceiling and Wall Finishes.
 - 5. Division 22: Plumbing.
 - 6. Division 26: Electrical.

1.2 ADMINISTRATIVE REQUIREMENTS

- A. Preassembly Meetings
 - 1. Schedule a preassembly meeting 1 week prior to assembly of the work of this section in the field and comply with requirements of Division 01.

1.3 SUBMITTALS

- A. Refer to Section 01 00 00 – Basic Requirements for submittal requirements and procedures.
- B. ACTION SUBMITTALS
 - 1. Shop Drawings: Indicate room layout, equipment locations, dimensions, door and frame assembly, and details of assembly, anchors, utility rough-in locations, and assembly procedure.
- C. INFORMATIONAL SUBMITTALS

1. Manufacturers' Instructions: Provide detailed instructions for assembly and disassembly of modules for relocation and transport.
2. Qualification Statements

D. CLOSEOUT SUBMITTALS

1. Warranty Documentation

1.4 QUALITY ASSURANCE

- A. Manufacturer: Company specializing in manufacturing building modules as specified in this section with minimum three years documented experience.
- B. Erectors: Company specializing in performing Work of this section with minimum 3 years experience approved by manufacturer.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Deliver the modules to location of assembly, with equipment required to place and assemble on prepared foundation.
- B. Examine modules on transport with Architect for damage or deficiencies prior to unloading.

1.6 WARRANTY

- A. Manufacturer Warranty: Provide manufacturer's standard warranty against defective materials and workmanship.

PART 2 PRODUCTS

2.1 MANUFACTURER

- A. Haven Custom Homes.

2.2 COMPONENTS

- A. Refer to the individual Specification sections for building components as indicated on the Drawings.
- B. Intermodular Connectors: Simpson Strongtie, # ST2122 or 3/8 inch lag bolts with Simpson SPH4/6 strap, double studs or blocking at each end hold down location.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify foundation and utility infrastructure are installed and ready to receive building modules.

3.2 ASSEMBLY

- A. Assemble modules per manufacturer's instructions.
- B. Tolerances:
 - 1. Walls: Plumb within 1/4 inch
 - 2. Floors: Level within 1/8 inch in 10 feet.

3.3 ADJUSTING:

- A. Tighten connectors as required to maintain plumb and level on all modules, forming a single building.

END OF SECTION

SECTION 21 05 00

COMMON WORK RESULTS FOR FIRE SUPPRESSION

PART 1 GENERAL

1.1 SUMMARY

- A. Section includes complete fire suppression system including sprinkler system, standpipe system, fire department connections and fire pump system.

1.2 SYSTEM DESCRIPTION

- A. Sprinkler System: Conform to the following criteria:
 - 1. Coverage for entire building .
 - 2. Design system hydraulically to NFPA 13D .
 - 3. System performance to achieve light hazard occupancy requirements.
- B. Standpipe System: Design to NFPA 14.

1.3 CLOSEOUT SUBMITTALS

- A. Project Record Documents: Record actual locations of sprinkler heads.
- B. Operation and Maintenance Data: Submit description of components of system, servicing requirements, record drawings, inspection data, and parts lists.

1.4 QUALITY ASSURANCE

- A. Perform Work in accordance with:
 - 1. Sprinkler Systems: NFPA 13D.
 - 2. Standpipe and Hose Systems: NFPA 14.
- B. Maintain one copy of each document on site.

PART 2 PRODUCTS

2.1 PIPE AND TUBE

- A. Manufacturers:
 - 1. Blazemaster
 - 2. Substitutions: Not permitted.

- B. CPVC Tubing: ASTM F442, standard specification for Chlorinated Poly (Vinyl) Chloride (CPVC) pipe

2.2 PUMP

- A. Manufacturers:
 - 1. Goulds Model JRS7.
 - 2. Substitutions: Not permitted.

2.3 SPRINKLERS

- A. Manufacturers:
 - 1. TYCO Rapid Response Model TY2234.
 - 2. Substitutions: Not permitted.

PART 3 EXECUTION

3.1 INSTALLATION

- A. Install in accordance NFPA 13D.

END OF SECTION

SECTION 21 41 00

STORAGE TANKS FOR FIRE SUPPRESSION WATER

PART 1 GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Water Storage tanks.

1.2 SUBMITTALS

- A. Refer to Section 01 00 00 – General Requirements for Submittal Procedures
- B. Product Data: Submit manufacturer's literature.

1.3 CLOSEOUT SUBMITTALS

- A. Refer to Section 01 00 00 – General Requirements for Submittal Procedures
- Operation and Maintenance Data: Submit literature and parts list.

1.4 PRODUCTS

- A. WATER STORAGE TANKS
 - 1. Manufacturers:
 - a. American Tank Model 005-020.
 - b. Substitutions: Not permitted.

PART 2 EXECUTION

2.1 INSTALLATION

- A. Clean and flush tanks prior to delivery to site and after installation. Keep openings sealed until pipe connections are made.

END OF SECTION

SECTION 22 05 00

COMMON WORK RESULTS FOR PLUMBING

PART 1 GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Identification for Plumbing Piping and Equipment.

1.2 SUBMITTALS

- A. Refer to Section 01 00 00 – General Requirements for Submittal Procedures.
- B. Shop Drawings: Submit for piping and equipment identification list of wording, symbols, letter size, and color coding for pipe identification and valve chart and schedule, including valve tag number, location, function, and valve manufacturer's name and model number.
- C. Product Data for Pipe and Equipment Identification: Submit for mechanical identification manufacturers catalog literature for each product required.

1.3 QUALITY ASSURANCE

- A. Include Manufacturer's documentation

PART 2 PRODUCTS

2.1 IDENTIFICATION FOR PLUMBING PIPING AND EQUIPMENT

- A. Manufacturers:
 - 1. TBD Model TBD.
- B. Supply Pipes
 - 1. Pex tubing
 - 2. Substitutions: Not permitted
- C. Waste Pipes
 - 1. Schedule 40 PVC
 - 2. Substitutions: Not permitted.

- D. Plastic Tags: Laminated three-layer plastic with engraved black letters on light background color, minimum 1-1/2 inches (38 mm) diameter.
- E. Plastic Underground Pipe Markers: Bright colored continuously printed plastic ribbon tape, minimum 6 inches (150 mm) wide by 4 mil (0.10 mm) thick, manufactured for direct burial service. (For permanent use only) - Check this!!

PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify openings are ready to receive sleeves.

3.2 INSTALLATION - PIPING AND EQUIPMENT IDENTIFICATION

- A. Install plastic nameplates with adhesive.
- B. Install plastic tags with corrosion resistant metal chain.

END OF SECTION

SECTION 22 07 19

PLUMBING PIPING INSULATION

PART 1 GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Plumbing piping insulation, jackets and accessories.
 - 2. Plumbing equipment insulation, jackets and accessories.

1.2 SUBMITTALS

- A. Product Data: Submit product description, thermal characteristics and list of materials and thickness for each service, and location.
- B. Manufacturer's Installation Instructions: Submit manufacturers published literature indicating proper installation procedures.
- C. Manufacturer's Certificate: Certify products meet or exceed specified requirements.

1.3 QUALITY ASSURANCE

- A. Test pipe insulation for maximum flame spread index of 25 and maximum smoke developed index of not exceeding [50] in accordance with ASTM E84
- B. Pipe insulation manufactured in accordance with ASTM C585 for inner and outer diameters.
- C. Factory fabricated fitting covers manufactured in accordance with ASTM C450.

1.4 DELIVERY, STORAGE, AND HANDLING

- A. Accept materials on site in original factory packaging, labeled with manufacturer's identification, including product density and thickness.
- B. Protect insulation from weather and construction traffic, dirt, water, chemical, and damage, by storing in original wrapping.

1.5 ENVIRONMENTAL REQUIREMENTS

- A. Install insulation only when ambient temperature and humidity conditions are within range recommended by manufacturer.
- B. Maintain temperature before, during, and after installation for minimum period of [24] hours.

1.6 WARRANTY

- A. Furnish five year manufacturer warranty for man made fiber.

PART 2 PRODUCTS

2.1 MANUFACTURER

- A. Manufacturers for Closed Cell Elastomeric Insulation Products:
 - 1. Armacell, LLC. Armaflex.

2.2 PIPE INSULATION

- A. TYPE P-5: ASTM C534, Type I, flexible, closed cell elastomeric insulation, tubular.
 - 1. Thermal Conductivity: 0.25 at 75 degrees F (0.036 at 24 degrees C).
 - 2. Operating Temperature Range: Range: Minus 297 to 220 degrees F (minus 183 to 105 degrees C).

2.3 PIPE INSULATION JACKETS

- A. Closed Cell Elastomeric Insulation Pipe Hanger: Polyurethane insert with aluminum or stainless steel jacket single piece construction with self adhesive closure. Thickness to match pipe insulation.
- B. Adhesives: Compatible with insulation.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify piping has been tested before applying insulation materials.

- B. Verify surfaces are clean and dry, with foreign material removed.

3.2 INSTALLATION - PIPING SYSTEMS

- A. Piping Exposed to View in Finished Spaces: Locate insulation and cover seams in least visible locations.
- B. Continue insulation through penetrations of building assemblies or portions of assemblies having fire resistance rating of one hour or less. Provide intumescent firestopping when continuing insulation through assembly. Finish at supports, protrusions, and interruptions. Refer to Section 07 84 00 {07840} for penetrations of assemblies with fire resistance rating greater than one hour.
- C. Piping Systems Conveying Fluids Below Ambient Temperature:
 1. Insulate entire system including fittings, valves, unions, flanges, strainers, flexible connections, pump bodies, and expansion joints.
 2. Furnish factory-applied or field-applied vapor retarder jackets. Secure factory-applied jackets with pressure sensitive adhesive self-sealing longitudinal laps and butt strips. Secure field-applied jackets with outward clinch expanding staples and seal staple penetrations with vapor retarder mastic.
 3. Insulate fittings, joints, and valves with molded insulation of like material and thickness as adjacent pipe. Finish with glass cloth and vapor retarder adhesive or PVC fitting covers.
- D. Hot Piping Systems greater than 140degrees F (60 degrees C):
 1. Furnish factory-applied or field-applied standard jackets. Secure with outward clinch expanding staples or pressure sensitive adhesive system on standard factory-applied jacket and butt strips or both.
 2. Insulate fittings, joints, and valves with insulation of like material and thickness as adjoining pipe.
 3. Insulate flanges and unions at equipment.
- E. Inserts and Shields:
 1. Piping 1-1/2inches (40 mm) Diameter and Smaller: Install galvanized steel shield between pipe hanger and insulation.
- F. Insulation Terminating Points:
 1. Coil Branch Piping 1 inch (25 mm) and Smaller: Terminate hot water piping at union upstream of the coil control valve.
 2. Chilled Water Coil Branch Piping: Insulate chilled water piping and associated components up to coil connection.
 3. Condensate Piping: Insulate entire piping system and components to prevent condensation.
- G. Closed Cell Elastomeric Insulation:
 1. Push insulation on to piping.
 2. Miter joints at elbows.
 3. Seal seams and butt joints with manufacturer's recommended adhesive.
 4. When application requires multiple layers, apply with joints staggered.

5. Insulate fittings and valves with insulation of like material and thickness as adjacent pipe.

H. Prepare pipe insulation for finish painting. Refer to Section 09 90 00 {09990}.

3.3 INSTALLATION - EQUIPMENT

A. Factory Insulated Equipment: Do not insulate.

B. Exposed Equipment: Locate insulation and cover seams in least visible locations.

C. Fill joints, cracks, seams, and depressions with bedding compound to form smooth surface. On cold equipment, use vapor retarder cement.

D. Equipment Containing Fluids Below Ambient Temperature:

1. Insulate entire equipment surfaces.
2. Apply insulation close to equipment by grooving, scoring, and beveling insulation. Fasten insulation to equipment with studs, pins, clips, adhesive, wires, or bands.
3. Furnish factory-applied or field-applied vapor retarder jackets. Secure factory-applied jackets with pressure sensitive adhesive self-sealing longitudinal laps and butt strips. Secure field-applied jackets with outward clinch expanding staples and seal staple penetrations with vapor retarder mastic.
4. Finish insulation at supports, protrusions, and interruptions.

E. Equipment Containing Fluids Over 140degrees F (60 degrees C):

1. Insulate flanges and unions with removable sections and jackets.
2. Install insulation with factory-applied or field applied jackets, with or without vapor barrier. Finish with glass cloth and adhesive.
3. Finish insulation at supports, protrusions, and interruptions.

F. Nameplates and ASME Stamps: Bevel and seal insulation around; do not cover with insulation.

G. Equipment Requiring Access for Maintenance, Repair, or Cleaning: Install insulation for easy removal and replacement without damage.

H. Prepare equipment insulation for finish painting. Refer to Section 09 90 00 {09990}.

3.4 SCHEDULES

A. Water Supply Services Piping Insulation Schedule:

PIPING SYSTEM	INSULATION TYPE	PIPE SIZE	INSULATION THICKNESS inches (mm)
Domestic Hot Water Supply and Recirculation	[P-1]	1-1/4 inches (32 mm) and smaller	0.5 (13)
Domestic Hot Water Supply and Recirculation systems with domestic water temperature maintenance cable	[P-1]	1 inch (25 mm) and smaller	1.0 (25)
Domestic Cold Water	[P-1] [or] [P-5]	1-1/4 inches (32 mm) and smaller	0.5 (13)

B. Equipment Insulation

EQUIPMENT	INSULATION TYPE	INSULATION THICKNESS inches (mm)
Domestic Hot Water Storage Tank	[E-1] [E-2]	[2 (50.8)]

END OF SECTION

SECTION 22 10 00

PLUMBING PIPING AND PUMPS

PART 1 GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Pipe and pipe fittings.
 - 2. Plumbing pumps.

1.2 SUBMITTALS

- A. Refer to Section 01 00 00 – General Requirements for Submittal Procedures
- B. Product Data:
 - 1. Pumps: Include capacities, pump curves, equipment performance, and electrical characteristics.
- C. Manufacturer's Installation Instructions: Submit installation instructions for material and equipment.
- D. Manufacturer's Certificate: Certify products meet or exceed specified requirements.

1.3 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: Submit spare parts lists and maintenance procedures.

1.4 QUALITY ASSURANCE

- A. Provide Manufacturer's documentation.
- B. Maintain one copy of each document on site.

PART 2 PRODUCTS

2.1 PIPES AND TUBES

- A. Sanitary Sewer Piping, above Grade:
 - 1. PVC Pipe: ASTM D2665 or ASTM D3034 SDR 26, polyvinyl chloride (PVC) material.
 - a. Fittings: PVC, ASTM D2665 or ASTM D3034.
 - b. Joints: ASTM D2855, solvent weld with ASTM D2564 solvent cement.

2. PVC Pipe: ASTM D2665, ASTM D3034, or ASTM F679 with PVC fittings and elastomeric gasket joints.
- B. Water Piping, above Grade:
 1. Copper Tubing: ASTM B88 (ASTM B88M), Type L, drawn, with cast brass or wrought copper fittings and Grade 95TA solder joints.
 2. Pex Tubing: ASTM F 888-07, Copper ring crimped connections ASTM F 1807
 - C. Storm Water Piping, above Grade:
 1. PVC Pipe: ASTM D2665 or ASTM D3034 SDR 26, polyvinyl chloride (PVC) material.
 - a. Fittings: PVC, ASTM D2665 or ASTM D3034.
 - b. Joints: ASTM D2855, solvent weld with ASTM D2564 solvent cement.
 - D. Equipment Drains and Overflows:
 1. PVC Pipe: ASTM D1785, Schedule 40, or ASTM D2241, SDR 21 or 26, PVC fittings, solvent weld joints.

2.2 IN-LINE PUMPS

- A. Manufacturers:
 1. DuraMAC Model 17052R020PC1.
- B. Substitutions: Not permitted.

2.3 SUBMERSIBLE PUMPS

- A. Manufacturers:
 1. Gould Model JRS5
 2. Gould Model WW0511A
 3. A.Y. McDonald Mfg. Co. Model 300611TPK
- B. Substitutions: Not permitted.

PART 3 EXECUTION

3.1 PREPARATION

- A. Ream pipe and tube ends. Remove burrs. [Bevel plain end ferrous pipe.]
- B. Remove scale and dirt, on inside and outside piping before assembly.
- C. Prepare piping connections to equipment with flanges or unions.

3.2 INSTALLATION - PIPING SYSTEMS

- A. Install unions downstream of valves and at equipment or apparatus connections.

- B. Route piping parallel to building structure and maintain gradient.
- C. Install piping to maintain headroom. Group piping to conserve space. Group piping whenever practical at common elevations.
- D. Install piping to allow for expansion and contraction without stressing pipe, joints, or connected equipment.
- E. Provide clearance in hangers and from structure and other equipment for installation of insulation and access to valves and fittings.
- F. Sleeve pipe passing through partitions, walls and floors.
- G. Install piping system allowing clearance for installation of insulation and access to valves and fittings.
- H. Protect piping systems from entry of foreign materials by temporary covers, completing sections of the work, and isolating parts of completed system.

3.3 INSTALLATION - PLUMBING SUPPLY PIPING

- A. Install water piping in accordance with ASME B31.9.
- B. Provide support for utility meters in accordance with requirements of utility companies.
- C. Slope water piping and arrange to drain at low points.
- D. Install piping from relief valves, back-flow preventers and drains to nearest floor drain.
- E. Install water hammer arrestors complete with accessible isolation valve on hot and cold water supply piping to Kitchen sink.
- F. Install flow controls in water circulating systems as indicated on Drawings.
- G. Disinfecting of Domestic Water Systems:
 1. Prior to starting, verify system is complete, flushed and clean.
 2. Verify pH of water to be treated is between 7.4 and 7.6 by adding alkali (caustic soda or soda ash) or acid (hydrochloric).
 3. Inject disinfectant, free chlorine in liquid, powder and tablet or gas form, throughout system to obtain residual from 50 to 80 mg/L.
 4. Bleed water from outlets to obtain distribution and test for disinfectant residual at minimum 15 percent of outlets.
 5. Maintain disinfectant in system for 24 hours.
 6. When final disinfectant residual tests less than 25 mg/L, repeat treatment.
 7. Flush disinfectant from system until residual concentration is equal to incoming water or 1.0 mg/L.
 8. Take samples no sooner than 24 hours after flushing, from 2 outlets and from water entry, and analyze in accordance with AWWA C651.

3.4 INSTALLATION - PLUMBING DRAINAGE PIPING

- A. Install bell and spigot pipe with bell end upstream.
- B. Extend cleanouts to finished floor or wall surface. Lubricate threaded cleanout plugs with mixture of graphite and linseed oil. Install with clearance at cleanout for rodding of drainage system.
- C. Encase exterior cleanouts in concrete flush with grade.
- D. Install floor cleanouts at elevation to accommodate finished floor.
- E. Establish invert elevations, slopes for drainage to [1/8] inch per foot minimum. Maintain gradients.
- F. Test drainage piping in accordance with local code requirements.

3.5 INSTALLATION - PUMPS

- A. Install pumps with shaft length allowing sump pumps to be located minimum 24 inches (600 mm) below lowest invert into sump pit and minimum 6 inches (150) clearance from bottom of sump pit.

3.6 DISINFECTION OF DOMESTIC WATER PIPING SYSTEM

- A. Prior to starting work, verify system is complete, flushed and clean. Verify pH of water to be treated is between 7.4 and 7.6 by adding alkali (caustic soda or soda ash) or acid (hydrochloric).
- B. Inject disinfectant, free chlorine in liquid, powder, tablet or gas form, throughout system to obtain 50 to 80 mg/L residual. Bleed water from outlets to accomplish distribution.
- C. Maintain disinfectant in system for 24 hours. When final disinfectant residual tests less than 25 mg/L, repeat treatment.
- D. Flush disinfectant from system. Take samples no sooner than 24 hours after flushing, and analyze in accordance with AWWA C601.

3.7 SCHEDULES

- A. Pumps:

Drawing Code	P-1	P-2	P-3	P-4
Manufacturer	A. Y. McDonald Mfg. Co.	Goulds	DuraMAC	Goulds

Model No.	300611TPK	WW0511	17052R020 PC1	JRS5
Location	Rainwater tank	Greywater dosing tank	Supply	Fire Suppression
Service	19 psi	18 ft	52 psi	64 psi
Capacity	7 GPM	75 GPM	20 GPM	14.1 GPM
Motor Size	1/6 HP	1/2 HP	3/4 HP	1/2 HP

END OF SECTION

SECTION 22 30 00

PLUMBING EQUIPMENT

PART 1 GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Tankless Water heaters.
 - 2. Water Storage tanks.

1.2 SUBMITTALS

- A. Refer to Section 01 00 00 – General Requirements for Submittal Procedures
- B. Product Data: Submit manufacturer's literature for plumbing equipment.

1.3 CLOSEOUT SUBMITTALS

- A. Refer to Section 01 00 00 – General Requirements for Submittal Procedures
- B. Operation and Maintenance Data: Submit literature and parts list.

1.4 QUALITY ASSURANCE

- A. Maintain one copy of each document on site.

PART 2 PRODUCTS

2.1 RESIDENTIAL ELECTRIC TANKLESS WATER HEATER

- A. Manufacturers:
 - 1. Stiebel Eltron Model Tempra 20 [Plus].
 - 2. Substitutions: Not permitted.

2.2 WATER STORAGE TANKS

- A. Manufacturers:
 1. American Tank Company Model 300-005.
 2. RUUD Model PE2-52-2
 3. Custom
 4. Substitutions: Not permitted.

PART 3 EXECUTION

3.1 INSTALLATION

- A. Clean and flush tanks prior to delivery to site and after installation. Keep openings sealed until pipe connections are made.
- B. On hot water tanks, install drain at water inlet and outlet, thermometer with range of 40 to 200 degrees F (4 to 93 degrees C), and ASME pressure relief valve suitable for maximum working pressure.

3.2 SCHEDULES

- A. Tanks:

Drawing Code	T-1	T-2	T-3	T-4	T-5
Location	North in flower bed	North	Northwest in flower bed	Core	Core
Service	Greywater	Rainwater/ Fire Suppression	Return	Supply	Hot Water Storage
Capacity	50 Gal	1,100 Gal	550 Gal	550 Gal	50Gal
Diameter	N/A	7' 3"	N/A	N/A	1' 7"
Length	3' 0"	N/A	7' 6"	18'	N/A
Width	1' 7"	N/A	3' 0"	2' 6"	N/A
Height	1' 9.5"	4' 4"	3' 0"	2' 6"	57"

END OF SECTION

SECTION 22 40 00

PLUMBING FIXTURES

PART 1 GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Water closets.
 - 2. Lavatories.
 - 3. Sinks.
 - 4. Faucets.
 - 5. Bathtubs.

1.2 SUBMITTALS

- A. Refer to Section 01 00 00 – General Requirements for Submittal Procedures
- B. Product Data: Submit manufacturer's literature for plumbing fixtures.

1.3 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: Submit literature and parts list.

1.4 QUALITY ASSURANCE

- A. Provide plumbing fixture fittings in accordance with ASME A112.18.1 that prevent backflow from fixture into water distribution system.
- B. Maintain one copy of each document on site.

PART 2 PRODUCTS

2.1 TANK TYPE WATER CLOSETS

- A. Manufacturers:
 - 1. Sterling Model 402027.
 - 2. Substitutions: Not permitted.

- B. Bowl: Wall hung vitreous china, reverse trap, close-coupled closet combination with regular rim, insulated vitreous china closet tank with fittings and lever flushing valve, chrome plated bolt caps; maximum 1.6 gallon flush volume.
- C. Seat: Solid white plastic, closed front and cover.
- D. Wall Mounted Carrier: Adjustable cast iron frame, integral drain hub and vent, adjustable spud, lugs for floor and wall attachment, threaded fixture studs with nuts and washers.

