



**Santa Clara University
Specifications
Aug 7th, 2007**



Submitted To:
National Renewable Energy Laboratory
Mail Stop 3214
1617 Cole Blvd.

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Electrical Specifications

Santa Clara University Solar Decathlon
Electrical System Calculations

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Wire Sizes and Breakers Calculations:

Notes:

- As a general rule we decided to oversize the conductors on the DC side in order to minimize inefficiencies due to voltage drop across the wires.
- Outdoor temperature correction factor is 0.58 (141–158°F)
- Mechanical Room correction factor is 0.82 (114–122°F)
- Conduit fill calculations are determined in accordance with NEC Annex C Table C.1(A)

- **From Solar Array to SunnyBoy DC Disconnect**

Ampacity Calculations:

$$PanelI_{sc} \times \# \text{ Strings Parallel} \times 1.25 = \text{Amps}$$

$$5.80A \times 2 \times 1.25 = 14.5A$$

As shown in E-100, each of the inverters will be fed by two strings of 8 (south module) and 9 (north module) panels each.

#10 USE-2 Rated for up to $40A \times 0.58 = 23.2A$. This is an oversized conductor but allows us to minimize the voltage drop to 0.9%.

DC Disconnects are rated for up to 18A, and are incorporated into the SunnyBoy4000US inverter.

Conduit Fill:

$\frac{3}{4}$ " EMT will be used on the roof to route the #10 conductors in order to make the system neat. As indicated by the system schematic four conductors plus ground will run up to each DC disconnect/string combiner with a dedicated conduit. $\frac{3}{4}$ " conduit can contain up to 6 USE-2 #10 .

- **From SunnyBoys to Subpanel:**Ampacity Calculations:

$$\frac{W_{out}}{V_{out}} \times 1.25 = Amps$$

$$\frac{4000W}{240V} \times 1.25 = 20.83A$$

AC disconnects will be 30A, Square-D D221NRB

#8 THHN rated for up to $55A \times 0.82 = 45.1A$ is suitable

Conduit:

$\frac{3}{4}$ " EMT is rated for up to 6 #8 THHN conductors. Each inverter has its own conduit run to the AC load center. Hence conduit fill will be three conductors plus ground.

- **From Panel to SunnyIslands:**

According to the SunnyIsland specifications there is no need for an AC disconnect between the panel and the inverter, a 70A 2-pole breaker is recommended by the manufacturer in order to stack the inverters to produce $240V_{AC}$.

Ampacity Calculations:

$$\frac{W_{ACout}}{V_{ACout}} \times 1.25 = Amps$$

$$\frac{4200W}{120V} \times 1.25 = 43.75A$$

#4 Gage THHN rated for up to $95 \times 0.82 = 77.9A$ will be suitable for the 70A 2-pole breaker

Conduit:

1" EMT is appropriate for the three conductors plus ground required for the connection to the panel.

- **From Batteries to SunnyIslands:**

SunnyIslands are equipped with integrated DC disconnects, hence there will be no need to use external DC disconnects.

The battery bank is rated at 48V with a capacity of 3306Ah. There are 4 gallons of electrolyte per cell.

Ampacity Calculations:

$$\frac{W_{DC}}{(V_{DC} \times 0.85)} \times 1.25 = Amps$$

$$\frac{4200W}{(48 \times 0.85)} \times 1.25 = 128.68A$$

#2/0 Gage THHW-2 rated for up to $195 \times 0.82 = 159.9A$. #1/0 would also be appropriate but we oversized the design to minimize voltage drop.

Conduit:

1½" EMT is appropriate for up to 4 #2/0 conductors. Each battery string will have a dedicated conduit run to the inverter.

- **Subpanel:**

Ampacity Calculations:

$$\frac{W_{OutMax}}{V_{AC}} \times 1.25 = Amps$$

$$\frac{(2 \times 4000 + 4200)}{240} \times 1.25 = 61.5A$$

We will use a 225 Amp 42 slot panel with a 100A main, Square-D model QO 142L225G. This is larger than a usual panel but necessary if we are not to undersize the main for Gird-Tie connection upon return of the house to the Santa Clara University campus. Refer to Drawing E-500 for further details on panel Schedule and phase balancing

SPR-215-BLK RESIDENTIAL PV MODULE

The SunPower SPR-215-BLK is designed specifically for on-grid residential systems where a combination of high module efficiency and outstanding appearance is desirable. Utilizing 72 series-connected A-300 solar cells, the SPR-215-BLK delivers industry-leading power density in a unique all-black module package with exceptionally uniform appearance.

SunPower modules—innovative design, proven materials, outstanding performance.

FEATURES & BENEFITS

- All-black module package eliminates harsh reflections and other noticeable cosmetic module features to provide optimum array appearance
- Unique all-back-contact solar cells with conversion efficiency up to 21.5%
- Low voltage temperature coefficient, exceptional low-light performance, and high sensitivity to light across the entire solar spectrum maximize yearly energy delivery
- Highest quality, high-transmission tempered glass provides enhanced stiffness and impact resistance
- Aerospace style cell interconnects with in-plane strain relief provide extremely high reliability
- Advanced EVA encapsulation system with multi-layer backsheets meets the most stringent safety requirements for high-voltage operation
- A sturdy, black anodized aluminum frame allows modules to be easily roof-mounted with a wide variety of standard mounting systems



SPR-215-BLK RESIDENTIAL PV MODULE
An unequalled combination of power and grace

 LISTED UL 1703, Class C Fire Rating

 IEC 61215, Safety Class II Certified

SUNPOWER®

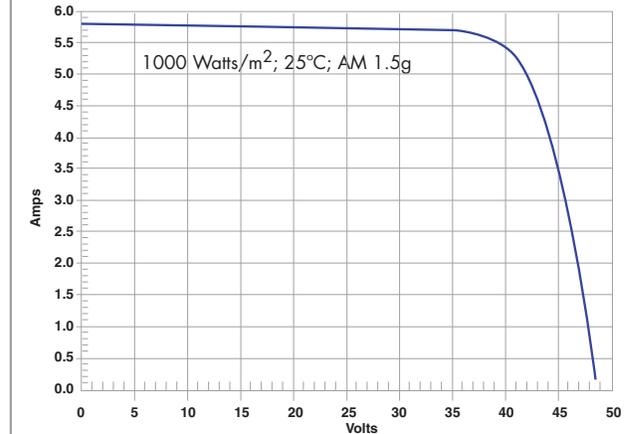
SPR-215-BLK RESIDENTIAL PV MODULE

ELECTRICAL CHARACTERISTICS AT STANDARD TEST CONDITIONS (STC)

STC is defined as: irradiance of 1000W/m², spectrum AM 1.5g and cell temperature of 25°C

Peak Power ^{1,2}	P _{max}	215W
Rated Voltage	V _{mp}	39.8V
Rated Current	I _{mp}	5.40A
Open Circuit Voltage	V _{oc}	48.3V
Short Circuit Current	I _{sc}	5.80A
Series Fuse Rating		15A
Maximum System Voltage		600V (UL)
		1000V (IEC)
Temperature Co-efficients	Power	-0.38%/°C
	Voltage	-136.8mV/°C
	Current	2.3mA/°C
Module Efficiency		17.3%
Peak Power per Unit Area		16W/sq.ft. ; 173W/m ²
PTC Rating		197.6W

IV CURVE



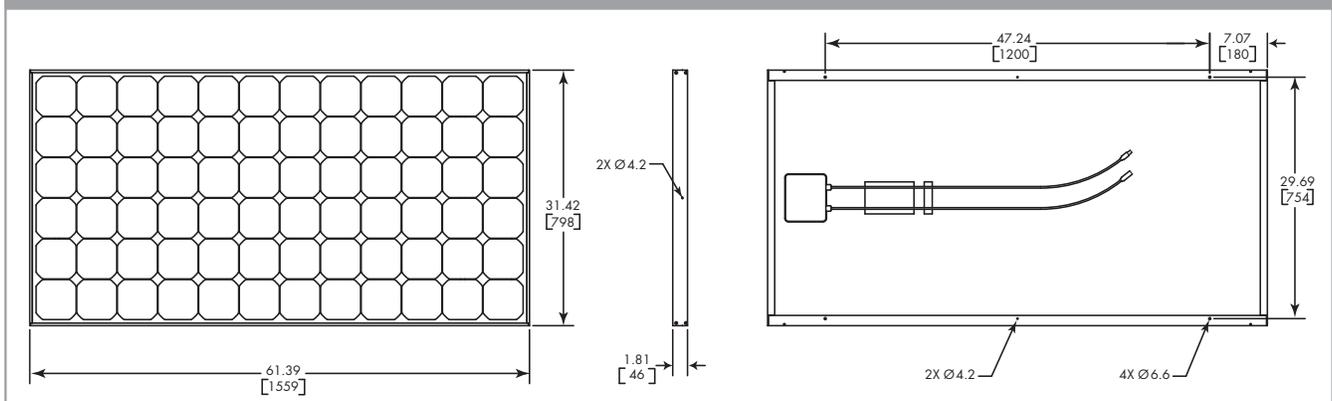
¹ Peak Power Tolerance: +/- 8%

² Power guaranteed for 25 years. See SunPower Limited Warranty for details.

MECHANICAL SPECIFICATIONS

Length	61.39 in x 31.42 in [1559 mm x 798mm]
Thickness, including junction box	1.81 in [46 mm]
Weight	33 lbs [15 kg]

DIMENSIONS



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SunPower Corporation®
 1.877.SUN.0123 Email: sales@sunpowercorp.com www.sunpowercorp.com
 Engineered in California

SB 3000US / SB 4000US



- > Certified to the new UL1741/IEEE 1547
- > 10 yr. standard warranty
- > Improved CEC efficiency
- > Integrated load-break rated DC disconnect switch
- > Integrated fused series string combiner
- > Sealed electronics enclosure & Opticool
- > Comprehensive SMA communications and data collection options
- > Ideal for residential or light commercial applications
- > Rugged cast aluminum outdoor rated enclosure



Sunny Boy 3000 / 4000

The best in their class

SMA is proud to introduce our new line of inverters updated with our latest technology and designed specifically to meet the new IEEE 1547 requirements. Compact design makes them ideal for residential use and the integrated DC disconnect makes installation more cost effective. They are field-configurable for positive ground systems making them more versatile than ever. Increased efficiency means better performance and shorter payback periods. With over 500,000 fielded units, Sunny Boy has become the benchmark for PV inverter performance and reliability throughout the world.

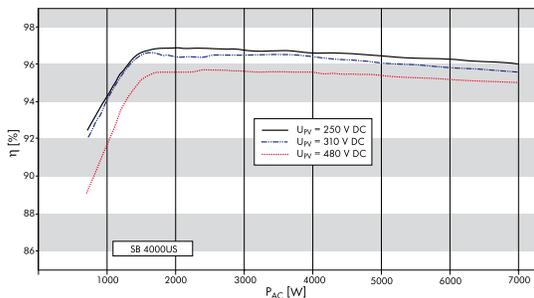


Technical Data

Sunny Boy 3000 / 4000

	SB 3000US	SB 4000US
Input Data (DC)		
Max. Recommended Array Input Power (DC @ STC)	3750 W	5000 W
Max. DC Voltage	500 V	600 V
Peak Power Tracking Voltage	180 - 400 V @ 208 V 200 - 400 V @ 240 V	220 - 480 V @ 208 V 250 - 480 V @ 240 V
DC Max. Input Current	17 A	18 A
DC Voltage Ripple	< 5%	< 5%
Number of Fused String Inputs	4	4
PV Start Voltage (adjustable)	228 V	285 V
Output Data (AC)		
AC Nominal Power	3000 W	3500 W @ 208 V / 4000 W @ 240 V
AC Maximum Output Power	3000 W	4000 W
AC Maximum Output Current	15 A @ 208 V, 12.5 A @ 240 V	17 A @ 208 V, 16.6 A @ 240 V
AC Nominal Voltage / Range	183 - 229 V @ 208 V 211 - 264 V @ 240 V	183 - 229 V @ 208 V 211 - 264 V @ 240 V
AC Frequency / Range	60 Hz / 59.3 Hz - 60.5 Hz	60 Hz / 59.3 Hz - 60.5 Hz
Power Factor	1	1
Efficiency		
Peak Inverter Efficiency	96.6%	96.8%
CEC weighted Efficiency	95.0% @ 208 V 95.5% @ 240 V	95.5% @ 208 V 96.0% @ 240 V
Mechanical Data		
Dimensions W x H x D in inches	17.8 x 13.8 x 9.3	17.8 x 13.8 x 9.3
Weight / Shipping Weight	88 lbs / 94 lbs	88 lbs / 94 lbs
Ambient temperature range	-13 to +113 °F	-13 to +113 °F
Power Consumption: standby / nighttime	< 7 W / 0.1 W	< 7 W / 0.1 W
Topology	PWM, true sinewave, current source	PWM, true sinewave, current source
Cooling Concept	Convection, regulated fan cooling	Convection, regulated fan cooling
Mounting Location Indoor / Outdoor (NEMA 3R)	● / ●	● / ●
Features		
LCD Display	●	●
Lid Color: aluminum / red / blue / yellow	● / ○ / ○ / ○	● / ○ / ○ / ○
Communication: RS485 / Wireless	○ / ○	○ / ○
Warranty: 10-year	●	●
Compliance: IEEE-929, IEEE-1547, UL 1741, UL 1998, FCC Part 15 A & B	●	●
Specifications for nominal conditions	● Included ○ Option – Not available	

Efficiency Curves



www.sma-america.com
 Phone 530-273-4895
 Toll Free 888-4SMAUSA

SMA America, Inc.

Sunny Island 4248U



SMA's new off grid inverter - A technological leap into the future

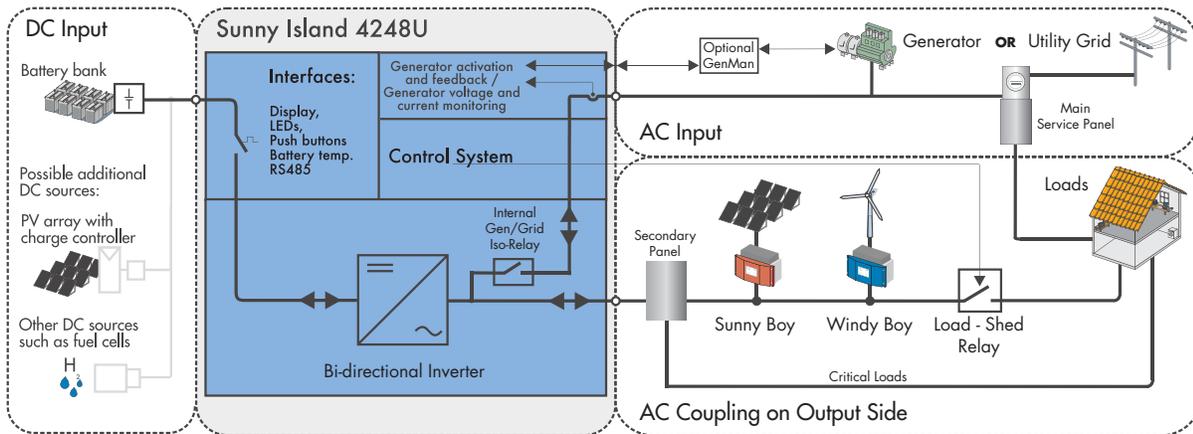


- Optimized for high ambient temperatures
- Very high overload capability
- High efficiency
- Integrated DC breaker
- Intuitive user interface
- Output load shedding
- DC and AC coupling of energy sources
- Nearly silent operation
- Automatic generator start
- Battery protection
- Insect proof
- Easy installation and commissioning
- Non volatile parameter settings
- Compatible with the Sunny Family of products

The new Sunny Island 4248U battery based inverter is the first off-grid inverter from SMA for use in the U.S. Perfect sine wave off-grid electricity is now available with high efficiency, robust power and outstanding reliability. Simple to install and use, yet loaded with powerful and advanced features, the Sunny Island 4248U is designed to meet the needs of off-grid as well as back-up power system applications.

Whenever and wherever electric power is needed, the new Sunny Island 4248U will perform!





The Sunny Island 4248U provides a continuous power output of 4200 watts at 25°C and 3400 watts even at scorching temperatures up to 45°C. That's enough power to comfortably energize most household appliances with power to spare. Large critical loads such as water pumps and refrigerators can be easily powered by the Sunny Island 4248U. This inverter operates silently and can be powered from multiple sources: wind, utility grid (for back-up power), hydro, solar electric and is even compatible with fuel cells. A number of communication options provide flexible remote system monitoring. The optional SMA "GenMan" (Generator Management Box) provides advanced control of even the most basic generators. The Sunny Island 4248U also works in conjunction with grid tied Sunny Boy solar systems to provide a powerful and efficient back up power solution.

The internal battery charger can supply up to 100A to the battery when in charge mode. Transition from charge to invert mode is a lightning fast 20ms, so even your computers will stay on-line. A pass-through relay with a rating of 60A at 120V is also included. Two Sunny Island 4248's may be paralleled to support 240VAC split-phase load centers. Once installed, the Sunny Island 4248U will run with basically no maintenance for years to come. With its state-of-the-art software and non-volatile memory, just set it and forget it.

Technical Data

Electrical / Mechanical data

Nom. Battery Voltage:	V _{DC,nom}	48 V
Battery Voltage Range:	V _{DC}	41 - 63 V
Nom. AC Voltage:	V _{AC,nom}	120 V
AC Voltage Range:	V _{AC}	105 - 132 V
Nom. AC Frequency:	f _{AC,nom}	60 Hz
AC Input Charge Current:	I _{AC,chg}	40A @ 25°C 28A @ 45°C
Max. AC pass through current (transfer relay):		60 A
Consumption (no load operation):		<22 W
Consumption (standby):		<4 W
Total harmonic distortion:		<3 %

Temperature Range

-20°C to +45°C / -4.0°F to +113.0°F

Enclosure: IP30

Weight: 39 kg / 86 lbs

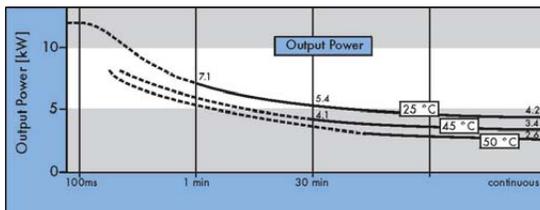
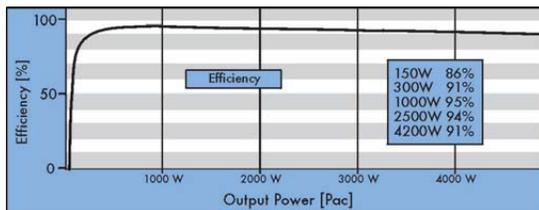
Size: W 390 x L 590 x H 245 millimeters
W 15.35 x L 23.22 x H 9.64 inches

Interfaces

- 2 LEDs; 2-line LCD; 4 push buttons
- 1 dry contact output for load shedding
- 1 dry contact for generator start
- 1 generator-ready opto isolated input

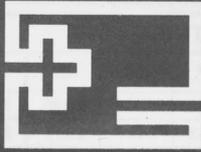
Accessories

- Remote battery temperature sensor (included)
- Generator Management Box (optional)
- 1 RS232/485 galvanic isolated for communication (optional)



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12438 Loma Rica Drive
Grass Valley, CA 95945
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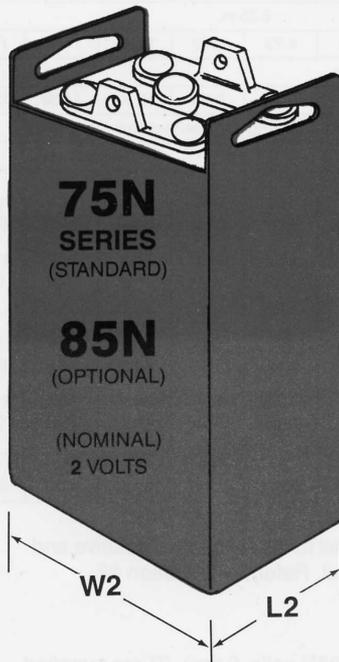
75N CELL BATTERY

• PHOTOVOLTAIC •
POWER SUPPLY

“5 YEAR” LIMITED WARRANTY

STANDARD FEATURES

- Flag type terminals on positive and negative posts for easy installation. A .375 in. diameter hole in each flag for bolting inter-cell connectors (up to 75N-27).
- The cell is high capacity Industrial Type for deep cycle operation and high recovery characteristics.
- Heat Sealed cell cover to eliminate the major source of electrolyte leakage and thereby reducing corrosion build-up.
- Sealing compound around edge of case and cell to reduce the problem of electrolyte starting the corrosion process at edge of steel case.
- Powder Coat Paint is standard. Is highly acid resistant and tough.
- Lifting handles are provided for easy handling and transporting.
- With larger cells, 27 plate and higher, it may be appropriate to supply the steel case with the lift handles located on the long side — opposite from that illustrated.
- Batteries can be discharged to 80% of rated capacity without plate damage. Heavy charging will return battery specific gravity level to approximately 1.275 to 1.285 measured by hydrometer.



ADDITIONAL DATA

- Add distilled water when electrolyte level is low. DO NOT ADD ACID.
- Keep top of battery clean and all hardware free of corrosion — battery life can be extended.
- More than one cell can be placed in one steel case, 75N-9 up to but not to exceed 75N-11.

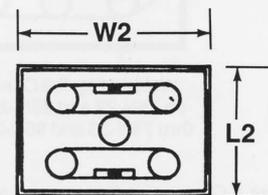
OPTIONAL FEATURES

- Dry charge cells can be provided at additional cost. Consult factory. End user supplies electrolyte.
- Larger DC cables can be provided — additional cost.
- Hydro-caps available through your Photovoltaic Dealer.
- Contact factory for other color painted surface.
- Corrosion resistant surface coating for terminals and hardware can be supplied.

BATTERY CELL CHARACTERISTICS

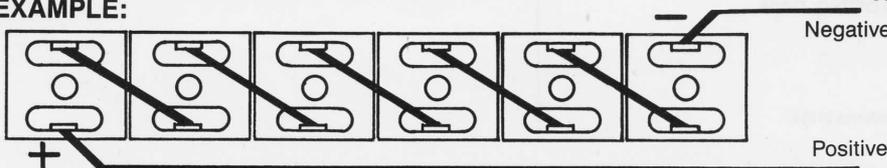
- **INDUSTRIAL LEVEL ANTIMONY** is 6% by weight and is accepted for industrial deep cycling and enhanced recovery. Plate thickness is approximately 43% greater than Low Antimony plates. Industrial Level Antimony is standard.
- Battery capacity ratings are based upon an ambient temperature of 77°F (25°C).
- Cycle Life: 1500 cycles @ 80% depth of Discharge Cycles
5000 cycles @ 20% depth of Discharge Cycles.
- The minimum or final cell voltage is 1.70 VPC.
- Specific Gravity (SG) of a fully charged cell is 1.275-1.285 @ 77°F.
- Minimum cell current leakage is 1.0% to 1.25% per week.