2.2 LAVATORIES

- A. Manufacturers:
 - 1. RSI Model CG18830.
 - 2. Substitutions: Not permitted.

2.3 SINKS

- A. Manufacturers:
 - 1. Franke USA Model OMMT945-18BX.
 - 2. Substitutions: Not permitted.

2.4 FAUCETS

- A. Manufacturers:
 - 1. Moen Model CA6711.
 - 2. Moen Model S7597C.
 - 3. Substitutions: Not permitted
- B. Trim: Chrome plated brass supply with swing spout, water economy aerator with maximum 2.2 gpm (8.3 L/m) flow, single lever handle and retractable spray; chrome plated brass P-trap with clean-out plug and arm with escutcheon

2.5 BATHTUBS [AND SHOWERS]

- A. Manufacturers:
 - 1. Moen Model T2713.
 - 2. Lasco Model 2603 - SG

3. Substitutions: Not permitted.

- B. For individual showers or tub showers, provide controls to limit discharge temperature to 120 degrees F (49 degrees C). Do not provide inline thermostatic valve to comply with this requirement.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify adjacent construction is ready to receive rough-in work of this section.
- B. Review millwork shop drawings. Confirm location and size of fixtures and openings before rough in and installation.

3.2 INSTALLATION

- A. Install each fixture with chrome plated rigid or flexible supplies with screwdriver stops, reducers, and escutcheons.
- B. Adjust stops or valves for intended water flow rate to fixtures without splashing, noise, or overflow.

END OF SECTION

SECTION 23 07 00

HVAC INSULATION

PART 1 GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. HVAC piping insulation, jackets and accessories.
 - 2. HVAC ductwork insulation, jackets, and accessories.

1.2 SUBMITTALS

- A. Product Data: Submit product description, thermal characteristics and list of materials and thickness for each service, and location.
- B. Manufacturer's Installation Instructions: Submit manufacturers published literature indicating proper installation procedures.
- C. Manufacturer's Certificate: Certify products meet or exceed specified requirements.
- D. Refer to 010000 general requirements for submittal procedures.

1.3 QUALITY ASSURANCE

- A. Test pipe insulation for maximum flame spread index of 25 and maximum smoke developed index of not exceeding [50] in accordance with ASTM E84.
- B. Pipe insulation manufactured in accordance with ASTM C585 for inner and outer diameters.

1.4 DELIVERY, STORAGE, AND HANDLING

- A. Accept materials on site in original factory packaging, labeled with manufacturer's identification, including product density and thickness.
- B. Protect insulation from weather and construction traffic, dirt, water, chemical, and damage, by storing in original wrapping.

1.5 ENVIRONMENTAL REQUIREMENTS

- A. Install insulation only when ambient temperature and humidity conditions are within range recommended by manufacturer.
- B. Maintain temperature before, during, and after installation for minimum period of [24] hours.

1.6 WARRANTY

- A. Furnish five year manufacturer warranty for manmade fiber.

PART 2 PRODUCTS

2.1 MANUFACTURER

- A. Manufacturers for Glass Fiber and Mineral Fiber Insulation Products:
 - 1. TBD
- B. Manufacturers for Closed Cell Elastomeric Insulation Products:
 - 1. TBD

2.2 PIPE INSULATION

- A. TYPE P-5: ASTM C534, Type I, flexible, closed cell elastomeric insulation, tubular.
 - 1. Thermal Conductivity: 0.27 at 75 degrees F.
 - 2. Operating Temperature Range: Range: Minus 70 to 180 degrees F.

2.3 DUCTWORK INSULATION

- A. TYPE D-1: ASTM C1290, Type III, flexible glass fiber, commercial grade with factory applied reinforced aluminum foil jacket meeting ASTM C1136, Type II.
 - 1. Thermal Conductivity: 0.30 at 75 degrees F.
 - 2. Maximum Operating Temperature: 250 degrees F.

Density: 0.75 pound per cubic foot

PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify piping and applicable ductwork has been tested before applying insulation materials.

- B. Verify surfaces are clean and dry, with foreign material removed.

3.2 INSTALLATION - PIPING SYSTEMS

- A. Piping Systems Conveying Fluids Below Ambient Temperature:
 - 1. Insulate entire system including fittings, valves, unions, flanges, strainers, flexible connections, and expansion joints.
- B. Insulation Terminating Points:
 - 1. Condensate Piping: Insulate entire piping system and components to prevent condensation.
- C. Closed Cell Elastomeric Insulation:
 - 1. Push insulation on to piping.
 - 2. Miter joints at elbows.
 - 3. Seal seams and butt joints with manufacturer's recommended adhesive.
 - 4. When application requires multiple layers, apply with joints staggered.
 - 5. Insulate fittings and valves with insulation of like material and thickness as adjacent pipe.
- D. Piping Exterior to Building: Insulate fittings, joints, and valves with insulation of like material and thickness as adjoining pipe, and finish with glass mesh reinforced vapor retarder cement. Cover with aluminum jacket with seams located at 3 or 9 o'clock position on side of horizontal piping with overlap facing down to shed water or on bottom side of horizontal piping.

3.3 INSTALLATION - DUCTWORK SYSTEMS

- A. Insulated ductwork conveying air below ambient temperature:
 - 1. Provide insulation with vapor retarder jackets.
 - 2. Finish with tape and vapor retarder jacket.
 - 3. Continue insulation through walls, sleeves, hangers, and other duct penetrations.
 - 4. Insulate entire system including fittings, joints, flanges, fire dampers, flexible connections, and expansion joints.
- B. Insulated ductwork conveying air above ambient temperature:
 - 1. Provide with or without standard vapor retarder jacket.
 - 2. Insulate fittings and joints. Where service access is required, bevel and seal ends of insulation.

END OF SECTION

SECTION 23 23 00

REFRIGERANT PIPING

PART 1 GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Refrigerant piping.
 - 2. Unions, flanges, and couplings.

1.2 REFERENCES

- A. American Society of Heating, Refrigerating and Air-Conditioning Engineers:
 - 1. ASHRAE 15 - Safety Code for Mechanical Refrigeration.
- B. American Society of Mechanical Engineers:
 - 1. ASME B16.22 - Wrought Copper and Copper Alloy Solder Joint Pressure Fittings.
 - 2. ASME B16.26 - Cast Copper Alloy Fittings for Flared Copper Tubes.
 - 3. ASME B31.5 - Refrigeration Piping.

1.3 SYSTEM DESCRIPTION

- A. Where more than one piping system material is specified, provide compatible system components and joints. Use non-conducting dielectric connections when joining dissimilar metals in systems.
- B. Provide flanges, unions, or couplings at locations requiring servicing. Use unions, flanges, or couplings downstream of valves and at equipment connections. Do not use direct welded or threaded connections to valves or equipment.
- C. Flexible Connectors: Use at or near compressors & blowers where piping configuration does not absorb vibration.

1.4 SUBMITTALS

- A. Manufacturer's Installation Instructions: Submit hanging and support methods, joining procedures and isolation.
- B. Refer to 010000 general requirements for submittal procedures.

PART 2 PRODUCTS

2.1 REFRIGERANT PIPING

- A. Copper Tubing: ASTM B280, drawn.
 - 1. Fittings: ASME B16.22 wrought copper.
 - 2. Joints: Braze, AWS A5.8 BCuP silver/phosphorus/copper alloy with melting range 1190 to 1480 degrees F.

2.2 UNIONS, FLANGES, AND COUPLINGS

- A. **2 inches** and Smaller:
 - 1. Copper Pipe: Bronze, soldered joints.

PART 3 EXECUTION

3.1 PREPARATION

- A. Ream pipe and tube ends. Remove burrs.
- B. Remove scale and dirt on inside and outside before assembly.
- C. Prepare piping connections to equipment with flanges or unions.
- D. Keep open ends of pipe free from scale and dirt. Protect open ends with temporary plugs or caps.

3.2 INSTALLATION - PIPE HANGERS AND SUPPORTS

- A. Install hangers and supports in accordance with ASME B31.5.
- B. Install hangers to allow **1-1/2 inch** minimum vertical adjustment. Design hangers for pipe movement without disengagement of supported pipe.

3.3 INSTALLATION - ABOVE GROUND PIPING SYSTEMS

- A. Route piping parallel to building structure and maintain gradient.
- B. Install piping to conserve building space, and not interfere with use of space.
- C. Group piping whenever practical at common elevations.
- D. Install piping to allow for expansion and contraction without stressing pipe, joints, or connected equipment.
- E. Insulate piping refer to Section 23 07 00.

- F. Fully charge completed system with refrigerant after testing.
- G. Follow ASHRAE 15 procedures for charging and purging of systems and for disposal of refrigerant.
- H. Install refrigerant piping in accordance with ASME B31.5.

END OF SECTION

SECTION 23 30 00

HVAC AIR DISTRIBUTION

PART 1 GENERAL

1.1 SUMMARY

- A. Section Includes:
1. Ductwork.
 2. Ductwork accessories.
 3. Air Outlets.
 4. Filters.

1.2 SUBMITTALS

- A. Product Data:
1. Submit sizes, capacities, materials, controls and connections to other work.
 2. Submit catalog performance ratings, construction, electric and duct connections, flashing and dimensions for fans and exhausters.
- B. Operation and Maintenance Data: Submit instructions for lubrication, motor and drive replacement, spare parts lists, and wiring diagrams.
- C. Manufacturer's Installation Instructions: Submit relevant instructions.
- D. Refer to 010000 general requirements for submittal procedures.

PART 2 PRODUCTS

2.1 DUCTWORK

- A. Duct Materials:
1. Manufacturers: TBD
 2. Furnish materials in accordance with, Galvanized Steel Ducts: ASTM A653/A653M galvanized steel sheet, lock-forming quality, having **G60**.
- B. Ductwork Fabrication:

1. See Section 233100

C. Insulated Flexible Ducts:

1. Product Description: Two ply vinyl film supported by helical wound spring steel wire; fiberglass insulation; [polyethylene] [aluminized] vapor barrier film.
 - a. Pressure Rating: 10 inches wg positive and 1.0 inches wg negative.
 - b. Maximum Velocity: 4000 fpm.
 - c. Temperature Range: -10 degrees F to 160 degrees F.
 - d. Thermal Resistance: 4.2 square feet-hour-degree F per BTU.

2.2 DUCT ACCESSORIES

A. Volume Control Dampers:

1. Fabricate in accordance with SMACNA HVAC Duct Construction Standards - Metal and Flexible, and as indicated on Drawings.
2. Fabricate single blade dampers for duct size **3 inch**.
3. Furnish locking, indicating quadrant regulators on damper.

B. Flexible Duct Connections:

1. UL listed fire-retardant neoprene coated woven glass fiber fabric to NFPA 90A, approximately **3 inches** wide, crimped into metal edging strip.

2.3 FANS

A. Bath Room Exhaust Fan:

1. Manufacturers:
 - a. Broan Model QTRE080FLT.

2.4 AIR OUTLETS AND INLETS

A. Registers/Grilles: Streamlined and individually adjustable blades

B. Louvers: 4 inches deep with blades on 45 degree slope, channel frame, birds-screen with 1/2 inch square mesh for exhaust and 3/4 inch for intake.

1. Material: 16 gage thick galvanized steel.
2. Installation: Interior flat flange.

2.5 FILTERS

A. Within the grill of the return fans.

- B. Washable Permanent Panel Filters: Media: 14 mesh steel screen, zinc electroplated, rod reinforced; enclosed in galvanized steel frame.
 - 1. Nominal Size: 12 x 12 inches.
 - 2. Thickness: one inch.

PART 3 EXECUTION

3.1 INSTALLATION

- A. Install per manufacturers recommendations

END OF SECTION

SECTION 23 31 00

HVAC DUCTS

PART 1 GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Duct Materials.
 - 2. Insulated flexible ducts.
 - 3. Ductwork fabrication.
 - 4. Kitchen hood exhaust ductwork fabrication.

1.2 PERFORMANCE REQUIREMENTS

- A. Variation of duct configuration or sizes other than those of equivalent or lower loss coefficient is not permitted except by written permission. Size round ducts installed in place of rectangular ducts in accordance with ASHRAE table of equivalent rectangular and round ducts.

1.3 SUBMITTALS

- A. Product Data: Submit data for duct materials & duct connectors.
- B. Refer to 010000 general requirements for submittal procedures

1.4 QUALITY ASSURANCE

- A. Perform Work in accordance with SMACNA - HVAC Duct Construction Standards - Metal and flexible.
- B. Construct ductwork to NFPA 90A and NFPA 90B standards.

PART 2 PRODUCTS

2.1 DUCT MATERIALS

- A. Manufacturers:
 - 1. TBD

- B. Galvanized Steel Ducts: ASTM A653/A653M galvanized steel sheet, lock-forming quality, having G60 zinc coating of in conformance with ASTM A90/A90M.
- C. Fasteners: Rivets, bolts, or sheet metal screws.

2.2 INSULATED FLEXIBLE DUCTS

- A. Manufacturers:
 1. TBD
- B. Product Description: See section 233000

2.3 DUCTWORK FABRICATION

- A. Fabricate and support rectangular ducts in accordance with SMACNA HVAC Duct Construction Standards - Metal and Flexible and as indicated on Drawings. Provide duct material, gages, reinforcing, and sealing for operating pressures indicated.
- B. Construct T's, bends, and elbows with minimum radius 1-1/2 times centerline duct width. Where not possible and where rectangular elbows are used, provide airfoil turning vanes.
- C. Increase duct sizes gradually, not exceeding 15 degrees divergence wherever possible; maximum 30 degrees divergence upstream of equipment and 45 degrees convergence downstream.
- D. Seal joints between duct sections and duct seams with welds, gaskets, mastic adhesives, mastic plus embedded fabric systems, or tape.
 1. Sealants, Mastics and Tapes: Conform to UL 181A. Provide products bearing appropriate UL 181A markings.
 2. Do not provide sealing products not bearing UL approval markings.

2.4 KITCHEN HOOD RECIRCULATING DUCTWORK FABRICATION

- A. Fabricate in accordance with SMACNA HVAC Duct Construction Standards - Metal and Flexible and NFPA 96.
- B. Exposed Kitchen Hood Exhaust Ducts: Construct of stainless steel ASTM 240/A240M using continuous external welded joints.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Section 01 30 00 - Administrative Requirements : Coordination and project conditions.
- B. Verify sizes of equipment connections before fabricating transitions.

3.2 INSTALLATION

- A. Install and seal ducts in accordance with SMACNA HVAC Duct Construction Standards - Metal and Flexible.
- B. During construction, install temporary closures of metal or taped polyethylene on open ductwork to prevent construction dust from entering ductwork system.
- C. Connect flexible ducts to metal ducts with adhesive.
- D. Exhaust Outlet Locations:
 - 1. Minimum Distance from Property Lines: 3 feet.
 - 2. Minimum Distance from Building Openings: 3 feet.
 - 3. Minimum Distance from Outside Air Intakes: 10 feet.

3.3 TESTING

- A. For ductwork designed for 3 inches w.c. above ambient, pressure test minimum 25 percent of ductwork after duct cleaning, but before duct insulation is applied or ductwork is concealed.
 - 1. Test in accordance with SMACNA HVAC Air Duct Leakage Test Manual.
 - 2. Maximum Allowable Leakage: In accordance with ICC IECC.

END OF SECTION

SECTION 23 56 13

HEATING SOLAR COLLECTORS

PART 1 GENERAL

1.1 SUMMARY

- A. Section includes solar collectors, controls, pipe and fittings, valves, tanks, pumps, cabinet fans, cleaning and chemical treatment of systems.
- B. Related Sections:
 - 1. Section 08 31 13 - Access Doors and Frames: Product requirements for access doors for placement by this section.
 - 2. Section 23 05 13 - Common Motor Requirements for HVAC Equipment: Product requirements for pump motors for placement by this section.
 - 3. Section 23 31 00 - HVAC Ducts and Casings: Product requirements for collector connection to ductwork for placement by this section.
 - 4. Section 26 05 03 - Equipment Wiring Connections: Execution requirements for electric connections specified by this section.

1.2 REFERENCES

- A. American Society of Mechanical Engineers:
 - 1. ASME Section VIII - Boiler and Pressure Vessel Code - Pressure Vessels.
- B. ASTM International:
 - 1. ASTM A53/A53M - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless.
 - 2. ASTM B88 - Standard Specification for Seamless Copper Water Tube.

1.3 SUBMITTALS

- A. Section 01 33 00 - Submittal Procedures.
- B. Shop Drawings: Indicate manufactured assembly's system and control schematics, solar collector installation, layout, weights, mounting and support details, and piping connections.
- C. Product Data: Submit data on specialties, including manufacturers catalog information. Indicate chemical treatment materials, chemicals, and equipment. Submit certified pump performance and NPSH curve. Submit performance ratings and rough-in details for solar collectors.

- D. Manufacturer's Installation Instructions: Submit mounting and other structural requirements.
- E. Manufacturer's Certificate: Certify products meet or exceed specified requirements.
- F. Manufacturer's Field-Reports: Indicate start-up of treatment systems and include analysis of system water after cleaning and treatment.

1.4 CLOSEOUT SUBMITTALS

- A. Section 01 70 00 - Execution and Closeout Requirements.
- B. Operation and Maintenance Data: Spare parts lists, procedures, and treatment programs.

1.5 QUALITY ASSURANCE

- A. Light Transmitting Plastics: Class defined by applicable code when tested in accordance with ASTM D635 in thickness for intended use.
 - 1. Self Ignition Temperature: Minimum 650 degrees F (343 degrees C) when tested in accordance with ASTM D1929.
 - 2. Smoke Developed Index: Maximum 450 when tested in accordance with ASTM E84 or maximum 75 when tested in accordance with ASTM D2843 in thickness for intended use.
- B. Surface Burning Characteristics:
 - 1. Foam Insulation: Maximum 75/450 flame spread/smoke developed index when tested in accordance with ASTM E84.
- C. Apply label from agency approved by authority having jurisdiction to identify each foam plastic insulation board.

1.6 QUALIFICATIONS

- A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years documented experience, and with service facilities within 100 miles of Project.
- B. Installer: Company specializing in performing Work of this section with minimum three years documented experience approved by manufacturer.

1.7 PRE-INSTALLATION MEETINGS

- A. Section 01 30 00 - Administrative Requirements: Pre-installation meeting.
- B. Convene minimum one week prior to commencing work of this section.

1.8 DELIVERY, STORAGE, AND HANDLING

- A. Section 01 60 00 - Product Requirements: Product storage and handling requirements.
- B. Accept and store solar collectors and valves in shipping containers and maintain in place until installation.
- C. Protect piping from debris and other foreign matter by using caps on piping connections.

1.9 FIELD MEASUREMENTS

- A. Verify field measurements prior to fabrication.

1.10 WARRANTY

- A. Section 01 70 00 - Execution and Closeout Requirements: Product warranties and product bonds.
- B. Furnish five year manufacturer warranty for collectors.

1.11 MAINTENANCE SERVICE

- A. Section 01 70 00 - Execution and Closeout Requirements: Maintenance service.
- B. Furnish monthly technical service visits for one years starting with date of substantial completion to perform field inspections and make water analysis on site. Detail findings in writing. Submit two copies of report after each visit.

1.12 EXTRA MATERIALS

- A. Section 01 70 00 - Execution and Closeout Requirements: Spare parts and maintenance products.
- B. Furnish supply of chemicals for treatment and testing during warranty period.
- C. Furnish one extra set of mechanical seals for pumps.
- D. Furnish 1 year supply of chemicals for treatment.

PART 2 PRODUCTS

2.1 SOLAR COLLECTORS

- A. Manufacturers:
 - 1. American Energy Technologies Ltd. Model: AE-40.

- B. Construction: Unit consisting of manufacturers standard assembly of frame, cover, back cover with insulation, absorber plate assembly, and accessories.
- C. Frame:
 - 1. Aluminum: Extrusion shapes including I-beam, top battens, double battens, strips, channels, or angles, assembled with stainless steel screws with self sealing neoprene washers.
- D. Cover: Fiberglass reinforced polymer sheet.
 - 1. Solar energy transmittance: 90 percent at 0-degree angle of incidence.
 - 2. Heat transmittance: $-0.865 \text{ Btu/hr} \times \text{sq ft} \times \text{degrees F}$ ($-4.9099 \text{ W/sq m} \times \text{K}$).
 - 3. Index of refraction: 1.55.
 - 4. Tensile strength: 10,000 psi (68,950 kPa).
 - 5. Flexural strength: 17,150psi (118,250 kPa).
 - 6. Flexural modulus: 1,000,000 psi (689,500kPa).
 - 7. Shear strength: 12,800 psi (88,250 kPa).
 - 8. Water absorption: 0.6 percent by weight.
 - 9. Thermal expansion: 1.36in/in/degree F
 - 10. Thermal conductivity: 0.713 Btu/hr sq ft degree F/in.
 - 11. Weight: 4.7 oz/sq ft (1435 kg/sq meter).
 - 12. Thickness 0.060inches 0.15 mm).
 - 13. Nominal size: 48 x 120 inches (1219.2 x 3048 mm).
- E. Back Cover: Galvanized steel with 2 inch (50 mm) thick rigid fiberglass insulation.
- F. Plate and Tube Assembly: Copper sheet bonded to copper tubes.
 - 1. Tubes: 0.375 diameter, 0.013 inch ([0.016 mm]) wall, copper.
 - 2. Sheet: 0.0032 to 0.0035 inch ([0.081 to 0.089] mm) thick copper alloy sheet.
 - 3. Working pressure: 150 psig (1034 kPa).
 - 4. Paint: Selective-absorptivity 0.94, emissivity 0.47.
 - 5. Construction: Tubes brazed to header, sheet soldered to tubes.
 - 6. Headers: [0.75 inch (20 mm)] Type M copper tube.
 - 7. Sheet width: [48] inches [1219.2] mm).
 - 8. Sheet length: [120 inches ([3048] mm).
 - 9. Area: [40] sq ft ([3.71] sq meters).

2.2 DIFFERENTIAL CONTROLLERS

- A. Manufacturers:
 - 1. Steca Model: TR0603MCU.
- B. Description: Solid-state differential temperature thermostat with two low resistance thermistors and SPDT relay contactor, and field adjustable differential.

C. Functions:

1. Standard: When collector outlet temperature exceeds storage temperature, close contacts.
2. Ambient Override: When collector temperature is less than 80 degrees F (26 degrees C), open contacts.
3. High Limit Off: When storage temperature rises above 160 degrees F (71 degrees C), open contacts.

2.3 PIPING

A. Copper Tubing: ASTM B88 (ASTM B88M), Type [M,] drawn.

1. Fittings: Cast brass or wrought copper.
2. Joints: Grade 95TA solder joint.

2.4 GATE VALVES

- A. Up to 2 inches (50 mm): Bronze body, bronze trim, non- rising stem, hand wheel, inside screw, single wedge or disc, solder or threaded ends.

2.5 ISOLATION BALL VALVES

- A. Up to 2 inches (50 mm): Bronze one piece body, stainless steel ball, teflon seats and stuffing box ring, lever handle, solder or threaded ends.

2.6 SPRING CHECK VALVES

- A. Up to 2 inches (50 mm): Br swing disc, solder or screwed ends.

2.7 RELIEF VALVES

- A. Bronze body, Teflon seat, stainless steel stem and springs, automatic, direct pressure actuated capacities ASME certified and labeled.

2.8 PUMPS

A. Manufacturers:

1. Armstrong Model: ASTRO-30B. Potable water loop circulation pump.
2. Armstrong Model: ASTRO-230CI. Drainback/collector loop heat transfer fluid pump.

- B. General Construction Requirements:
 1. Balance: Rotating parts, statically and dynamically.
 2. Construction: To permit servicing without breaking piping or motor connections.
 3. Motors: Operate at 1750 rpm unless specified otherwise.
 4. Connections: Flanged.
- C. Close Coupled Pumps:
 1. Type: [Horizontal] [Vertical] shaft, single stage, close coupled, radial split casing, for [125 psig (860 kPa)] maximum working pressure.
 2. Construction: Cast iron casing with suction and discharge gage ports, renewable bronze casing wearing rings, seal flush connection, drain plug, flanged suction and discharge, bronze, fully enclosed impeller keyed to motor shaft extension, non mechanical seal.

2.9 TANKS

- A. Manufacturers:
 1. AET Model DB-10-10XSS.
- B. Tank: 10 gal Drainback Heat Exchanging reservoir. $\frac{3}{4}$ " NPT fittings for collector loop, $\frac{1}{2}$ " NPT fittings for heat exchanger.

PART 3 EXECUTION

3.1 PREPARATION

- A. Ream pipe and tube ends. Remove burrs.
- B. Remove scale and dirt on inside and outside before assembly.
- C. Prepare piping connections to equipment with flanges or unions.
- D. After completion, fill, clean, and treat systems.

3.2 INSTALLATION

- A. Route piping in orderly manner, installing plumb and parallel to building structure, and maintain gradient.
- B. Install piping to conserve building space, and not interfere with use of space and other work. Group piping whenever practical at common elevations.
- C. Install piping to allow for expansion and contraction without stressing pipe, joints, or connected equipment.

- D. Maintain clearance for installation of insulation, and access to valves and fittings.
- E. Install access doors where valves and fittings are not exposed. Coordinate size and location of access doors with Section 08 31 13.
- F. Slope piping and arrange systems to drain at low points. Use eccentric reducers to maintain top of pipe level.
- G. Where pipe support members are welded to structural building framing, scrape, brush clean, and apply one coat of zinc rich primer to welding.
- H. Prepare pipe, fittings, supports, and accessories for finish painting. Refer to Section 09 90 00.
- I. Install valves with stems upright or horizontal.
- J. Support tanks inside building from building structure.
- K. Install drain with valve and hose connection on strainer blow down connection.
- L. Select system relief valve capacity greater than make-up pressure reducing valve capacity. Select equipment relief valve capacity to exceed rating of connected equipment. Pipe relief valve outlet to nearest floor drain.
- M. Verify pumps operate at specified system fluid temperatures without vapor binding and cavitation, are non-overloading in parallel or individual operation, and operate within 25 percent of midpoint of published maximum efficiency curve.
- N. Make changes in piping size with reducing fittings. Support piping adjacent to pump so no weight is carried on pump casings.
- O. Install line sized shut-off valve and strainer on pump suction, and line sized check valve and balancing valve on pump discharge. Install air vent and drain connection on horizontal pump casings.
- P. Install unions downstream of valves and at equipment or apparatus connections.
- Q. Install threaded brass male adapters each side of valves in copper piped system. Sweat solder adapters to pipe.
- R. Install [gate] [ball] [butterfly] valves for shut-off and to isolate equipment, part of systems, or vertical risers.
- S. Install [globe] [ball] [butterfly] valves for throttling, bypass, or manual flow control services.

- T. Install 3/4 inch (20 mm) [gate] [ball] drain valves at main shut-off valves, low points of piping, bases of vertical risers, and at equipment. [Pipe to nearest drain.]
- U. Install [manual] [automatic] air vents at system high points. [Install vent tubing to nearest drain.]
- V. Install relief valves on system at expansion tanks.
- W. Connect air collectors and fans with flexible connectors and ductwork. Refer to Section 23 31 00.

3.3 CLEANING

- A. Section 01 70 00 - Execution and Closeout Requirements: Final cleaning.
- B. After completion, fill, start, and vent prior to cleaning. Use water meter to record capacity in each system. Place terminal control valves in open position during cleaning.
- C. Add cleaner to closed systems at concentration as recommended by manufacturer.
- D. Circulate for 48 hours, then drain systems as quickly as possible. Refill with clean water, circulate for 24 hours, then drain. Refill with clean water and repeat until system cleaner is removed.
- E. Use neutralizer agents on recommendation of system cleaner supplier and acceptance of Architect/Engineer.
- F. Flush open systems with clean water for one-hour minimum. Drain completely and refill.
- G. Remove, clean, and provide new strainer screens. Inspect, remove sludge, and flush low points with clean water after cleaning process is completed.
- H. Closed System Treatment:
 - 1. Install one bypass feeder on each system. Install isolating and drain valves and interconnecting piping. Install around globe valve downstream of circulating pumps [as indicated on Drawings].
 - 2. Introduce closed system treatment through bypass feeder.
- I. Open System Treatment:
 - 1. Install two glass mesh feeder bags for each unit, suspended in sump, filled with sequestering agent.
 - 2. Install drip feeder to feed sequestering agent into sump. Interlock solenoid valve on drip system with circulating pump.
 - 3. Install 1/2 inch (13 mm) bleed-off complete with globe valve piped to drain. Install bleed-off above flood line.

3.4 SCHEDULES

- A. Pump Schedule:

Drawing Code	P-1	P-2
[Manufacturer]	Armstrong	Armstrong
[Model No.]	ASTRO-30B	ASTRO-230CI
Location	Potable Loop	Collector Loop
Service	Hot Water	Antifreeze
Flow Capacity	5 GPM@10 ft of head	5 GPM10 ft of head
Head	12 Ft	12 Ft
Seal Type	Non Mechanical	Non Mechanical
Motor Size	1/25 HP	1/25 HP
Motor Volt/Phase/Cycle	1	1

B. Tank Schedule:

Drawing Code	ET-1
Location	AET DB10-10XC Drainback Tank
Service	Drainback Tank
Capacity	10 G
Diameter	18 in
Length	21 in

END OF SECTION

SECTION 23 81 26

SPLIT-SYSTEM AIR-CONDITIONERS

PART 1 GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Air handling units.
 - 2. Condensing unit.
 - 3. Remote Controller

1.2 SUBMITTALS

- A. Product Data: Submit data indicating:
 - 1. Cooling and heating capacities.
 - 2. Dimensions.
 - 3. Weights.
 - 4. Rough-in connections and connection requirements.
 - 5. Duct connections.
 - 6. Electrical requirements with electrical characteristics and connection requirements.
 - 7. Controls.
 - 8. Accessories.
- B. Manufacturer's Installation Instructions: Submit assembly, support details, connection requirements, and include start-up instructions and maintenance and repair data.
- C. Manufacturer's Certificate: Certify Products are Energy Star Compliant.
- D. Refer to 010000 general requirements for submittal procedures.

PART 2 PRODUCTS

2.1 SPLIT SYSTEM AIR CONDITIONING UNITS

- A. Manufacturer:
 - 1. Mitsubishi Electric Mr. Slim Multi-Split System
Model MXZ-2B20NA Outdoor Unit with one SEZ-KD09NA Indoor Blower one SEZ-KD12NA Indoor Blower and one PAR-21MAA Remote Controller.

PART 3 EXECUTION

3.1 INSTALLATION

- A. Install per manufacturers installation instructions and IMC 2006.

END OF SECTION

SUBMITTAL DATA: MXZ-2B20NA
MULTI-INDOOR INVERTER HEAT-PUMP SYSTEM

Job Name: _____ Location: _____ Date: _____

Purchaser: _____ Engineer: _____

Submitted to: _____ For Reference Approval Construction

Unit Designation: _____ Schedule No.: _____

GENERAL FEATURES

- Compact side discharge outdoor unit
- Wireless or wired remote controller, depending on the indoor units used
- Quiet operation—both indoor and outdoor units
- Automatic fan speed control
- Auto restart following a power outage
- Self-check function—integrated diagnostics
- Advanced microprocessor control
- Limited warranty: five years on parts and defects and seven years on compressors



Outdoor Unit: MXZ-2B20NA

OPTIONAL OUTDOOR UNIT ACCESSORIES

- Air Outlet Guide (MAC-889SG)
- 3/8" x 1/2" Port Adapter (MAC-A454JP-E; for use with 15,000 Btu/h Indoor units)

Cooling*

Rated Capacity (Non-ducted/Ducted) . . . 18,000 Btu/h / 20,000 Btu/h
 Minimum Capacity (Non-ducted/Ducted) . . . 7,800 Btu/h / 7,800 Btu/h
 Total Input (Non-ducted/Ducted) 1,440 W / 2,190 W

Heating at 47°F*

Rated Capacity (Non-ducted/Ducted) . . . 22,000 Btu/h / 22,000 Btu/h
 Minimum Capacity (Non-ducted/Ducted) . . . 8,500 Btu/h / 8,500 Btu/h
 Total Input (Non-ducted/Ducted) 1,650 W / 1,780 W

Heating at 17°F*

Rated Capacity (Non-ducted/Ducted) . . . 12,500 Btu/h / 12,500 Btu/h
 Total Input (Non-ducted/Ducted) 1,350 W / 1,430 W

* Rating Conditions (Cooling) - Indoor: 80°F (27°C) DB / 67°F (19°C) WB. Outdoor: 95°F (35°C) DB / 75°F (24°C) WB.
 (Heating) - Indoor: 70°F (21°C) DB / 60°F (16°C) WB. Outdoor: 47°F (8°C) DB / 43°F (6°C) WB.
 (Heating at 17°F) - Indoor: 70°F (21°C) DB / 60°F (16°C) WB. Outdoor: 17°F (-8°C) DB / 15°F (-9°C) WB.

(For data on specific indoor units [all ducted, all non-ducted, and both ducted and non-ducted] combinations, see the MXZ Technical and Service Manual.)

Electrical Requirements

Power Supply 208 / 230V, 1-Phase, 60 Hz
 Breaker Size 20 A
 MCA 15 A

Voltage

Indoor - Outdoor S1-S2 AC 208 / 230V
 Indoor - Outdoor S2-S3 DC 12 - 24V

OPERATING RANGE

		Indoor Intake Air Temp.		Outdoor Intake Air Temp.	
Cooling	Maximum	95°F (35°C) DB, 71°F (22°C) WB		115°F (46°C) DB	
	Minimum	67°F (19°C) DB, 57°F (14°C) WB		14°F (-10°C) DB	
Heating	Maximum	80°F (27°C) DB, 67°F (19°C) WB		75°F (24°C) DB, 65°F (18°C) WB	
	Minimum	70°F (21°C) DB, 60°F (16°C) WB		14°F (-10°C) DB, 12°F (-11°C) WB	

Compressor DC Inverter-driven Twin Rotary
 Fan Motor 0.96 F.L.A.

Sound Pressure Level

Cooling (Non-ducted/Ducted) 49 dB(A)
 Heating (Non-ducted/Ducted) 51 dB(A)

DIMENSIONS	INCHES / MM
W	33-1/16 / 840
D	13 / 330
H	27-15/16 / 710

Weight 130 lbs. / 59 kg
 External Finish Munsell No. 5Y 8.0 / 1.0
 Refrigerant Type R410A
 Refrigerant Pipe Size O.D. — Two Ports
 Gas Side A, B: 3/8" / 9.52 mm
 Liquid Side 1/4" / 6.35 mm
 Max. Refrigerant Pipe Length 164' / 50 m
 Max. Refrigerant Pipe Height Difference
 If Indoor Unit is Above Outdoor Unit 49' / 15 m
 If Indoor Unit is Below Outdoor Unit 33' / 10 m
 Connection Method Flared

COMPATIBLE INDOOR UNITS AND ASSOCIATED REMOTE CONTROLLERS

Horizontal-ducted Indoor Units: SEZ-KD09, 12, 15, 18NA


 Remote Controller PAR-21MAA -
 Packaged with SEZ

Wall-mounted Indoor Units: MSZ-A09,12,15,17NA and MSZ-GE09,12,15,18NA


 Wireless Remote Controller -
 Packaged with MSZ-A, -GE -FD,
 and -FE (Optional Wired PAR-21-
 MAA Remote Controller)

Wall-mounted Indoor Units: MSZ-FD09,12NA
 and MSZ-FE09,12NA



Refer to the separate submittal forms for the SEZ and MSZ Indoor Units.

MXZ-2B20NA ENERGY EFFICIENCIES

Indoor Unit Type	SEER	HSPF
Non-ducted	18	8.9
Ducted and Non-ducted	16.7	8.7
Ducted	15.5	8.5

MXZ-2B20 Combinations* (with wall-mounted and/or horizontal-ducted indoor units)

Indoor Unit (Unit A + Unit B) Combinations	Cooling Capacity (Btu/h)			Power Usage (W)
	Heating Capacity (Btu/h)			
	Unit A	Unit B	Total	
9 + 9	9,000	9,000	18,000	1,440 - 1,780
	Wall: 11,000 Ducted: 10,900	Wall: 11,000 Ducted: 10,900	All Wall-mounted MSZ: 22,000 All Ducted SEZ: 21,800 Combination: 21,900	1,650 - 1,820
9 + 12	8,500 9,500	11,500 12,500	20,000 22,000	1,660 - 2,190 1,650 - 1,780
9 + 15	7,500 8,250	12,500 13,750		
12 + 12	10,000 11,000	10,000 11,000		1,630 - 2,190 1,650 - 1,780

* Information provided at 208/230V.

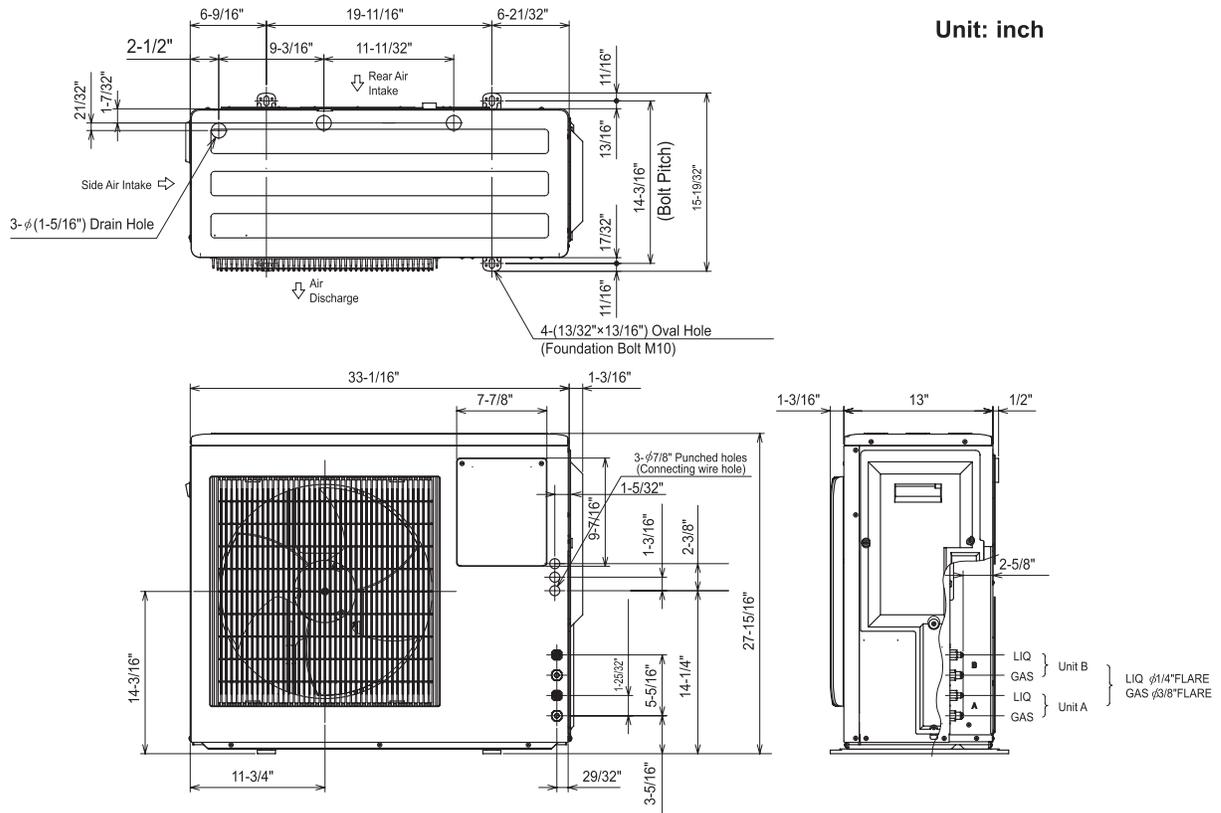
SYSTEM COMPONENTS

Outdoor Unit MXZ-2B20NA
 Indoor Unit Two Indoor Units
 Necessary (Select Style as Installation Requires)



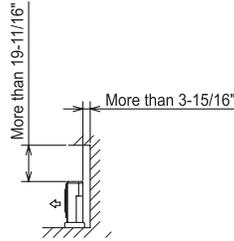
DIMENSIONS: MXZ-2B20NA

Unit: inch

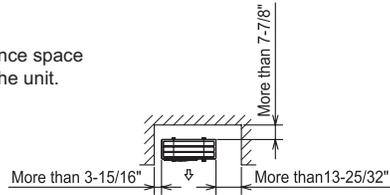


1. Installation space

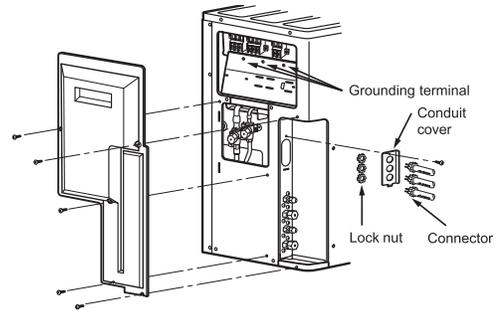
Note: Include enough clearance space in the front and both sides of the unit.



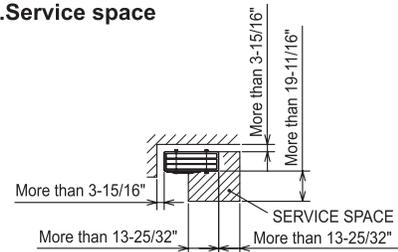
Note: Include enough clearance space in the front and top of the unit.



Note: Include enough clearance space in the back, top, and both sides of the unit.



2. Service space



HVAC Advanced Products Division
 3400 Lawrenceville Suwanee Rd
 Suwanee, GA 30024
 Tele: 678-376-2900 • Fax: 800-889-9904
 Toll Free: 800-433-4822 (#3)
 www.mehvac.com
Specifications are subject to change without notice.

SECTION 26 05 00

COMMON WORK RESULTS FOR ELECTRICAL

PART 1 GENERAL

1.1 SUMMARY

- A. Section includes grounding electrodes and conductors; bonding methods and materials; conduit and equipment supports, anchors and fasteners; and nameplates and wire markers.

1.2 SYSTEM DESCRIPTION

- A. Grounding systems use metal frame of building. Grounding system connections use mechanical fasteners.
- B. Select materials, sizes, and types of anchors, fasteners, and supports to carry loads of equipment and raceway, including weight of wire and cable in raceway. Anchor and fasten electrical products to building elements and finishes as follows:
 - 1. Gypsum Board Partitions: Toggle bolts and hollow wall fasteners.
 - 2. Solid Masonry Walls: Expansion anchors [and preset inserts].
 - 3. Wood Elements: Wood screws.
- C. Identify Electrical components as follows:
 - 1. Nameplate for each electrical distribution and control equipment enclosure.
 - 2. Wire marker for each conductor at panelboard, pull boxes, and junction boxes.

1.3 SUBMITTALS

- A. Product Data: Submit manufacturer's catalog data for grounding electrodes and connections; for fastening components; and nameplates, labels, and markers.

PART 2 PRODUCTS

2.1 NAMEPLATES

- A. Product Description Embossed adhesive tape, with white letters on black background.
- B. Letter Size:
 - 1. 1/8 inch (3mm) letters for identifying individual equipment and loads.

2.2 WIRE MARKERS

- A. Product Description: Cloth tape type wire markers with circuit or control wire number permanently stamped or printed.

PART 3 EXECUTION

3.1 INSTALLATION

- A. Install sheet metal channel to bridge studs above and below cabinets and panelboards recessed in hollow partitions.
- B. Install nameplate parallel to equipment lines. Secure nameplate to equipment front using screws or rivets.

END OF SECTION

SECTION 26 05 19

LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES

PART 1 GENERAL

1.1 SUMMARY

- A. Section includes building wire and cable, conduit and tubing, surface raceway, boxes, wiring devices, wiring connectors, and connections.

1.2 SYSTEM DESCRIPTION

- A. Wiring Products:
1. Solid conductor for feeders and branch circuits 10 AWG and smaller.
 2. Stranded conductors for control circuits.
 3. Conductor not smaller than 12 AWG for power and lighting circuits.
 4. Conductor not smaller than 14 AWG for control circuits.
 5. Increase wire size in branch circuits to limit voltage drop to a maximum of 3 percent.
- B. Wiring Methods:
1. Concealed Dry Interior Locations: Use only building wire, Type THHN/THWN insulation, in raceway, nonmetallic- sheathed cable
 2. Above Accessible Ceilings: Use only building wire, Type THHN/THWN.
 3. Exterior Locations: Use only building wire, Type THHN/THWN.
- C. Conductor sizes are based on copper, size to match circuit requirements, terminations, conductor ampacity and voltage drop.
- D. Raceway and boxes are located as indicated on Drawings, and at other locations where required for splices, taps, wire pulling, equipment connections, and compliance with regulatory requirements.
- E. Raceway Products:
1. Wet and Damp Locations: Use thickwall nonmetallic conduit. Use nonmetallic outlet, junction, and pull boxes. Use flush mounting outlet box in finished areas.
 2. Concealed Dry Locations: Use thickwall nonmetallic conduit and nonmetallic tubing. Use flush mounting outlet box in finished areas. Use hinged enclosure for large pull boxes.
 3. Exposed Dry Locations: Use thickwall nonmetallic conduit. Use sheet-metal boxes. Use flush mounting outlet box in finished areas. Use hinged enclosure for large pull boxes.
- F. Minimum Raceway Size: 1/2 inch (13 mm) unless otherwise specified.

1.3 SUBMITTALS

- A. Product Data: Submit manufacturer's catalog information for each wiring device.

1.4 QUALITY ASSURANCE

- A. Provide wiring materials located in plenums with peak optical density not greater than 0.5, average optical density not greater than 0.15, and flame spread not greater than 5 feet (1.5 m) when tested in accordance with NFPA 262.
- B. Maintain two (2) copies of each document on site.

PART 2 PRODUCTS

2.1 WALL SWITCHES

- A. Single Pole Switch:
 - 1. Douglas Model WWS-1301.
 - 2. Substitutions: Permitted.
- B. Color: Ivory.

2.2 WALL DIMMERS

- A. Manufacturers:
 - 1. Douglas Model WWS-1301.
 - 2. Substitutions: Permitted.
- B. Product Description: Semiconductor dimmer for incandescent lamps with ON-OFF switch operation at lowest brightness setting.
- C. Body and Handle: Ivory plastic with linear slide.
- D. Voltage: 120 volts.

2.3 RECEPTACLES

- A. Duplex Convenience Receptacle:
 - 1. Carlon Productions. Model: B118A
 - 2. Substitutions: Permitted.
- B. GFCI Receptacle:
 - 1. Warehouse Lighting. Model WL-108557.

2. Substitutions: Permitted.

C. Color: Ivory

2.4 WALL PLATES

A. Manufacturers:

1. Douglas Model WWS-1301
2. Substitutions: Permitted.

B. Decorative Cover Plate: Ivory

C. Jumbo Cover Plate: Ivory

PART 3 EXECUTION

3.1 INSTALLATION

- A. Route raceway and cable to meet Project conditions.
- B. Set wall mounted boxes at elevations to accommodate mounting heights indicated.
- C. Adjust box location up to 10 feet (3 m) prior to rough-in when required to accommodate intended purpose.
- D. Do not install flush mounting box back-to-back in walls; install boxes with minimum 24 inches (600 mm) separation.
- E. Install wall plates on flush mounted switches, receptacles, and blank outlets.