Illustration #1



Flag Terminal connections are used on 75N-9 to 75N-27 and 85N-9 to 85N-27

EXAMPLE:



BATTERY CELL DATA

BATTERY CELL CONFIGURATION AND SPECIFICATIONS														
POSITIVE PLATE SIZE		-9	-11	-13	-15	-17	-19	-21	-23	-25	-27	-29	-31	-33
KWH Cap. @ 6 Hr. Discharge Rate	75N	.582	.728	.873	1.019	1.164	1.310	1.455	1.601	1.764	1.892	2.037	2.183	2.328
	85N	.659	.824	.989	1.154	1.318	1.483	1.648	1.813	1.978	2.142	2.307	2.472	2.637
75N Amp. Hour Capacity Discharge Rates	6 Hr.	300	375	450	525	600	675	750	825	900	975	1050	1125	1200
	20 Hr.	389	461	554	646	738	830	923	1015	1107	1199	1292	1384	1476
	50 Hr.	420	525	630	735	840	945	1050	1155	1260	1365	1470	1575	1680
	100 Hr.	450	563	675	788	900	1012	1125	1238	1350	1462	1575	1688	1800
85N Amp. Hour Capacity Discharge Rates	6 Hr.	340	425	510	595	680	765	850	935	1020	1105	1190	1275	1360
	20 Hr.	418	523	627	732	836	941	1046	1150	1255	1359	1464	1568	1673
	50 Hr.	476	595	714	833	952	1071	1190	1309	1428	1547	1666	1785	1904
	100 Hr.	510	638	765	892	1020	1148	1275	1402	1530	1658	1785	1912	2040
Single Cell Jar Size	L1	6.19 in.						6.25 in.						
	W1	3.50	4.25	5.00	5.75	6.50	7.25	8.00	8.75	9.50	10.25	11.00	11.75	12.50
Single Cell Steel Case Dim.	L2	6.62 in.												
	W2	3.88	4.62	5.38	6.12	6.88	7.62	8.38	9.12	9.88	10.62	11.38	12.12	12.88
Steel Case Height	24.0" with Flag Terminals or 23.0" with Pig-Tail Connections													
Cable Size	#2 AWG					#1/0 AWG				#2/0 AWG				
Cell Weight With Steel Case	75N	77 (Lbs)	82 (Lbs)	90 (Lbs)	104 (Lbs)	118 (Lbs)	128 (Lbs)	150 (Lbs)	162 (Lbs)	176 (Lbs)	190 (Lbs)	204 (Lbs)	220 (Lbs)	236 (Lbs)
		35.0 (Kg)	37.3 (Kg)	41.0 (Kg)	47.3 (Kg)	53.6 (Kg)	58.2 (Kg)	68.2 (Kg)	73.6 (Kg)	80.0 (Kg)	86.4 (Kg)	92.7 (Kg)	100.0 (Kg)	107.3 (Kg)
	85N	80 (Lbs)	85 (Lbs)	95 (Lbs)	112 (Lbs)	128 (Lbs)	136 (Lbs)	158 (Lbs)	170 (Lbs)	184 (Lbs)	198 (Lbs)	214 (Lbs)	228 (Lbs)	242 (Lbs)
		36.4 (Kg)	38.6 (Kg)	43.2 (Kg)	50.9 (Kg)	58.2 (Kg)	61.8 (Kg)	71.8 (Kg)	77.3 (Kg)	83.6 (Kg)	90.0 (Kg)	97.3 (Kg)	103.6 (Kg)	110.0 (Kg)
Steel Case Weight	10 (Lbs)	12 (Lbs)	15 (Lbs)	19 (Lbs)	24 (Lbs)	26 (Lbs)	28 (Lbs)	30 (Lbs)	32 (Lbs)	34 (Lbs)	36 (Lbs)	38 (Lbs)	40 (Lbs)	

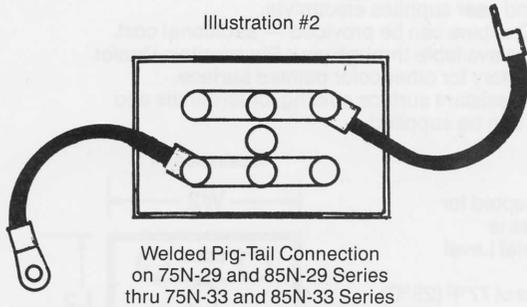
Welded Pig-Tails are directly connected for each adjacent cell to the respective positive and negative terminals. A crimp type lug is affixed to each Pig-Tail. Refer to illustration #2.

NOTE:

All 75N and 85N cells -9 thru -27 are supplied without inter-cell connectors and hardware.

All 75N and 85N cells -29 thru -33 are standard with welded Pig-Tails. No connecting hardware is supplied. It is recommended a coating of a corrosion resistant spray be applied to all crimp lug connections.

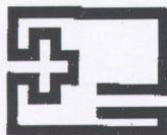
Remove insulating tape from each crimp lug before connecting to the adjacent cells.



Where a Generator-Set is used as a prime power source or back-up system to a Solar Panel Bank, an IBE GPU Battery Charger should be considered to recharge the battery bank.



Gaiam Energy Tech dba
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INDUSTRIAL
BATTERY
ENGINEERING
INC.

MATERIAL SAFETY DATA SHEET

MANUFACTURER
Industrial Battery Engineering, Inc.
9121 De Garmo Avenue
Sun Valley, CA 91352

For Emergency
CHEMTREC (800) 424-9300
24-Hour Emergency Response Contact
Ask for Environmental Coordinator

FOR INFORMATION
818 767-7067
Derek Sloan, Environmental, Safety & Health

Section 1. Manufacturer Product Identification

Product Name or Number	Lead/Acid Storage Battery
Synonyms	Lead/Acid Storage Forklift Battery
Chemical/Trade Name	Lead Acid
Chemical Family:	Toxic & Corrosive Material
Regulated	DOT Proper Shipping Name: Batteries, Electric Storage, Wet Filled with Acid 8
Identification	Shipping ID Number: UN 2794, Pg111, NMFC #60720, Class 70
EPA Hazardous Waste ID Number:	N/A

Section 2. Hazardous Ingredients Data

Hazardous Ingredients	T.L.V.	%	Cas Number
Lead/Lead Oxide/Lead Sulfate	0.05 mg/m ³	60	7439-92-1
Antimony	0.5 mg/m ³	1-5	7440-36-0
Arsenic	0.01 mg/m ³	< 1	7440-38-2
Sulfuric Acid	1.0 mg/m ³	10-30	7664-93-9
Case Material/Steel			
Plate Separator: Polypropylene			9002-884

NOTE: Inorganic lead and electrolyte (water and sulfuric acid solution) are the primary components of every battery manufactured by Industrial Battery Engineering Inc.

Section 3. Physical Hazard Data

Flammability in air	LFL 4.0 %	LFL 74.2	Flash Point	N/A	°F	°C
Stability	Stable	<input checked="" type="checkbox"/>	Conditions to Avoid: Overcharging & smoking, or sparks near battery surface may cause explosion.			
	Unstable	<input type="checkbox"/>				
Hazardous Polymerization	Will not occur when handled per instructions					
Incompatibility	Materials to avoid: Combustibles, organic materials, and strong reducing agents.					

IBE 9121 DeGarmo Avenue, Sun Valley, California 91352 • (818) 767-7067 FAX (818) 767-7173
Internet <http://www.ibe-inc.com>

Section 4. Hazard Specifications

Known Hazards Under 29 CFR 1910.1200					TLV See Above	
	Y	N		Y	N	ppm mg/m ³
Combustible Liquid		<input checked="" type="checkbox"/>	Skin Hazard	<input checked="" type="checkbox"/>		PEL ppm mg/m ³
Flammable Material		<input checked="" type="checkbox"/>	Eye Hazard	<input checked="" type="checkbox"/>		NFPA Hazard Signal
Pyrophoric Material		<input checked="" type="checkbox"/>	Toxic Agent	<input checked="" type="checkbox"/>		Health 3 Flammability 0
Explosive Material		<input checked="" type="checkbox"/>	Sensitize		<input checked="" type="checkbox"/>	Stability 0 Special Reactivity 2
Unstable Material		<input checked="" type="checkbox"/>	Carcinogen		<input checked="" type="checkbox"/>	
Water Reactive Material		<input checked="" type="checkbox"/>	Reproductive Toxin		<input checked="" type="checkbox"/>	DOT Hazard Class
Oxidizer		<input checked="" type="checkbox"/>	Blood Toxin		<input checked="" type="checkbox"/>	Corrosive Material (8)
Organic Peroxide		<input checked="" type="checkbox"/>	Nervous System Toxin		<input checked="" type="checkbox"/>	
Corrosive Material	<input checked="" type="checkbox"/>		Lung Toxin	<input checked="" type="checkbox"/>		EPA Hazard Waste Class
Compressed Gas		<input checked="" type="checkbox"/>	Kidney Toxin	<input checked="" type="checkbox"/>		D002 Corrosive Characteristics
Irritant	<input checked="" type="checkbox"/>		Liver Toxin	<input checked="" type="checkbox"/>		D008 Lead Bearing Waste

Section 5. Health Hazard Data

Effects of Exposure.	
Eyes:	Severe burns, cornea damage and blindness
Skin:	Severe irritation, burns, ulceration
Inhalation:	Breathing of vapors or mists may cause respiratory damage
Ingestion:	Burns of mouth, throat, and intestinal track
Entry Route	Eyes <input checked="" type="checkbox"/> Skin <input checked="" type="checkbox"/> Inhale <input checked="" type="checkbox"/> Ingest <input checked="" type="checkbox"/>
*** No possibility of over exposure to lead etc., unless battery is destroyed***	

Section 6. Safe Usage Data

Protective Equipment Types	Eyes:	Goggles
	Respirator:	Sulfuric Acid Mist – Half mask with dust and acid mist filter
	Gloves:	Rubber Gloves
	Other:	Rubber Plastic apron
Ventilation	General Mechanical:	Acceptable at 1 to 4 changes per hour.
	Local Exhaust:	Preferred
Precautions	Handling and Storage	Keep away from flames during and immediately after charging
	Other:	Avoid overcharging

IBE 9121 DeGarmo Avenue, Sun Valley, California 91352 • (818) 767-7067 FAX (818) 767-7173
 Internet <http://www.ibe-inc.com>

Section 7. Emergency Treatment and Response Data

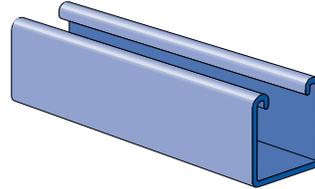
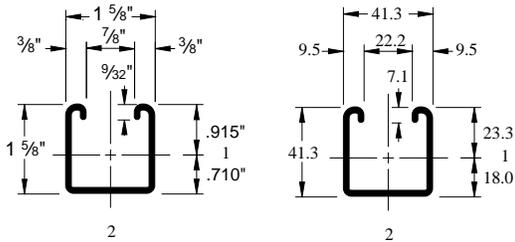
Fire	Extinguishing Media
	Special Procedures: Halon or Dry Chemical
	Unusual Hazards: Hydrogen gas and sulfuric acid vapors are generated upon overcharge. Ventilate Charging area.
Exposure	First Aid Measures:
	Eyes: Wash the eyes with copious quantities of running water for 15 minutes.
	Skin: Flush area with plentiful amounts of running water.
Spills	Ingestion: Give milk to drink, DO NOT induce vomiting, CALL PHYSICIAN
	Steps to be taken: Wash with water or neutralize with sodium carbonate or bicarbonate
No#	Waste Disposal Method: Neutralize with sodium carbonate or bicarbonate and comply with all State, Federal, and Local regulations.

Section 8. Physical and Chemical Properties

Boiling Pt.	Approx. 203°F	Vapor Density	Greater Than 1	Volatile Components
Vapor Press	10% @ 18°F			
Solubility in H ₂ O	100%	Will Dissolve In		Evaporation Rate
Appearance		Clear Liquid		Is Material: Paste Powder Solid <input checked="" type="checkbox"/> Liquid XXX Gas
Odor		Sharp, penetrating pungent odor		

P1000

Wt/100 Ft: 190 Lbs (283 kg/100 m)
 Allowable Moment 5,080 In-Lbs (570 N•m)
 12 Gauge Nominal Thickness .105" (2.7mm)



Channel Finishes:
 PL, GR, HG, PG;
 Standard Lengths:
 10' & 20'

COLUMN LOADING – P1000

Unbraced Height In	Maximum Allowable Load at Slot Face Lbs	Maximum Column Load Applied at C.G.			
		K = 0.65 Lbs	K = 0.80 Lbs	K = 1.0 Lbs	K = 1.2 Lbs
24	3,450	10,750	9,900	8,770	7,730
36	3,050	8,910	7,730	6,370	5,280
48	2,660	7,250	5,980	4,660	3,770
60	2,290	5,890	4,660	3,600	2,940
72	2,000	4,800	3,770	2,940	2,380
84	1,760	4,010	3,170	2,460	1,970
96	1,570	3,450	2,730	2,090	1,650
108	1,410	3,020	2,380	1,800	**
120	1,270	2,680	2,090	**	**

BEAM LOADING – P1000

Span In	Max Allowable Uniform Load Lbs	Defl. at Uniform Load In	Uniform Loading at Deflection		
			Span/180 Lbs	Span/240 Lbs	Span/360 Lbs
24	1,690	0.06	1,690	1,690	1,690
36	1,130	0.13	1,130	1,130	900
48	850	0.22	850	760	510
60	680	0.35	650	490	320
72	560	0.50	450	340	220
84	480	0.68	330	250	170
96	420	0.89	250	190	130
108	380	1.13	200	150	100
120	340	1.40	160	120	80
144	280	2.01	110	80	60
168	240	2.74	80	60	40
192	210	3.57	60	50	NR
216	190	4.52	50	40	NR
240	170	5.58	40	NR	NR

MATERIAL

Unistrut channels are accurately and carefully cold formed to size from low-carbon strip steel. All spot-welded combination members, except P1001T, are welded 3" (76 mm) maximum on center.

STEEL: PLAIN

12 Ga. (2.7 mm), 14 Ga. (1.9 mm) and 16 Ga. (1.5 mm)
 ASTM A1011 GR33

STEEL: PRE-GALVANIZED

12 Ga. (2.7 mm), 14 Ga. (1.9 mm) and 16 Ga. (1.5mm)
 ASTM A653 GR 33

For other materials, see Special Metals or Fiberglass sections.

FINISHES

All channels are available in:

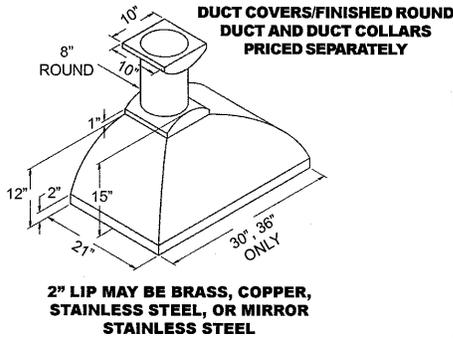
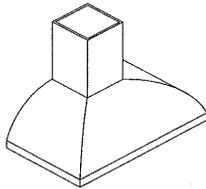
- Perma Green II (GR)
- Pre-galvanized (PG), conforming to ASTM A653 G90
- Hot-dipped galvanized (HG), conforming to ASTM A123
- Plain (PL)

Project: _____	Approval Stamp:
Architect / Engineer: _____	
Date: _____ Phone: _____	
Contractor: _____	
Address: _____	
Notes 1: _____	
Notes 2: _____	

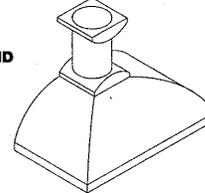
VentA Hood® WALL MOUNT RANGE HOOD SPECIFICATIONS

XLH12 Equipped with halogen lighting. This model not available with heat lamps. Only available in stainless steel. Optional duct covers/finished duct available in standard and custom sizes (sold separately).

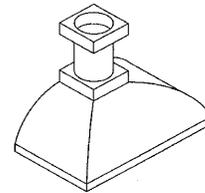
HOOD WITH OPTIONAL 10" X 10" DUCT COVER



XLH12

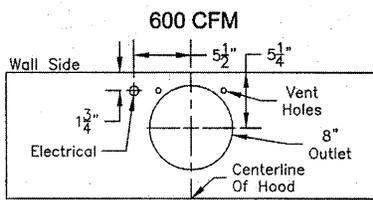


HOOD WITH OPTIONAL ROUND DUCT COLLARS AND FINISHED ROUND DUCT

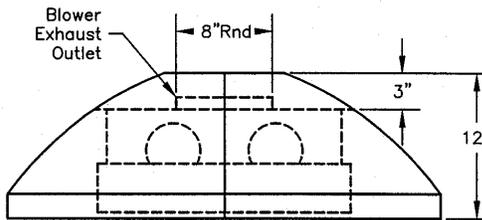


HOOD WITH OPTIONAL SQUARE DUCT COLLARS AND FINISHED ROUND DUCT

Connection Diagram (30", 36" Width)

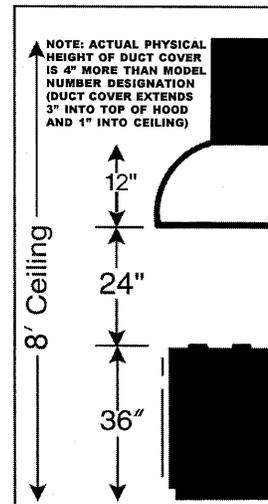


(Top View)



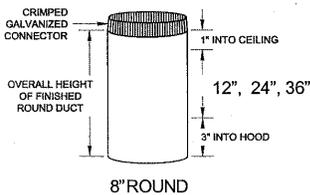
(Front View)

Recommended Mounting Height*



*Exceeding recommended mounting height may compromise performance.

FINISHED ROUND DUCT (REQUIRES TWO DUCT COLLARS)



NOTE: TOP END OF FINISHED ROUND DUCT IS CRIMPED TO ALLOW FOR DUCT CONNECTION IN THE CEILING (CRIMP IS NOT INCLUDED IN THE OVERALL HEIGHT OF THE FINISHED ROUND DUCT)

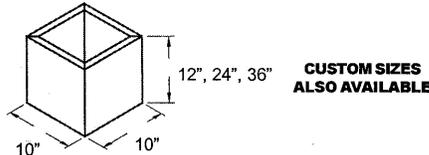
NOTE: OVERALL PHYSICAL HEIGHT OF FINISHED ROUND DUCT IS 4" MORE THAN MODEL NUMBER DESIGNATION (FINISHED ROUND DUCT EXTENDS 3" INTO TOP OF HOOD AND 1" INTO CEILING)

NOTE: WHEN PRICING CUSTOM FINISHED ROUND DUCT, INCLUDE THE 3" THAT EXTENDS INTO TOP OF HOOD AND 1" THAT EXTENDS INTO CEILING (4" TOTAL.) TOTAL OVERALL HEIGHT CANNOT EXCEED 48" (9' 8" CEILING)

ROUND DUCT COLLAR SQUARE DUCT COLLAR



SQUARE DUCT COVER



Electrical/Mechanical Specifications For Blower Unit

Model	Type	Volts	Amps	HZ	RPM	CFM SP@.0"	Equivalent CFM	CFM SP@.1"	CFM SP@.2"	CFM SP@.3"	Minimum Round Duct Size	Square Inches
B200 Dual	(2) Shaded Pole	115	3.4*	60	1550	600	900	572	540	480	8" (or equivalent)	50

●Note: Add .5 amp for each halogen bulb. Equivalent CFM refers to the fact that the Magic Lung blower uses centrifugal filtration units, whereas others use conventional filters. Apply this guideline when comparing blower units made by other manufacturers. Hood is only available with 2 halogen lights.

SPECIFICATIONS SUBJECT TO CHANGE WITHOUT NOTICE Rev. 05/07

SPECS / DIMENSIONS



**CM301BS
30" CM STAINLESS STEEL SINGLE CONVECTION MICROWAVE SPEEDCOOKING
OVEN WITH ROBUST HANDLE**

PRINT

GENERAL INFORMATION

Approximate Shipping Weight (LBS.) 240
 Approvals US

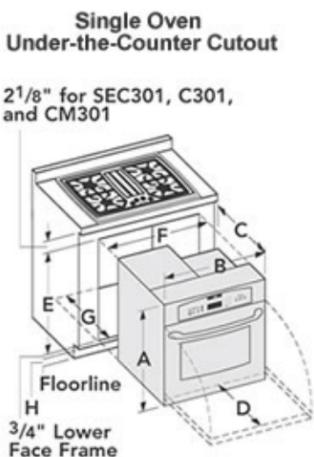
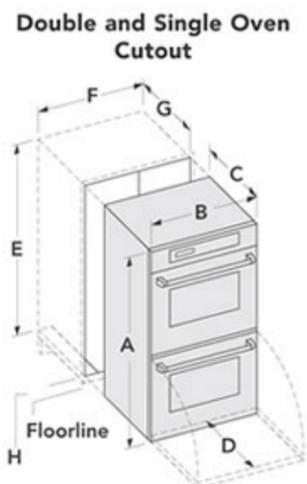
TECHNICAL INFORMATION

Microwave Wattage 650
 Broil/Bake Wattage 3,600 / 2,300
 Third Element Wattage 2750
 AMPS 40
 Dual-Rated 120/208-240 Volts, 4-Wire, 60HZ ✓

DIMENSIONS (INCHES)

Microwave Dimensions - A 28 5/8
 Microwave Dimensions - B 29 3/4
 Microwave Dimensions - C 23 7/8
 Trim Kit Dimensions - D** 22
 Cutout Dimensions* E 28-1/4"
 Cutout Dimensions* F 28-1/2"
 Cutout Dimensions* G 24
 Cutout Dimensions* H 4-3/4" to 31-3/8"
 Door Handle Projection **** 3-3/4"
 Upper / Single Oven Interior Dimensions - Height 16 1/4
 Upper / Single Oven Interior Dimensions - Width 25
 Upper / Single Oven Interior Dimensions - Depth 17 1/2

Diagrams



[Click Here to View Features](#)

PRINT **CLOSE** **EMAIL**



Approved by:



Diva de Provence
885 Don Mills Road, Suite 207
Toronto, Ontario
M3C 1V9
Canada
Tel: (416) 256-2646
Fax: (416) 256-7121

Quick Installation Guide - DDP-4

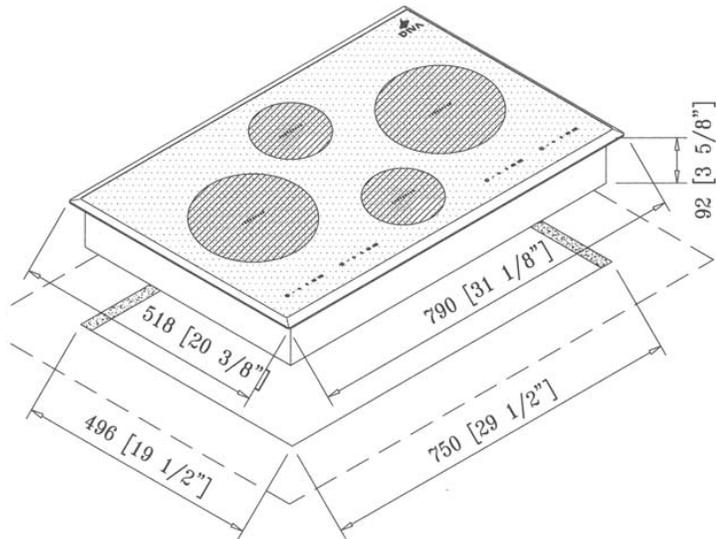
To install the unit, create a cut-out in your countertop following the dimensions given on the drawing and the table below.