END OF SECTION

SECTION 26 05 26

GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Rod electrodes.
 - 2. Wire.
 - 3. Mechanical connectors.

1.2 SYSTEM DESCRIPTION

- A. Grounding systems use the following elements as grounding electrodes:
 - 1. Metal building frame.
 - 2. Concrete-encased electrode.
 - 3. Ground ring.
 - 4. Rod electrode.

1.3 DESIGN REQUIREMENTS

- A. Construct and test grounding systems for access flooring systems on conductive floors accordance with IEEE 1100.

1.4 PERFORMANCE REQUIREMENTS

- A. Grounding System Resistance: 25 ohms maximum.

1.5 SUBMITTALS

- A. Product Data: Required.
- B. Test Reports: Required.
- C. Manufacturer's Installation Instructions: Required.
- D. Manufacturer's Certificate: Required.

1.6 CLOSEOUT SUBMITTALS

- A. Project Record Documents: Required.

1.7 QUALITY ASSURANCE

- A. Provide grounding materials conforming to requirements of NEC, IEEE 142, and UL labeled.

PART 2 PRODUCTS

2.1 ROD ELECTRODES

- A. Manufacturers:
 - 1. Erico, Inc. Model CGE51K
 - 2. Substitutions: Permitted
- B. Product Description:
 - 1. Material: Copper.
 - 2. Diameter: ½ inch (13mm)
 - 3. Length: 8 feet (2.4m)
- C. Connector: U-Bolt clamp.

2.2 WIRE

- A. Material: Stranded copper.
- B. Foundation Electrodes: 6 AWG.
- C. Grounding Electrode Conductor: Copper conductor insulated.
- D. Bonding Conductor: Copper conductor insulated.

2.3 MECHANICAL CONNECTORS

- A. Manufacturers:
 - 1. Solar Bonding Lugs Model EL6CS.
 - 2. Substitutions: [Permitted].
- B. Description: Bronze connectors, suitable for grounding and bonding applications, in configurations required for particular installation.

PART 3 EXECUTION

3.1 INSTALLATION

- A. Install in accordance with IEEE 142.

- B. Install grounding electrode conductor and connect to reinforcing steel in foundation footing. Electrically bond steel together.
- C. Install isolated grounding conductor for circuits supplying, personal computers in accordance with IEEE 1100.
- D. Equipment Grounding Conductor: Install separate, insulated conductor within each feeder and branch circuit raceway. Terminate each end on suitable lug, bus, or bushing.
- E. Bond to lightning protection system.
- F. Permanently ground entire light and power system in accordance with NEC, including service equipment, distribution panels, lighting panelboards, switch and starter enclosures, motor frames, grounding type receptacles, and other exposed non-current carrying metal parts of electrical equipment.
- G. Install branch circuits feeding isolated ground receptacles with separate insulated grounding conductor, connected only at isolated ground receptacle, ground terminals, and at ground bus of serving panel.
- H. Accomplish grounding of electrical system by using insulated grounding conductor installed with feeders and branch circuit conductors in conduits. Size grounding conductors in accordance with NEC. Install from grounding bus of serving panel to ground bus of served panel, grounding screw of receptacles, lighting fixture housing, light switch outlet boxes or metal enclosures of service equipment. Ground conduits by means of grounding bushings on terminations at panelboards with installed number 12 conductor to grounding bus.

3.2 FIELD QUALITY CONTROL

- A. Inspect and test in accordance with NETA ATS, except Section 4.
- B. Perform inspections and tests listed in NETA ATS, Section 7.13.
- C. Perform ground resistance testing in accordance with IEEE 142.
- D. Perform leakage current tests in accordance with NFPA 99.
- E. Perform continuity testing in accordance with IEEE 142.

END OF SECTION

SECTION 26 05 33

RACEWAY AND BOXES FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.1 SUMMARY

- A. Section includes conduit and tubing, surface raceways, wireways, outlet boxes, pull and junction boxes, and handholes.
- B. Related Sections:
 - 1. Section 26 05 03 - Equipment Wiring Connections.
 - 2. Section 26 05 26 - Grounding and Bonding for Electrical Systems.
 - 3. Section 26 05 34 - Floor Boxes for Electrical Systems.
 - 4. Section 26 05 53 - Identification for Electrical Systems.
 - 5. Section 26 27 26 - Wiring Devices.

1.2 REFERENCES

- A. American National Standards Institute:
 - 1. ANSI C80.1 - Rigid Steel Conduit, Zinc Coated.
 - 2. ANSI C80.3 - Specification for Electrical Metallic Tubing, Zinc Coated.
 - 3. ANSI C80.5 - Aluminum Rigid Conduit - (ARC).
- B. National Electrical Manufacturers Association:
 - 1. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum).
 - 2. NEMA FB 1 - Fittings, Cast Metal Boxes, and Conduit Bodies for Conduit and Cable Assemblies.
 - 3. NEMA OS 1 - Sheet Steel Outlet Boxes, Device Boxes, Covers, and Box Supports.
 - 4. NEMA OS 2 - Nonmetallic Outlet Boxes, Device Boxes, Covers, and Box Supports.
 - 5. NEMA RN 1 - Polyvinyl Chloride (PVC) Externally Coated Galvanized Rigid Steel Conduit and Intermediate Metal Conduit.
 - 6. NEMA TC 2 - Electrical Polyvinyl Chloride (PVC) Tubing and Conduit.
 - 7. NEMA TC 3 - PVC Fittings for Use with Rigid PVC Conduit and Tubing.

1.3 SYSTEM DESCRIPTION

- A. Raceway and boxes located as indicated on Drawings, and at other locations required for splices, taps, wire pulling, equipment connections, and compliance with regulatory requirements. Raceway and boxes are shown in approximate locations unless dimensioned. Provide raceway to complete wiring system.
- B. Wet and Damp Locations: thickwall nonmetallic conduit. Provide cast metal or nonmetallic outlet, junction, and pull boxes. Provide flush mounting outlet box in finished areas.

- C. Concealed Dry Locations: Provide thickwall nonmetallic conduit and nonmetallic tubing. Provide sheet-metal boxes. Provide flush mounting outlet box in finished areas. Provide hinged enclosure for large pull boxes.
- D. Exposed Dry Locations: Provide thickwall nonmetallic conduit. Provide sheet-metal boxes. Provide flush mounting outlet box in finished areas. Provide hinged enclosure for large pull boxes.

1.4 DESIGN REQUIREMENTS

- A. Minimum Raceway Size: 1/2 inch (13 mm) unless otherwise specified.

1.5 SUBMITTALS

- A. Section 01 33 00 - Submittal Procedures: Submittal procedures.
- B. Product Data: Submit for the following:
 - 1. Nonmetallic conduit.
 - 2. Pull and junction boxes.
- C. Manufacturer's Installation Instructions: Submit application conditions and limitations of use stipulated by Product testing agency specified under Regulatory Requirements. Include instructions for storage, handling, protection, examination, preparation, and installation of Product.

1.6 CLOSEOUT SUBMITTALS

- A. Section 01 70 00 - Execution and Closeout Requirements: Closeout procedures.
- B. Project Record Documents:
 - 1. Record actual locations and mounting heights of outlet, pull, and junction boxes.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Section 01 60 00 - Product Requirements: Product storage and handling requirements.
- B. Protect conduit from corrosion and entrance of debris by storing above grade. Provide appropriate covering.
- C. Protect PVC conduit from sunlight.

1.8 COORDINATION

- A. Section 01 30 00 - Administrative Requirements: Coordination and project conditions.
- B. Coordinate installation of outlet boxes for equipment connected under Section 26 05 03.

- C. Coordinate mounting heights, orientation and locations of outlets mounted above counters, benches, and backsplashes.

PART 2 PRODUCTS

2.1 NONMETALLIC CONDUIT

- A. Manufacturers:
 - 1. Carlon Electrical Productions. Model: 12007-100.
 - 2. Substitutions: Section 01 60 00 - Product Requirements.
- B. Product Description: NEMA TC 2; Schedule 40 PVC.

2.2 OUTLET BOXES

- A. Manufacturers:
 - 1. Carlon Electrical Productions. Model: B118A.
 - 2. Substitutions: Section 01 60 00 - Product Requirements.
- B. Nonmetallic Outlet Boxes: NEMA OS 2.
- C. Wall Plates for Finished Areas: As specified in Section 26 27 26.
- D. Wall Plates for Unfinished Areas: Furnish gasketed cover.

2.3 PULL AND JUNCTION BOXES

- A. Manufacturers:
 - 1. Carlon Electrical Productions. Model: BH325LR.
 - 2. Substitutions: Section 01 60 00 - Product Requirements.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Section 01 30 00 - Administrative Requirements: Coordination and project conditions.
- B. Verify outlet locations and routing and termination locations of raceway prior to rough-in.

3.2 INSTALLATION

- A. Ground and bond raceway and boxes in accordance with Section 26 05 26.
- B. Fasten raceway and box supports to structure and finishes in accordance with Section 26 05 29.
- C. Identify raceway and boxes in accordance with Section 26 05 53.

- D. Arrange raceway and boxes to maintain headroom and present neat appearance.

3.3 INSTALLATION - RACEWAY

- A. Raceway routing is shown in approximate locations unless dimensioned. Route to complete wiring system.
- B. Arrange raceway supports to prevent misalignment during wiring installation.
- C. Support raceway using coated steel or malleable iron straps, lay-in adjustable hangers, clevis hangers, and split hangers.
- D. Group related raceway; support using conduit rack. Construct rack using steel channel specified in Section 26 05 29.
- E. Do not support raceway with wire or perforated pipe straps. Remove wire used for temporary supports
- F. Do not attach raceway to ceiling support wires or other piping systems.
- G. Construct wireway supports from steel channel specified in Section 26 05 29.
- H. Route exposed raceway parallel and perpendicular to walls.
- I. Route raceway installed above accessible ceilings parallel and perpendicular to walls.
- J. Route conduit in and under slab from point-to-point.
- K. Maintain clearance between raceway and piping for maintenance purposes.
- L. Maintain 12 inch (300 mm) clearance between raceway and surfaces with temperatures exceeding 104 degrees F (40 degrees C).
- M. Cut conduit square using saw or pipe cutter; de-burr cut ends.
- N. Bring conduit to shoulder of fittings; fasten securely.
- O. Join nonmetallic conduit using cement as recommended by manufacturer. Wipe nonmetallic conduit dry and clean before joining. Apply full even coat of cement to entire area inserted in fitting. Allow joint to cure for minimum 20 minutes.
- P. Install conduit hubs to fasten conduit to sheet metal boxes in damp and wet locations and to cast boxes.
- Q. Install no more than equivalent of three 90 degree bends between boxes. Install conduit bodies to make sharp changes in direction, as around beams. Install factory elbows for bends in metal conduit larger than 2 inch (50 mm) size.

- R. Avoid moisture traps; install junction box with drain fitting at low points in conduit system.
- S. Install fittings to accommodate expansion and deflection where raceway crosses expansion joints.
- T. Install suitable pull string or cord in each empty raceway except sleeves and nipples.
- U. Install suitable caps to protect installed conduit against entrance of dirt and moisture.
- V. Surface Raceway: Install flat-head screws, clips, and straps to fasten raceway channel to surfaces; mount plumb and level. Install insulating bushings and inserts at connections to outlets and corner fittings.
- W. Close ends and unused openings in wireway.

3.4 INSTALLATION - BOXES

- A. Install wall mounted boxes at elevations to accommodate mounting heights specified in section for outlet device.
- B. Adjust box location up to 3 feet (1 m) prior to rough-in to accommodate intended purpose.
- C. Orient boxes to accommodate wiring devices oriented as specified in Section 26 27 26.
- D. Install pull boxes and junction boxes above accessible ceilings and in unfinished areas only.
- E. In Accessible Ceiling Areas: Install outlet and junction boxes no more than 6 inches (150 mm) from ceiling access panel or from removable recessed luminaire.
- F. Locate flush mounting box in masonry wall to require cutting of masonry unit corner only. Coordinate masonry cutting to achieve neat opening.
- G. Do not install flush mounting box back-to-back in walls; install with minimum 6 inches (150 mm) separation. Install with minimum 24 inches (600 mm) separation in acoustic rated walls.
- H. Secure flush mounting box to interior wall and partition studs. Accurately position to allow for surface finish thickness.
- I. Install stamped steel bridges to fasten flush mounting outlet box between studs.
- J. Install flush mounting box without damaging wall insulation or reducing its effectiveness.
- K. Install adjustable steel channel fasteners for hung ceiling outlet box.
- L. Do not fasten boxes to ceiling support wires or other piping systems.
- M. Support boxes independently of conduit.

- N. Install gang box where more than one device is mounted together. Do not use sectional box.
- O. Install gang box with plaster ring for single device outlets.

3.5 INTERFACE WITH OTHER PRODUCTS

- A. Install conduit to preserve fire resistance rating of partitions and other elements, using materials and methods in accordance with Section 07 84 00.
- B. Locate outlet boxes to allow luminaires positioned as indicated on Drawings.
- C. Align adjacent wall mounted outlet boxes for switches, thermostats, and similar devices.

3.6 ADJUSTING

- A. Section 01 70 00 - Execution and Closeout Requirements: Testing, adjusting, and balancing.
- B. Adjust flush-mounting outlets to make front flush with finished wall material.
- C. Install knockout closures in unused openings in boxes.

3.7 CLEANING

- A. Section 01 70 00 - Execution and Closeout Requirements: Final cleaning.
- B. Clean interior of boxes to remove dust, debris, and other material.
- C. Clean exposed surfaces and restore finish.

END OF SECTION

SECTION 26 09 23

LIGHTING CONTROL DEVICES

PART 1 GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Remote control lighting relays.
 - 2. Switches.
 - 3. Switch plates.
 - 4. Occupancy sensors.

1.2 SUBMITTALS

- A. Shop Drawings: Indicate dimensioned drawings of lighting control system components and accessories.
 - 1. One Line Diagram: Indicating system configuration indicating panels, number and type of switches or devices.
 - 2. Include typical wiring diagrams for each component.
- B. Product Data: Submit manufacturer's standard product data for each system component.
- C. Manufacturer's Installation Instructions: Submit for each system component.
- D. Manufacturer's Certificate: Certify Products meet or exceed specified requirements.

1.3 CLOSEOUT SUBMITTALS

- A. Project Record Documents: Record the following information:
 - 1. Actual locations of components and record circuiting and switching arrangements.
 - 2. Wiring diagrams reflecting field installed conditions with identified and numbered, system components and devices.
- B. Operation and Maintenance Data:
 - 1. Submit replacement parts numbers.
 - 2. Submit manufacturer's published installation instructions and operating instructions.
 - 3. Recommended renewal parts list.

1.4 QUALITY ASSURANCE

- A. Maintain Two (2) copies of each document on site.

1.5 WARRANTY

- A. Furnish five year manufacturer warranty for components.

PART 2 PRODUCTS

2.1 REMOTE CONTROL LIGHTING RELAYS

- A. Manufacturers:
 - 1. Douglas model WRS-2224.
 - 2. Substitutions: Permitted.

2.2 SWITCHES

- A. Manufacturers:
 - 1. Douglas Model WWS-1301.
 - 2. Substitutions: Permitted
- B. Wall Switch: Industrial Grade non-pilot light toggle switches for overriding relays.
 - 1. Color: Ivory.

2.3 SWITCH PLATES

- A. Manufacturers:
 - 1. Douglas Model WWS-1301.
 - 2. Substitutions: Permitted.
- B. Product Description: Specification Grade.
 - 1. Material: Plastic.
 - 2. Color: Ivory.

2.4 OCCUPANCY SENSOR

- A. Manufacturers:
 - 1. Douglas Model CM-PDT-DL Occupancy.
 - 2. Substitutions: Permitted.
- B. Compatible with modular relay panels. Capable of being wired directly to Class 2 wiring without auxiliary components or devices.
- C. Separate sensitivity and time delay adjustments with LED indication of sensed movement. User adjustable time-delay: 30 seconds to 12 minutes.
- D. Furnish with manual override.

- E. Operation: Silent.
- F. Room Sensors: Two-way Pattern.
- G. Corridor and Hallway Sensors:
 - 1. Capable of detecting motion 6 feet (2 m) wide and 12 feet (4 m) long with one sensor mounted 8 feet (3 m) above floor.

PART 3 EXECUTION

3.1 INSTALLATION

- A. Mount switches, and occupancy sensors, as indicated on Drawings.
- B. Install wiring in accordance with Section 26 05 19.
- C. Use only properly color coded, stranded wire. Install wire sizes as indicated on Drawings. Install wire in conduit in accordance with Section 26 05 19.
- D. Label each low voltage wire clearly indicating connecting relay panel. Refer to Section 26 05 00.
- E. Mount relay as indicated on Drawings. Wire numbered relays in panel to control power to each load. Install relays to be accessible. Allow space around relays for ventilation and circulation of air.
- F. Identify power wiring with circuit breaker number controlling load. When multiple circuit breaker panels are feeding into relay panel, label wires to indicate originating panel designation.
- G. Label each low voltage wire with relay number at each switch or sensor.

3.2 FIELD QUALITY CONTROL

- A. Furnish services for minimum of one day for check, test, and start-up. Perform the following services:
 - 1. Check installation of panelboards.
 - 2. Test operation of remote controlled devices.
 - 3. Repair or replace defective components.
- B. Test each system component after installation to verify proper operation.
- C. Test relays, contactors, and switches after installation to confirm proper operation.
- D. Confirm correct loads are recorded on directory card in each panel.

END OF SECTION

SECTION 26 24 16

PANELBOARDS

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:

1. Distribution and branch circuit panelboards.
2. Electronic grade branch circuit panelboards.
3. Load centers.

B. Related Requirements:

1. Section 26 05 26 - Grounding and Bonding for Electrical Systems.
2. Section 26 05 53 - Identification for Electrical Systems.
3. Section 26 28 13 - Fuses.

1.2 REFERENCE STANDARDS

A. Institute of Electrical and Electronics Engineers:

1. IEEE C62.41 - Recommended Practice on Surge Voltages in Low-Voltage AC Power Circuits.

B. National Electrical Manufacturers Association:

1. NEMA FU 1 - Low Voltage Cartridge Fuses.
2. NEMA KS 1 - Enclosed and Miscellaneous Distribution Equipment Switches (600 Volts Maximum).
3. NEMA PB 1 - Panelboards.
4. NEMA PB 1.1 - General Instructions for Proper Installation, Operation, and Maintenance of Panelboards Rated 600 Volts or Less.

C. International Electrical Testing Association:

1. NETA ATS - Acceptance Testing Specifications for Electrical Power Distribution Equipment and Systems.

D. National Fire Protection Association:

1. NFPA 70 - National Electrical Code.

E. Underwriters Laboratories Inc.:

1. UL 50 - Cabinets and Boxes
2. UL 67 - Safety for Panelboards.
3. UL 489 - Molded-Case Circuit Breakers, Molded-Case Switches, and Circuit-Breaker Enclosures.
4. UL 1283 - Electromagnetic Interference Filters.
5. UL 1449 - Transient Voltage Surge Suppressors.

6. UL 1699 - Arc-Fault Circuit Interrupters.

1.3 SUBMITTALS

- A. Section 01 33 00 - Submittal Procedures: Requirements for submittals.
- B. Product Data: Submit catalog data showing specified features of standard products.
- C. Shop Drawings: Indicate outline and support point dimensions, voltage, main bus ampacity, integrated short circuit ampere rating, circuit breaker and fusible switch arrangement and sizes.
- D. Source Quality control submittals: Indicate results of factory tests and inspections.
- E. Field Quality Control Submittals: Indicate results of Contractor furnished tests and inspections.

1.4 CLOSEOUT SUBMITTALS

- A. Section 01 70 00 - Execution and Closeout Requirements: Requirements for submittals.
- B. Project Record Documents: Record actual locations of panelboards and record actual circuiting arrangements.
- C. Operation and Maintenance Data: Submit spare parts listing; source and current prices of replacement parts and supplies; and recommended maintenance procedures and intervals.

1.5 QUALITY ASSURANCE

- A. Qualifications
 - 1. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years documented experience.

PART 2 PRODUCTS

2.1 DISTRIBUTION PANELBOARDS

- A. Manufacturer List:
 - 1. Eaton Cutler-Hammer Model BR2040B100V9
- B. Substitution Limitations:
 - 1. Section 01 60 00 - Product Requirements: Requirements for substitutions for other manufacturers and products.
- C. Description: NEMA PB 1, circuit breaker type panelboard.
- D. Materials

1. Panelboard Bus: Copper current carrying components, ratings as indicated on Drawings. Furnish copper ground bus in each panelboard.

2. Cabinet Front: Surface hinged door with flush lock.

E. Finishes

1. Manufacturer's standard gray enamel.

2.2 SOURCE QUALITY CONTROL

- A. Section 01 40 00 - Quality Requirements: Testing, inspection and analysis requirements.

- B. Independently test integral surge suppressers with category C3 high exposure waveform (20 kV-1.2/50us, 10kA-8/20 us) per IEEE C62.41.

PART 3 EXECUTION

3.1 INSTALLATION

- A. Install panelboards in accordance with NEMA PB 1.1.

- B. Install panelboards plumb.

- C. Install recessed panelboards flush with wall finishes.

- D. Height: 6 feet (1800 mm) to top of panelboard.

- E. Install filler plates for unused spaces in panelboards.

- F. Provide typed, or neatly handwritten circuit directory for each branch circuit panelboard. Revise directory to reflect circuiting changes to balance phase loads. Identify each circuit as to its clear, evident and specific purpose of use.

- G. Install spare conduits out of each recessed panelboard to accessible location above ceiling. Identify each as SPARE.

- H. Ground and bond panelboard enclosure according to Section 26 05 26. Connect equipment ground bars of panels in accordance with NFPA 70.

3.2 FIELD QUALITY CONTROL

- A. Section 01 40 00 - Quality Requirements: Requirements for inspecting, testing.

- B. Inspect and test in accordance with NETA ATS, except Section 4.

- C. Perform circuit breaker inspections and tests listed in NETA ATS, Section 7.6.

- D. Perform switch inspections and tests listed in NETA ATS, Section 7.5.
- E. Perform controller inspections and tests listed in NETA ATS, Section 7.16.1.

3.3 ADJUSTING

- A. Section 01 70 00 - Execution and Closeout Requirements: Requirements for starting and adjusting.
- B. Measure steady state load currents at each panelboard feeder; rearrange circuits in panelboard to balance phase loads to within 20 percent of each other. Maintain proper phasing for multi-wire branch circuits.

END OF SECTION

SECTION 26 27 26

WIRING DEVICES

PART 1 GENERAL

1.1 SUMMARY

- A. Section includes wall switches; wall dimmers; receptacles; multioutlet assembly; and device plates and decorative box covers.
- B. Related Sections:
 - 1. Section 26 05 33 - Raceway and Boxes for Electrical Systems: Outlet boxes for wiring devices.
 - 2. Section 26 05 34 - Floor Boxes for Electrical Systems: Service fittings for receptacles installed on floor boxes.

1.2 REFERENCES

- A. National Electrical Manufacturers Association:
 - 1. NEMA WD 1 - General Requirements for Wiring Devices.
 - 2. NEMA WD 6 - Wiring Devices-Dimensional Requirements.