This cooktop must be installed in accordance with pertaining local building, trade, fire protection and electrical codes. If local codes do not exist, then installation must be done in accordance with federal codes.

The cooktop is to be connected - hard-wired - to the electrical power supply inside a client-supplied junction box which should be installed inside the cabinet below the unit.

The unit must be properly grounded.

This cooktop is to be installed under a ventilation hood or a downdraft ventilation system.



DDP-4 electrical characteristics are:

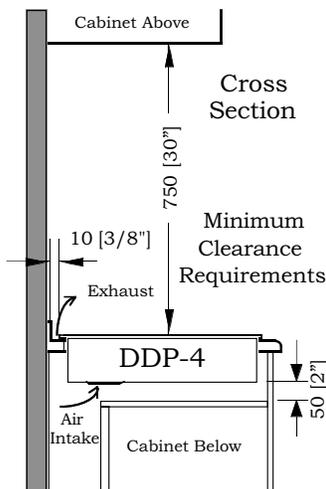
Operating voltage ... 240 V~ 60 Hz

Total power ... 7200 W

**Connect to ... 240 V, 60 Hz, 2 Pole+G,
40 A supply
(3 wire #8 AWG)**

Cooktop and Cut-out Sizes	Width	Depth	Thickness
Cut-out Size	750 mm [29 1/2"]	496 mm [19 1/2"]	142 mm* [5 5/8"]*
Cooktop Box Size	743 mm [29 1/4"]	488 mm [19 7/32"]	92 mm [3 5/8"]
Cooktop Rim Size	790 mm [31 1/8"]	518 mm [20 3/8"]	10 mm [25/64"]

*This dimension includes clearance underneath the unit of 50 mm [2"]



Clearance

You should keep:

- **In the back of your unit** - between the unit and any vertical surface: minimum clearance of **10 mm (3/8")**;

- **If a downdraft ventilation system is used** - between the unit and the downdraft snorkel: minimum clearance of **6 mm (1/4")**;

- **Above the unit to any combustible surface** - e.g. cabinet above the unit: minimum clearance of **750 mm (30")**;

- **Below the unit** - between the bottom of the unit and any horizontal partition inside your cabinet: minimum clearance of **50 mm (2")**.

Close

Specs/Dimensions



Product Information

Product Category	Axxis®
Product Series	Axxis Vented Dryers
Product Name	Axxis Vented Dryer
Model Number	WTA4410US
Color	White
Also available in	-

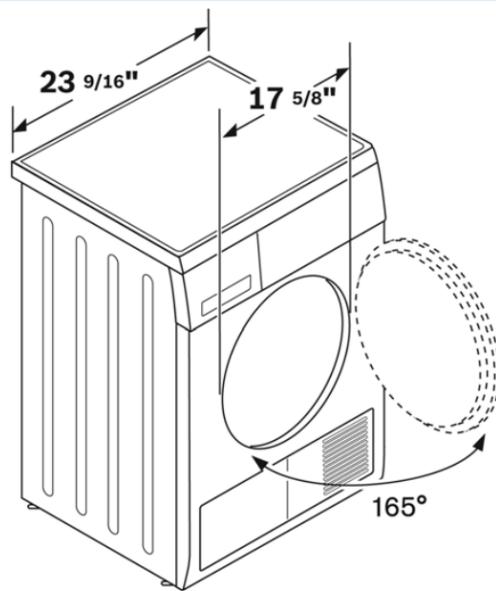
Silence Rating

dB	67
----	----

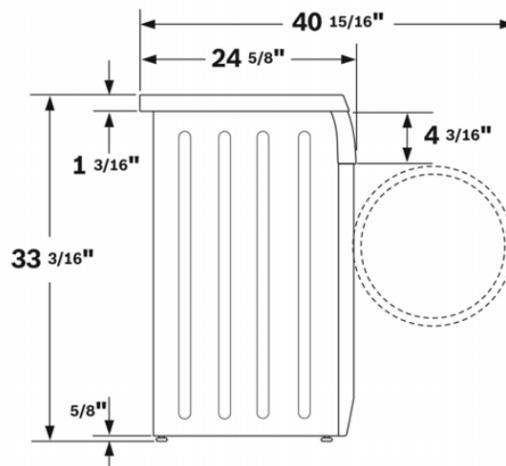
Technical Data

Supply Voltage	208/240V
Frequency	60Hz
Amperage	15A
UL	UL Listed
CFM	96

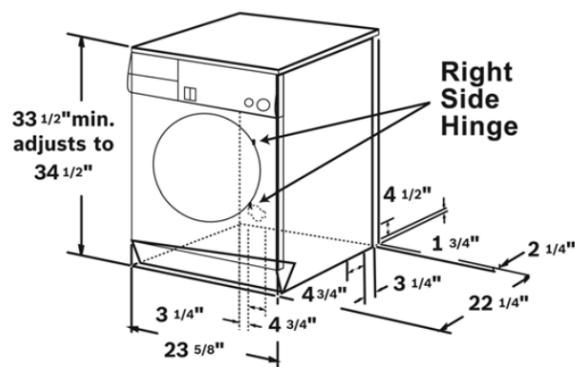
Dimensions



Click Image for Full Size



Click Image for Full Size



Click Image for Full Size

Special Notes

Stacked installation height: 67". Height with optional Stacking Kit accessory WTZ1180UC: 68-9/16"

Dimensions are for planning only. For details, see installation manual. Specifications subject to change without notice.

UL and CUL listed.

[Click Here to View Features](#)

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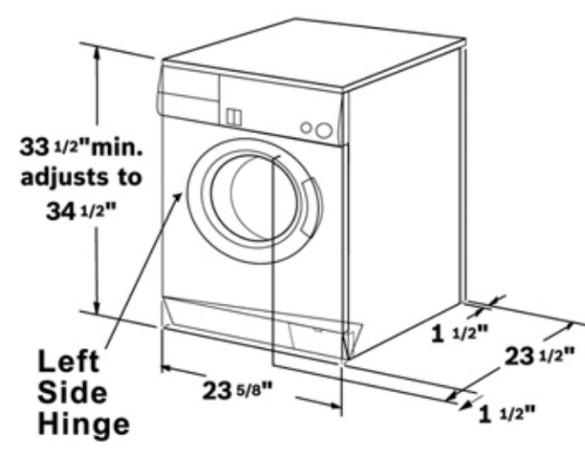
Close

Specs/Dimensions



Product Information	
Product Category	Axxis Washers
Product Series	Axxis
Product Name	Axxis Washer
Model Number	WFL2090UC
Color	White
Also available in	-
Core Features	
Drum Capacity (IEC)	2.1
Spin Speed	Up to 1000
Silence Rating	
dB	56dB
Water & Energy Efficiency	
Energy Usage	121 kWh
Annual Water Usage (Gallons)	4,755
ENERGY STAR® Qualified	✓
Technical Data	
Supply Voltage	120V
Frequency	60Hz
Amperage	15A
Heating	1800W
UL	UL Listed

Dimensions



Click Image for Full Size

Special Notes

All models are 100% quality tested.

Stacked installation height: 67". Height with optional Stacking Kit accessory WTZ1180: 68-9/16"

If installed with a Bosch dryer, refer to dryer electrical requirements.

Dimensions are for planning only. For details, see installation manual. Specifications subject to change without notice.

UL and CUL listed.

[Click Here to View Features](#)

Lighting Specifications

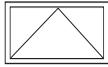
Milgard



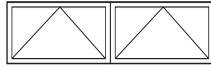
5421 Awning Windows

5000

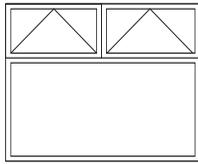
SERIES
CLASSIC VINYL



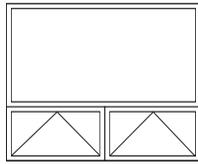
Full awning



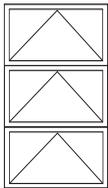
Double awning



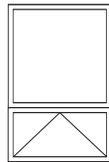
Double-top awning



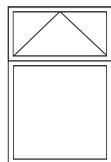
Double-bottom awning



Triple awning



Bottom awning



Top awning

FULL AWNING

- Min 1°1'
- Max 4°3'

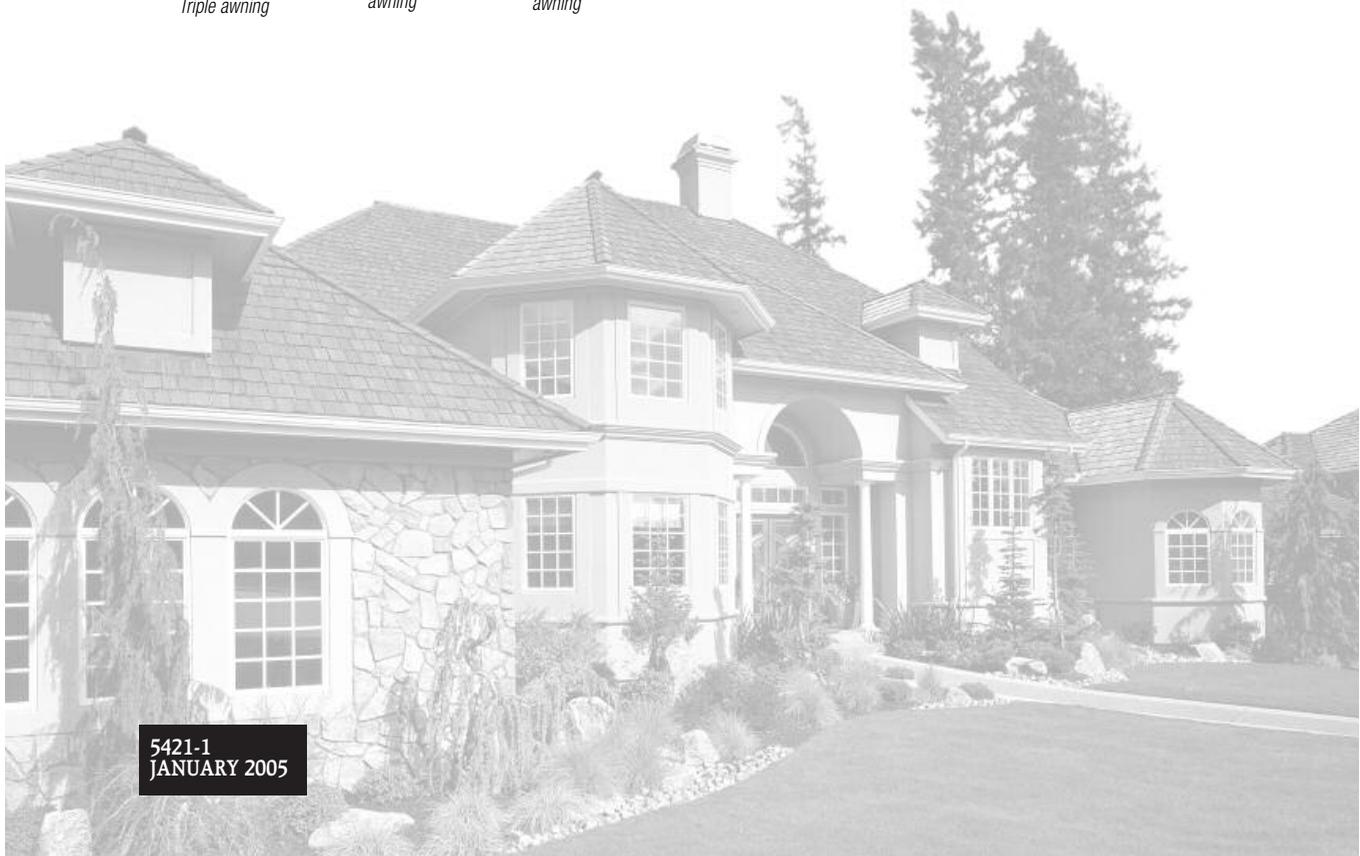
DOUBLE AWNING

- Min 3°1'
- Max 9°3'

No egress for awning.

NOTE: For engineering approval contact your Milgard representative for any configuration over 40 square feet. Each Milgard Manufacturing plant reserves the right to alter or change sizes and configurations according to location capabilities. Ask your Milgard rep about specialty applications.

Windows over 40 square feet shipped open for field glazing. Varies by location.



5421-1
JANUARY 2005

Milgard



5421 Awning Windows

5000
SERIES
CLASSIC VINYL



The 5421 series vinyl (PVC) Awning Windows offer the outstanding insulating properties, low maintenance, and contemporary aesthetic appeal only vinyl can provide. Available in White and Tan homogenous window frames, the 5421's durable vinyl exterior will never need painting. The windows will maintain their color and shape and can be constructed to your exact size specifications, subject to review.

Like all Milgard windows, doors and skylights, the 5421 carries a Lifetime Guarantee to the original single family homeowner covering both materials and labor.

Commercial and apartment projects are covered by a 10-year warranty from date of manufacture, covering all materials and labor, including the glazing unit.

CONFIGURATIONS

The 5421 series is designed as an awning window (the vent is hinged at the top and swings outward from the bottom). Awning windows can be used alone or in tandem with other Milgard vinyl windows for virtually any design.

COMPONENTS

FRAME

Frame components are made from high performance polyvinyl chloride, available in White and Tan window frames. The 5421 series are designed to offer outstanding visual appeal and low maintenance, mitered corners are precision welded resulting in an air and water tight seal. Standard frame depth is 3-3/8", ideal for both new construction and for use as a replacement window.

5421-2
JANUARY 2005

Milgard



5421 Awning Windows

5000
SERIES
CLASSIC VINYL

NAIL-ON FIN

A 1-1/16" pre-punched nail flange extends around the perimeter frame, securing the window in rough openings and acting as a part of the flashing system. The nailing fin may be removed as needed for particular replacement window block frame applications. Fin setbacks are available in 1-3/8" from outside of frame; also in 1" (5431 series) for our SW locations using 3 coat stucco applications (not available at all locations).

WEEP SYSTEM

Hollow sill construction and offset weep baffles release any accumulated moisture.

GLAZING MATERIAL

AAMA approved glazing tape adheres glass to the fixed panel and vent frame and seals and cushions the glass. Rigid vinyl setting blocks are used to support the unit above the sill, preventing glass slippage. Extruded vinyl glazing (snap-in) bead is applied around the interior edge. "Interior glazing" makes replacement of glazing unit convenient, and provides equal exterior sight lines.

GLASS

Insulating dual glazed panes, 1" in overall thickness, are butyl sealed for energy efficiency. Specialty glass options are available upon request.

STAIRSTEP WEATHERSTRIPPING

Two flexible PVC leaf seal on the vent panel providing a weather-tight seal.

OPERATING HARDWARE

Operator arms are plated with e-guard for long life and durability. Stainless steel option available.

LOCKING ASSEMBLY

A multi-point locking mechanism provides added security and a tight seal.

SCREEN

Screen frames are cambered aluminum, reinforced with rigid plastic corner clips. Screens come standard with matching frame color. The fiberglass charcoal screen mesh is strong, durable and easy to replace. Four concealed screen clips mount screen flush with perimeter frame.

OPTIONS

GRIDS

Available in 5/8" flat or 1-1/16" sculptured aluminum profiles sealed between panes. Color-matched to frame.

DRAPERY OPERATOR HANDLE

A low profile operator is available for applications involving interior shutters, mini blinds or similar treatments. Folding handle option is available.

GLASS

Refer to glass section.

Many more options are available. Please check with your Milgard Representative.

TEST STANDARDS

See Test Reports/Energy Ratings section.

Caution:

The use of petroleum based fuels or solvents as release agents in stucco wall installations or glass cleaning will chemically attack materials used in seals and other components, and voids the Milgard Guarantee. The use of wax based release agents is recommended.

Expanding foam for insulation purposes should not be used.

Loose packed batt insulation is recommended.

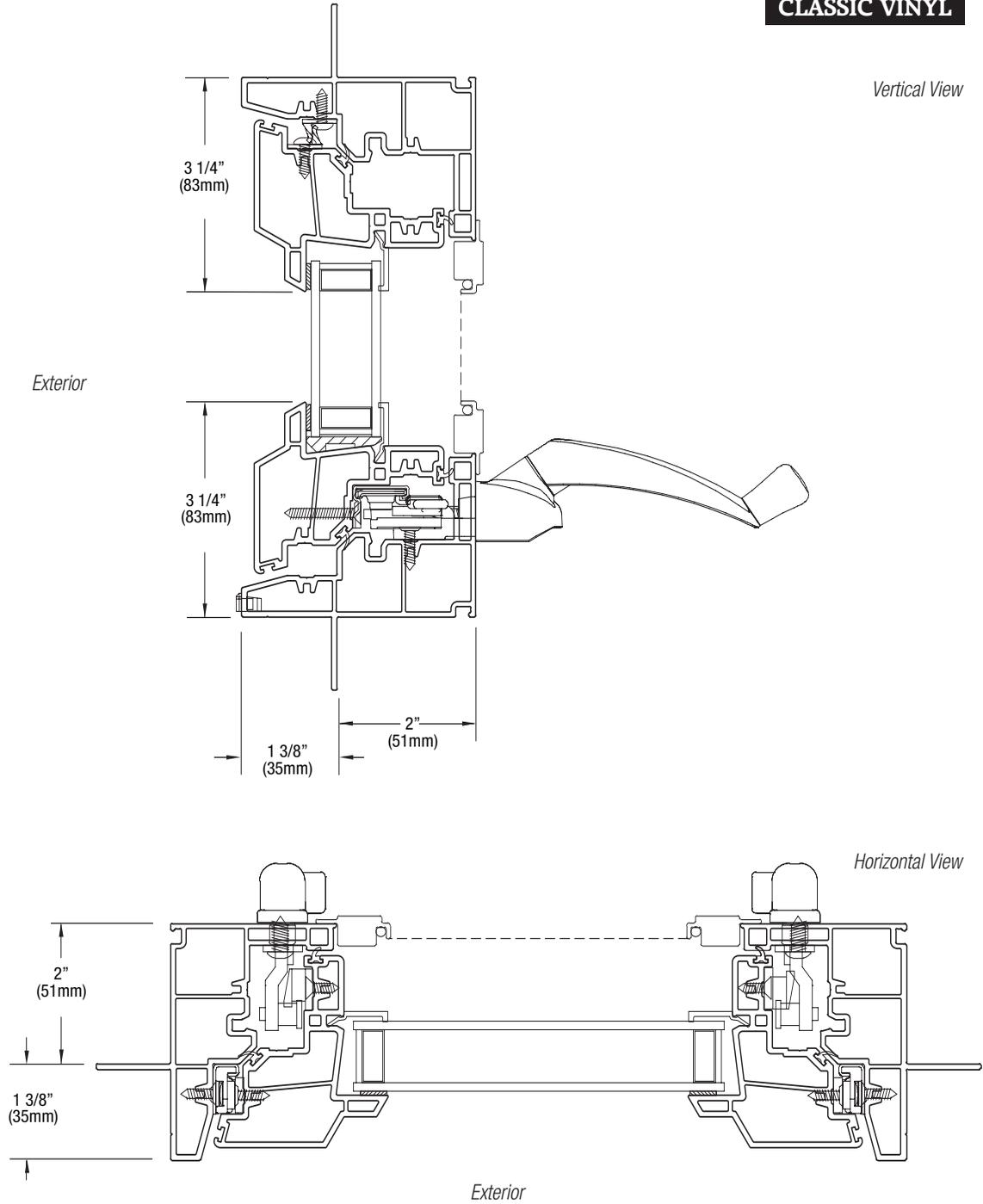
5421-3
JANUARY 2005

Milgard



5421 Assembly Drawing

5000
SERIES
CLASSIC VINYL



Scale: 6" = 1' (1/2 scale)

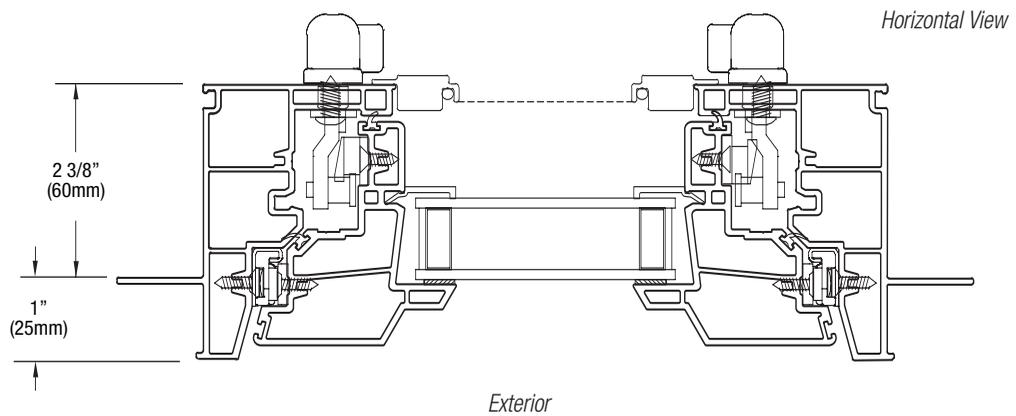
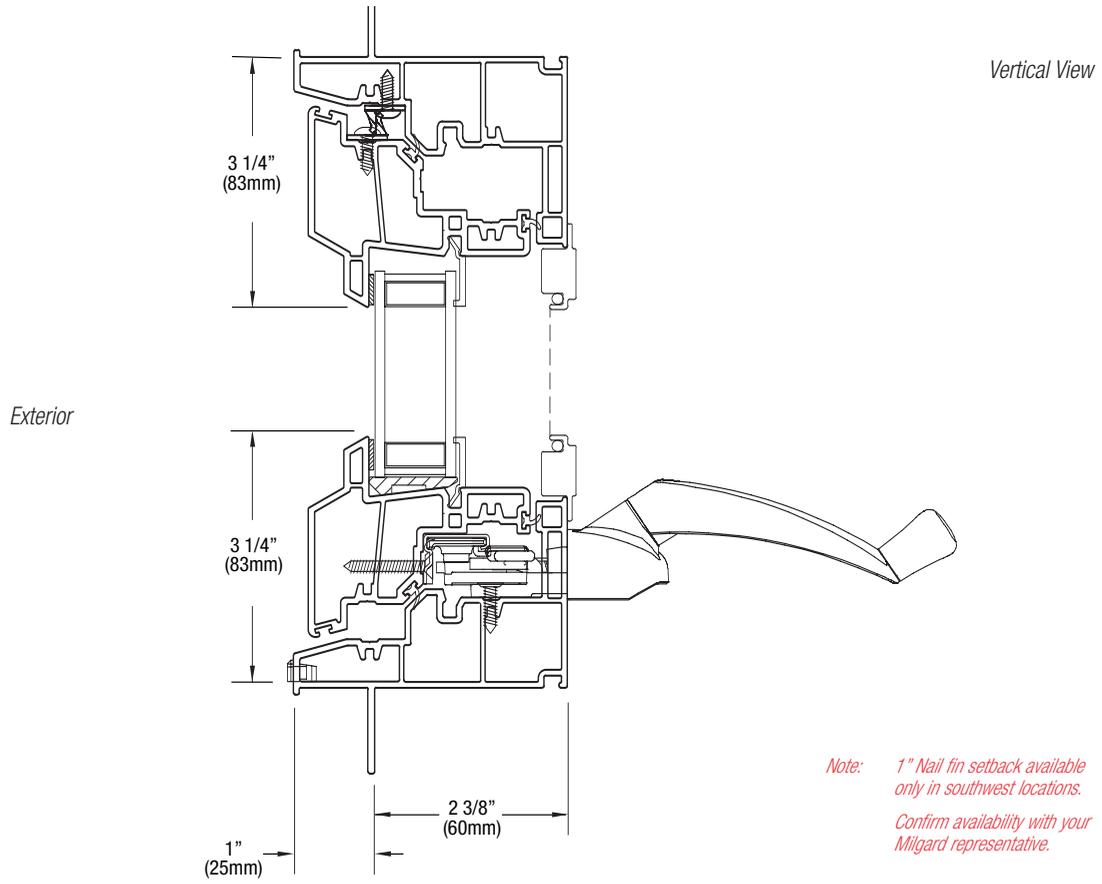
Due to continual product research and development, details may be changed at any time. ©2004
Products shown are not available at all locations – confirm availability with your local Milgard representative.

5421-4
JANUARY 2005

Milgard



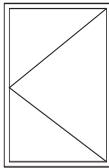
5000
SERIES
CLASSIC VINYL



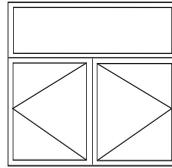
5421-5
JANUARY 2005

Scale: 6" = 1' (1/2 scale)

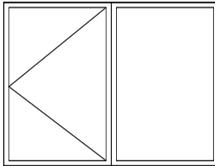
Due to continual product research and development, details may be changed at any time. ©2004 Products shown are not available at all locations – confirm availability with your local Milgard representative.



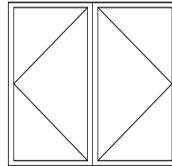
Full casement



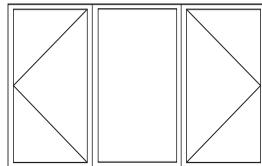
Double-bottom casement



Single casement



Double casement



Double casement/picture

FULL CASEMENT

- Min 1'1" Max 3'5" or 2'6"

DOUBLE CASEMENT

- Min 3'1" Max 6'5" or 5'6"

DOUBLE CASEMENT W/ PICTURE

- Min 4'1" Max 12'6" with 30" vent set
- Maximum vent size is 15 square feet
- Minimum egress for casement is 2'13" or 2'4"
- 18" height and width required for rotary hardware

NOTE: For engineering approval contact your Milgard representative for any configuration over 40 square feet. Each Milgard Manufacturing plant reserves the right to alter or change sizes and configurations according to location capabilities. Ask your Milgard rep about specialty applications.

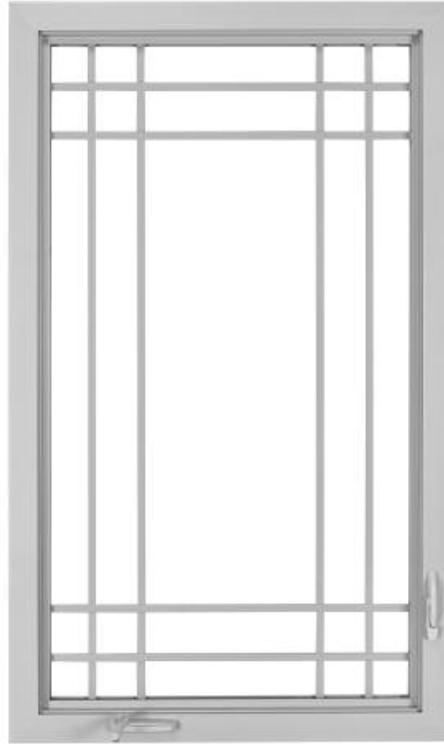
Windows over 40 square feet shipped open for field glazing. Varies by location.

Milgard



5521 Casement Windows

5000
SERIES
CLASSIC VINYL



The 5521 series vinyl (PVC) Casement Windows offer the outstanding insulating properties, low maintenance, and contemporary aesthetic appeal only vinyl can provide. Available in White and Tan homogenous window frames, the 5521's durable vinyl exterior will never need painting. The windows will maintain their color and shape and can be constructed to your exact size specifications, subject to review.

Like all Milgard windows, doors and skylights, the 5521 Series carries a Lifetime Guarantee to the original single family homeowner covering both materials and labor.

Commercial and apartment projects are covered by a 10-year warranty from date of manufacture, covering all materials and labor, including the glazing unit.

CONFIGURATIONS

The 5521 series is designed as a casement window (swinging outward like a door frame hinge on right or left side). Casement windows can be used alone or in tandem with other Milgard vinyl windows for virtually any design specification.

COMPONENTS

FRAME

Frame components are made from high performance polyvinyl chloride, available in White and Tan window frames. The 5521 series are designed to offer outstanding visual appeal and low maintenance, mitered corners are precision welded resulting in an air and water tight seal. Standard frame depth is 3-3/8", ideal for both new construction and for use as a replacement window.

5521-2
JANUARY 2005



5521 Casement Windows

5000
SERIES
CLASSIC VINYL

NAIL-ON FIN

A 1-1/16" pre-punched nail flange extends around the perimeter frame, securing the window in rough openings and acting as a part of the flashing system. The nailing fin may be removed as needed for particular replacement window block frame applications. Fin setbacks are available in 1-3/8" from outside of frame; also in 1" (5531 series) for our SW locations using 3 coat stucco applications (not available at all locations).

WEEP SYSTEM

Hollow sill construction and offset weep baffles release any accumulated moisture.

GLAZING MATERIAL

AAMA approved glazing tape adheres glass to the fixed panel and vent frame and seals and cushions the glass. Rigid vinyl setting blocks are used to support the unit above the sill, preventing glass slippage. Extruded vinyl glazing (snap-in) bead is applied around the interior edge. "Interior glazing" makes replacement of glazing unit convenient, and provides equal exterior sight lines.

GLASS

Insulating dual glazed panes, 1" in overall thickness, are butyl sealed for energy efficiency. Specialty glass options are available upon request

STAIRSTEP WEATHERSTRIPPING

Two flexible PVC leaf seal on the vent panel providing a weather-tight seal.

OPERATING HARDWARE

Operator arms are plated with e-guard for long life and durability. Stainless steel hardware option is available.

LOCKING ASSEMBLY

A multi-point locking mechanism provides added security and a tighter seal along the entire vertical leading sash edge.

SCREEN

Screen frames are cambered aluminum, reinforced with rigid plastic corner clips. Screens come standard with matching frame color. The fiberglass screen mesh is strong, durable and easy to replace. Four concealed screen clips mount screen flush with perimeter frame.

OPTIONS

GRIDS

Available in 5/8" flat or 1-1/16" sculptured aluminum profiles sealed between panes. Color-matched to frame.

DRAPERY OPERATOR HANDLE

A low profile operator is available for applications involving interior shutters, mini blinds or similar treatments. Folding handle option is available.

GLASS

Refer to glass section.

Many more options are available. Please check with your Milgard Representative.

TEST STANDARDS

See Test Reports/Energy Ratings section.

Caution:

The use of petroleum based fuels or solvents as release agents in stucco wall installations or glass cleaning will chemically attack materials used in seals and other components, and voids the Milgard Guarantee. The use of wax based release agents is recommended.

Expanding foam for insulation purposes should not be used. Foam or loose packed batt insulation is recommended.

5521-3
JANUARY 2005

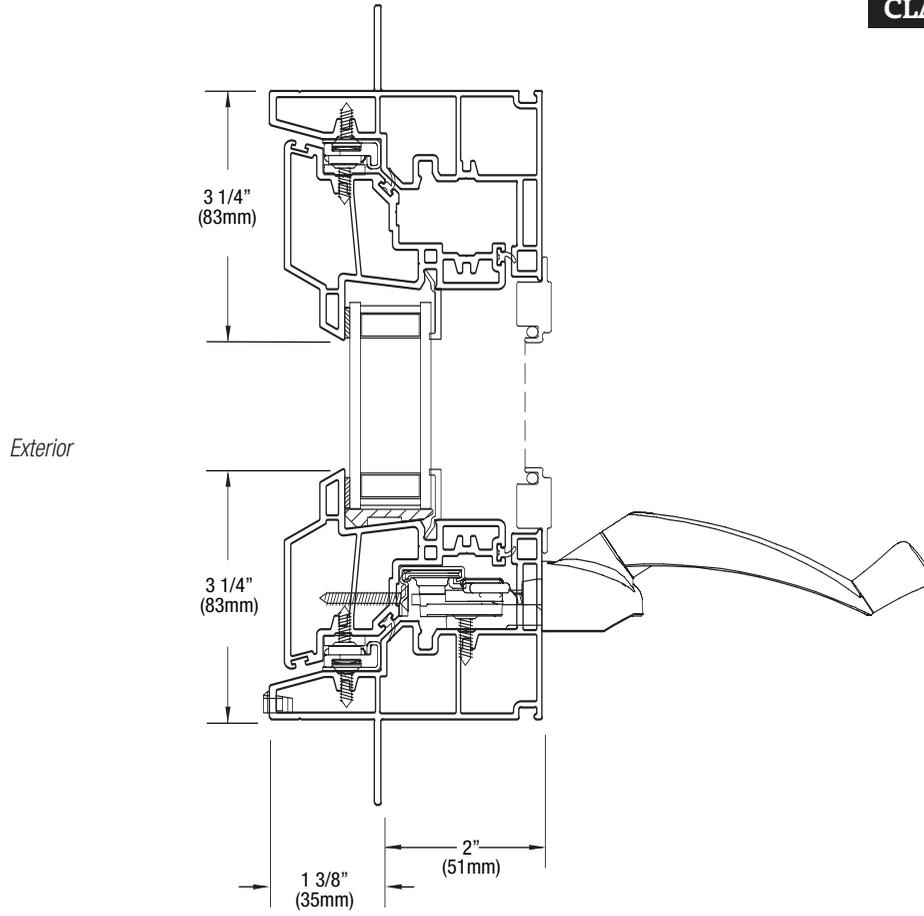
Milgard



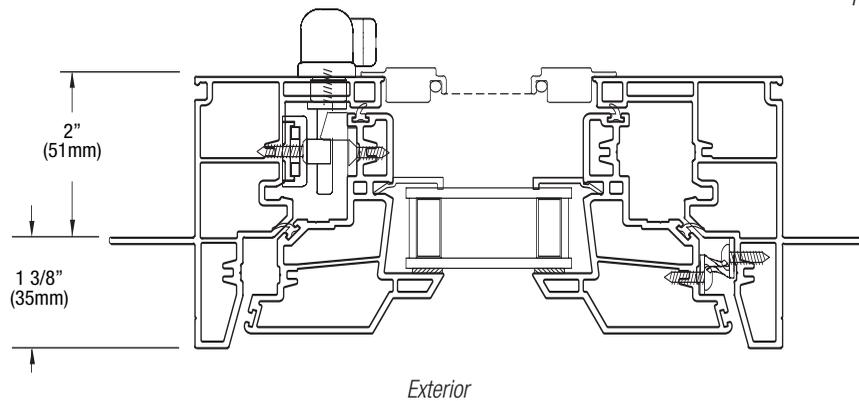
5521 Assembly Drawing

5000
SERIES
CLASSIC VINYL

Vertical View



Horizontal View



Scale: 6" = 1' (1/2 scale)

Due to continual product research and development, details may be changed at any time. ©2004
Products shown are not available at all locations – confirm availability with your local Milgard representative.

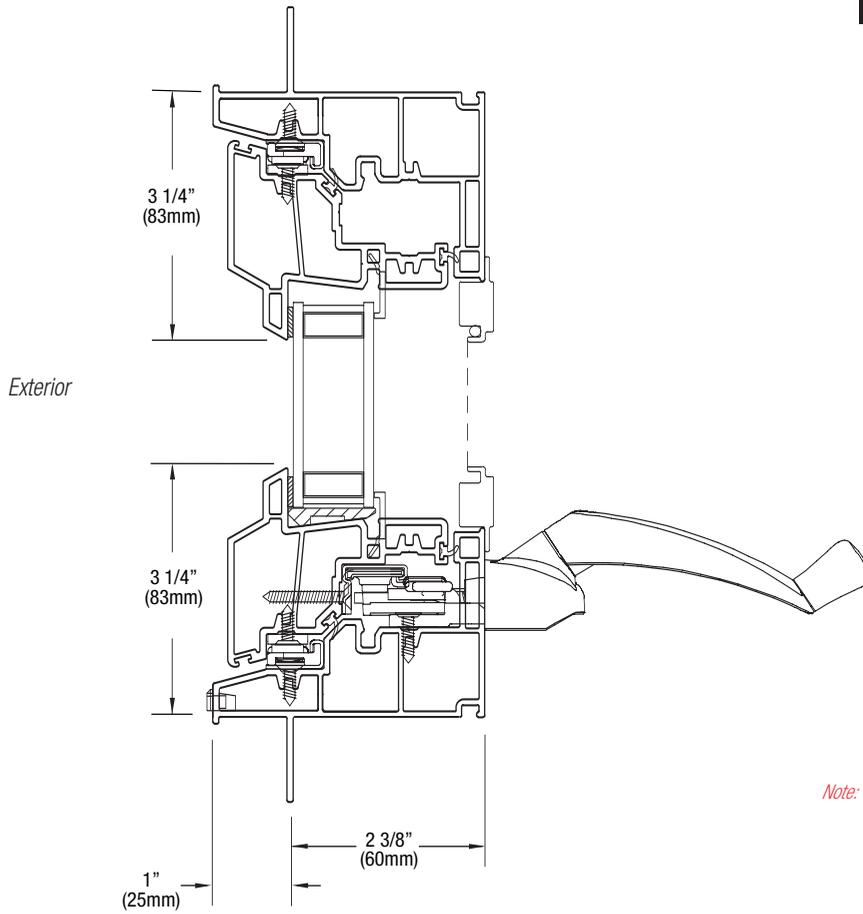
5521-4
JANUARY 2005

Milgard

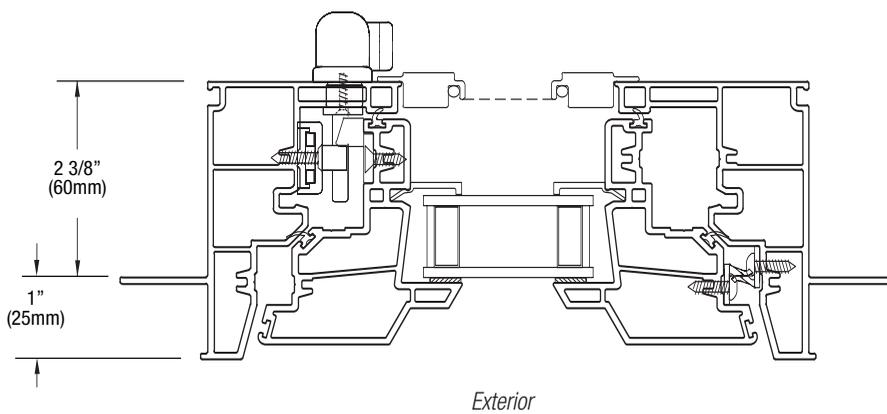


5531 Assembly Drawing (SW)

5000
SERIES
CLASSIC VINYL



Vertical View



Horizontal View

5521-5
JANUARY 2005

Scale: 6" = 1' (1/2 scale)

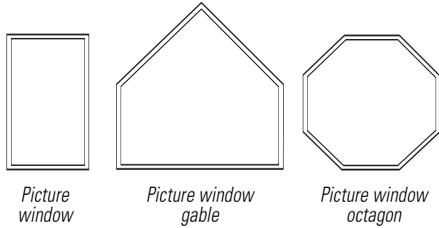
Due to continual product research and development, details may be changed at any time. ©2004
Products shown are not available at all locations – confirm availability with your local Milgard representative.

Milgard



5320 Picture/5720 Radius Windows

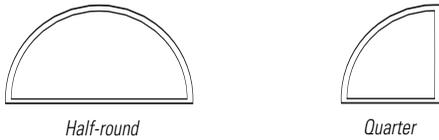
5000
SERIES
CLASSIC VINYL



Picture window

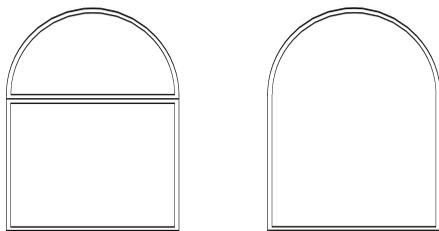
Picture window gable

Picture window octagon



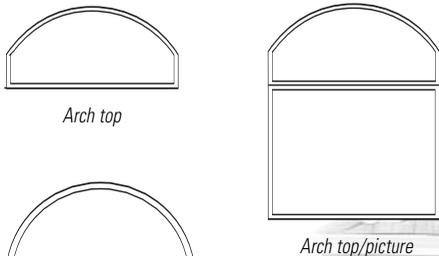
Half-round

Quarter



Round top/picture

Round top



Arch top

Arch top/picture



Full round

— PICTURE WINDOW

- Min 1'1" Max 8'6"

— OCTAGON

- Min 2'2" Max 6'6"

— HALF ROUNDS

- Min 2'1" Max 8'4"

— QUARTER ROUNDS

- Min 1'1" Max 6'6"

— FULL ROUND

- Min 2'2" Max 6'6"

— ARCH TOPS

- 48 square feet maximum
- Min 2'2" Max 8'6"
- must specify leg height and center height (minimum 6" leg height)

NOTE: For engineering approval contact your Milgard representative for any configuration over 40 square feet. Each Milgard Manufacturing plant reserves the right to alter or change sizes and configurations according to location capabilities. Ask your Milgard rep about specialty applications.

Windows over 40 square feet shipped open for field glazing. Varies by location.



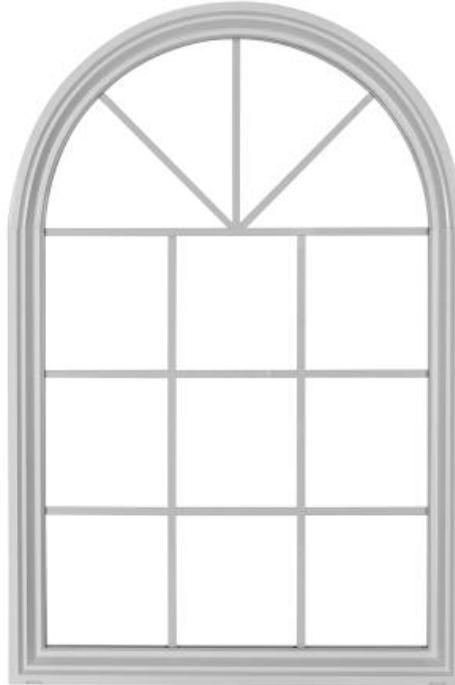
5320/5720-1
JANUARY 2005

Milgard



5320 Picture/5720 Radius Windows

5000
SERIES
CLASSIC VINYL



The 5320 series vinyl (PVC) Picture window and 5720 series vinyl (PVC) Radius window offers the outstanding insulating properties, low maintenance, and contemporary aesthetic appeal only vinyl can provide. Available in White and Tan homogenous window frames, the 5320's durable vinyl exterior will never need painting. The windows will maintain their color and shape and can be constructed to your exact size specifications, subject to review.

Like all Milgard windows, doors and skylights, the 5320 and 5720 Series carries a Lifetime Guarantee to the original owner covering both materials and labor.

Commercial and apartment projects are covered by a 10-year warranty from date of manufacture, covering all materials and labor, including the glazing unit.

CONFIGURATIONS

Milgard's 5320 Series Picture Windows can be combined with each other or other Milgard vinyl windows to create almost any configuration you can envision. Milgard Picture Windows are available in custom sizes to match almost any design, either new or retrofit.

- All windows over 40 square feet (location specific) are shipped open (may require multi-lite) and will require field glazing.

Milgard's 5720 Series Radius Windows can be combined with each other or other Milgard vinyl windows to create almost any configuration you can envision. Milgard Picture Windows are available in round tops, half rounds, quarter rounds and full rounds in custom sizes to match any design.

5320/5720-2
JANUARY 2005

Milgard



5320 Picture/5720 Radius Windows

5000

SERIES
CLASSIC VINYL

COMPONENTS

FRAME

Frame components are made from high performance polyvinyl chloride, available in White and Tan window frames. The 5320/5720 series is designed to offer outstanding visual appeal and low maintenance. Mitered corners are precision welded resulting in an air and water tight seal. Standard frame depth is 3-3/8", ideal for both new construction and for use as a replacement window.

NAIL-ON FIN

A 1-1/16" pre-punched nail flange extends around the perimeter frame, securing the window in rough openings and acting as a part of the flashing system. The nailing fin may be removed as needed for particular replacement window block frame applications. Fin set-backs are available in 1-3/8" from outside of frame; also in 1" (5331/5731 series) for our SW locations using 3 coat stucco applications (not available at all locations).

WEEP SYSTEM

Hollow sill construction and offset weep gates release any accumulated moisture.

GLAZING MATERIAL

AAMA approved glazing tape adheres glass to the fixed panel and vent frame and seals and cushions the glass. Rigid vinyl setting blocks are used to support the unit above the sill, preventing glass slippage. Extruded vinyl glazing (snap-in) bead is applied around the interior edge. "Interior glazing" makes replacement of glazing unit convenient, and provides equal exterior sight lines.

GLASS

Insulating dual glazed panes, 1" in overall thickness, are butyl sealed for energy efficiency. Specialty glass options are available upon request.

OPTIONS

GRIDS

Available in 5/8" flat or 1-1/16" sculptured aluminum profiles sealed between panes. Color-matched to frame.

GLASS

Refer to glass section.

Many more options are available. Please check with your Milgard Representative.

TEST STANDARDS

See Test Reports/Energy Ratings section.

Caution:

The use of petroleum based fuels or solvents as release agents in stucco wall installations or glass cleaning will chemically attack materials used in seals and other components, and voids the Milgard Guarantee. The use of wax based release agents is recommended.

Expanding foam for insulation purposes should not be used. Loose packed batt insulation is recommended.