1.3 SUBMITTALS

- A. Section 01 33 00 - Submittal Procedures.
- B. Product Data: Submit manufacturer's catalog information showing dimensions, colors, and configurations.
- C. Samples: Submit two samples of each wiring device and wall plate illustrating materials, construction, color, and finish.

1.4 QUALIFICATIONS

- A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years documented experience.

PART 2 PRODUCTS

2.1 WALL SWITCHES

- A. Single Pole Switch:
 - 1. Broan Pass and Seymour/legrand Model 6601GU.
 - 2. Substitutions: Section 01 60 00 - Product Requirements

- B. Radio Controlled Switch:
 1. Lighting Switch Model RMW120 P4.
 2. Substitutions: Not permitted.

C. Color: Ivory.

2.2 RECEPTACLES

- A. Duplex Convenience Receptacle:
 1. Pass and Seymour/legrand Model 3232TRWCP8.
 2. Substitutions: Section 01 60 00 - Product Requirements.

- B. GFCI Receptacle:
 1. Pass and Seymour/legrand Model 1595-W3PKCC4.
 2. Substitutions: Section 01 60 00 - Product Requirements.

C. Color: Ivory.

2.3 WALL PLATES

- A. Manufacturers:
 1. Pass and Seymour/legrand Model TP8ICP10.
 2. Substitutions: Section 01 60 00 - Product Requirements.

B. Decorative Cover Plate: Ivory, smooth lined plastic.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Section 01 30 00 - Administrative Requirements: Coordination and project conditions.
- B. Verify outlet boxes are installed at proper height.
- C. Verify wall openings are neatly cut and completely covered by wall plates.
- D. Verify branch circuit wiring installation is completed, tested, and ready for connection to wiring devices.

3.2 PREPARATION

- A. Clean debris from outlet boxes.

3.3 INSTALLATION

- A. Install devices plumb and level.

- B. Install switches with OFF position down.
- C. Install wall dimmers to achieve full rating specified and indicated after derating for ganging as instructed by manufacturer.
- D. Do not share neutral conductor on load side of dimmers.
- E. Install receptacles with grounding pole on bottom.
- F. Connect wiring device grounding terminal to and branch circuit equipment grounding conductor.
- G. Install wall plates on flush mounted switches, receptacles, and blank outlets.
- H. Install decorative plates on switch, receptacle, and blank outlets in finished areas.
- I. Connect wiring devices by wrapping solid conductor around screw terminal. Install stranded conductor for branch circuits 10 AWG and smaller. When stranded conductors are used in lieu of solid, use crimp on fork terminals for device terminations. Do not place bare stranded conductors directly under device screws.
- J. Install galvanized steel plates on outlet boxes and junction boxes in unfinished areas, above accessible ceilings, and on surface mounted outlets.

3.4 INTERFACE WITH OTHER PRODUCTS

- A. Coordinate locations of outlet boxes provided under Section 26 05 33 to obtain mounting heights as indicated on drawings.
- B. Install wall switch 48 inches (1.2 m) above finished floor.
- C. Install convenience receptacle 24 inches (600 mm) above finished floor.
- D. Install convenience receptacle 6 inches (150 mm) above counter back splash of counter.
- E. Install dimmer 48 inches (1.2 m) above finished floor.
- F. Coordinate installation of wiring devices with underfloor raceway service fittings provided under Section 26 05 39.
- G. Coordinate installation of wiring devices with floor box service fittings provided under Section 26 05 34.

3.5 FIELD QUALITY CONTROL

- A. Section 01 40 00 - Quality Requirements, and 01 70 00 - Execution and Closeout Requirements: Field inspecting, testing, adjusting, and balancing.

- B. Inspect each wiring device for defects.
- C. Operate each wall switch with circuit energized and verify proper operation.
- D. Verify each receptacle device is energized.
- E. Test each receptacle device for proper polarity.
- F. Test each GFCI receptacle device for proper operation.

3.6 ADJUSTING

- A. Section 01 70 00 - Execution and Closeout Requirements Testing, adjusting, and balancing.
- B. Adjust devices and wall plates to be flush and level.

3.7 CLEANING

- A. Section 01 70 00 - Execution and Closeout Requirements: Final cleaning.
- B. Clean exposed surfaces to remove splatters and restore finish.

END OF SECTION

SECTION 26 31 00

PHOTOVOLTAIC COLLECTORS

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes

1. A complete and operable photovoltaic (PV) power system with DC to AC automatic grid-tie (connected) inverter.

1.2 REFERENCES

A. Definitions

1. **Array:** A mechanically-integrated assembly of modules and panels, together with support structure and foundation, tracking, thermal control, and other components, if used, to form a DC power-producing unit.
2. **Azimuth angle:** For a surface such as a sloped roof, project a line that extends perpendicular from the roof onto a horizontal plane. The angular deviation of this projection from the local meridian (north-south line) constitutes the surface azimuth angle. Due south is zero azimuth, west of south is assigned as positive, and east of south is assigned as negative.
3. **Insolation:** Sunlight, direct and/or diffuse (not to be confused with insulation). The integrated intensity of sunlight reaching a given area, usually expressed in watts per square meter per day. This measurement may be used to express the average amount of solar energy falling on different regions of the country. I
4. **Magnetic declination:** The difference between true north (the axis around which the earth rotates) and magnetic north (the direction the needle of a compass will point).
5. **Module:** A number of solar cells connected together electrically and sealed inside a weatherproof package with a clear face. Sometimes called a "solar panel".
6. **Panel:** A designation for a number of PV modules assembled in a single mechanical frame.
7. **Photovoltaic:** Pertaining to the direct conversion of light into electricity.
8. **PTC (PVUSA Test Conditions):** Test conditions applied to PV modules intended to represent wattage during operation. Irradiance of 1000 W/m², 68 degrees F (20 degrees C) ambient temperature, 1 meter/second wind speed, and an air mass of 1.5.
9. **String:** A number of modules or panels interconnected electrically in series to produce the operating voltage required by the load.
10. **STC (Standard Test Conditions):** Test conditions applied to PV modules. Irradiance of 1000 W/m², cell temperature of 25 degrees C and an air mass of 1.5 mg/m³.
11. **Tilt Angle:** The angle of inclination of a solar panel measured from the horizontal plane.
12. **Utility-Interactive Inverter:** An inverter that can function only when electrically connected to the utility grid, and uses the prevailing line-voltage frequency on the utility

line as a control parameter to ensure that the photovoltaic array's DC output is converted to AC power and fully synchronized with the utility power.

B. Reference Standards

1. UL 1703 – Flat-Plate Photovoltaic Modules and Panels (Underwriter's Lab)

1.3 ADMINISTRATIVE REQUIREMENTS

A. Coordination

1. Section 01 00 00 – General Requirements: Coordination and project conditions.

B. Preinstallation Meetings

1. Schedule a preinstallation meeting 1 week prior to beginning work of this section in the field and comply with requirements of Project Management and Coordination in Div 01
2. Attendees should include Architect, Contractor, electrical subcontractor and roofing subcontractor to identify conflicts and coordination issues.

1.4 SUBMITTALS

A. Refer to Section 01 00 00 – General Requirements for submittal requirements and procedures.

B. ACTION SUBMITTALS /INFORMATIONAL SUBMITTALS

1. Product Data:

a. Submit product data for photovoltaic system components.

- 1) Provide data sheets for panels, inverters, wiring devices, software.
- 2) Include information for factory finishes, hardware, glass treatment, sealants, grounding, accessories, and other required components.

2. Shop Drawings: Provide installation and mounting details, solar orientation and placement, point to point wiring diagrams, and proposed identification designations.

C. INFORMATIONAL SUBMITTALS

1. Manufacturers' Instructions: Comply with listed manufacturer installation details. Comply with roof system manufacturer's warranty design criteria when penetrating roof system.
2. Source Quality Control Submittals: Attachment considerations shall take into account site peculiarities and expansion and contraction movements so there is no possibility of loosening, weakening, or fracturing connection between PV system and building envelope components.
3. Certificates: Statement of qualifications for manufacturer and installer.

D. CLOSEOUT SUBMITTALS

1. Operation and Maintenance Data: Submit manufacturer's printed, recommended operation, and maintenance data.

2. Warranty Documentation: Submit specified product warranty in accordance with Section 01 00 00
3. Record Documentation
 - a. Submit under provisions of Section 01 00 00
 - b. Record actual locations of grounding systems and penetration of building envelope.
4. Software: AC kWh energy production estimation shall utilize one of the following web sites or software programs or equal:
 - a. PV Watts: <http://rredc.nrel.gov/solar/calculators/PVWATTS>
 - b. RETscreen® International: www.retscren.net/ang/d_o_view.php
 - c. PV design Pro: www.mauisolarsoftware.com
 - d. PVSYST: www.pvsyst.com

1.5 QUALITY ASSURANCE

- A. Single Source Responsibility: To ensure quality of appearance and performance, obtain equipment for systems from a single photovoltaic system installer or from manufacturers approved by photovoltaic system installer.
- B. Qualifications:
 1. Manufacturer: Company specializing in manufacturing products specified in this section with minimum 5 years documented experience.
 2. Installer: Certified in writing by equipment manufacturers as qualified for installation of specified systems. Proper licensing, and no less than 5 years of installation experience.
- C. Certifications: Submit system component manufacturer's certification that products furnished for project meet or exceed specified requirements.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Comply with requirements of Section 01 00 00
- B. Protect finished surfaces as necessary to prevent damage.
- C. Do not use adhesive papers or sprayed coatings that become firmly bonded when exposed to sun.
- D. Do not leave coating residue on any surfaces
- E. Replace damaged units.

1.7 SITE CONDITIONS

- A. Ambient Conditions
 1. Do not install system during rain, snow, or windy conditions.
 2. Work on a dry roof only.

- B. Existing Conditions: Ensure existing conditions are stable, solid, and ready to accept new construction.

1.8 WARRANTY

- A. Manufacturer Warranty: Furnish standard PV modules and panel components providing manufacturer's limited warranty of 20 years minimum.
- B. Furnish DC to AC inverters covered by manufacturer's warranty for minimum of 5 year

PART 2 PRODUCTS

2.1 MANUFACTURERS

- A. PV Module Manufacturers:
 1. Solar Services www.solarservices.com
 2. Substitution: Refer to Section 01 00 00 for substitution requirements and approval procedures.
 3. Products:
 - a. Sanyo HIT-220A
 - b. Bosch c-Si M 60; 230Wp.
- B. Inverter Manufacturer:
 1. Opti-solar www.opti-solar.com
 2. Substitution: Refer to Section 01 00 00 for substitution requirements and approval procedures.
 3. Product Options:
 - a. Opti-solar grid-tied GT-3000
 - b. Opti-solar grid-tied GT-2000

2.2 REQUIRED EQUIPMENT

- A. PV modules:
 1. Shall be new, undamaged, fully warranted without defect.
 2. Listed to UL 1703
- B. DC to AC converter
 1. Sized to provide maximum power point tracking (MPPT) for voltage and current range expected from PV array for temperatures and solar insolation conditions expected for project conditions
 2. Capable of adjusting to "sun splash" from all possible combinations of cloud fringe effects without interruption of electrical production.
 3. Listed to UL 1741
- C. Mounting system
 1. Conform to Manufacturer mounting instructions.

2. Anchor system to building structure to withstand wind and seismic loading
 3. Module racking system shall utilize framed PV modules.
 4. Ground metal framed PV modules in conformance with electrical codes.
- D. AC disconnect switch
1. Coordinate with local electric Utility service provider requirements.
 2. Provide switch to disconnect ungrounded AC conductors
 3. Lockable, gang operated type, clearly indicating open and closed positions
 4. Easily visually inspected to determine that switch is in open or closed positions and clearly labeled in compliance with NEC and local electric Utility service provider requirements.
- E. Dedicated kWh meter: Install in readily accessible, outdoor, location between DC to AC inverter and interconnection with electric utility service provider to meter power produced by photovoltaic system. Refer to local electric utility service provider requirements.

2.3 ACCESSORIES

- A. Provide accessories for complete operating system, including:
1. Data display (including software and hardware).
 2. DC disconnect

2.4 FABRICATION

- A. [Shop assembled]: Pre-assemble PV equipment in controlled environment prior to on-site delivery
- B. [Site assembled]: Assemble PV equipment on Site

2.5 [FINISHES]

- A. Furnish PV module frames finished in custom color as selected by Architect

****OR****

- B. Finish PV array mounting structure to match PV module frames

PART 3 EXECUTION

3.1 EXAMINATION

- A. Verification of items provided by other sections of work are properly sized and located.
- B. Examine supporting members to ensure surfaces are at proper elevation and are free from dirt or other deleterious matter.

3.2 INSTALLATION

- A. Locate PV array as shown on drawings and approved shop drawings
- B. Install PV system in accordance with manufacturer's printed instructions, electric utility service provider requirements, and approved shop drawings
- C. Install PV modules and DC to AC inverters with sufficient clearance to allow for proper Ventilation and Cooling.
 - 1. Comply with manufacturer's clearance recommendations
- D. Preferred installation requires operational PV modules in location and manner to ensure maximum unobstructed, direct sun exposure.
- E. Provide suitable means to secure attachments to mounting surfaces and structures.
- F. Anchors, fasteners and braces shall be structurally stressed not more than 50% of allowable stress when maximum loads are applied.
- G. Allow for expansion and contraction due to thermal changes and structural movement without detriment to appearance or performance
- H. Installer shall verify that site mounting surface substrate supports and other site and work conditions are adequate and proper for installation.

3.3 SITE QUALITY CONTROL

- A. Site Tests: Comply with requirements of [Section 01-45-00]
- B. Manufacturer's Field Services: Comply with requirements of [Section 01-40-00]

3.4 ADJUSTING

- A. Test and adjust operating Functions in accordance with manufacturer's instructions to ensure smooth operation.

3.5 CLEANING

- A. Clean surfaces in compliance with manufacturer's recommendations; remove excess mastic, mastic smears, foreign materials, and other unsightly marks
- B. Clean metal surfaces exercising care to avoid damage.
- C. Clean energy generating surfaces of the PV module to ensure no obstructions block sunlight.

3.6 COMMISSIONING

- A. Provide system commissioning under provisions of [Section 01-91-00]
- B. Commissioning:
 - 1. To be provided by Contractor/Installer
 - 2. Prior to commissioning ensure PV system has passed and received final inspection certificate from authorities having jurisdiction and local utility.
 - 3. Prior training to designated Owners representative.
 - 4. Ensure the installation has been performed in accordance with NEC and other local codes. Following NEC articles refer to PV systems:
 - a. Article 690: Solar PV systems
 - b. Article 230: Service Equipment- Disconnecting Means
 - c. Article 240: Overcurrent Protection
 - d. Article 250: Grounding
 - e. Article 300: Wiring Methods
 - f. Article 310: Conductors for General Wiring
 - g. Article 705: Interconnected Electric Power Production Sources
 - 5. Refer to commissioning requirements contained within IEEE 1537.1 Standard Conformance Test Procedures for Equipment Interconnecting Distributed Resources with Electric Power Systems.
 - 6. Provide suitable tools and equipment for commissioning.
 - 7. Utilize system commissioning Check sheet
 - 8. Provide commissioning certificate to Owner.

3.7 PROTECTION

- A. Protect finished work in accordance with Section 01 00 00

END OF SECTION



HIT[®] Power 220A

Module Efficiency: 17.4%
Cell Efficiency: 19.8%
Power Output - 220Watts



HIT[®] Power
Photovoltaic Module

High Efficiency

HIT[®] Power solar panels are leaders in sunlight conversion efficiency. Obtain maximum power within a fixed amount of space. Save money using fewer system attachments and racking materials, and reduce costs by spending less time installing per watt. HIT Power models are ideal for grid-connected solar systems, areas with performance based incentives, and renewable energy credits.

Power Guarantee

SANYO's power ratings for HIT Power panels guarantee customers receive 100% of the nameplate rated power (or more) at the time of purchase, enabling owners to generate more kWh per rated watt, quicken investments returns, and help realize complete customer satisfaction.

Temperature Performance

As temperatures rise, HIT Power solar panels produce 10% or more electricity (kWh) than conventional crystalline silicon solar panels at the same temperature.

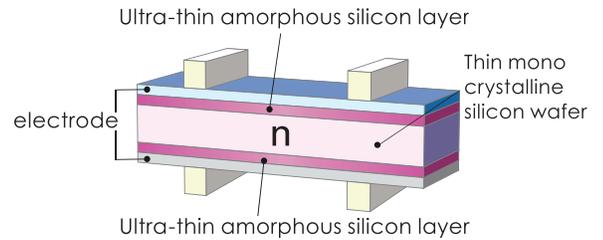
Valuable Features

The packing density of the panels reduces transportation, fuel, and storage costs per installed watt.

American Made Quality

SANYO silicon wafers located inside HIT solar panels are made in California and Oregon, and the panels are assembled in an ISO 9001 (quality), 14001 (environment), and 18001 (safety) certified factory. Unique eco-packing minimizes cardboard waste at the job site. The panels have a Limited 20-Year Power Output and 5-Year Product Workmanship Warranty.

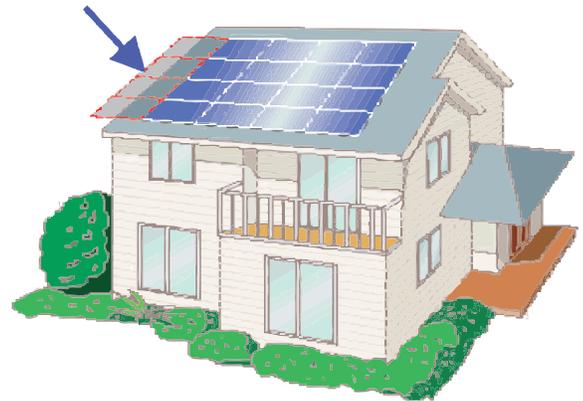
SANYO HIT[®] Solar Cell Structure



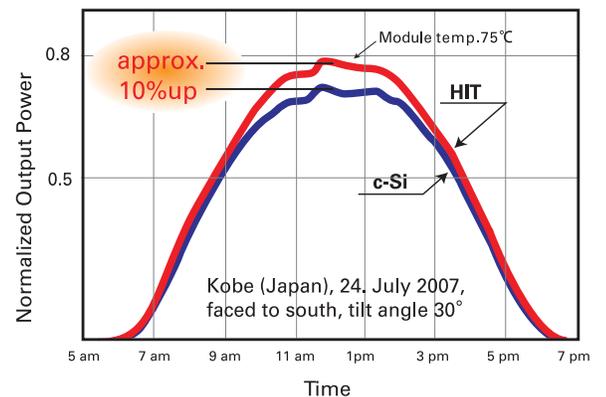
SANYO'S Proprietary Technology

HIT solar cells are hybrids of mono crystalline silicon surrounded by ultra-thin amorphous silicon layers, and are available solely from SANYO.

Unnecessary Section When Using SANYO



Increased Performance with SANYO



HIT Power 220A

Electrical Specifications

Model	HIT Power 220A or HIT-N220A01
Rated Power (Pmax) ¹	220 W
Maximum Power Voltage (Vpm)	42.7 V
Maximum Power Current (Ipm)	5.17 A
Open Circuit Voltage (Voc)	52.3 V
Short Circuit Current (Isc)	5.65 A
Temperature Coefficient (Pmax)	-0.336%/ °C
Temperature Coefficient (Voc)	-0.145 V/ °C
Temperature Coefficient (Isc)	1.98 mA/ °C
NOCT	114.8°F (46°C)
CEC PTC Rating	204.4 W
Cell Efficiency	19.8%
Module Efficiency	17.4%
Watts per Ft. ²	16.22 W
Maximum System Voltage	600 V
Series Fuse Rating	15 A
Warranted Tolerance (-/+)	-0% / +10%

Mechanical Specifications

Internal Bypass Diodes	3 Bypass Diodes
Module Area	13.56 Ft ² (1.26m ²)
Weight	35.3 Lbs. (16kg)
Dimensions LxWxH	62.2x31.4x1.8 in. (1580x798x46 mm)
Cable Length +Male/-Female	46.45/40.55 in. (1180/1030 mm)
Cable Size / Connector Type	No. 12 AWG / MC4™ Locking Connectors
Static Wind / Snow Load	60PSF (2880Pa) / 39PSF (1867Pa)
Pallet Dimensions LxWxH	63.2x32x72.8 in. (1607x815x1850 mm)
Quantity per Pallet / Pallet Weight	34 pcs./1234.5 Lbs (560 kg)
Quantity per 53' Trailer	952 pcs.

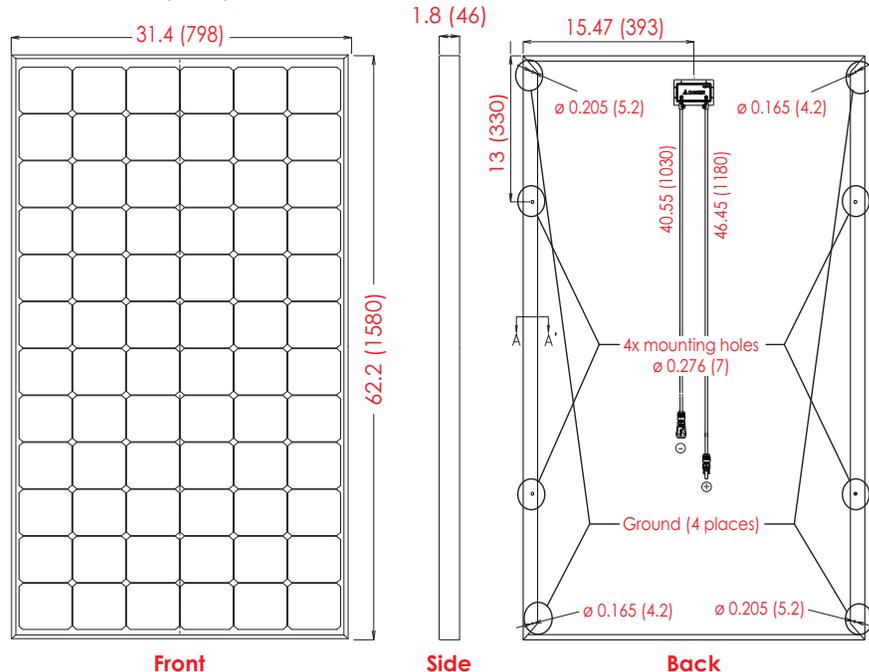
Operating Conditions & Safety Ratings

Ambient Operating Temperature	-4°F to 115°F (-20°C to 46°C) ²
Hail Safety Impact Velocity	1" hailstone (25mm) at 52 mph (23m/s)
Fire Safety Classification	Class C
Safety & Rating Certifications	UL 1703, cUL, CEC
Limited Warranty	5 Years Workmanship, 20 Years Power Output

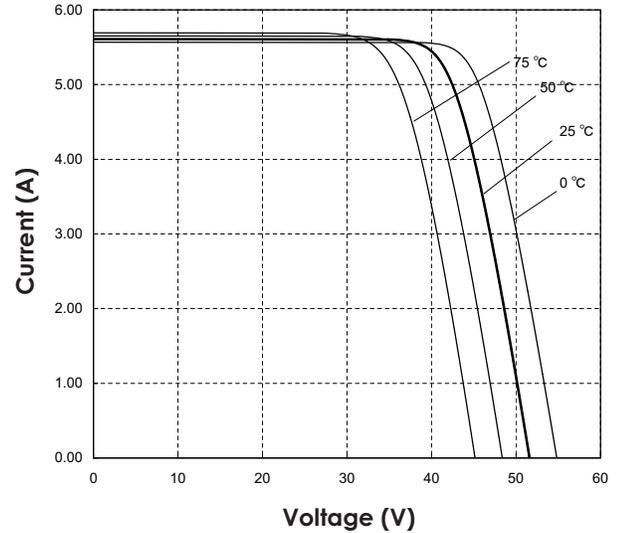
¹STC: Cell temp. 25°C, AM1.5, 1000W/m² ²Monthly average low and high of the installation site.
 Note: Specifications and information above may change without notice.
 All modules connected in the solar array should be of the same model number.