5320/5720-3
JANUARY 2005

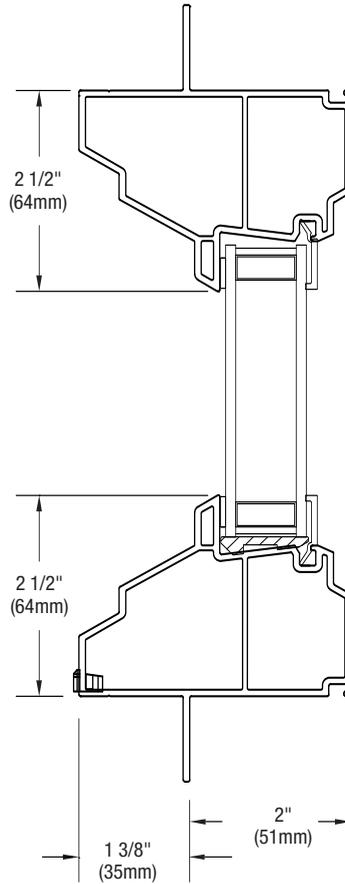
Milgard



5320/5720 Assembly Drawing

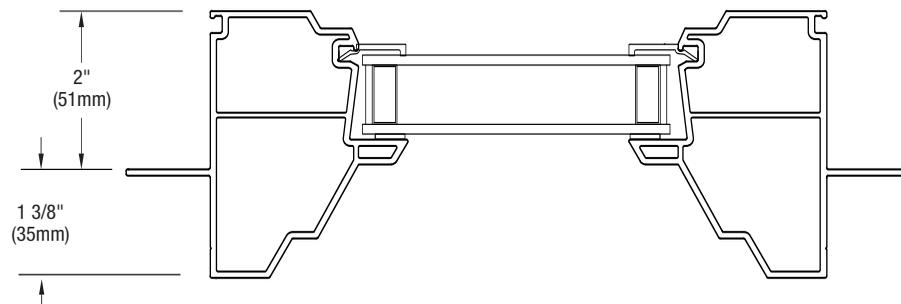
5000
SERIES
CLASSIC VINYL

Exterior



Vertical View

Horizontal View



Exterior

Scale: 6" = 1' (1/2 scale)

*Due to continual product research and development, details may be changed at any time. ©2004
Products shown are not available at all locations – confirm availability with your local Milgard representative.*

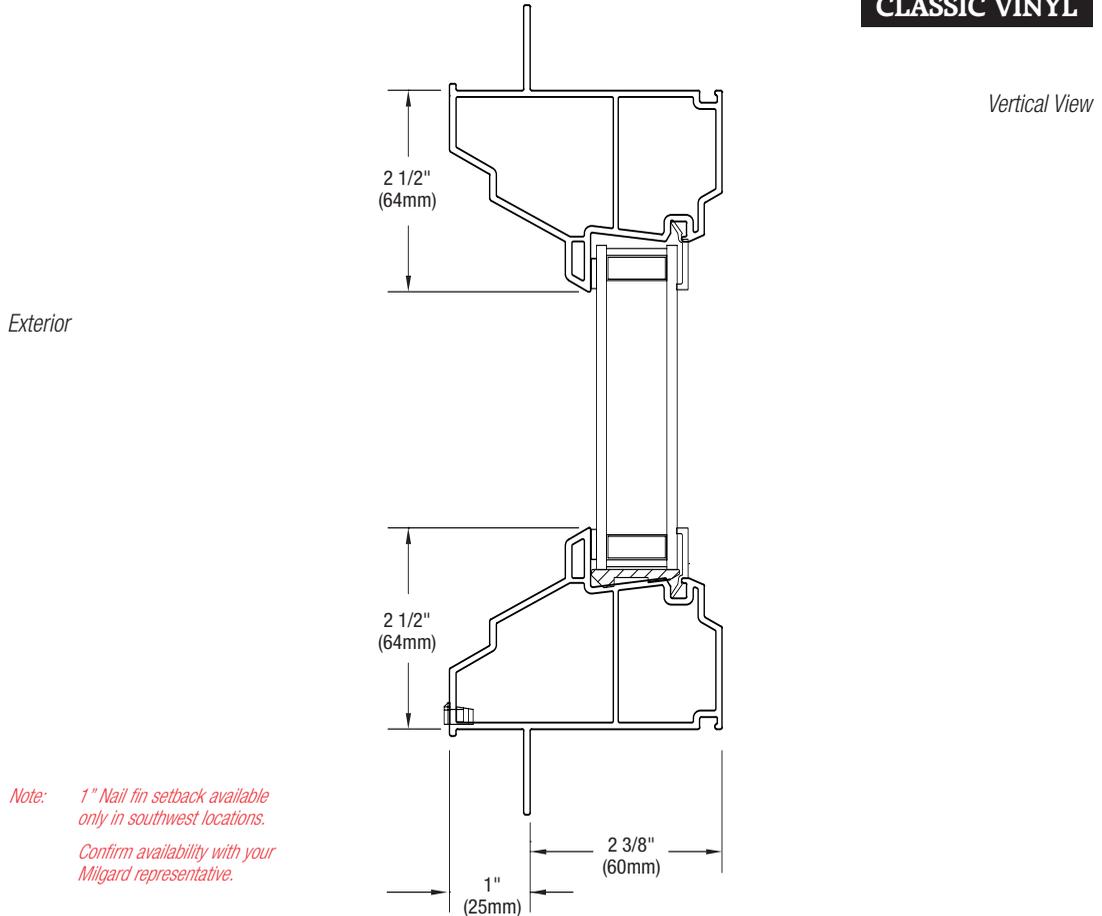
5320/5720-4
JANUARY 2005

Milgard

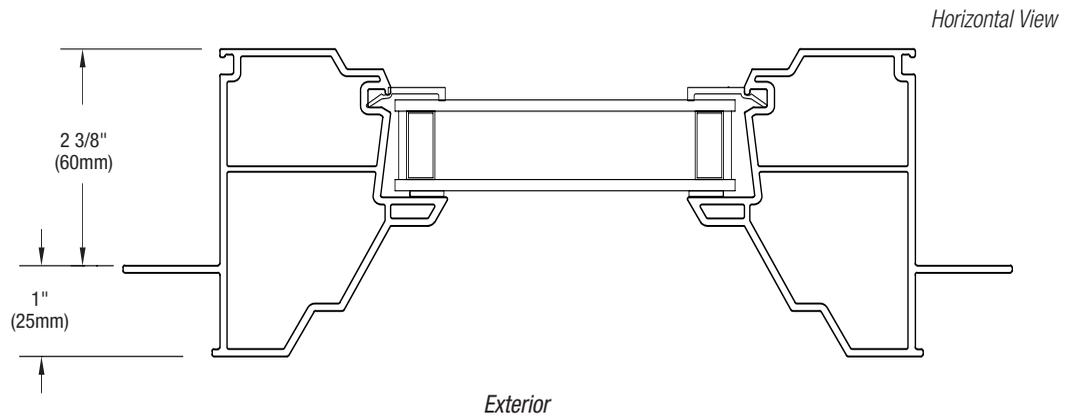


5331/5731 Assembly Drawing (SW)

5000
SERIES
CLASSIC VINYL



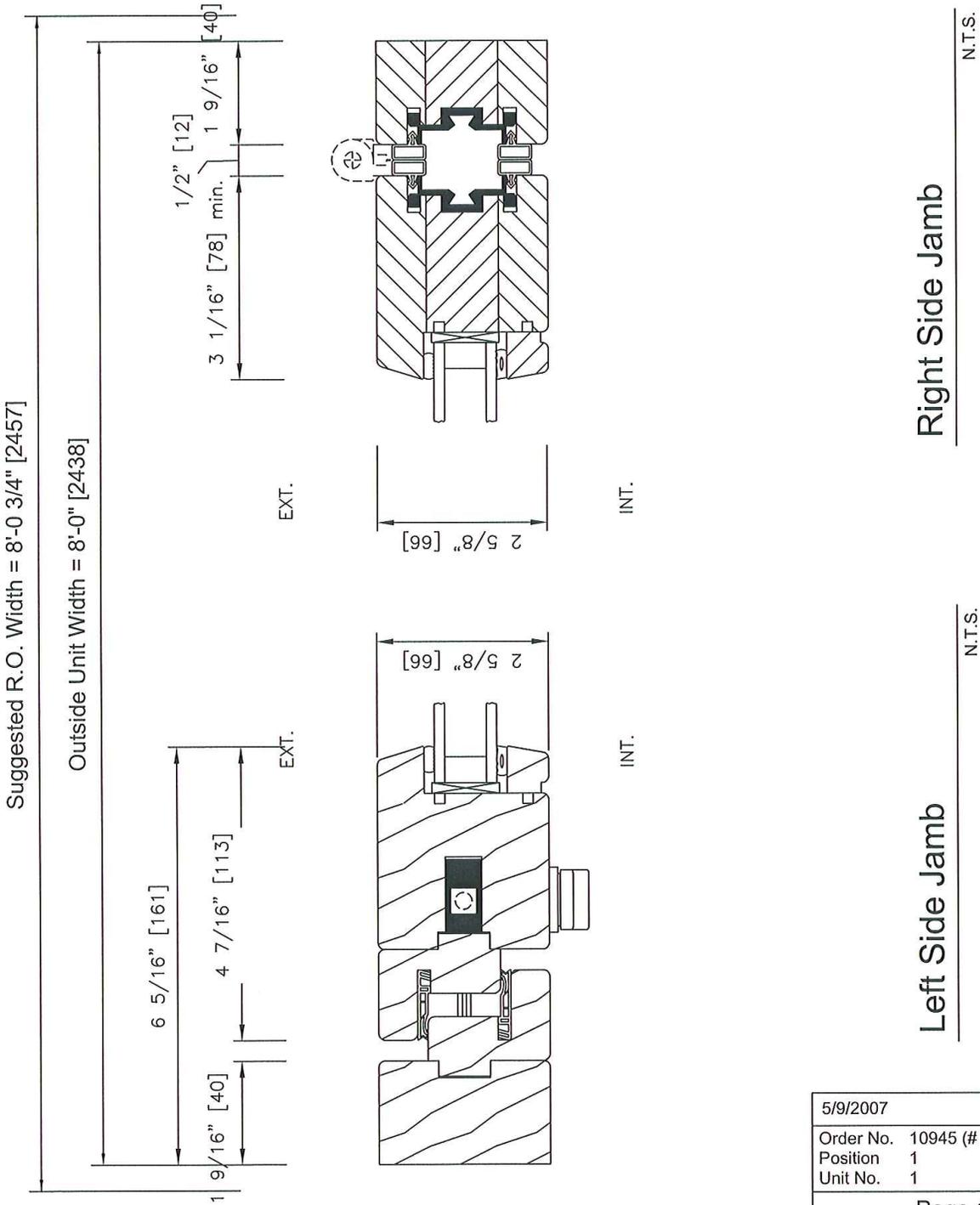
Note: 1" Nail fin setback available only in southwest locations. Confirm availability with your Milgard representative.



5320/5720-5
JANUARY 2005

Scale: 6" = 1' (1/2 scale)

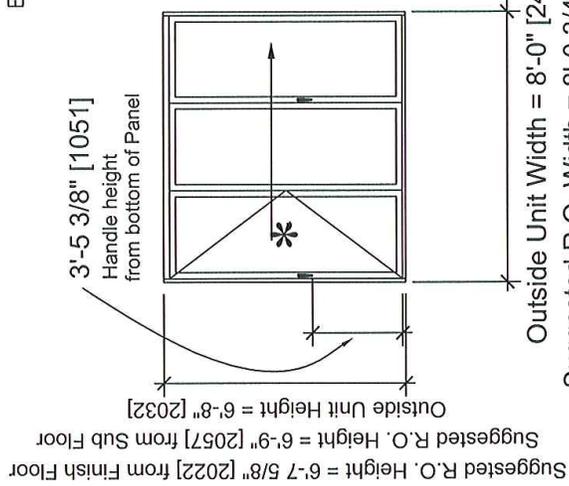
Due to continual product research and development, details may be changed at any time. ©2004 Products shown are not available at all locations – confirm availability with your local Milgard representative.



5/9/2007	
Order No.	10945 (# 7043)
Position	1
Unit No.	1
Page 1.3	

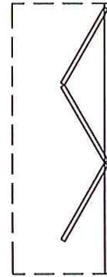
NOTE: The elevation illustrated below is for schematic purposes only. It is not to scale nor is it in proportion in terms of height and width nor in terms of widths of vertical stiles. Do not rely on this drawing for lining up transoms as the centerlines are not necessarily equal. Either see actual cross section details OR request NANA for actual centerline dimensions.

ELEVATION SEEN FROM INSIDE



DASHED LINE INDICATES LIMITS OF FINISHED FLOORING THAT MUST BE CLEAR AND LEVEL FOR PROPER OPERABLE FUNCTIONALITY.

OUTSIDE



INSIDE

5/9/2007	
Order No.	10945 (# 7043)
Position	1
Unit No.	1
Page 1.2	

Quote / Order Details

Nana Wall Systems	Unit Type :	WD66
Quote / Order No.: 10945 (# 70435)	Unit Configuration:	o3R
Position : 1	Outside Unit Width :	8'-0" [2438]
Number of Units : 1	Outside Unit Height :	6'-8" [2032]
Date : 5/9/2007	Glazing Type:	Other
Project : Santa Clara University - Solar Decathlon Santa Clara University	Sill Type:	Low Profile Saddle Sill
	Door and/or Height :	5'-0" [1524]
HM88 WITH KRYPTON FILLED	ED: heights 7'0" may result in a net panel height	
	Panel Options :	Standard Lites.
	(Panel Options not shown on drawings)	

NOTES:

As regulations governing the use of glazed windows, doors, storefronts and/or partitions vary widely, it is the sole responsibility of the architect, building owner, contractor and/or consumer (hereinafter referred to as "customer") to insure that the products and options selected conform to all applicable codes and regulations, including federal, state, and local.

Proper installation, operation and maintenance of the products are essential for proper performance. Detailed written installation, operation and maintenance instructions are available and provided to all customers. It is essential that these instructions be read and followed. It is highly recommended that an experienced installer of Nana's products be used. Installation, including but not limited to method of attachment, fastener selection and completion of appropriate waterproofing and flashing around the perimeter of the opening, is the sole responsibility of the customer.

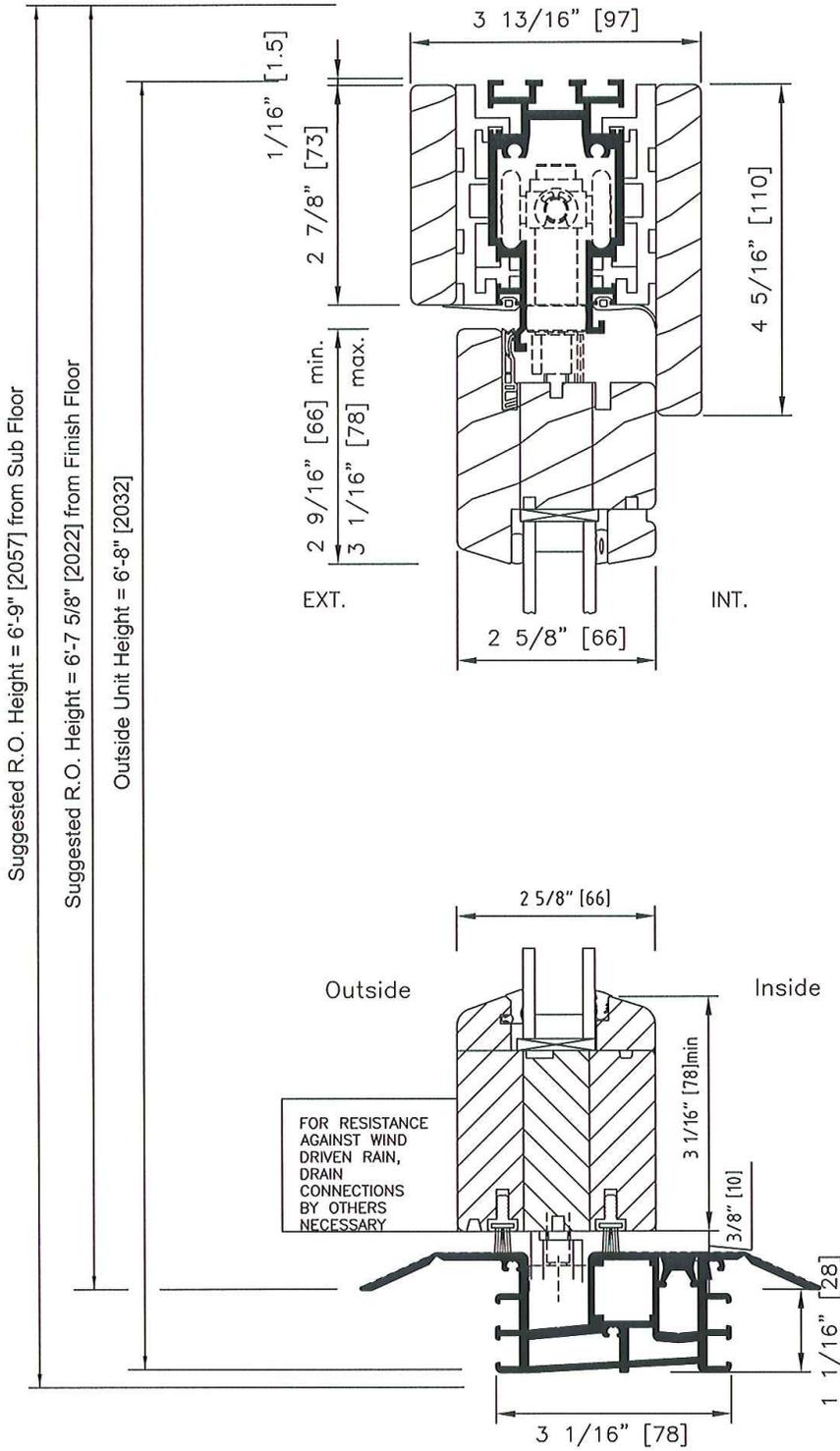
The structural integrity of the Header and/or overhead support is critical for proper operation. Among other factors, the deflection under full live and dead loads should be the lesser of L/720 of the span and 1/4".

Water tightness is relative. Many of Nana's systems with certain configurations have been tested with varying degrees of performance results. See information available in Nana's literature and website. It is the sole responsibility of the customer to determine the level of performance needed for his specific location and site conditions.

Details are subject to change without notice.

- Initial and date all pages, then please fax back at (415) 383-0312.
- Numbers shown in brackets, "[xxxx]", represent corresponding metric equivalent dimensions

5/9/2007	
Order No.	10945 (# 70435)
Position	1
Unit No.	1
Page 1.1	



Head

N.T.S.

Sill

N.T.S.

5/9/2007
Order No. 10945 (# 7043)
Position 1
Unit No. 1
Page 1.4



E GLASS Specifications

	SPD 1	SPD 2	SPD 3	SPD 4	LC
Color					
ON	Lt Blue Tint				Clear
OFF	Darker Blue Tint				Frosted White
Visible Light Transmittance (%)					
ON	55	45	40	35	77
OFF	10	5	2	0.5	58
Specular Light Transmitted (%)					
ON	n/a	n/a	n/a	n/a	75
OFF	n/a	n/a	n/a	n/a	0.01
Diffused Light Transmitted (%)					
ON	n/a	n/a	n/a	n/a	63
OFF	n/a	n/a	n/a	n/a	4
Shading Coefficient					
ON	0.8	0.75	0.71	0.64	0.8
OFF	0.57	0.51	0.49	0.47	0.65
Relative Heat Gain (btu / Sq Ft / Hr)					
ON (Film Only)	473	450	425	417	-
OFF (Film Only)	380	321	307	295	-
5/8" Insulated Clear Glass	191				-
5/8" Insulated Low E Glass	104				-
U Factor (btu / Hr / Deg (F)/Sq Ft)					
Laminated Only	5.3				
5/8" Insulated Clear Glass	0.5				
5/8" Insulated Low E Glass	0.28				
Response Time (In seconds)					
To switch ON	0.5				0.1
To switch Off	1				0.4
Temperature Limits	- 22 Deg F through 194 Deg F				-4 thru 158 Deg F
Operating Voltage	120 VAC / 50 - 60Hz				
Operating Current	1.5 mA / Sq. Ft. (.015 A / 10 Sq Ft.)				12 mA / Sq Ft (0.12 A / 10 Sq Ft)
Power Consumption	0.18 Watts / Sq Ft (1.8 Watts / 10 Sq Ft.)				1.44 W / Sq Ft (14.4 W / 10 Sq Ft.)
UV Blocking	99%				
Min & Max Size (Film Only)	47" W x 98" L				38" W x 96" L
Min & Max Size (Lami Glass)	8 1/2 Ft Wide x 16 Ft Long				

Lamination and Construction Options: Laminated with Annealed or Tempered Glass or Polycarbonate; Tinted Glass and Reflective Glass; 5/8" - 1 1/2" Thick Insulated Glass, Low E Glass, Argon Filled. Film Setback: 1/8" on all edges; Minimum Framing Bite: 1/2" on busbar edge

Decoration Options: Sandblast, Laser etch, Stained Glass Overlays, Patterns

R Values for the House

1)	Walls	Materials	Dimension	R/inch	R (ft ² F.h/BTU)	Notes
		Inside Air Film			0.68	
		Gypsum Board	1/2"	0.9	0.45	
		Wood Stud	2**6"	0.91	5.46	
		Wet Blown Cellulose Insulation	4"	3.7	14.8	Blown Cellulose Insulation between Wood Studs
		Rigid Celotex Insulation	2"	6.3	12.6	Rigid Celotex between Wood Studs
		Tyvek Vapor Barrier				
		Out-side Air Film			0.17	
		Series Heat paths			27.4	(Cellulose+Celotex)/Insulation
		Parallel Heat paths				Insulation & Wood Stud/corresponding area coverage
		Area Covered by wood stud in %	8.33			
		Area Covered by Insulation in %	91.67			
		R - Heat paths			20.53	
		Total R Walls			21.83	

2)	Roof	Materials	Dimension	R/inch	R (ft ² F.h/BTU)	Notes
		Inside Air Film			0.68	
		Bamboo Joists				
		CDX Plywood	15/32"	1.25	0.59	
		Rigid Celotex Insulation	6"	6.3	37.8	
		Acrylic Coating				
		Outside Air Film			0.17	
		Total R Roof			39.24	

3)	Floor	Materials	Dimension	R/inch	R (ft ² F.h/BTU)	Notes
		Inside Air Film			0.68	
		Bamboo Flooring	5/4"	0.96	1.2	
		CDX Plywood Sheathing	15/32"	1.25	0.59	
		Bamboo Joists	2-1/2**9-1/2"	0.96	9.12	Bamboo Joists at 16" centers
		Wet Blown Cellulose Insulation	9-1/2"	3.7	35.15	Blown Cellulose insulation between joists
		ACX Plywood	1/2"	1.25	0.625	
		Outside Air Film			0.17	
		Parallel Heat Path				
		Area covered by Bamboo Joists in %	15.63			
		Area covered by Blown Cellulose in %	84.38			
		R-Heat Path			24.32	
		Total R Floor			27.59	

4)	Windows	Materials	Dimension	R/inch	R (ft ² F.h/BTU)	Notes
		Vinyl Casement			2.7	
		Vinyl Awnings			2.7	

5)	Doors	Materials	Dimension	R/inch	R (ft ² F.h/BTU)	Notes
		Solid Wood Swinging Door with glass opening			3.13	

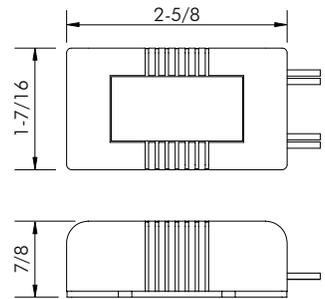
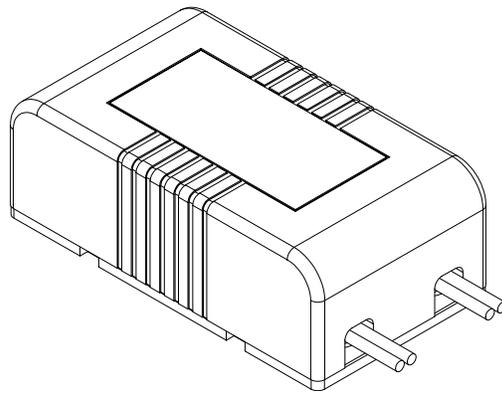
6)	Doors	Materials	Dimension	R/inch	R (ft ² F.h/BTU)	Notes
		Nana Wall (D2)			4.35	

Area Covered by Doors & Windows			
1)	East Wall	Mech Room	
		Area Covered by 2 Doors	42% 3.13
		Area Covered by Wall	58%
2)	East Wall	Bed Room	
		Area covered by a window	3.46% 2.7
		Area covered by a Door	19.65% 3.13
		Area covered by the wall	76.89%
3)	South Wall	Bed Room & Bath Room	
		Area covered by 6 windows	19%
		Area covered by wall	81%
4)	South Wall	Living Room	
		Area Covered by Door 1	18.10% 3.13
		Area covered by Door 2 (D2)	54.27% 4.35
		Area covered by wall	45.73
5)	West Wall	Bath Room	
		Area covered by a window	3.85% 2.7
		Area covered by the wall	96.15%
6)	West Wall	Living Room	
		Area covered by wall	100%
7)	North Wall	Living Room /Kitchen /Mech Room)	
		Area covered by a door	6.53% 3.13
		Area covered by a window	2.56% 2.7
		Area covered by the wall	90.91%

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1260E

Electronic Transformer



Primary Voltage: 120V
Secondary Voltage: 12V
Wattage: 60W MAX

100% Duty cycle. Hard wired remote transformer.
Dimmable with low voltage electronic dimmers
(i.e. Lutron Diva). Auto reset circuit protection.