Dimensions

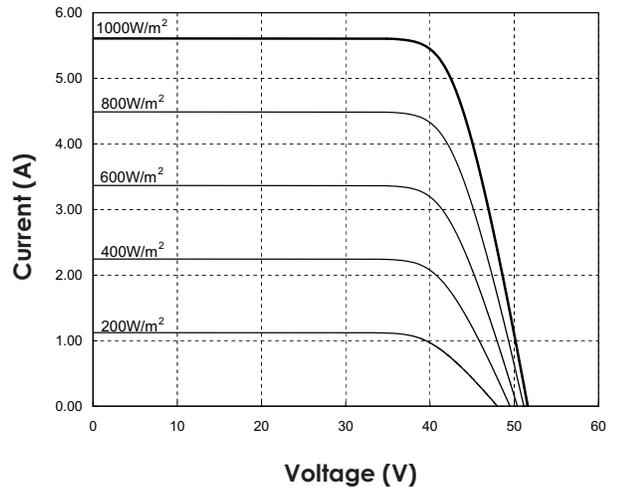
Unit: inches (mm)



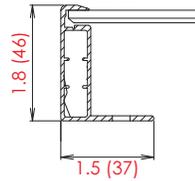
Dependence on Temperature



Dependence on Irradiance



Section A-A'



HIT® is a registered trademark of SANYO Electric Co., Ltd. The name "HIT®" comes from "Heterojunction with intrinsic Thin-layer" which is an original technology of SANYO Electric Co., Ltd..



CAUTION!

Read the operating instructions carefully before use of these products

SANYO

SANYO North America
Energy System Solutions Division

550 S. Winchester Blvd., Suite 510
San Jose, CA 95128, U.S.A.
www.sanyo.com/solar
solar@sec.sanyo.com

Powerful performance – high stability. Bosch Solar Module c-Si M 60

High-quality – high-performance – reliable.
Solar modules from Bosch Solar Energy.



BOSCH



Positive power sorting

USA & Canada-
version

Our crystalline solar modules offer impressive features including:

- ▶ Excellent quality assured through use of the best US and German-standard components
- ▶ Excellent processing and long-term stability right along the value-added chain
- ▶ Higher specific yields due to positive power sorting
- ▶ Professional customer service with unbureaucratic order and complaint processing carried out by designated contact persons
- ▶ Simple, safe installation thanks to standardized clamp mechanisms

Warranty conditions:

- ▶ 10 years product warranty
- ▶ 25-year performance guarantee (90% up to 10 years, 80% up to 25 years)
- ▶ Product certification to UL 1703
- ▶ CEC registered
- ▶ Product certification to IEC 61215 (ed. 2)
- ▶ Protection class II / IEC 61730
- ▶ CE conformity

Manufacturer	Length [x]	Width [y]	Height [z]	Weight	Junction box	Plug connector	Cable [l]	Front glass surface
16	64.57 in 1 660.0	39.37 in 1 000.0	1.65 in 42.0	51.81 lb 23.5	Tyco	Tyco Solarlok	39.37 in 1 000.0	Structured
If not stated differently, x, y, z, l in mm, ±2 mm; weight in kg ±0.5								

Crystalline solar module	
Performance classes	220 Wp, 225 Wp, 230 Wp, 235 Wp, 240 Wp
Performance sorting	±2.5 Wp (-0/+4.99 Wp NEW starting July 1 st 2010)
Structure	Glass-foil laminate <ul style="list-style-type: none"> ▶ Anodized aluminum frame ▶ Junction box (IP 65) with 3 bypass diodes ▶ Weather-resistant back sheet (white) ▶ Cable 12 AWG (4mm²)
Cells	60x monocrystalline solar cells in 156 mm x 156 mm format

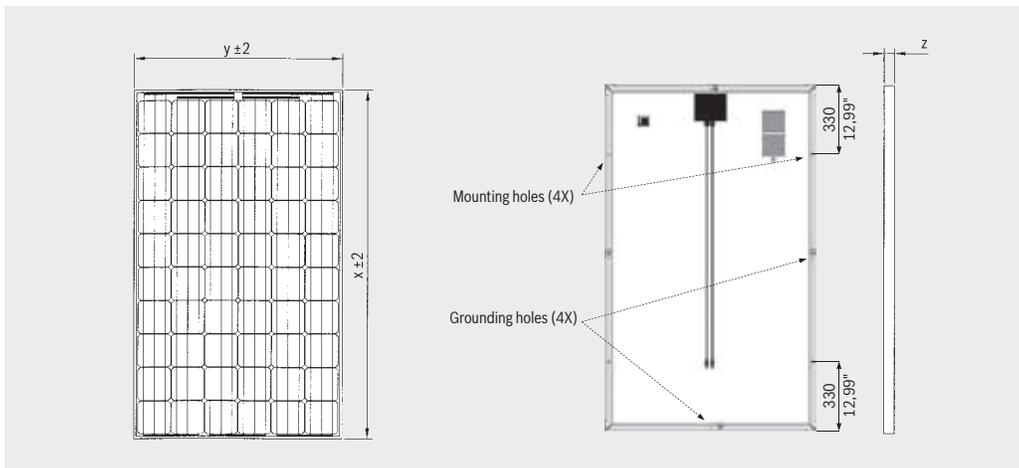
Electrical characteristics for STC*:

Designation	Pmpp [Wp]	Vmpp [V]	Imp [A]	Voc [V]	Isc [A]	Reverse-current load capacity [A]
M240 3BB	240	29.62	8.11	36.75	8.56	17
M235 3BB	235	29.41	7.99	36.48	8.47	17
M230 3BB	230	29.20	7.88	36.22	8.38	17
M225 3BB	225	29.00	7.76	35.96	8.29	17
Reduction in module efficiency with decrease in irradiation level from 1 000 W/m ² to 200 W/m ² (at 25 °C): -0.65% (absolute); measuring tolerance P ±3%						

Electrical characteristics for NOCT*:

Designation	Pmpp [W]	Vmpp [V]	Voc [V]	Isc [A]
M240 3BB	173	27.44	34.09	6.84
M235 3BB	169	27.24	33.89	6.76
M230 3BB	166	27.04	33.69	6.68
M225 3BB	162	26.83	33.49	6.60
NOCT: Normal Operation Cell Temperature 48.4 °C; Irradiation level 800 W/m ² , AM 1.5, temperature 20 °C, wind speed 1 m/s, electrical open circuit operation				

Dimensions:**



Notes on assembly:

- ▶ See installation and operating manual at www.bosch-solarenergy.de/en/products/crystallinepvmodules
- ▶ Horizontal and vertical assembly possible
- ▶ System voltage max. 600 V

Weak light performance:

Intensity [W/m ²]	Vmpp [%]	Imp [%]
800	0.0	-20
600	-0.9	-40
400	-2.1	-60
200	-5.1	-80
100	-8.7	-90
The electrical data applies for 25 °C and AM 1.5.		

Thermal characteristics:

Operating temperature range	-40 to 85 °C
Temperature coefficient Pmpp	-0,51%/K
Temperature coefficient Voc	-0.37%/K
Temperature coefficient Isc	0.03%/K



* Electrical parameters are typical mean values from historical production data. Bosch Solar Energy assumes no liability for the accuracy of this data for future production batches.

** Drawings are not to scale. For detailed dimensions and tolerances, see above.

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 Fax: +01 650 812 8035
solarenergy@us.bosch.com
www.bosch-solarenergy.com



M I D N I T E S O L A R

MidNite Solar offers a range of PV Combiners from our MNPV3 to the MNPV16. This range of combiners accommodates PV systems as small as a two string off grid cabin up to 16 strings for a 100KW commercial grid tie inverter. The MNPV series of combiners are the result of 20 years of design and manufacturing experience in the renewable energy industry. Each unit has the same quality features such as:

- * Aluminum rainproof type 3R enclosure
- * Internal plastic injection molded dead front covers
- * Knock outs that accept waterproof strain reliefs, conduit or panel mount MC type connectors
- * Knock outs for lightning arrestors
- * Uses 150VDC & 300VDC breakers or 600VDC fuses depending on model number
- * ETL listed to UL1741 for use in the US and Canada
- * Adaptable for two separate inverters or charge controllers on certain models



MNPV 3



Configured for 600VDC Fuses (Gridtie)



Installation photo courtesy of APRS World



Configured for 150VDC Breakers (Offgrid)



Been mooned lately?

www.midnitesolar.com

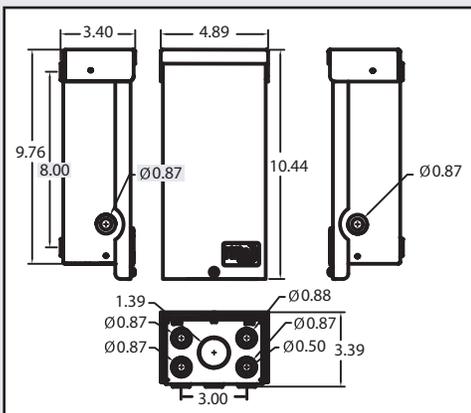
PV Combiners- MNPV3

Model	Max VDC	Max # of Input Circ.	PV Source Circuits			PV Output Circuits			Approved Mounting Orientation	Enclosure Type/ Material	Listing
			Max OCPD Rating Amps	OCPD	Wire Range AWG	Max # of Output Circ.	Max Cont. Current Amps	Wire Range AWG			
MNPV3 (LV)	150	3	20	CB 150V	14-6	1	60	14-1/0	90 to 14 ⁰	3R/Alum	UL1741
MNPV3 (HV)	600	3	20	FUSE	14-6	1	60	14-1/0	90 to 14 ⁰	3R/Alum	UL1741
MNPV6 (LV)	150	6	20	CB 150V	14-6	2	120	14-1/0	90 to 14 ⁰	3R/Alum	UL1741
MNPV6 (HV)	600	4	20	FUSE	14-6	2	80	14-1/0	90 to 14 ⁰	3R/Alum	UL1741
MNPV12 (LV)	150	12	30	CB 150V	14-6	2	200	14-2/0	90 to 14 ⁰	3R/Alum	UL1741
MNPV12 (HV)	600	10	30	FUSE	14-6	2	200	14-2/0	90 to 14 ⁰	3R/Alum	UL1741
MNPV12-250	300	6	50	CB 300V	14-6	2	168	14-2/0	90 to 14 ⁰	3R/Alum	UL1741
MNPV16 (HV)	600	16	15	FUSE	14-6	1	240	250MCM	90 to 14 ⁰	3R/Alum	UL1741
MNPV16-250	300	12	20	CB 600V	14-6	1	240	14-2/0	90 to 14 ⁰	3R/Alum	UL1741

MNPV3 (For 150 VDC charge controllers and 600 VDC gridtie inverters)

(The second most popular PV combiner in North America.) Gray aluminum type 3R rainproof enclosure with insulating deadfront, will accept three 150VDC (MNEPV) breakers or two 600/1000 VDC fuse holders. With modifications to the deadfront 3 dinrail fuse holders can be used. Includes a 60 amp plus bus bar, 6 position PV negative bus bar and a 6 position ground bus bar. Punch out tabs on the plastic deadfront make for a clean installation using circuit breakers. An included snap in adapter makes for a professional looking installation when installing fuse holders. A single 300VDC breaker from 7 to 50 amps may be installed as a disconnect (no combining busbar) . The enclosure may be mounted to a pole or wall indoors or out.

Breakers/fuse holders sold separately
Boxed size: 11 x 5 x 4 weight: 2 Lbs.



Configured with 2 600 VDC fuses



Configured with 3 150 VDC breakers



ETL Listed for US & Canada



17722—67th Ave NE, Unit C, Arlington WA 98223

Ph 425.374.9060 Fax 360.691.6862

<http://www.midnitesolar.com>

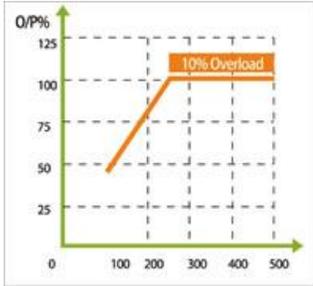


GRID-TIED INVERTER SPECIFICATIONS (U.S.)

Model	GT 1500	GT 2000	GT 3000	GT 4000
Input Data				
Maximum Input Power (W)	1875	2500	3750	5000
Nominal Input Power (W)	1575	2160	3159	4230
Maximum input voltage (V)	450			
Nominal DC voltage (V)	360 - 400			
Working voltage range	100V +/-5% ~ 450 - 5% +0%			
MPPT voltage range	150 - 450 +/-5%			
System start-up voltage (V)	100 +/-5%			
Full rating working voltage	250V to 450V			
Max. input current	7.5ADC	10ADC	15ADC	20ADC
Shutdown voltage	80V typical			
DC voltage ripple	< 10%			
DC insulation resistance	> 8M ohm			
GFDI Switch	On / Off 20A			
DC Terminal	Terminal block			
Output Data				
Nominal output power	1500W	2000W	3000W *7	4000W
Maximum continuous output power (20°C)	1650W	2200W	3300W *8	4400W
Operational Voltage range *1	183V ~ 228V @ 208Vac 211V ~ 264V @ 240Vac			
Operational Normal Voltage	208Vac / 240Vac			
Operational Frequency range (Hz)	59.3 ~ 60.5 for 50Hz*2 59.5 ~ 60.5 for 60Hz*3			
Nominal output Frequency	60Hz			
Max. input short circuit current	<30A			
Max. input source back feed current to input source (A)	0			
Max. output over current protection	< 14.0A	< 18.8A	< 28.1A	< 37.5A
Synchronization in rush current (*208Vac / 240Vac)	10.6A*	14.1A*	21.2A*	28.3A*
	9.3A	12.2A	18.4A	24.6A
Nominal output current (*208Vac / 240Vac)	7.2A*	9.6A*	14.4A*	19.2A*
	6.3A	8.3A	12.5A	16.7A
O/P current distortion *4	THD<5%, each harmonics <3%			
Power Factor	> 0.99%			
Accuracy	≤ 2%			
Utility interconnection voltage and frequency	< 0.16 sec			
Trip limit and trip time				
DC current injection	< 0.5% of rated inverter output current			
General Data				
Internal power consumption	< 7W			
Standby power (at night)	< 0.1W			
Minimum Conversion Efficiency (DC/AC)	> 90%, Under input voltage> 210V, load >20%			
Maximum Conversion Efficiency (DC/AC) *5	> 95.0%	> 95.5%	> 96.0%	> 96.0%
CEC Efficiency	> 94.5%	> 95.0%	> 95.5%	> 95.5%
GFDI threshold *6	See ground fault current detection			
Max. output fault current and duration	< 100A Duration time < 80 msec			
Ground current detection frequency	0~700Hz			
Protection degree	NEMA 3R (rain proof)			
Operation temperature	-25 to 45° C		-25 to 45° C -25 to 40° C full rating output About 40° C output de-rating	
Storage temperature	-25° C to 70° C			
Humidity	0 to 95%, non-condensing			
Heat Dissipation	Convection			
Acoustic noise level	< 40dB, A-weighted, frequency up to 20kHz			

Altitude	Up to 3000m w without pow er derating, 5°C dearted for each additional 500m			
Physical: WxDxH(mm)	352x450x133	352x450x133	352x450x143	550x450x143
Physical: Weight(kg)	15	15	16	22
Shipping: WxDxH(mm)	470x580x290	470x580x290	470x580x290	670x580x290
Shipping: Weight(kg)	17	17	18	24
Certifications				
Approvals	ETL+CSA			--

The relation of input DC voltage and output power is shown in figure. Once input V is less than 250V, the relation of I/PV and load % is: $LOAD\% = 0.4 \times V1$



Explanation

1. VDE0126-1-1, it is -20%/ +15%
2. Based on the limit of VDE0126-1-1
3. Based on limit of IEEE1547
4. Under utility voltage THD<3%, reference IEEE1547, EN61000-3-2
5. Under input voltage >=400V, full rated output power, 25°C ambient
6. According to VDE0126-1-1 requirement
7. Based on the output voltage is higher than 200Vac
8. Based on the output voltage is higher than 220Vac



[Close]

Listing Verification

The following Company/product(s) is listed for use with the ETL/cETL Listed Mark(s).

Standard: **Inverters, Converters, Controllers & Interconnection System
Equipment for Use With Distributed Energy Resources
(UL-1741) & General Use Power Supplies
(CAN/CSA-C22.2 No. 107.1)**

Company: **OPTI INTERNATIONAL CORP.**

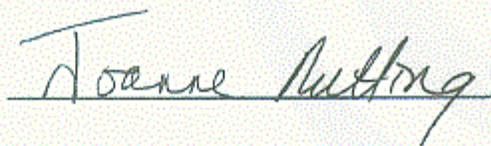
Trade Name: **OPTI-Solar**

Product: **PV Inverter**

Model(s): **GT followed by 1500, 2000, 3000**

If you have any further questions, please feel free to call me at 1-888-347-5478.

Thanks,



Joanne Nutting
Senior Directory Coordinator

August 23, 2010



SECTION 26 50 00

LIGHTING

PART 1 GENERAL

1.1 SUMMARY

- A. Section includes interior luminaires, lamps, ballasts, and accessories.

1.2 SUBMITTALS

- A. Product Data: Submit dimensions, ratings, and performance data.
- B. Samples: Submit two color chips 3 x 3 inch (75 x 75 mm) in size illustrating luminaire finish color as indicated in luminaire schedule.

PART 2 PRODUCTS

2.1 LUMINAIRES

- A. Product Description: Complete luminaire assemblies, with features, options, and accessories as indicated on Drawings.
- B. Substitutions: Permitted.
- C. Minimum Efficacy, Lamps Greater Than 100 Watts: 60 lumens/W, except where otherwise indicated or permitted by applicable code.

PART 3 EXECUTION

3.1 INSTALLATION

- A. Install suspended luminaires using pendants supported from swivel hangers.
- B. Locate recessed ceiling luminaires as indicated on Drawings.
- C. Install surface mounted ceiling luminaires plumb and adjust to align with building lines and with each other. Secure to prevent movement.

3.2 ADJUSTING

- A. Aim and adjust luminaires.
- B. Relamp luminaires, lighting units, and exit signs with failed lamps at Substantial Completion.



END OF SECTION

SECTION 26 51 00

INTERIOR LIGHTING

PART 1 GENERAL

1.1 SUMMARY

- A. Section includes interior luminaires, lamps, ballasts, and accessories.
- B. Related Sections:
 - 1. Section 09 54 16 - Luminous Ceilings.
 - 2. Section 09 58 00 - Integrated Ceiling Assemblies.
 - 3. Section 23 37 00 - Air Outlets and Inlets: For interface with air handling fixtures.
 - 4. Section 26 05 26 - Grounding and Bonding for Electrical Systems.
 - 5. Section 26 05 33 - Raceway and Boxes for Electrical Systems.

1.2 REFERENCES

- A. American National Standards Institute:
 - 1. ANSI C82.1 - American National Standard for Lamp Ballast-Line Frequency Fluorescent Lamp Ballast.
 - 2. ANSI C82.4 - American National Standard for Ballasts-for High-Intensity-Discharge and Low-Pressure Sodium Lamps (Multiple-Supply Type).

1.3 SUBMITTALS

- A. Section 01 33 00 - Submittal Procedures: Submittal procedures.
- B. Shop Drawings: Indicate dimensions and components for each luminaire not standard product of manufacturer.
- C. Product Data: Submit dimensions, ratings, and performance data.
- D. Samples: Submit two color chips 3 x 3 inch (75 x 75 mm) in size illustrating luminaire finish color where indicated in luminaire schedule.

1.4 QUALIFICATIONS

- A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years documented experience.

1.5 FIELD MEASUREMENTS

- A. Verify field measurements prior to fabrication.

PART 2 PRODUCTS

2.1 COMPACT FLUORESCENT LAMPS (CFL)

- A. MANUFACTURERS:
 - 1. Westinghouse. Model: TT GX23
 - 2. Substitutions: Section 01 60 00 – Product Requirements.

PART 3 EXECUTION

3.1 INSTALLATION

- A. Install suspended luminaires using pendants supported from swivel hangers. Install pendant length required to suspend luminaire at indicated height.
- B. Support luminaires larger than 2 x 4 foot (600 x 1200 mm) size independent of ceiling framing.
- C. Locate recessed ceiling luminaires as indicated on Drawings.
- D. Install surface mounted luminaires plumb and adjust to align with building lines and with each other. Secure to prevent movement.
- E. Install recessed luminaires to permit removal from below.
- F. Install recessed luminaires using accessories and firestopping materials to meet regulatory requirements for fire rating.
- G. Install clips to secure recessed grid-supported luminaires in place.
- H. Install wall-mounted luminaires at height as indicated on Drawings.
- I. Install accessories furnished with each luminaire.
- J. Connect luminaires to branch circuit outlets provided under Section 26 05 33 as indicated on Drawings.
- K. Make wiring connections to branch circuit using building wire with insulation suitable for temperature conditions within luminaire.
- L. Install specified lamps in each luminaire.
- M. Interface with air handling accessories furnished and installed under Section 23 37 00.

N. Ground and bond interior luminaires in accordance with Section 26 05 26.

3.2 FIELD QUALITY CONTROL

- A. Section 01 40 00 - Quality Requirements and 01 70 00 - Execution and Closeout Requirements: Field inspecting, testing, adjusting, and balancing.
- B. Operate each luminaire after installation and connection. Inspect for proper connection and operation.

3.3 ADJUSTING

- A. Section 01 70 00 - Execution and Closeout Requirements: Testing, adjusting, and balancing.
- B. Aim and adjust luminaires as indicated on Drawings.

3.4 CLEANING

- A. Section 01 70 00 - Execution and Closeout Requirements: Final cleaning.
- B. Remove dirt and debris from enclosures.
- C. Clean photometric control surfaces as recommended by manufacturer.
- D. Clean finishes and touch up damage.

3.5 PROTECTION OF FINISHED WORK

- A. Section 01 70 00 - Execution and Closeout Requirements: Protecting finished work.
- B. Relamp luminaires having failed lamps at Substantial Completion.

3.6 SCHEDULES

- A. Type A Interior Luminaire:
 1. Fanimation FPD8087.
 2. Lightinguniverse.com Group No. 801251.
 3. Description: 60 in Landan Ceiling Fan
 4. Material: Satin Nickel/Maple.
 5. Voltage: 120VAC.
 6. Lamp: Eight uplight LEDs 10W; Twelve downlight LEDs 15W.
- B. Type B Interior Luminaire:
 1. Kichler Model: 5076NI Hendrik.
 2. Description: One-lamp wall sconce.
 3. Size: 12 inches (300 mm) high; 5.5 inches (140 mm) wide; 8 inches (200 mm) long.
 4. Material: Brushed Nickel.

5. Installation Conditions: Damp Location.
 6. Mounting: Wall surface mounting.
 7. Lamp: 100 W maximum.
- C. Type C Interior Luminaire:
1. Recessed canister.
 2. Height: 7”.
 3. Insulation Contact (IC) rated.
- D. Type D Interior Luminaire:
1. Access Lighting Model: 20661-BS/OPL
 2. Zenon two light flush mount
 3. Material: Brushed Steel; Opal Glass.
 4. Diameter: 12 inches (300 mm)
 5. Lamping: Two A-19 with E-26 Medium Base, 60W maximum each.
 6. Installation Conditions: Damp Location.
 7. Voltage: 120VAC.
- E. Type E Interior Luminaire:
1. Portfolio Model: 225908
 2. Description: 2-Light Bathroom Vanity Light.
 3. Material: Brushed Nickel.
 4. Lamping: Two A-19; 60W Maximum each.
 5. Size: 18.7 inches (475 mm) long; 8.7 inches (221 mm) high.
- F. Type F Interior Luminaire:
1. Lighting Science Group Model: Symetrie Slim
 2. Length: 22.56 inches; 33.19 inches.
 3. Power Supply: LSGC-PS-060-1. 60W max string. 120VAC input. 24VDC output.

END OF SECTION



LIGHTING

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Shown with Cherry blades.

801251G

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Overview

Landan Ceiling Fan

- Number of blades: 5
- 14° blade pitch
- Motor part number: DC-1255
- Only uses 25 watts to achieve a light output comparable to 140 watts of incandescent light.
- 6 forward and 6 reverse speeds (reversing switch in back of remote).
- Includes TR31 hand-held remote.
- Uplight 8 LED's for 10 watts.
- Downlight 12 LED's for 15 watts.
- Color Rendering Index: 79
- Color Temperature: 2800K
- ENERGY INFORMATION with fan at high speed:
 - Air flow: 5621 cubic feet per minute
 - Electrical usage: 29 watts
 - Air flow efficiency: 194 cubic feet/minute/watt
- Compare:
 - 36" to 48" ceiling fans have airflow efficiencies ranging from approximately 71 to 86 cubic feet per minute per watt at high speed.
 - 49" to 60" ceiling fans have airflow efficiencies ranging from approximately 51 to 176 cubic feet per minute per watt at high speed.
- Money-Saving Tip: Turn off fan when leaving room.

Light Bulb LED

Voltage 120 volt

Weight 21.85 Pounds

Compare Our Price

[Have you seen this item for less?](#)

Listing



Eco Friendly, LED, Energy Saving, Quick

Ship



Bulb is included free

Bulbs are not eligible for replacement

Accessories

Additional Accessories

[CCK8002 - Close to Ceiling Kit](#) - \$29.97

Fan Remotes

[TR31 - DC Reversible 6-Speed Fan, Downlight, and Uplight Remote Control](#) - \$0.00

Fan Mounting Accessories

[DRCP - Coupler](#) - \$38.85

Fan Wall Mount Controls

[TW30 - DC Reversible 6-Speed Fan and Downlight Wall Control](#) - \$0.00

Fan Mounting Accessories

[DR - Downrods](#) - \$20.72

Fan Wall Mount Controls

[TW32 - DC Reversible 6-Speed Fan, Downlight, and Uplight Wall Control](#) - \$0.00

Customer Reviews

This product has no customer reviews yet

[Write an online review](#) and be the first to share your thoughts with other customers

Questions & Answers



Type your question here...

We'll respond to your question in two days or less

There are no questions from the community yet

Manuals & Downloads

This product has no additional downloads

Brand Info

Fanimation® is a highly acclaimed manufacturer of some of the most creative and eclectic ceiling fans in the world. Founder Tom Frampton regularly tours around the world in search of inspiration from the myriad of different cultures he encounters.

Overall Grade

A+

Shipping

On Time Shipping

In Stock

Packaging

Customer Reviews

Overall ([54 Reviews](#))

Quality

Installation

Value

Support History

Rate of Return

Restocking Fee

No Fees

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Indoor Fans

- Ceiling Fans

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- Outdoor Ceiling Lights

Outdoor Fans

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Light Bulbs

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- Maxim
- Murray Feiss Lighting
- PLC Lighting
- Quorum International
- Quoizel
- Meyda Tiffany

Home > Indoor Lighting > Ceiling Lighting > Flush Lighting >

Access Lighting - 20661-BS/OPL: Zenon - 2 Light Flush Mount - Brushed Steel Finish/Opal Glass



List Price: \$52.50
Our Price: **\$31.50**
You save \$21.00!

Qty:

ADD TO CART

ADD TO WISH LIST

Availability:: Usually ships in 7-10 days if the item is in stock.
Product Code: ACC_20661-BS-OPL

To see this products complete family line [click here.](#)

LARGER PHOTO

SHARE

Description Manufacturer Description

Access Lighting - 20661-BS/OPL - Zenon - Flush Mount | 2Lt x 60w A19 (E-26 Medium Base) | Damp Location | CUL

Info
Length: 3.5"
Diameter: 12"
Lamping: 2Lt x 60w A19 (E-26 Medium Base)
Voltage: 120V
Location: Damp
CUL

To see this products complete family line [click here.](#)

Related Products...

E53020-09 - Louver 1 Light Flush Mount 22w T5

Our Price: **\$53.15**
Add



E20049-01 - 1 Light Small Bell Flushmount

Our Price: **\$18.05**
Add

E20049-02 - 1 Light Small Bell Flushmount

Our Price: **\$23.45**
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Savannah 3-Light Flush Mount

Our Price: **\$64.13**
Add

Brighton 2-Light Flush Mount

Our Price: **\$45.00**
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Malibu 2-Light Flush Mount

Our Price: **\$29.70**
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Aspen 3-Light Flush Mount

Our Price: **\$138.60**
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Canyon Rim 2-Light Flush Mount

Our Price: **\$45.00**
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1.800.445.6937
Hours of Operation:
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EST



Portfolio 3-Light Brushed Nickel Bathroom Vanity Light

Item #: 225908 | Model #:225908



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Description Specifications

Description

3-Light Brushed Nickel Bathroom Vanity Light

- Decorative Brushed Nickel finish
- Frosted glass shade
- 60 watt maximum
- All mounting hardware included

Specifications

Finish	Nickel	Series / Suite	Trent
UL Safety Listing	Yes	Finish Family	Nickel
CSA Safety Listing	No	Fluorescent	No
ETL Safety Listing	No	Length (Inches)	18.7
Shade / Glass Type	Frosted	Height (Inches)	8.7
Weight (lbs.)	6.5	Number of Lights	3.0
Style	Transitional	Light Output (Watts)	180.0
Depth (Inches)	5.8	ENERGY STAR Qualified	No
Bulbs Included	No	Material	Metal, Glass



Benefits

Low Energy Consumption.

- 5 (w/ft, w/305mm).

Free of UV and IR emissions.

- No product and packaging discoloration.

Lower Maintenance Cost.

- 50,000 hour life.

Environmentally Friendly.

- No mercury or other hazardous materials.
- Fully Recyclable

SLD SP002
July 2009

Symetrie Slim

The Slim is a thin profile, linear LED fixture that delivers high quality white light well suited for display cases, showcases, under shelves, exhibits, museum and cove applications.

Features

Typical Lumens

Warm White	130 (lm/ft, lm/305mm)
Neutral White	160 (lm/ft, lm/305mm)
Cool White	160 (lm/ft, lm/305mm)

Power Consumption¹

Warm White	3 (w/ft, w/305mm)
Neutral White	3 (w/ft, w/305mm)
Cool White	3 (w/ft, w/305mm)

Efficacy¹

Warm White	43 (lm/w)
Neutral White	53 (lm/w)
Cool White	53 (lm/w)

Color Temperature (CCT)

Warm White	2950K
Neutral White	4100K
Cool White	5200K

Color Rendering Index (CRI)²

Warm White	78
Neutral White	70
Cool White	70

Rated Life

50,000 Hours @
70% Lumen Maintenance

Housing

<i>Standard</i>	Black
<i>Optional</i>	Natural Aluminum

Mounting

All Options Included

Connections

Available with multiple series of fixtures

Lens

Polycarbonate

Beam Spread

50°

Operating Temperature

-40°C to +40°C

Voltage

20 Volts DC (24VDC Max.)

Warranty

3 Year Limited

Standards

UL48, UL2108

Certification



Environment

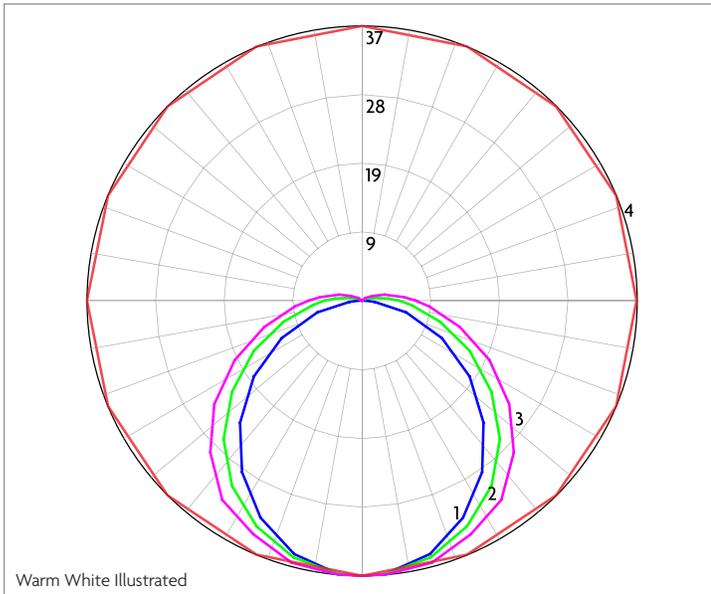


¹ Fixture power consumption for 24.0 VDC is 5 watts per foot max.

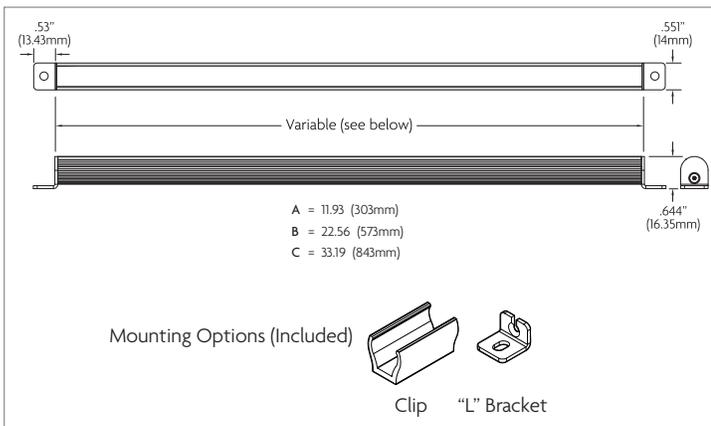
² Engineering data, pending photometric testing.

Symetrie Slim

Fixture Tested: Warm White, A



Maximum candela = 37 Located at Horizontal Angle = 0, Vertical Angle = 0
 #1—Vertical Plane Through Horizontal Angles (0–180) (Through Max. Cd.) : BLUE
 #2—Vertical Plane Through Horizontal Angles (45–225) : GREEN
 #3—Vertical Plane Through Horizontal Angles (90–270) : MAGENTA
 #4—Horizontal Cone Through Vertical Angle (0) (Through Max. Cd.) : RED



Dimensions shown in inches (mm)

Cautions

- Dry location use only.
- Fixtures are suitable for cabinet use or for surface mounting inside a cabinet.
- UL and ETL recognition is valid when fixtures are used only with 24 VDC, 4 Amp max output Class 2 power units that are cord connected or direct plug-in.



Lighting Science Group Corporation
 1227 S. Patrick Drive BLDG 2A
 Satellite Beach, FL 32937
 t: 877-999-5742
 www.lsgc.com

Specifications subject to change.

Luminance Data (cd/sq.m)

Angle In Degrees	Average 0°	Average 45°	Average 90°
45°	11,880	10,946	11,212
55°	11,125	10,085	10,455
65°	10,079	9,105	9,539
75°	6,441	8,080	8,565
85°	6,389	7,446	7,940

Zonal Lumen Summary

Zone	Lumens	% Lamp	% Fixt
0–30	20.78	N.A.	16.3
0–40	38.29	N.A.	30.1
0–60	78.04	N.A.	61.4
0–90	120.73	N.A.	95
90–120	5.87	N.A.	4.6
90–130	6.29	N.A.	4.9
90–150	6.37	N.A.	5
90–180	6.37	N.A.	5
0–180	127.1	N.A.	100.0

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Symetrie Slim

Ordering Information

Example: SLD WW A MTL W18 DFF BLK

Product	Color Temperature	Fixture Length	Power Connection	DC Cable Wire Length	Lens Type	Finish
SLD Slim	CW Cool White	A 11.93" (303mm)	MTL ¹ Multiple Series	W06 6"	DFF Diffused	BLK Black
	NW Neutral White	B 22.56" (573mm)	SGM Single End - Male	W18 18"		NTL Natural ³
	WW Warm White	C 33.19" (843mm)		Custom ²		
		Custom ²				

All mounting hardware included with each unit. Custom DC extension cables available to order as a separate unit.

1. Male connector on one end, female on opposite end to connect a series of fixtures.
2. Please contact a representative for available options.
3. For lead time contact a representative.

Power Supply Compatibility

Must be ordered separately

Power Supply Part No.	Fixture Length (Max) (Inches/Mm)	DC Output Voltage	Input Voltage	Output Wattage	AC Cord ¹ Options	DC Cord (Inches/Mm)	Certifications	IP Rating	Operating Temp	Frequency	Weight (Ounces/Grams)
Fixture Only (w/ft. w/305mm) 4											
PS 025W 1 ^{3,6}	72 / 1828	21 VDC	120 VAC	25W	Wall-Mount USA Plug	1 - 48 / 1 - 1219	UL, cUL, VCCI, CB	Dry Location	0° to 40°C	60Hz	5.2 / 145
PS 025W 2/ ³	72 / 2134	21 VDC	100-240 VAC	25W	Univ. AC, Wall-Mount, UK, EU, Japan	1 - 48 / 1 - 1219	UL, cUL, VCCI, CB	Dry Location	0° to 40°C	50/60 Hz	9.4 / 262
PS 025 1 ⁶	72 / 21344	24 VDC	85-277 VAC	25W	NEMA 5-15P	1 - 48 / 1 - 1219	UL ² , cUL ² , CE, ETL, FCC	Dry Location	-25° to 50°C	50/60 Hz	11b-9.6oz / 725
PS 025 2					UK-Type G						
PS 025 3					EU-Type E						
PS 025 4					AU-Type I						
PS 060 1 ^{4,6}	168 / 4267	24 VDC	100-240 VAC	60W	NEMA 5-15P	2 - 48 / 2 - 1219	UL, cUL, CE, ETL, FCC	IP64	-25° to 50°C	50/60 Hz	21b-3.6oz / 1010
PS 060 2 ⁴					UK-Type G						
PS 060 3 ⁴					EU-Type E						
PS 060 4 ⁴					AU-Type I						
Dimmable⁵											
PSDM 060 1 ^{4,6}	168 / 4267	24 VDC (Adjustable)	100-240 VAC	60W	NEMA 5-15P	2 - 48 / 2 - 1219	Pending	IP64	-30° to 70°C	47 to 63 Hz	21b-9oz / 1177
PSDM 060 2 ⁴					UK-Type G						
PSDM 060 3 ⁴					EU-Type E						
PSDM 060 4 ⁴					AU-Type I						
PS 096 1 ⁶	NA / NA	24 VDC (Adjustable)	90-240 VAC OR 90-277 VAC	96W	NEMA 5-15P	3 - 48 / 3 - 1219	UL, cUL, CE, ETL, FCC, CISPR, Class B	IP66**	-30° to 70°C	47 to 63 Hz	21b-9.1oz / 1177
PS 096 2					UK-Type G						
PS 096 3					EU-Type E						
PS 096 4					AU-Type I						
Dimmable⁵											
PSDM 096 1 ⁶	NA / NA	24 VDC (Adjustable)	90-240 VAC OR 90-277 VAC	96W	NEMA 5-15P	2 - 48 / 2 - 1219	Pending	IP66**	-30° to 70°C	47 to 63 Hz	21b-9oz / 1177
PSDM 096 2					UK-Type G						
PSDM 096 3					EU-Type E						
PSDM 096 4					AU-Type I						

1. Power Supply P/N with "1" suffix is USA/Japan Plug, "2" is European UK Plug, "3" is EU Plug, "4" is Australian/New Zealand, "5" is Wire Leads.

2. Approval pending.

3. Minimum length of 60" (1524mm) required.

4. Minimum length of 144" (3659mm) required.

5. Currently tested for use with the following 3-wire dimmers Leviton Illumatech IP710-DLX; Lutron® Nova NTFTV; Lithonia Control Systems Advance Mark VII, and Hunt Control Systems PS-010.

6. Products using a NEMA 5-15P AC connector for the input cord must be marked with 120 VAC per UL and ETL guidelines; even if the power supply capability is 100-277 VAC.

* IP66 in accordance to EN60529. Contact factory for conditions of acceptability.

**The power supply primary strain relief must be changed by the customer for a connection to liquid tight conduit fitting. The liquid tight shall be provided by the customer with listed (QCRV) 1/2 inch, liquid tight conduit fittings. When field wired, a junction box is not provided. Installer is to use a UL listed junction box suitable for use in wet location for primary leads connection.



Lighting Science Group Corporation
1227 S. Patrick Drive BLDG 2A
Satellite Beach, FL 32937
t: 877-999-5742
www.lsgc.com



Symetrie Series Power Supplies



Lighting Science Group (LSG) offers an array of power supplies specifically designed for use with our superior LED lighting fixtures. With a compact and slender design, we create ease of use and installation. Available in a range of AC cord options including, NEMA 5-15P, UK-Type G, EU-Type E, AU-Type I, and wire leads. In 25W wall mount, 25-96W standard, or 60-96W dimmable. Integrating LSG Class II power supplies will enhance any LED application.

Power Supply Compatibility

Power Supply Part No.	DC Output Voltage	Input Voltage	Output Wattage	AC Cord ¹ Options	DC Cord (Inches/Mm)	Certifications	IP Rating	Operating Temp	Frequency	Weight (Ounces/Grams)
PS 025W 1 ³	21 VDC	120 VAC	25W	Wall-Mount NEMA 5-15P	1 - 48 / 1 - 1219	UL, cUL, VCCI, CB	Dry Location	0° to 40°C	60Hz	5.2 / 145
PS 025W 2/3/4	21 VDC	100-240 VAC	25W	Univ. AC, Wall-Mount, UK, EU, AU	1 - 48 / 1 - 1219	UL, cUL, VCCI, CB	Dry Location	0° to 40°C	50/60 Hz	9.4 / 262
PS 025 1 ³ PS 025 2 PS 025 3 PS 025 4	24 VDC	85-277 VAC	25W	NEMA 5-15P UK-Type G EU-Type E AU-Type I	1 - 48 / 1 - 1219	UL ² , cUL ² , CE, ETL, FCC	Dry Location	-25° to 50°C	50/60 Hz	11b-9.6oz / 725
PS 060 1 ³ PS 060 2 PS 060 3 PS 060 4	24 VDC	85-277 VAC	60W	NEMA 5-15P UK-Type G EU-Type E AU-Type I	2 - 48 / 2 - 1219	UL, cUL, CE, ETL, FCC	IP64	-25° to 50°C	50/60 Hz	21b-3.6oz / 1010
Dimmable ⁴ PSDM 060 1 ³ PSDM 060 2 PSDM 060 3 PSDM 060 4	24 VDC (Adjustable)	100-240 VAC	60W	NEMA 5-15P UK-Type G EU-Type E AU-Type I	2 - 48 / 2 - 1219 1 - Control	Pending	IP64	-30° to 70°C	47 to 63 Hz	21b-9oz / 1177
PS 096 1 ³ PS 096 2 PS 096 3 PS 096 4	24 VDC (Adjustable)	90-240 VAC OR 90-277 VAC	96W	NEMA 5-15P UK-Type G EU-Type E AU-Type I	3 - 48 / 3 - 1219	UL, cUL, CE, ETL, FCC, CISPR Class B	IP66*	-30° to 70°C	47 to 63 Hz	21b-9.1oz / 1177
Dimmable ⁴ PSDM 096 1 ³ PSDM 096 2 PSDM 096 3 PSDM 096 4	24 VDC (Adjustable)	100-277 VAC	96W	NEMA 5-15P UK-Type G EU-Type E AU-Type I	2 - 48 / 2 - 1219 1 - Control	Pending	IP66*	-30° to 70°C	47 to 63 Hz	21b-9oz / 1177

1. Power Supply P/N with "1" suffix is USA/Japan Plug, "2" is European UK Plug, "3" is EU Plug, "4" is Australian/New Zealand, "5" is Wire Leads.
Note: Products using a NEMA 5-15P AC connector for the input cord must be marked with 120 VAC per UL and ETL guidelines; even if the power supply capability is 100-277 VAC. This pertains to products PS-025-1, PS-060-1, PSDM-60-1, PS-096-1 and PSDM-096-1.

2. Approval pending.

3. Products using a NEMA 5-15P AC connector for the input cord must be marked with 120 VAC per UL and ETL guidelines; even if the power supply capability is 100-277 VAC.

4. Dimmable power supplies can be used on all LSG Symetrie fixtures and currently tested for use with the following 3-wire dimmers Leviton Illumatch IP710-DLX; Lutron® Nova NTFTV; Lithonia Control Systems Advance Mark VII, and Hunt Control Systems PS-010

* The power supply primary strain relief must be changed by the customer for a connection to liquid tight conduit fitting. The liquid tight conduit shall be provided by the customer with Listed (QCRV) 1/2 inch, liquid tight conduit fittings. When field wired, a junction box is not provided. Installer is to use a UL listed junction box suitable for use in wet location for primary leads connection. IP66 in accordance to EN60529. Contact factory for conditions of acceptability.

Cautions:

Always disconnect power before installation and/or removal of the unit.

Install in accordance with national and local electrical codes.

Wires: input wires 0.75mm² or 18AWG, output wires 20AWG.

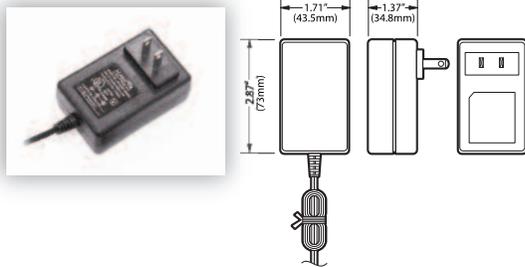


Please see specifications for certifications/listings.

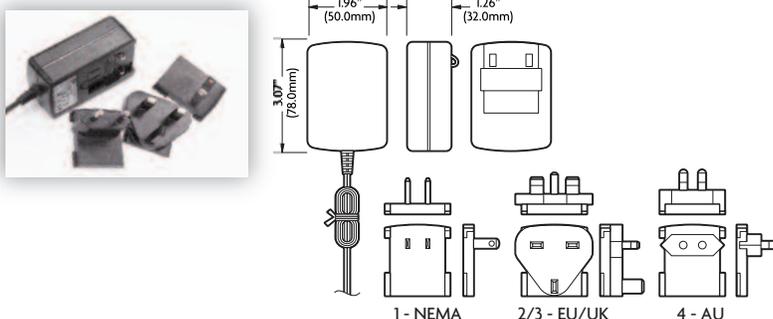


Symetrie Series Power Supplies

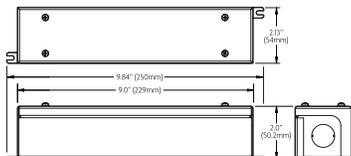
PS 025W 1



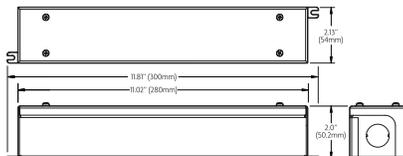
PS 025W 2/3/4



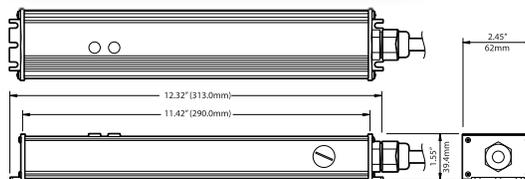
PS 025



PS 060



PS 096



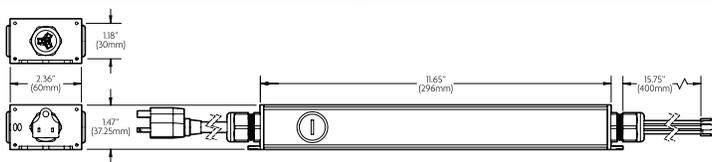
Dimmable

PSDM-060 and PSDM-096 power supplies are compatible with 0-10 VDC wall mounted dimming controls. Typical dimming controls are Leviton Illumatech IP710-DLX; Lutron® Nova NTFTV; Lithonia Control Systems Advance Mark VII, and Hunt Control Systems PS-010. The DC control cable from the PSDM power supplies mates to a male Molex Micro-Fit connector (Molex P/N 43645-0200, Pin P/N 43030-0007).