Weight: 0.2 lb / 0.08 kg

Rated: Dry Locations



Approved to UL standards by CSA/US

Ordering

type

1260E

[Project]

[Quantity]

[Note]



16 W 4TH AVE VANCOUVER BC V5Y 1G3 CANADA
T 604 708 1184 F 604 708 1185 MPLIGHTING.COM

Version 10-2006

DESCRIPTION

The H99ICT is a small aperture housing for accent and task lighting. It is designed for use in insulated ceilings where it will be in direct contact with insulation. It is an AIR-TITE housing designed to prevent air flow between living spaces and unconditioned areas.

Catalog #		Type
Project		
Comments		Date
Prepared by		

DESIGN FEATURES

A... Outer Housing

Aluminum construction helps dissipate heat.

B... Inner Housing

Double wall aluminum construction helps dissipate heat. The inner housing can be adjusted in the plaster frame to compensate for different ceiling materials.

C... Plaster Frame

Galvanized steel construction. The housing can be removed from plaster frame to provide access to the junction box.

Plaster frame features include:

- Regressed locking screw for securing hanger bars from below the ceiling
- Six cutouts for easily crimping hanger bars in position
- Halo name embossed on plaster frame

C... Junction Box

- Listed for through branch circuit wiring
- Positioned to accommodate straight conduit runs
- Seven 1/2" trade size conduit knockouts with true pry-out slots
- Slide-N-Side™ wire traps allow non-metallic sheathed cable to be installed without tools and without removing knockouts. Accepts a wider range of non-metallic

sheathed cable – the standard cable types used in lighting for both U.S. and Canada.

- Allows wiring connections to be made outside the junction box
- Simply insert the cable directly into the trap after connections are made
- accommodates the following standard non-metallic sheathed cable types: (US) #14/2, #14/3, #12/2, #12/3 (Canada) #14/2, #14/3, #12/2

E... "GOT NAIL! Pass-N-Thru™ Bar Hangers
Bar Hanger Features include:

- Pre-installed nail easily installs in regular lumber, engineered lumber and laminated beams
- Safety and guidance system prevents snagging, ensures smooth straight nail penetration and allows bar hangers to be easily removed if necessary.
- Automatic levelling flange aligns the housing and lets you hold the housing in place with one hand while driving nails
- Housing can be positioned at any point within 24" joist span
- Score lines allow "toolless" shortening for 12" joists
- Bar hangers may be repositioned 90°
- Bar hangers do not need to be

removed from frame for shortening

- Integral T-bar clips snaps onto T-bars - no additional clips required

F... Socket

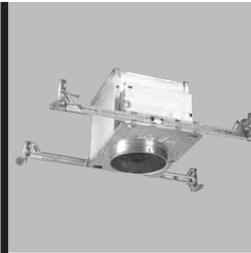
Fixed position porcelain socket with nickel plated brass screw shell provides consistent lamp positioning.

G... Thermal Protector

Self resetting thermal protector deactivates fixture if overheating occurs due to improper lamping.

Labels

- UL/cUL Listed for Damp Location
 - UL/cUL listed for Feed Through
 - UL/cUL listed for Direct Contact with Insulation and combustible material
- Meets following requirements:
- California Title 24 Low Efficacy Luminaire IC and AT requirement
 - State of Washington Energy Code
 - International Energy Conservation Code
 - New York State Energy Conservation Code (NY-ECCC)
 - Certified under ASTM-E283 for air-tight construction



H99ICT

4" Insulated Ceiling
AIR-TITE™ Recessed
Housing

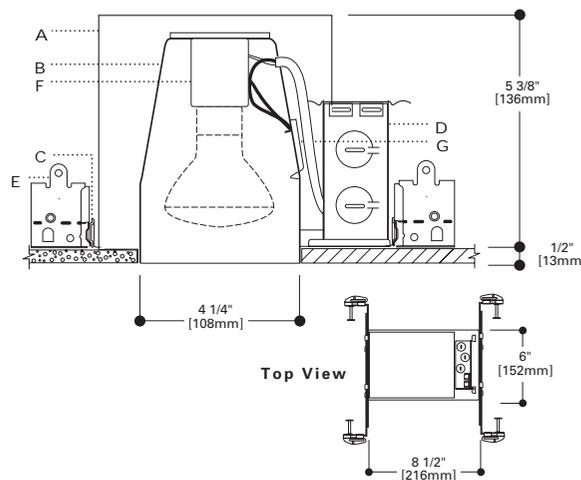
4" TRIMS

**FOR USE IN
INSULATED CEILINGS**

**FOR DIRECT CONTACT
WITH INSULATION**



with all trims listed



TRIMS

ORDERING INFORMATION

SAMPLE NUMBER: H99ICT-999RG

Order housing, trim and accessories separately.

Housing



H99ICT=4" AIR-TITE™ Insulated Ceiling Small Aperture Housing

Trims



Accessories



Socket Extender
H1999=Socket extender for use with PAR lamps with 993 Coilex Baffle Trim

REFLECTORS



999

Specular Reflector Cone
50W R20, 40W R16, 50W PAR20, 40W A19
999=Specular Clear, White Trim Ring
999AC=Antique Copper with Antique Copper Trim Ring
999RG=Residential Gold, white trim ring
999H=Haze Reflector, White Trim Ring
999HB=Specular Black Reflector, White Trim Ring
999SL=Specular Clear Reflector with Silver Trim Ring
999SN=Satin Nickel Reflector with Satin Nickel Trim Ring
999TBZ=Tuscan Bronze Reflector with Tuscan Bronze Trim Ring
OD: 5 1/16" (129mm)

BAFFLES



993

Coilex Baffle with Die Cast Trim Ring
50W R20 or 50W PAR20 with H1999 Socket Extender
993P=Black Baffle with White Trim Ring
993AC=Black Baffle with Antique Copper Trim Ring
993PB=Black Baffle with Polished Brass Trim Ring
993W=White Baffle with White Trim Ring
993SL=Black Baffle with Silver Trim Ring
993SN=Black Baffle with Satin Nickel Trim Ring
993TBZ=Black Baffle with Tuscan Bronze Trim Ring
OD: 5 1/16" (129mm)



953

Metal Baffle with Die Cast Trim Ring
30W R20, 35W PAR20, (50W PAR20 with H1999 Socket Extender)
953AC=Antique Copper Baffle with Antique Copper Trim Ring
953SN=Satin Nickel Baffle with Satin Nickel Trim Ring
953TBZ=Tuscan Bronze Baffle with Satin Tuscan Bronze Trim Ring
OD: 5 1/16" (129mm)

ADJUSTABLES



996

Eyeball - 15° Tilt
50W PAR20
996P=White Eyeball
996AC=Antique Copper Eyeball
996SL=Silver Eyeball
996SN=Satin Nickel Eyeball
996TBZ=Tuscan Bronze Eyeball
OD: 5 1/16" (129mm)



998

Eyeball - 30° Tilt
40W R16
998P=White Eyeball
998AC=Antique Copper Eyeball
998PB=Polished Brass Eyeball
998SL=Silver Eyeball
998SN=Satin Nickel Eyeball
998TBZ=Tuscan Bronze Eyeball
OD: 5 1/16" (129mm)

OPEN



945

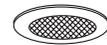
Metropolitan Ice Light
30W R20
945=Clear Frosted
945BLUE=Blue Frosted
OD: 5 5/16" (135mm)



946

Metropolitan Deco
35W R20
946BC=Green Tint Rings with Black Chrome Metal Body
946PB=Green Tint Rings with Polished Brass Metal Body
OD: 5 5/8" (143mm)

SHOWER LIGHT

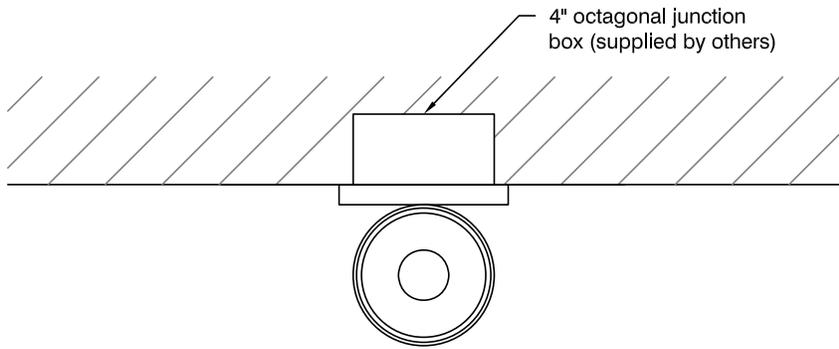


951

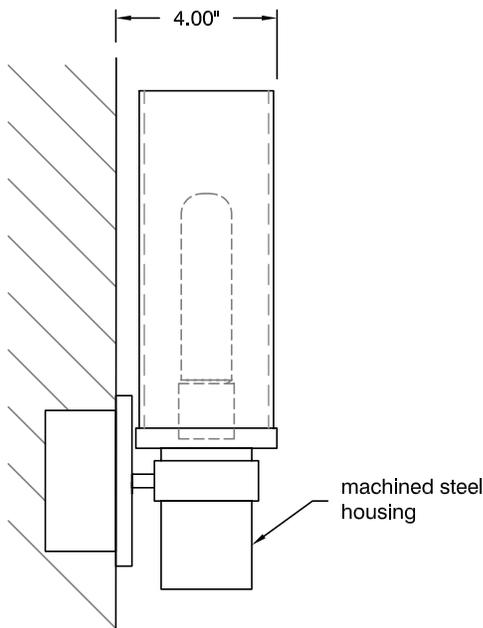
Shower Light
50W PAR20 with H1999 Socket Extender
30W R20, 35W PAR20
951PS=Shower Light, White Trim Ring, Glass Lens
951ACS=Shower Light, Antique Copper Trim Ring, Glass Lens
951SLS=Shower Light, Silver Trim Ring, Glass Lens
951SNS=Shower Light, Satin Nickel Trim Ring, Glass Lens
951TBZS=Shower Light, Tuscan Bronze Trim Ring, Glass Lens
OD: 5 1/16" (129mm)

Note: Specifications and Dimensions subject to change without notice.

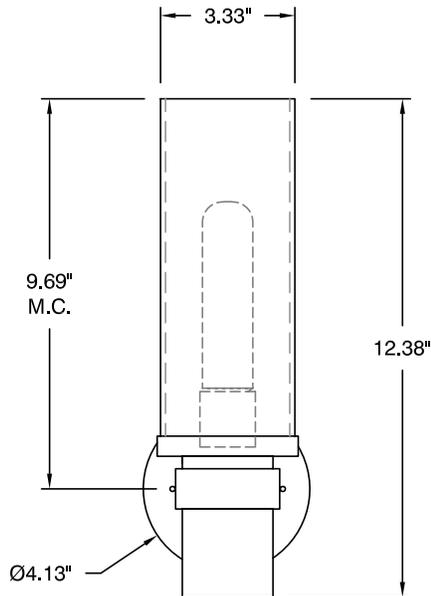
Visit our web site at www.cooperlighting.com



TOP VIEW



SIDE VIEW



FRONT VIEW

PEBBLE sconce
oxygen **2-573-1xx**

OXYGEN LIGHTING ©

LAMPING

- o 1 x 60W T10 medium base incandescent

DIFFUSERS

- o 1 - white opal glass

METAL FINISHES

- o 24 - satin nickel
- o 30 - satin brass
- o 14 - polished chrome
- o 2 - polished brass
- o 95 - old world

DIMENSIONS

- o 3.33" (w) x 12.38" (h)
- o 4" ext. from wall

INSTALLATION

- o 4" octagonal "J"- Box
- o UL Damp Listed
- o ADA

VOLTAGE

- o 120V

Sample Catalog Number

Series #	Diffuser	Finish	Options	Catalog number
2-573	- 1	95	-	= 2-573-195

oxygen

OXYGEN LIGHTING SUITE 900
580 BROADWAY, NEW YORK, NY 10012
TEL. (877) 607-0202 FAX (877) 607-0203

PROJECT: _____

DATE: _____

DESCRIPTION

260-A Luminous Cylinder features a direct downlight component.

Catalog #		Type
Project		
Comments		Date
Prepared by		

SPECIFICATION FEATURES

Material

Solid aluminum with a matte white acrylic cylinder.

Finish

Standard: Natural Aluminum (NA) [Sustainable Design].
Premium: Matte White (MW), Lacquered Satin Aluminum (SAL), Clear Anodized Aluminum (CAL) or Custom Color (CC).

Optics

Refer to www.shaperlighting.com for complete photometrics.

Ballast

Integral electronic HPF, multi-volt 120/277V (347V Canada), thermally protected with end-of-life circuitry to accommodate the specified lamp wattage.

Lamp/Socket

One (1) 18W (GX24q-2) or 26W (GX24q-3) 4-pin triple CFL lamp or 75W A-19 lamp. CFL socket injection molded plastic. INC socket fired ceramic rated for 660W-250V. Lamps furnished by others.

Installation

Supplied with a universal circular strap for a standard 4" J-box or plaster ring.

Options

Damp Location (DL): All Painted Finishes only, Perforated Band (PFB), Remote Emergency Ballast - Supplied by others (REM), MRI applications, (INC only) - Contact factory. Energy Star Rating- Consult Factory.

Labels

U.L. and C.U.L. approved for indoor and damp location. See options for damp location finishing requirements.

Modifications

Shaper's skilled craftspeople with their depth of experience offer the designer the flexibility to modify standard surface luminaires for project specific solutions. Contact the factory regarding scale options, unique finishes, mounting, additional materials/colors, or decorative detailing.



260-A SERIES

Surface Luminaire
Starter Collection Luminous
Cylinder



ORDERING INFORMATION

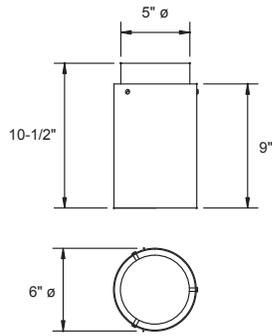
Sample Number: 260-A-CFL/1/18-277V-CAL

<p>Series 260-A: Cylinder Surface</p>	<p>Lamp CFL/1/18 CFL/1/26 INC/1/75</p>	<p>Voltage 120V 277V* 347V*</p>	<p>Finish <u>Standard</u> NA: Natural Aluminum <u>Premium</u> CAL: Clear Anodized Aluminum CC: Custom Color MW: Matte White SAL: Lacquered Satin Aluminum</p>	<p>Options DL: Damp Location REM: Remote Emergency Battery² PFB: Perforated Band</p>
--	---	--	--	--

Notes: 1 Available with CFL only.
2 Supplied by others.

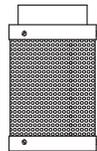
Dimensions

260-A SERIES SURFACE LUMINAIRE



260 STANDARD

OPTION



PERF BAND (PFB)

DESCRIPTION

461 Solid Aluminum or 461-A Luminous Cylinder Pendants.

Catalog #		Type
Project		
Comments		Date
Prepared by		

SPECIFICATION FEATURES

Material/Mounting

Base metal is solid aluminum.
Matte white acrylic cylinder.

SJ Cord White (Standard): 4 1/2" x 1/2" canopy for incandescent and CFL. One 3 (INC) or 5 (CFL) conductor clear SJ cord with a standard overall hang height of 24" (OA), minimum 18" (OA) with either a 4 1/2" x 1/2" canopy for incandescent and CFL. Maximum (OA) for CFL is 10'. Optional Clear SJ cord (CSJ).

Finish

Standard: Natural Aluminum (NA) [Sustainable Design]. Premium: Matte White (MW), Lacquered Satin Aluminum (SAL), or Custom Color (CC).

Optics

Refer to www.shaperlighting.com for complete photometrics.

Ballast

Integral electronic HPF, multi-volt 120/277V (347V Canada), thermally protected with end-of-life circuitry to accommodate the specified lamp wattage.

Lamp/Socket

461: One (1) 18W (GX24q-2) or 26W (GX24q-3) 4-pin triple CFL lamp or one (1) 100W A-19 or 50PAR20H, 75PAR30H or 90PAR38H lamp 461-A: One (1) 18W (GX24q-2) or 26W (GX24q-3) 4-pin triple CFL lamp or one (1) 75W A-19 lamp. CFL socket injection molded plastic. INC socket fired ceramic rated for 660W-250V. Lamps furnished by others.

Installation

Supplied with a bar strap that mounts to a 4" J-box or plaster ring. Integral safety cable provided with stem option.

Options

Dimming Ballast - Contact factory for ballast options (DM), Sloped Ceiling Adaptor - Specify up to 45° (SCA), Perf Band - 461-A only (PFB), Two Trim Bars (2TB), Two Trim Bands - Stem only (2BD), Clear SJ Cord (CSJ), Remote Emergency Battery - Supplied by others (REM), Luminous Band (LUB), MRI Applications (INC only) - Contact the factory, Damp Location (DL): All Painted Finishes only. Energy Star Rating- Consult Factory.

Labels

U.L. and C.U.L approved for indoor and damp location. See options for damp location finishing requirements.

Modifications

Shaper's skilled craftspeople with their depth of experience offer the designer the flexibility to modify standard pendant luminaires for project specific solutions. Contact the factory regarding scale options, unique finishes, mounting, additional materials/colors, or decorative detailing.



461 SERIES & 461-A SERIES

Pendant Luminaire
Starter Collection
Solid Aluminium
or Luminous Cylinder



ORDERING INFORMATION

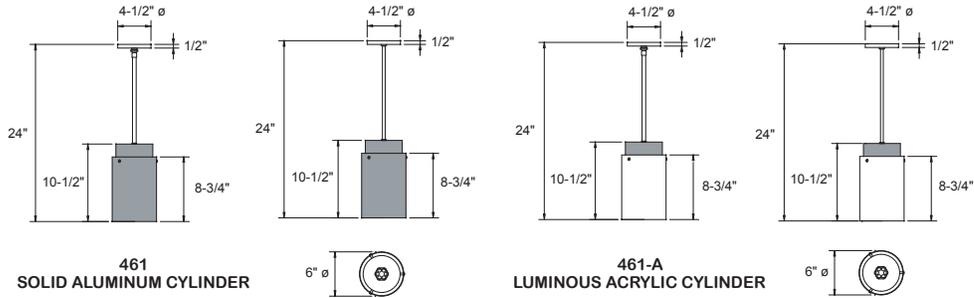
Sample Number: 461-CFL/1/18-277V-SAL-24

<p>Series 461: Solid Aluminum Cylinder 461-A: Luminous Cylinder</p>	<p>Lamp CFL/1/18 CFL/1/26 INC/1/75¹ INC/1/100² HAL/1²</p>	<p>Voltage 120V 277V³ 347V³</p>	<p>Finish <u>Standard</u> NA: Natural Aluminum <u>Premium</u> CC: Custom Color MW: Matte White SAL: Lacquered Satin Aluminum</p>	<p>Options 1S: Single Stem 2CL: Double Cluster 3CL: Triple Cluster 4CL: Four Cluster CSJ: Clear SJ Cord 2BD: Two Trim Bands⁴ 2TB: Two Trim Bars DL: Damp Location DM: CFL Dimming Ballast⁵ REM: Remote Emergency Battery⁶ SCA: Sloped Ceiling Adapter⁷ LUB: Luminous Band PFB: Perforated Band¹</p>	<p>Suspension Height 24" Or Specify</p>
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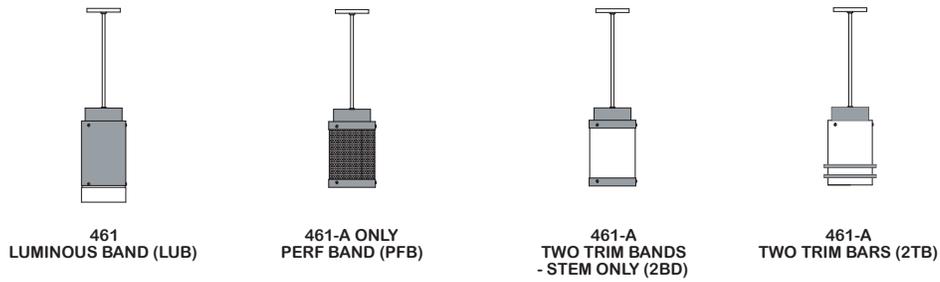
- Notes: 1 Available with 461-A.
2 Available with 461.
3 Available with CFL only.
4 Stem only.
5 Consult the factory for available options.
6 Supplied by others.
7 Specify up to 45°.

461 Standard

Single Stem (1S): 4 1/2" x 4 1/2" canopy for incandescent and CFL. One 1/2" stem with a standard hang height of 24" (OA), minimum 18" (OA). Maximum overall hang height for one piece stem assembly is 8' (OA). 9' to 30' (OA) stems are supplied in multiple sections. Supplied with a self aligning swivel which will accommodate up to 15° (total) adjustment. Specify SCA for sloped ceilings from 15° to 45°.



TRIM OPTIONS



COMPANION PRODUCTS



461 Suspension Options

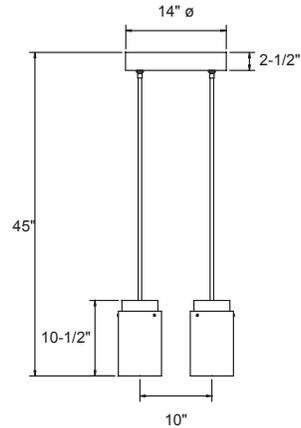
Double Cluster (2CL): 5" canopy with a 1 1/2" swivel ball. One 5/8" stem with a standard hang height of 45" (OA), minimum. Maximum overall hang height for one piece stem assembly is 8' (OA). 9' to 30' (OA) stems are supplied in multiple sections. Supplied with a self aligning swivel which will accommodate up to 15° (total) adjustment. Specify SCA for sloped ceilings from 15° to 45°.