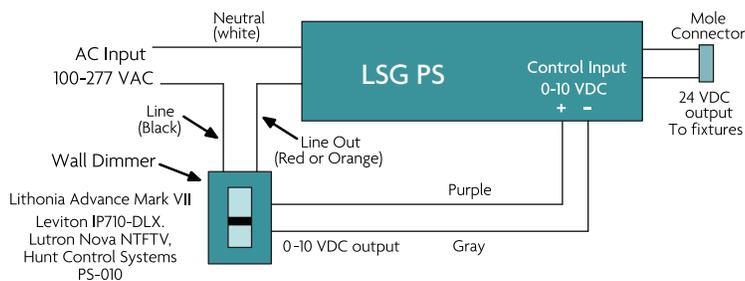
PSDM 060



PSDM 096



Symetrie LED fixture assembly of power supply to dimmer control.



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Satellite Beach, FL 32937
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Kichler 5076NI Hendrik Sconce Brushed Nickel



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- Manufacturer: Kichler Lighting
- Part Number: 5076NI
- Product Description: Sconce 1 Light Incandescent
- Product Collection: Hendrik
- Product Category: Wall Brackets And Sconces
- Product Style: Casual
- Finish: Brushed Nickel
- Dimensions: 12" Height x 5.5" Width x 8" Length
- Extension: 8"
- Height From Junction Box: 6"
- Backplate Dimensions: 12" x 4.5"
- Bulbs: (1) Medium Base, 100 Watt Max Bulb Not Included
- Diffuser: Satin Etched Cased Opal Glass
- Lead Wire Length: 6"
- Weight: 4.3 Lbs
- UL And/Or CA Listed
- Named after renowned Dutch architect, Hendrik Belage, the Hendrik Collection is a gorgeous family of contemporary fixtures that honor the man who was regarded by many as the "Father of Modern architecture". Much like Belage himself, The Hendrik Collection is regarded as an intermediary between modern and traditional styles. Classic lines are enhanced with a soft touch of current style cues to work in a number of aesthetic environments. The clean look provided by Kichler's Brushed Nickel finish is partnered with the Satin-etched cased opal glass for a fantastic pure and frosted color palate. The 1-light Hendrik Wall Sconce uses a 100-watt max bulb, measures 5 -1/2" wide with a body height of 12". It is UL listed for damp location



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SECTION 26 56 00

EXTERIOR LIGHTING

PART 1 GENERAL

1.1 SUMMARY

A. Section includes exterior luminaires, poles, and accessories.

1.2 REFERENCES

A. American National Standards Institute:

1. ANSI C82.1 - American National Standard for Lamp Ballast-Line Frequency Fluorescent Lamp Ballast.
2. ANSI C82.4 - American National Standard for Ballasts-for High-Intensity-Discharge and Low-Pressure Sodium Lamps (Multiple-Supply Type).
3. ANSI O5.1 - Wood Poles, Specifications and Dimensions.

1.3 SUBMITTALS

A. Section 01 33 00 - Submittal Procedure: Submittal procedures.

B. Shop Drawings: Indicate dimensions and components for each luminaire not standard Product of manufacturer.

C. Product Data: Submit dimensions, ratings, and performance data.

D. Samples: Submit two color chips 3 x 3 inch (75 x 75 mm) in size illustrating luminaire finish color where indicated in luminaire schedule.

1.4 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years documented experience.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Section 01 60 00 - Product Requirements: Product storage and handling requirements.

B. Store and handle solid wood poles in accordance with ANSI O5.1.

1.6 COORDINATION

A. Section 01 30 00 - Administrative Requirements: Coordination and project conditions.

- B. Furnish bolt templates and pole mounting accessories to installer of pole foundations.

PART 2 PRODUCTS

2.1 LUMINAIRES

- A. Product Description: Complete exterior luminaire assemblies, with features, options, and accessories as scheduled.
- B. Refer to Section 01 60 00 - Product Requirements for product options.

2.2 LAMPS - GENERAL

- A. Minimum Efficacy, Lamps Greater Than 100 Watts: 60 lumens/W, except where otherwise indicated or permitted by applicable code.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Section 01 30 00 - Administrative Requirements: Coordination and Project conditions.
- B. Verify foundations are ready to receive fixtures.

3.2 INSTALLATION

- A. Install concrete bases for lighting poles at locations as indicated on Drawings, in accordance with Section 03 30 00.
- B. Install lamps in each luminaire.

3.3 FIELD QUALITY CONTROL

- A. Section 1 40 00 - Quality Requirements and 01 70 00 - Execution and Closeout Requirements: Field inspecting, testing, adjusting, and balancing.
- B. Operate each luminaire after installation and connection. Inspect for improper connections and operation.
- C. Measure illumination levels to verify conformance with performance requirements.
- D. Take measurements during night sky, without moon or with heavy overcast clouds effectively obscuring moon.

3.4 ADJUSTING

- A. Section 01 70 00 - Execution and Closeout Requirements: Testing, adjusting, and balancing.
- B. Aim and adjust luminaries to provide illumination levels and distribution as indicated on Drawings.

3.5 CLEANING

- A. Section 01 70 00 - Execution and Closeout Requirements: Final cleaning.
- B. Clean photometric control surfaces as recommended by manufacturer.
- C. Clean finishes and touch up damage.

3.6 PROTECTION OF FINISHED WORK

- A. Section 01 70 00 - Execution and Closeout Requirements: Protecting finished work.
- B. Relamp luminaries having failed lamps at Substantial Completion.

3.7 SCHEDULE

- A. Type A Exterior Luminaire:
 - 1. Portfolio Model: 4560WB
 - 2. Description: Outdoor Wall Light.
 - 3. Material: Weathered Bronze.
 - 4. Lamping: One medium base lamp. Max 100W.
 - 5. Weather Resistant.

END OF SECTION



Lowe's Customer Care
1.800.445.6937
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Portfolio Weathered Bronze Outdoor Wall Light

Item #: 262469 | Model #:45640WB

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Description Specifications

Description

Weathered Bronze Outdoor Wall Light

- Easy installation
- UL listed
- Weathered bronze finish
- Requires one 100 watt medium base bulb

Specifications

Outdoor Fashion Lighting Type	Wall Fixtures	Finish	Bronze
CSA Safety Listing	Yes	Height (Inches)	12.0
ETL Safety Listing	No	Weather Resistant	Yes
Weight (lbs.)	6.0	Maximum Bulb Wattage (Watts)	100.0
Package Contents	Fixture, instructions, hardware	Warranty	1 Year limited
Finish Family	Bronze	UL Safety Listing	Yes
Material	Die Cast Aluminum		

SECTION 28 16 00

INTRUSION DETECTION

PART 1 GENERAL

1.1 SUMMARY

- A. Section includes intrusion detection devices, alarm control panel, signaling devices, and signal wiring.

1.2 SYSTEM DESCRIPTION

- A. Intrusion Detection System: Protect building and selected areas from intrusion during SECURE hours.
- B. Alarm Sequence of Operation:
 - 1. Actuation of intrusion detecting device causes the following operations:
 - a. Local alarm signaling devices sound and display with non-coded signal.
- C. Non-coded signal transmits to municipal connection.
- D. Location of actuated device indicates on control panel.
- E. Zoning: As indicated on Drawings.

1.3 SUBMITTALS

- A. Shop Drawings: Not required.
- B. Product Data: Required.
- C. Test Reports: Required.
- D. Manufacturer's Field Reports: Not required.

1.4 CLOSEOUT SUBMITTALS

- A. Project Record Documents: Required.
- B. Operation and Maintenance Data: Required.

1.5 QUALITY ASSURANCE

- A. Provide wiring materials located in plenums with peak optical density not greater than 0.5, average optical density not greater than 0.15, and flame spread not greater than 5 feet (1.5 m) when tested in accordance with NFPA 262.

1.6 MAINTENANCE SERVICE

- A. Furnish service and maintenance of intrusion detection system for two years from Date of Substantial Completion.

PART 2 PRODUCTS

2.1 CONTROL PANEL

- A. Manufacturers:
 - 1. Honeywell. Model: Vista 10P.
 - 2. Substitutions: Permitted.
- B. Product Description: Modular control panel with flush wall-mounted enclosure.
- C. Power supply: Adequate to serve control panel modules, and alarm signaling devices. Furnish battery-operated emergency power supply with capacity for operating system in standby mode for 24 hours.
- D. System Supervision: Furnish electrically supervised system, with supervised alarm initiating and alarm signaling circuits. Component or power supply failure places system in alarm mode.
- E. Initiating Circuits: Supervised zone module with alarm and trouble indication.
- F. Signal Circuits: Supervised signal module, sufficient for signal devices connected to system; occurrence of single ground, or open condition, places circuit in trouble mode, and does not disable circuit from transmitting alarm.
- G. Remote Station Signal Transmitter: Electrically supervised, capable of transmitting alarm and trouble signals over telephone lines to central station receiver.
- H. Auxiliary Relays: Furnish sufficient SPDT auxiliary relay contacts to provide accessory functions specified.
- I. Occupied/Unoccupied Selector: Keyed switch.
- J. Alarm Reset: Key-accessible reset function resets alarm system out of alarm when alarm initiating circuits have cleared.
- K. Lamp Test: Manual lamp test function causes alarm indication at each zone at control panel and at annunciator panel.
- L. Entry and Exit Time Delays: 45 seconds.

2.2 WINDOW CONTACTS

- A. Manufacturers:
 - 1. Winn. Model: BR-1012T.
 - 2. Substitutions: Permitted.
- B. Product Description: 3/8 inch pressfit contact with terminals.

2.3 ALARM BELLS

- A. Manufacturers:
 - 1. Honeywell Model Wave2.
 - 2. Substitutions: Permitted.
- B. Product Description: NFPA 72, single-stroke, electric bell with the following features:
 - 1. Operating mechanism behind dome.
 - 2. Size: 3.25 inch x 4.25 inch.
 - 3. Sound Rating: 106 dB at 12 VDC, 3 feet (1 m).

PART 3 EXECUTION

3.1 INSTALLATION

- A. Install 18 AWG minimum size conductors for detection and signal circuit conductors. Install wiring in cable.
- B. Make conduit and wiring connections to door hardware devices.
- C. Manufacturer's Field Services Not required.
- D. Demonstration and Training: Furnish one (1) hour of instruction each for two persons, with manufacturer's representative.

3.2 FIELD QUALITY CONTROL

- A. Test in accordance with NFPA 72 and manufacturer's recommendations.

END OF SECTION

VISTA-10P

CONTROL PANEL



Honeywell's feature-rich VISTA-10P is the industry's most economical and versatile control panel and is ideally suited for a wide range of applications. The six-zone panel significantly reduces dealer training and service call costs thanks to user-friendly features that make operation easier than ever. VISTA-10P gives you the ability to send alarm signals and upload/download via an Internet Protocol (IP), improving the speed at which information can be delivered to and from the control panel. In addition, when used with an AlarmNet Internet or digital communicator, the VISTA-10P can be installed in premises without TELCO lines – guaranteeing communication independent of any home infrastructure. The VISTA-10P increases upsell opportunities through its expansion capabilities and flexibility.

FEATURES

- IP alarm reporting and uploading/downloading capability for Internet and Intranet use via 7845i, 7845i-ENT, 7845GSMR or 7845i-GSM
- Six hardwired zones on board
- 16 wireless expansion zones totaling 22 protection zones
- Eight independent keyfob zones allow two wireless keys to be programmed without using any of the 22 zones
- 32 Event log
- 16 user codes
- One configurable zone type allows installers to create their own custom zone type

- Two on-board triggers
- Four output devices using a 4204 relay module

Valuable End-User Features

- Flexible function keys allow single button arming
- One programmable macro key
- Viewable on system keypad display
 - Exit countdown
 - Time and date*
 - Event log*
- Two schedules
 - Can activate relays on programmed times or on events
 - Latchkey reports to a pager
 - “User Access” time windows

- Chime by zone
- 4286 Phone Module allows system control from any touchtone phone
- Four output devices with multiple actions per device
 - Turn lights on when system disarms with a 4204 Relay
 - Flash same lights when system is in alarm using a 4204 Relay

*with Alpha Keypad

VISTA-10P

CONTROL PANEL

SPECIFICATIONS

Electrical

- Aux power 12VDC, 600mA max
- Seven hour standby at 400 mA aux load with four amp hour battery
- 16.5VAC/25VA transformer
- Alarm output 12VDC, 2.0A max
- For UL installations, combined aux and alarm output cannot exceed 700mA

Output Control

- Supports multiple output devices, one 4204 and two triggers

Zones

- Six hardwired zones
- Selectable response: 10msec, 350msec, 750msec
- 16 selectable zone types plus one configurable zone type
- Programmable swinger suppression

Expansion Devices

- 4204 – Up to four relays – 15mA standby (each active relay draws an additional 40mA)

Accessories

- 7845i Internet Communicator
- 7845i-ENT Enterprise Internet Communicator
- 7845GSMR Dual-Path Digital Wireless Communicator
- 7845i-GSM Triple-Path Digital Communicator
- 4286 VIP Voice Module – 220mA
- 5881ENL supports up to eight zones – 60mA, 5881ENM supports up to 16 zones
- 5881ENH supports up to 22 zones – 50mA
- 5883 Transceiver supports up to 26 zones – 80mA
- Supports Eagle 1225 and 1221 boards

Keypads

- 6160 Custom Alpha (required for programming) – 100mA
- 6160V Custom Alpha Voice – 100mA
- 6150 Fixed English LCD – 85mA/40mA
- 6150V Fixed English Voice LCD – 85mA/40mA
- 6150RF Fixed English RF LCD – 85mA/40mA
- 6148 Fixed English LCD – 70mA/30mA

Agency Listings

- UL Residential Fire, Burglary and CSFM
- ETL Residential Fire, Burglary

Smoke Detectors

- Supports four-wire smoke detectors

Communications

- 7845i Internet Communicator
- 7845i-ENT Enterprise Internet Communicator
- 7845GSMR Dual-Path Digital Wireless Communicator
- 7845i-GSM Triple-Path Digital Communicator
- Touchtone or pulse
- Formats supported
 - ADEMCO Contact ID
 - ADEMCO 4 + 2 Express
 - ADEMCO low speed
 - Sescoa/Radionics
- 3 + 1, 4 + 1 and 4 + 2 reporting
- Reporting capabilities
 - Split
 - Dual
 - Split/Dual - True dial tone detection
- Low battery reports 11.2 – 11.6VDC
- AC loss and restoral reporting supported

ORDERING

VISTA-10P	Control Panel
VISTA-10PSIA	Control Panel for CP-01 SIA certifications

Automation and Control Solutions

Honeywell Security & Communications
2 Corporate Center Dr. Suite 100
P.O. Box 9040
Melville, NY 11747

www.honeywell.com

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SECTION 28 31 00

FIRE DETECTION AND ALARM

PART 1 GENERAL

1.1 SUMMARY

- A. Section includes fire alarm control panels, manual fire alarm stations, automatic smoke and heat detectors, fire alarm signaling appliances, and auxiliary fire alarm equipment and power and signal wire and cable.

1.2 SYSTEM DESCRIPTION

- A. Fire Alarm System: NFPA 72, automatic local fire alarm system with connections to municipal system.
- B. Alarm Sequence of Operation: Actuation of initiating device causes the following system operations:
 - 1. Local fire alarm signaling devices sound and display with march time signal.
 - 2. Non-coded signal transmits to municipal connection.
 - 3. Location of alarm zone indicates on fire alarm control panel.
- C. Drill Sequence of Operation: Manual drill function causes alarm mode sequence of operation.
- D. Trouble Sequence of Operation: System or circuit trouble causes the following system operations:
 - 1. Visual and audible trouble alarm indicates at fire alarm control panel.
 - 2. Visual and audible trouble alarm indicates at remote annunciator panel.
 - 3. Trouble signal transmits to municipal connection.
 - 4. Zoning: As indicated on Drawings.

1.3 SUBMITTALS

- A. Shop Drawings: Not required.
- B. Product Data: Required.
- C. Test Reports: Not required.
- D. Manufacturer's Field Reports: Not required.

1.4 CLOSEOUT SUBMITTALS

- A. Project Record Documents: Not required.
- B. Operation and Maintenance Data: Required.

1.5 QUALITY ASSURANCE

- A. Provide wiring materials located in plenums with peak optical density not greater than 0.5, average optical density not greater than 0.15, and flame spread not greater than 5 feet (1.5 m) when tested in accordance with NFPA 262.

1.6 MAINTENANCE SERVICE

- A. Furnish service and maintenance of fire alarm equipment for one year from Date of Substantial Completion.

PART 2 PRODUCTS

2.1 FIRE DETECTION AND ALARM

- A. Manufacturers:
 - 1. ADT Model Smoke alarm.
 - 2. Substitutions: Permitted.

2.2 CONTROL PANEL

- A. Product Description: Modular fire alarm control panel with flush wall-mounted enclosure.
- B. Power supply: Adequate to serve control panel modules, and alarm signaling devices.
- C. System Supervision: Component or power supply failure places system in trouble mode.
- D. Initiating Device Circuits: Supervised zone module with alarm and trouble indication; occurrence of single ground or open condition places circuit in trouble mode
- E. Indicating Appliance Circuits: Supervised march time signal module, sufficient for signal devices connected to system; occurrence of single ground or open condition places circuit in trouble mode.

2.3 SPOT HEAT DETECTOR

- A. Product Description: Combination rate-of-rise and fixed temperature, spot heat detector.
- B. Temperature Rating: 135 degrees F (57 degrees C).
- C. Rate-of-Rise: 15 degrees F (8.3 degrees C).

2.4 CEILING SMOKE DETECTOR

- A. Product Description: NFPA 72, ionization type ceiling smoke detector with the following features:

1. Adjustable sensitivity.
2. Plug-in base.
3. Auxiliary relay contact.
4. Integral thermal element rated 135 degrees F (57 degrees C).
5. Visual indication of detector actuation.

B. Furnish two-wire detector with common power supply and signal circuits.

2.5 WIRE AND CABLE

- A. Product Description: Non-power limited fire-protective signaling cable, copper conductor, 150 volt insulation rated 60 degrees C.

PART 3 EXECUTION

3.1 INSTALLATION

- A. Install 16 AWG minimum size conductors for fire alarm detection and signal circuit conductors in cable.
- B. Mount end-of-line device in control panel.
- C. Mount outlet box for electric door holder to withstand 80 pounds (36.4 kg) pulling force.
- D. Automatic Detector Installation: Conform to NFPA 72.
- E. Manufacturer's Field Services: Not required.

3.2 FIELD QUALITY CONTROL

- A. Test in accordance with NFPA 72 and local fire department requirements.

END OF SECTION

SECTION 31 66 16

TEMPORARY FOUNDATIONS

PART 1 GENERAL

1.1 SUMMARY

- A. Section includes the temporary foundation construction for a single story multiple modular building and decking components.

1.2 SYSTEM DESCRIPTION

- A. Temporary Foundation: Design and construct temporary foundation system for support of structure as required to meet Solar Decathlon competition code.

1.3 SUBMITTALS

- A. Section 01 00 00 – General Requirements: For submittal requirements and procedures.
- B. Shop Drawings: Indicate placement of temporary placement of temporary foundation blocks.

PART 2 PRODUCTS

2.1 TEMPORARY FOUNDATION SYSTEM

- A. Concrete Block: Solid core fiber reinforced concrete blocks.
 - 1. Sizes:
 - a. 12" x 12" x 6"
 - b. 20" x 20" x 6"
 - c. 18" x 18" x 6"
 - d. 10" x 24" x 6"
 - e. 8" x 16" x 6"
 - 2. Strength: 4000 psi
 - 3. Standard: ASTM C90
- B. Wood Frame
 - 1. 2 x 4 Pressure treated wood frame.
- C. Geotextile Fabric: Generic
- D. Masonry Sand: Generic

2.2 FABRICATION

- A. Construct wood frames to dimensions indicated for each foundation footing.
- B. Staple geotextile fabric securely to bottom of each frame.
- C. Place masonry sand inside of geotextile fabric to achieve level surface.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify grade and levelness of site.
- B. Locate foot print of building location and determine lowest point of grade and required elevation for the finished floor of structure.

3.2 TEMPORARY FOUNDATION PLACEMENT

- A. Starting at lowest point on site place temporary foundation units in accordance with placement drawings, and level foundations from that point.
- B. Place wood frames at designated temporary foundation locations as indicated on drawings.
- C. Compact masonry sand to achieve level bearing surface for concrete blocks.
- D. Place concrete blocks within wood frames to achieve level house elevation.
 - 1. Maintain structure height elevation within 18'-0" maximum height allowance from highest foundation point.
 - 2. Use metal and wood shims at various thicknesses to achieve level foundations across entire house.
- E. Assemble house on temporary concrete foundations as indicated on drawings.

END OF SECTION

SECTION 32 94 00

PLANTING ACCESSORIES

PART 1 GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Placement of plant life.
 - 2. Accessories for plant life.

1.2 QUALIFICATIONS

- A. Nursery: Company specializing in growing and cultivating plant life specified in this section.
- B. Planters will be a attached products to the house. Please refer to 06 20 00 for information regarding planters.
- C. Maintenance Services: Performed by installer.

1.3 WARRANTY

- A. Furnish one year warranty including one continuous growing season including coverage of plants from death or unhealthy conditions.
- B. Replacements: Plants of same size and species as specified, planted in next growing season, with new warranty beginning on date of replacement.

1.4 MAINTENANCE SERVICE

- A. Maintain plant life one year from Date of Substantial Completion.

PART 2 PRODUCTS

2.1 TREES, PLANTS, AND GROUND COVER

- A. Trees, Plants, and Ground Cover: Species and size identified in Plant Schedule as indicated on Drawings, grown in climatic conditions similar to those in locality of the Work.

2.2 SOIL AND SOIL MODIFICATION MATERIALS

- A. Topsoil: Excavated from site and reused Engineered Soil: Manufacturer Filtrexx

2.3 ACCESSORIES

- A. Planter Liner: Manufacturer: Garden in a flower pot.
- B. Planter Boxes: Please refer to 06 20 00

PART 3 EXECUTION

3.1 EXAMINATION AND PREPARATION

- A. Verify required underground utilities are in proper location.
- B. Prepare subsoil to eliminate uneven areas. Maintain profiles and contours. Make changes in grade gradual. Blend slopes into level areas.
- C. Scarify subsoil to depth of 4 inches.

3.2 PLACING TOPSOIL

- A. Spread topsoil to minimum depth of 4 inches. Rake smooth.
- B. Grade topsoil to eliminate rough, low or soft areas. Slope for positive drainage
- C. Place topsoil into pits and beds intended for plant root balls to minimum thickness of 6 inches.

3.3 PLANTING

- A. Set plants in pits or beds partly filled with prepared topsoil mixture. Backfill soil mixture.
- B. Saturate soil with water when pit or bed is half full of top soil and again when full.

3.4 MAINTENANCE

- A. Water to prevent grass and soil from drying out.
- B. Control growth of weeds.

END OF SECTION