Triple Cluster (3CL): 5" canopy with a 1 1/2" swivel ball. One 5/8" stem with a standard hang height of 60" (OA), minimum. Maximum overall hang height for one piece stem assembly is 8' (OA). 9' to 30' (OA) stems are supplied in multiple sections. Supplied with a self aligning swivel which will accommodate up to 15° (total) adjustment. Specify SCA for sloped ceilings from 15° to 45°.

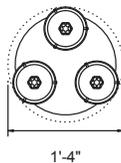
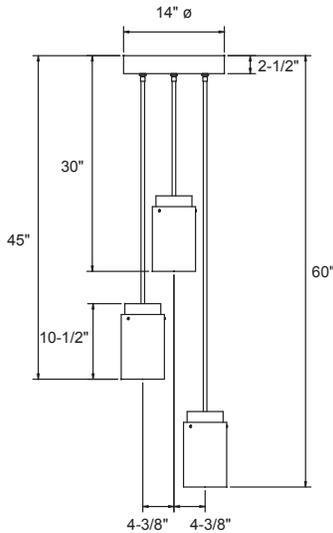
Four Cluster (4CL): 5" canopy with a 1 1/2" swivel ball. One 5/8" stem with a standard hang height of 72" (OA), minimum. Maximum overall hang height for one piece stem assembly is 8' (OA). 9' to 30' (OA) stems are supplied in multiple sections. Supplied with a self aligning swivel which will accommodate up to 15° (total) adjustment. Specify SCA for sloped ceilings from 15° to 45°.

Installation

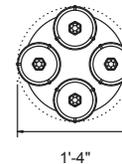
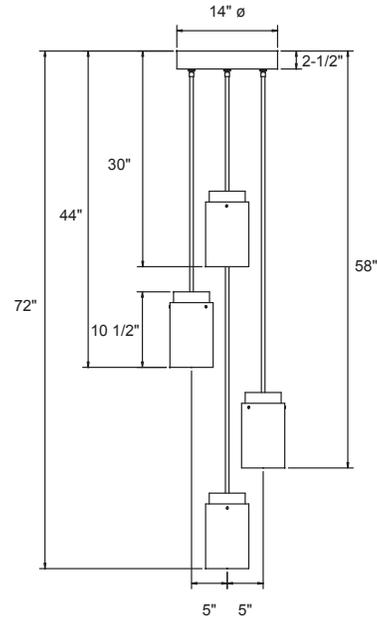
Cluster Pendants: Supplied with a 5" canopy with swivel ball. Contractor to provide appropriate J-box installation to support 50 lbs. Refer to the installation drawings for details. Integral safety cable provided.



461 DOUBLE CLUSTER (2CL)



461 TRIPLE CLUSTER (3CL)



461 FOUR CLUSTER (4CL)



SOLATUBE®



Innovation
in Daylighting™



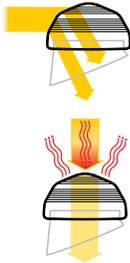
Highest Performance
GUARANTEED*
All day long. All year long.



Breakthrough Technology for Higher Performance

1 Raybender® 3000 Technology

- Patented daylight-capturing dome lens
- Redirects low-angle sunlight
- Rejects overpowering summer midday sunlight
- Consistent daylighting throughout the day



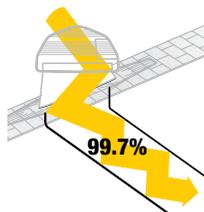
2 LightTracker™ Reflector

- Patented in-dome reflector
- Redirects low-angle winter sunlight
- Increases light input for increased light output
- Unsurpassed year-round performance



3 Spectralight® Infinity

- World's most reflective tubing
- 99.7% spectral reflectivity
- Purest color rendition possible
- Transfers sunlight a phenomenal 30 ft/9 m



4 Engineered Light Diffusion

- Blocks UV transmission
- Optical lenses deliver superior diffusion
- Designed for visual comfort



Solatube® Daylighting System

CAPTURE zone

Sunlight is captured by the dome and directed down into the tube.



TRANSFER zone

Sunlight is directed downward through the attic.

DELIVERY zone

Sunlight is distributed throughout the room.

The Right Light For Every Room

The Brighten Up® Series transforms difficult to light and often forgotten rooms into extraordinary spaces filled with pure, natural daylight. Highly effective and simple to install, the Solatube Brighten Up® Series is designed to light hard to reach places. Choose the size that works for your room.

Model	Tube Size (diameter)	EDCS*	Light Coverage Area (residential)	Potential Tube Length
Solatube 160 DS	≈ 10 in (250 mm)	160 in ² (1032 cm ²)	150 - 200 ft ² (14 - 19 m ²)	20 ft+ (6 m+)
Solatube 290 DS	≈ 14 in (350 mm)	290 in ² (1871 cm ²)	250 - 300 ft ² (23 - 28 m ²)	30 ft+ (9 m+)

*EDCS (Effective Daylight Capture Surface) represents the surface area of the dome that collects and redirects sunlight. For comparison, a clear dome with no lens on a typical 10 inch tube system has an EDCS of 78.5 square inches.



Ideal for:

- Bathrooms
- Hallways
- Closets
- Laundry Rooms
- Dens/Home Office
- Kitchens
- Dining Rooms
- Family Rooms



We offer a Solatube 21-C or 21-O for larger rooms. Available as special order.



OptiView® Diffuser

Vusion™ Diffuser

Diffusers

Two diffuser choices are designed with our proprietary lenses for highly effective light diffusion. Each features a sleek, low-profile dress ring in white. These attractive and stylish diffusers seamlessly integrate into most ceiling surfaces with no visible fasteners.

OptiView® Diffuser

This technologically superior diffuser delivers crystal clear daylight and a unique view of the sky.

Vusion™ Diffuser

The fresh design of the Vusion diffuser harmonizes with most any décor.

Flashings

Flashing kits are available for all roof types and pitches. They're fabricated as a single, seamless piece to ensure leak-proof performance.



Tile



Shingle/Shake



Tile



Curb Mounted*

Special metal roof installation kit available upon request.

*Available in 290 DS.

Accessories

Light Add-On Kit

The Light Add-On Kit provides the convenience of a switched light for night time use.

Incandescent (shown)

Accepts one 100 watt lamp for the 160 DS and two 100 watt lamps for the 290 DS.

Compact Fluorescent

Uses one 26 watt lamp for the 160 DS and 290 DS.



Ventilation Add-On Kit

The Solatube 160 DS is available with an optional Ventilation Add-On Kit. When combined with this innovative accessory, the 2-in-1 ceiling fixture minimizes ceiling penetrations for a more attractive look.



Optional Ventilation Roof Cap



Ventilation Kit Diffuser

Daylight Dimmer*



* Patent #7,082,726

Our proprietary variable butterfly baffle easily controls the amount of light entering a room with the convenience of a switch.

- Perfect for bedrooms, media rooms and offices.
- Wall mounted switch provides convenient low voltage control.



Daylight Dimmer Switch Kit (sold separately) includes DPDT switch, wall plate and 15 ft/4.5 m of cable. Multiple Daylight Dimmers can be controlled by one switch.

www.solatube.com



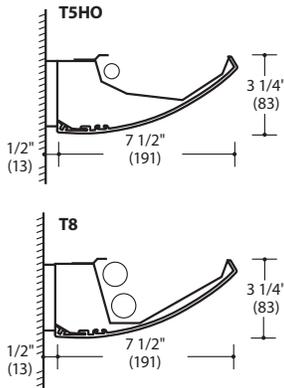
Type:
Project:

Wall Xa-56™

W-AI-5600

Wall-Mounted Asymmetric Indirect

Specifications



HOUSING. Fixture body is one-piece extruded aluminum .100" thick attached to an 18-gauge steel back plate.

END CAPS. Steel, 14-gauge, with no holes or knockouts, finished to match housing.

REFLECTOR. Die-formed steel with high-reflectance white finish with additional areas of specular aluminum to enhance distribution and performance. Luminance Control Deflector™ (LCD) positioned above lamps provides uniform light distribution on wall to diminish any appearance of socket shadows.

LAMPING. Available in one- and two-lamp T8, one-lamp T5 or T5HO and one-lamp twin-tube compact fluorescent cross-sections.

BALLAST. Electronic Ballast (ELB - for T8 and BX lamping) or Low-profile Electronic Ballast (LP/ELB - for T5 or T5HO lamping), high power factor, thermally protected Class P, Sound Rated A, manufactured by a UL Listed manufacturer, as available, determined by Litecontrol. Ballasts with a voltage range of 120 to 277 will be used when fixture configuration and ballast availability allow. The minimum number of ballasts will be used.

TANDEM WIRING. When selected from Ordering guide below, fixtures wired to switch in-line lamps separately, providing two levels of light (2-lamp cross-section fixtures only).

PRE-WIRING. Fixtures are supplied with #12 AWG type THHN wire for branch circuits. One end will have factory-installed push-in quick-connects. The other end will be stripped back 1/2" for quick connection in field. For fixtures to accommodate special circuits such as night light and emergency, etc., in-field wiring will be required. See Pre-Wiring Information for details.

MOUNTING. Provided with two wall-mounting brackets measuring 2 3/4" high x 7" wide x 1/2" deep. Finish is CWM (Matte White). **2' fixture:** provided with one wall-mounting bracket measuring 2 3/4" high x 22 1/2" wide x 1/2" deep. Finish is CWM (Matte White).

CERTIFICATION. Fixture and electrical components shall be UL and/or CUL Listed and shall bear the I.B.E.W., AF of L label. © 2015

Note: Litecontrol reserves the right to change specifications without notice for product development and improvement.

Ordering guide

Product, lamping, & length					Options						
W -	AI -	56	2	4	T8 -	TCWM -	TW -	ELB -	2CWQ -	F -	120
Mounting	Distribution	Series	Lamp Count	Nominal Length(ft)	Lamp Type	Finish	Tandem Wiring	Ballast	Pre-Wiring	Other Options	Volts
W Wall-Mounted	AI Asymmetric Indirect	56	1 →	3,4 →	T5HO	TCWM (Textured Matte White) is standard see LiteColors™ in Product Guide for other finishes	-- → TW → see notes	ELB is std. for T8 or BX LP/ELB is std. for T5 or T5HO DA/ELB HEL/ELB ECO/ELB see Ballast options	1CWQ 2CWQ	F LP/EF EF see Other options	120 277
			2 →	6,8 →	T5						
			3 →	12 →							
			1 →	2,3,4 →	T8						
			2 →	2,4,6,8 →							
			3,6 →	12 →							
			4 →	6,8 →							
			1 →	2 →	BX40						
			2 →	4 →	BX50						
			3 →	6 →							
			4 →	8 →							
			6 →	12 →							
2 →	3 →	BX39									
		see notes									

Cross-section lamping



W-AI-5624T8-TCWM-TW-ELB-2CWQ-F-120 is a typical catalog number for a 2-lamp (2 lamps in cross-section), 4-foot long, T8 fixture with Textured Matte White finish, tandem-wired electronic ballast, pre-wired with two-circuit branch wiring and quick-connects, fuse, 120 volts.

Questions to Ask

1. 120 or 277 volt?
2. Row information, including desired fixture lengths?
3. White, LiteColor, or special color?
4. Tandem wiring?
5. Other options?

litecontrol.com

Ballast options

Specify in place of **ELB** or **LP/ELB**, contact factory for availability/compatibility with lampping:

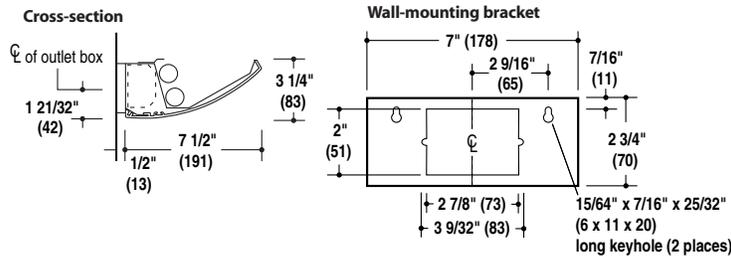
- DA/ELB** Advance Mark VII Dimming Ballast.
- HEL/ELB** Osram Sylvania Dimming Ballast.
- ECO/ELB** Lutron ECO-10 Dimming Ballast.

Other options

- F** Fuse. Slow or fast blow, determined by Litecontrol.
- LP/EF** Low-profile Emergency Fluorescent Ballast. Battery-powered ballast from a UL Listed manufacturer will operate one T5 or T5HO lamp for 1 1/2 hours.
- EF** Emergency Fluorescent Ballast. Battery-powered ballast from a UL Listed manufacturer will operate one T8 lamp for 1 1/2 hours.

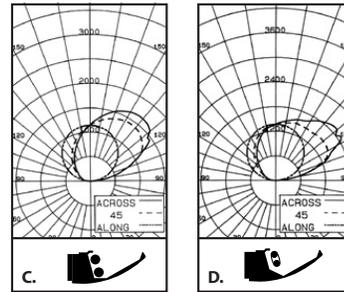
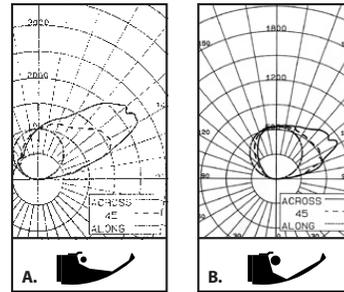
Planning for installation

Wall Xa-56



Mounts to and covers either a 2" x 4" single device box positioned horizontally or a standard outlet box with plaster ring ears positioned horizontally.

Photometric data



A. W-AI-5614T5HO 91.4% Efficiency
Litecontrol Certified Test Report #25416000

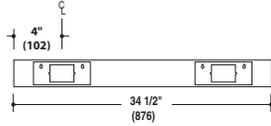
B. W-AI-5614T8 79.5% Efficiency
Litecontrol Certified Test Report #25411000

C. W-AI-5624T8 70.0% Efficiency
Litecontrol Certified Test Report #25421000

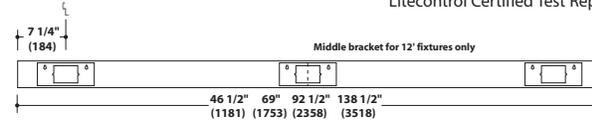
D. W-AI-5624BX40 79.3% Efficiency
Litecontrol Certified Test Report #25410000

For complete photometric information, see website.

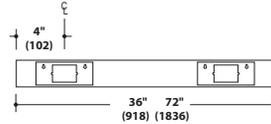
3' T5HO Fixture



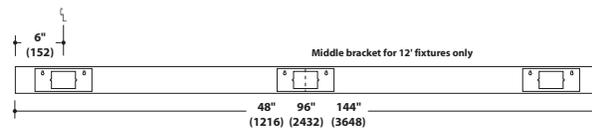
4', 6', 8', 12' T5HO Fixtures



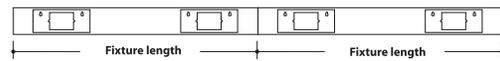
3' and 6' T8 & BX Fixtures



4', 8', 12' T8 & BX Fixtures



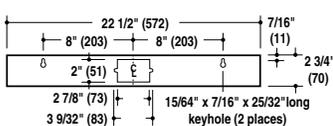
Row diagram



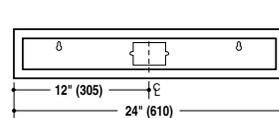
T5HO Fixture Lengths:
34 1/2", 46 1/2", 69", 92 1/2", 138 1/2"
T8 & BX Fixture Lengths:
24", 36", 48", 72", 96", and 144"

2' Fixture

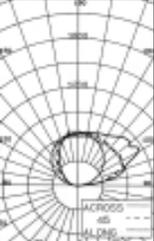
Wall-mounting bracket



Back view of bracket and housing



PHOTOMETRIC DATA: T8



CANDLEPOWER SUMMARY

ANGLE	0	45	90	135	180	OUTPUT LUMENS
180	636	636	636	636	636	61
175	630	629	639	643	653	
170	628	626	631	646	663	
165	595	615	620	647	672	178
160	559	584	604	661	678	
155	501	551	582	636	698	275
150	442	505	555	626	711	
145	386	451	523	625	742	341
140	335	393	486	615	786	
135	286	337	445	616	817	380
130	238	288	402	622	819	
125	191	240	356	626	835	387
120	170	194	307	603	835	
115	144	155	236	593	862	346
110	118	124	204	520	589	
105	94	95	148	398	508	249
100	76	69	91	309	326	
95	52	50	36	130	126	92
90	13	14	4	0	0	



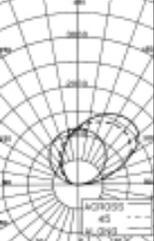
W-AI-5614T8 79.5 % Efficiency
Litecontrol Certified Test Report #25411000

RCC	80				70				50				30				10				0
RW	70	50	30	10	70	50	30	10	50	30	10	50	30	10	50	30	10	50	30	10	0
0	.76	.76	.76	.76	.65	.65	.65	.65	.44	.44	.44	.25	.25	.25	.08	.08	.08	.08	.08	.00	
1	.69	.66	.63	.60	.59	.56	.54	.51	.38	.37	.36	.22	.21	.21	.07	.07	.07	.07	.07	.00	
2	.62	.57	.53	.49	.53	.49	.45	.42	.34	.31	.29	.19	.18	.17	.06	.06	.06	.06	.06	.00	
3	.57	.50	.45	.41	.49	.43	.39	.35	.30	.27	.25	.17	.16	.15	.05	.05	.05	.05	.05	.00	
4	.52	.44	.38	.34	.44	.38	.33	.30	.26	.23	.21	.15	.14	.12	.05	.04	.04	.04	.04	.00	
5	.48	.38	.33	.29	.40	.34	.29	.25	.23	.20	.18	.13	.12	.11	.04	.04	.03	.03	.03	.00	
6	.44	.35	.29	.25	.37	.30	.25	.22	.21	.18	.15	.12	.10	.09	.04	.03	.03	.03	.03	.00	
7	.40	.31	.25	.21	.34	.27	.22	.19	.18	.15	.13	.11	.09	.08	.03	.03	.03	.03	.03	.00	
8	.37	.28	.22	.18	.31	.24	.19	.16	.17	.14	.11	.10	.08	.07	.03	.03	.02	.02	.02	.00	
9	.34	.25	.20	.16	.29	.22	.17	.14	.15	.12	.10	.09	.07	.06	.03	.02	.02	.02	.02	.00	
10	.32	.23	.18	.14	.27	.20	.15	.12	.14	.11	.09	.08	.06	.05	.03	.02	.02	.02	.02	.00	

Floor Cavity Reflectance .20

ZONAL LUMEN SUMMARY

ZONE	LUMENS	% LAMP	% LUMINAIRE
180-90°	2305	79.50	100.00
90-0°	0	.00	.00
180-0°	2305	79.50	100.00



CANDLEPOWER SUMMARY

ANGLE	0	45	90	135	180	OUTPUT LUMENS
180	1143	1143	1143	1143	1143	110
175	1067	1085	1140	1210	1255	
170	974	1017	1126	1266	1349	
165	879	944	1108	1321	1441	321
160	788	868	1077	1362	1524	
155	704	791	1038	1396	1585	506
150	626	712	990	1419	1634	
145	552	637	934	1427	1658	645
140	481	562	869	1423	1664	
135	416	488	796	1401	1642	718
130	354	420	717	1349	1575	
125	289	354	635	1290	1460	704
120	259	292	546	1191	1233	
115	219	237	452	1027	999	579
110	183	192	357	783	779	
105	151	149	255	564	569	364
100	125	112	154	344	342	
95	80	85	61	140	139	118
90	17	23	7	1	1	



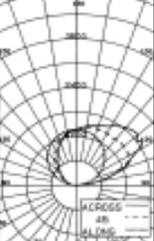
W-AI-5624T8 70.0 % Efficiency
Litecontrol Certified Test Report #25421000

RCC	80				70				50				30				10				0
RW	70	50	30	10	70	50	30	10	50	30	10	50	30	10	50	30	10	50	30	10	0
0	.67	.67	.67	.67	.57	.57	.57	.57	.39	.39	.39	.22	.22	.22	.07	.07	.07	.07	.07	.00	
1	.61	.58	.55	.53	.52	.49	.47	.45	.34	.33	.32	.19	.19	.18	.06	.06	.06	.06	.06	.00	
2	.55	.50	.46	.43	.47	.43	.40	.37	.30	.28	.26	.17	.16	.15	.05	.05	.05	.05	.05	.00	
3	.50	.44	.40	.36	.43	.38	.34	.31	.26	.24	.22	.15	.14	.13	.05	.04	.04	.04	.04	.00	
4	.46	.39	.34	.30	.39	.33	.29	.26	.23	.20	.18	.13	.12	.11	.04	.04	.04	.04	.04	.00	
5	.42	.34	.29	.25	.36	.30	.25	.22	.20	.18	.16	.12	.10	.09	.04	.03	.03	.03	.03	.00	
6	.38	.31	.25	.22	.33	.26	.22	.19	.18	.15	.13	.11	.09	.08	.03	.03	.03	.03	.03	.00	
7	.35	.27	.22	.19	.30	.24	.19	.16	.16	.14	.12	.09	.08	.07	.03	.03	.02	.02	.02	.00	
8	.32	.25	.20	.16	.28	.21	.17	.14	.15	.12	.10	.09	.07	.06	.03	.02	.02	.02	.02	.00	
9	.30	.22	.17	.14	.26	.19	.15	.12	.13	.11	.09	.08	.06	.05	.03	.02	.02	.02	.02	.00	
10	.28	.20	.16	.12	.24	.17	.14	.11	.12	.10	.08	.07	.06	.05	.02	.02	.02	.02	.02	.00	

Floor Cavity Reflectance .20

ZONAL LUMEN SUMMARY

ZONE	LUMENS	% LAMP	% LUMINAIRE
180-90°	4061	70.03	100.00
90-0°	0	.00	.00
180-0°	4061	70.03	100.00



CANDLEPOWER SUMMARY

ANGLE	0	45	90	135	180	OUTPUT LUMENS
180	1366	1366	1366	1366	1366	131
175	1330	1339	1366	1403	1432	
170	1272	1304	1351	1429	1483	
165	1196	1243	1328	1453	1536	382
160	1099	1177	1294	1491	1584	
155	996	1095	1249	1473	1614	594
150	891	999	1194	1473	1688	
145	786	902	1130	1462	1782	753
140	683	800	1057	1478	1852	
135	584	694	971	1500	1914	853
130	493	595	881	1492	1926	
125	397	496	784	1483	1895	868
120	346	407	681	1444	1685	
115	289	324	572	1365	1417	755
110	239	256	455	1076	1190	
105	194	194	328	852	831	501
100	159	143	199	521	506	
95	104	105	78	185	158	160
90	24	29	10	2	0	



W-AI-5624BX40 79.3 % Efficiency
Litecontrol Certified Test Report #25410000

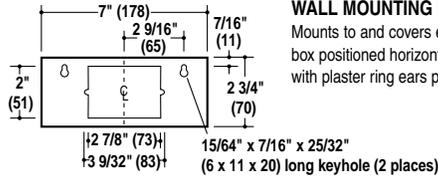
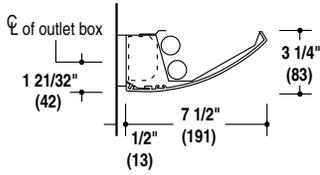
RCC	80				70				50				30				10				0
RW	70	50	30	10	70	50	30	10	50	30	10	50	30	10	50	30	10	50	30	10	0
0	.75	.75	.75	.75	.65	.65	.65	.65	.44	.44	.44	.25	.25	.25	.08	.08	.08	.08	.08	.00	
1	.69	.65	.63	.60	.59	.56	.54	.51	.38	.37	.36	.22	.21	.21	.07	.07	.07	.07	.07	.00	
2	.62	.57	.52	.49	.53	.49	.45	.42	.33	.31	.29	.19	.18	.17	.06	.06	.06	.06	.06	.00	
3	.57	.50	.45	.41	.48	.43	.39	.35	.29	.27	.25	.17	.16	.15	.05	.05	.05	.05	.05	.00	
4	.52	.44	.38	.34	.44	.38	.33	.30	.26	.23	.21	.15	.14	.12	.05	.04	.04	.04	.04	.00	
5	.47	.38	.33	.29	.40	.34	.29	.25	.23	.20	.18	.13	.12	.11	.04	.04	.03	.03	.03	.00	
6	.43	.35	.29	.25	.37	.30	.25	.21	.21	.18	.15	.12	.10	.09	.04	.03	.03	.03	.03	.00	
7	.40	.31	.25	.21	.34	.27	.22	.18	.18	.15	.13	.11	.09	.08	.03	.03	.03	.03	.03	.00	
8	.37	.28	.22	.18	.31	.24	.19	.16	.17	.14	.11	.10	.08	.07	.03	.03	.02	.02	.02	.00	
9	.34	.25	.20	.16	.29	.22	.17	.14	.15	.12	.10	.09	.07	.06	.03	.02	.02	.02	.02	.00	
10	.32	.23	.18	.14	.27	.20	.15	.12	.14	.11	.09	.08	.06	.05	.03	.02	.02	.02	.02	.00	

Floor Cavity Reflectance .20

ZONAL LUMEN SUMMARY

ZONE	LUMENS	% LAMP	% LUMINAIRE
180-90°	4993	79.26	100.00
90-0°	0	.00	.00
180-0°	4993	79.26	100.00

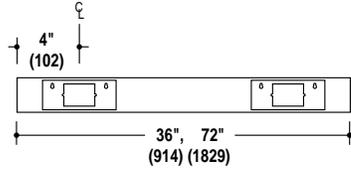
PLANNING FOR INSTALLATION T8



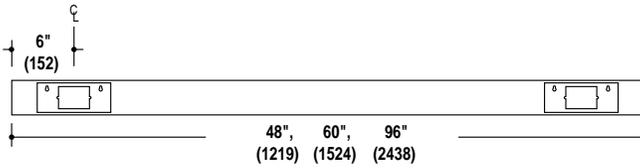
WALL MOUNTING BRACKET

Mounts to and covers either a 2" x 4" single device box positioned horizontally or a standard outlet box with plaster ring ears positioned horizontally.

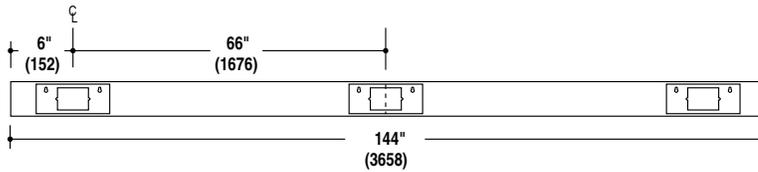
3' & 6' FIXTURE



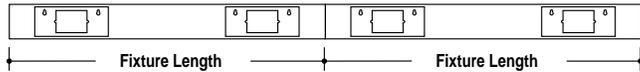
4', 5', 8' FIXTURE



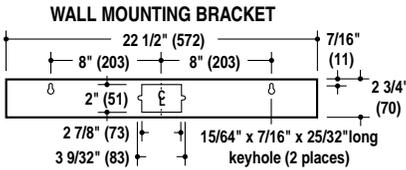
12' FIXTURE



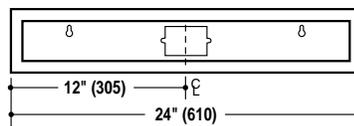
ROW DIAGRAM: 3', 4', 5', 6', 8' Fixtures



2' FIXTURE



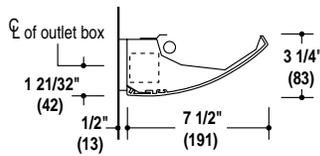
BACK VIEW OF BRACKET AND HOUSING



PHOTOMETRIC DATA: T5HO

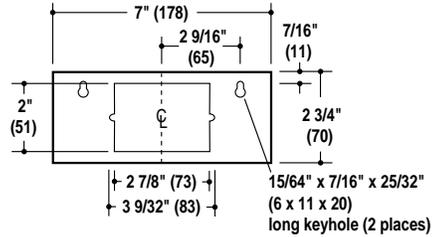
CANDLEPOWER SUMMARY		W-AI-5614T5HO 91.4% Efficiency Litecontrol Certified Test Report #25416000												ZONAL LUMEN SUMMARY																	
ANGLE	0	45	90	135	180	OUTPUT LUMENS	RCC			70			50			30			10			0			ZONE	LUMENS	% LAMP	% LUMINAIRE			
180	1004	1004	1004	1004	1004	96	RCC	70	80	10	70	50	30	10	50	30	10	50	30	10	50	30	10	0	0	0	180-90°	4569	91.38	100.00	
175	941	950	998	1046	1086		RCC	70	80	10	70	50	30	10	50	30	10	50	30	10	50	30	10	0	0	0	90-0°	0	.00	.00	
170	861	897	986	1088	1157		0	.87	.87	.87	.74	.74	.74	.74	.51	.51	.51	.29	.29	.29	.09	.09	.09	.00	.00	.00	180-0°	4569	91.38	100.00	
165	776	830	967	1126	1225	278	1	.79	.75	.72	.69	.68	.65	.62	.59	.44	.43	.41	.25	.25	.24	.08	.08	.08	.00	.00	.00				
160	707	761	944	1156	1282		2	.72	.66	.60	.56	.61	.56	.52	.48	.39	.36	.34	.22	.21	.20	.07	.07	.06	.00	.00	.00				
155	636	703	906	1179	1371	440	3	.66	.58	.52	.47	.56	.49	.45	.41	.34	.31	.29	.20	.18	.17	.06	.06	.05	.00	.00	.00				
150	571	641	867	1187	1529		4	.60	.51	.44	.39	.51	.44	.38	.34	.30	.27	.24	.17	.16	.14	.06	.05	.05	.00	.00	.00				
145	532	577	818	1237	1743	594	5	.55	.44	.38	.33	.47	.39	.33	.29	.27	.23	.20	.15	.14	.12	.05	.04	.04	.00	.00	.00				
140	542	517	764	1306	1958		6	.50	.40	.33	.28	.43	.34	.29	.25	.24	.20	.18	.14	.12	.10	.04	.04	.03	.00	.00	.00				
135	548	473	699	1406	2097	755	7	.46	.36	.29	.24	.39	.31	.25	.21	.21	.18	.15	.12	.10	.09	.04	.03	.03	.00	.00	.00				
130	510	463	631	1512	2231		8	.42	.32	.26	.21	.36	.28	.22	.18	.19	.16	.13	.11	.09	.08	.04	.03	.03	.00	.00	.00				
125	436	451	562	1560	2264	865	9	.39	.29	.23	.18	.33	.25	.20	.16	.17	.14	.11	.10	.08	.07	.03	.03	.02	.00	.00	.00				
120	387	410	486	1601	2216		10	.36	.26	.20	.16	.31	.23	.18	.14	.16	.12	.10	.09	.07	.06	.03	.02	.02	.00	.00	.00				
115	322	343	407	1554	1809	825	Floor Cavity Reflectance .20																								
110	258	279	323	1380	1420																										
105	203	208	235	971	878	547																									
100	164	147	146	533	651																										
95	96	102	66	227	167	174																									
90	13	21	10	4	3																										

PLANNING FOR INSTALLATION T5HO

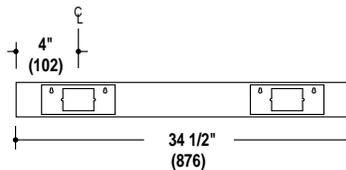


WALL MOUNTING BRACKET

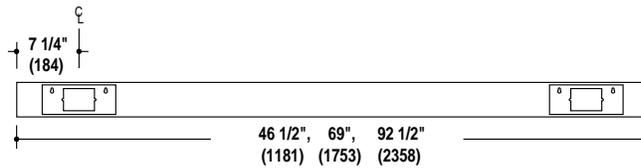
Mounts to and covers either a 2" x 4" single device box positioned horizontally or a standard outlet box with plaster ring ears positioned horizontally.



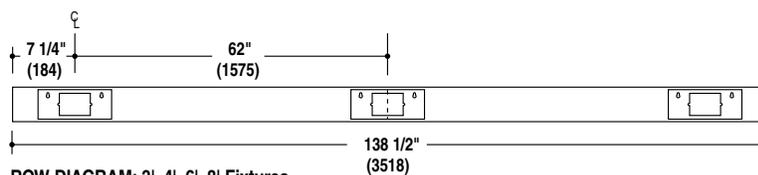
3' FIXTURE



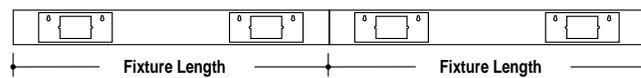
4', 6', 8' FIXTURE



12' FIXTURE



ROW DIAGRAM: 3', 4', 6', 8' Fixtures

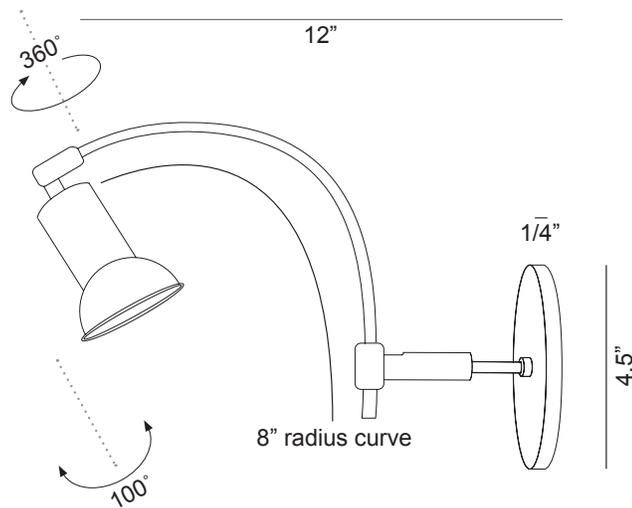


Ceiling Fixtures

Wall Spotlight 21

wall mounted fixture designed to flood light down surface of wall, swivels 100° and rotates 330°, 60W electronic auto-reset transformer, 12" standard arm length with 8" radius curve, custom lengths available (specify), canopy also available in white or black finish (specify)

WSL21/CH chrome
WSL21/MCH matte chrome
WSL21/BN brushed nickel



Solar Thermal Systems Specifications

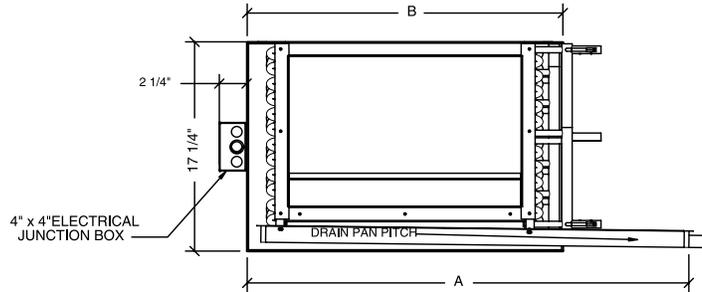


HI-CAPACITY FAN-COIL DIMENSIONAL VIEWS

MODEL "FDHP"

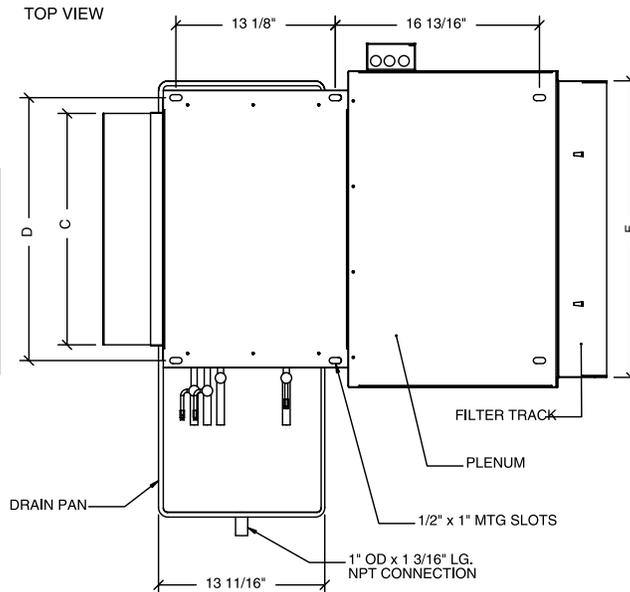
FRONT VIEW

Motor & Blower Info:		
Model	Motor(s)	Blower(s)
06, 08 & 12	1	1
16 & 20	1	2



TOP VIEW

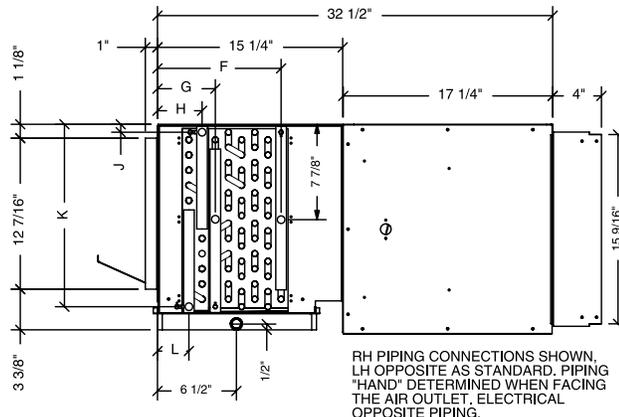
Dimensional Data					
Unit Size	A	B	C	D	E
06	33-1/4	22-13/16	16-1/16	18-1/2	21-5/16
08	36-3/8	26	19-1/4	21-5/8	24-7/16
12	45-5/8	35-1/4	28-1/2	30-7/8	33-11/16
16	56-1/16	45-11/16	38-15/16	41-5/16	44-1/8
20	63-15/16	53-9/16	46-13/16	49-3/16	52



SIDE VIEW (COOLING & REHEAT)

Coil Connection Locations						
COIL	F	G	H	J	K	L
4 Row	5-13/16	2-9/16	N/A	N/A	N/A	N/A
6 Row	7-15/16	2-9/16	N/A	N/A	N/A	N/A
4/1 Row	6-7/8	3-5/8	2-1/2	1-1/4	15	2-1/2
4/2 Row	8	4-3/4	3-5/8	5/8	15	2-9/16
6/1 Row	9	3-5/8	2-1/2	1-1/4	15	2-1/2
6/2 Row	10-1/8	4-3/4	3-5/8	5/8	15	2-9/16

Coil Connection Sizes (Nominal)					
COIL	06	08	12	16	20
1 Row	1/2	1/2	1/2	1/2	3/4
2 Row	1/2	1/2	1/2	1/2	3/4
4 Row	1/2	1/2	3/4	3/4	3/4
6 Row	1/2	3/4	3/4	1	1



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All listed dimensions are approximate and are subject to change without notice.
Modifications to the product specifications must be accepted by Hydro-Air at its base office.

HCFC-SUB-032407

TABLE A - Direct Drive Standard Ratings

UNIT SIZE		06	08	12	16	20
CERTIFIED COOLING RATINGS (4 - Row Main Coil)	Total MBH	17.9	24.5	39.9	54.8	67.3
	Sensible MBH	15.8	20.0	30.2	42.3	53.0
	GPM	3.6	4.8	7.9	10.9	13.5
	PD, ft. of H ₂ O	2.2	3.8	4.5	3.8	3.4
HEATING CAPACITY (4-Row Main Coil)	MBH	57.1	69.9	98.7	136.4	167.4
	GPM	3.8	4.6	6.6	9.1	11.1
	PD, ft. of H ₂ O	2.4	3.5	3.2	2.7	2.3
CERTIFIED COOLING RATINGS (6-Row High Capacity Coil)	Total MBH	29.9	36.3	51.2	72.3	93.1
	Sensible MBH	20.6	24.8	34.9	49.5	63.5
	GPM	6.0	7.2	10.3	14.3	17.6
	PD, ft. of H ₂ O	2.7	3.8	3.4	3.7	5.6
HEATING CAPACITY (6-Row High Capacity Coil)	MBH	65.3	80.2	113.0	160.2	208.9
	GPM	4.3	5.3	7.5	10.7	13.9
	PD, ft. of H ₂ O	1.4	2.1	1.9	2.1	3.5
HEATING CAPACITY (Optional 1-Row Reheat Coil)	MBH	17.9	22.8	36.7	55.1	65.3
	GPM	1.1	1.4	2.3	3.5	4.1
	PD, ft. of H ₂ O	0.9	1.4	3.5	7.7	4.9
HEATING CAPACITY (Optional 2-Row Reheat Coil)	MBH	37.8	46.4	65.7	97.3	119.7
	GPM	2.4	2.9	4.1	6.1	7.6
	PD, ft. of H ₂ O	3.7	5.4	4.9	10.5	9.0
CFM	High	840	990	1380	1980	2550
	Medium	660	810	1150	1620	2150
	Low	360	480	675	975	1250
COIL	FPI	12	12	12	12	12
	Face Area, ft ²	1.73	2.06	3.03	4.11	4.93
	Coil Connections	1/2" Cu				
BLOWER	Quantity	1	1	1	2	2
	Diameter	8.8"	8.8"	8.8"	8.8"	8.8"
	Width	9.9"	9.9"	9.9"	9.9"	9.9"
FILTER	Number	1	1	1	1	2
	Length, in.	21.0	24.2	33.4	43.9	24.2
	Width, in.	15.5	15.5	15.5	15.5	15.5
	Thickness, in.	2	2	2	2	2
SHIPPING WEIGHT, lbs.	Std. Coil Ceiling	160	190	225	300	380
	Hi-Cap Coil Ceiling	170	205	245	320	410
	Std. Coil w/ Plenum	135	150	180	240	290
	Hi-Cap Coil w/ Plenum	145	165	200	260	320
	Std. Coil w/o Plenum	90	100	115	160	180
	Hi-Cap Coil w/o Plenum	100	115	135	180	210

Notes:

1. Airflow under dry conditions. Inlet air 70-80 °F DB and 0.0" ESP for FDHP model.
2. Cooling capacity based on inlet air 80 °F DB, 67 °F WB, 45 °F entering water, 55 °F leaving water, high fan speed, 0.0" ESP.
3. Heating capacity based on inlet air 70 °F DB, 180 °F entering water, 150 °F leaving water, high fan speed, 0.0" ESP.
4. All direct drive units supplied with replaceable filter with the exception of model FDH.
5. Model FDC filters are (filter width - 3-13/16") by (06: 13-11/16", 08: 17-11/16", 12: 27-11/16", 16 & 20: (2) 17-11/16") length.
6. ARI certified for sizes 06, 08, and 12. Larger sizes exceed the maximum airflow rate in ARI 440 and are therefore not certified.



TABLE B - Belt Drive Standard Ratings

UNIT SIZE		08		12		16		20		30	
COOLING RATINGS (4-Row Main Coil)	Total MBH	21.6	23.0	36.6	38.7	49.5	53.4	57.6	61.2	91.5	95.7
	Sensible MBH	17.0	18.6	27.2	29.0	36.5	40.0	43.9	47.3	67.8	71.4
	GPM	4.3	4.6	7.3	7.8	9.9	10.7	11.6	12.3	18.3	19.1
	PD, ft. of H ₂ O	3.1	3.4	3.9	4.4	4.0	4.7	2.5	2.8	6.0	6.5
HEATING CAPACITY (4-Row Main Coil)	MBH	80.0	86.8	118.9	125.6	159.8	173.3	191.8	204.7	294.4	307.8
	GPM	7.6	8.2	11.2	11.9	15.1	16.4	18.2	19.4	27.9	29.1
	PD, ft. of H ₂ O	9.0	10.6	8.9	9.9	9.0	10.5	5.9	6.7	13.4	14.6
COOLING RATINGS (6-Row High Capacity Coil)	Total MBH	30.8	33.8	45.7	48.8	61.4	67.7	78.5	84.9	121.2	127.9
	Sensible MBH	20.8	22.9	30.9	33.1	41.4	45.9	52.5	57.0	80.1	84.7
	GPM	6.2	6.8	9.2	9.8	12.3	13.6	15.8	17.1	24.2	25.5
	PD, ft. of H ₂ O	2.8	3.4	2.8	3.2	2.8	3.4	4.5	5.2	10.2	11.3
HEATING CAPACITY (6-Row High Capacity Coil)	MBH	91.7	99.9	136.4	144.5	183.2	199.5	231.0	247.6	352.0	368.9
	GPM	8.7	9.5	12.9	13.7	17.3	18.9	21.8	23.4	33.3	34.9
	PD, ft. of H ₂ O	5.4	6.4	5.3	5.9	5.4	6.3	8.4	9.6	18.8	20.6
HEATING CAPACITY (Optional 1-Row Reheat Coil)	MBH	20.4	21.7	34.1	35.6	49.1	52.3	57.4	60.4	90.0	93.2
	GPM	1.3	1.4	2.1	2.2	3.1	3.3	3.6	3.8	5.7	5.9
	PD, ft. of H ₂ O	1.2	1.3	3.1	3.3	6.2	7.0	3.8	4.2	9.1	9.7
HEATING CAPACITY (Optional 2-Row Reheat Coil)	MBH	40.9	43.9	60.5	63.5	85.7	92.0	103.6	109.7	150.4	156.3
	GPM	2.6	2.8	3.8	4.0	5.4	5.8	6.5	6.9	9.5	9.9
	PD, ft. of H ₂ O	4.3	5.0	4.2	4.6	8.2	9.4	6.8	7.6	6.4	6.9
CFM		800	900	1200	1300	1600	1800	2000	2200	3000	3200
COIL	FPI	12		12		12		12		12	
	Face Area, ft ²	1.73		2.06		3.03		4.11		4.93	
	Coil Connections	1/2" Cu		1/2" Cu		1/2" Cu		1/2" Cu		1/2" Cu	
BLOWER	Quantity	1		1		2		2		2	
	Diameter	8.8"		8.8"		8.8"		8.8"		8.8"	
	Width	9.9"		9.9"		9.9"		9.9"		9.9"	
FILTER	Number	1		1		1		2		2	
	Length, in.	24.2		33.4		43.9		24.2		33.4	
	Width, in.	15.5		15.5		15.5		15.5		15.5	
	Thickness, in.	2		2		2		2		2	
SHIPPING WEIGHT, lbs.	Std. Coil Ceiling	205		235		315		410		510	
	Hi-Cap Coil Ceiling	220		255		335		440		550	
	Std. Coil w/ Plenum	155		190		260		320		385	
	Hi-Cap Coil w/ Plenum	175		210		280		350		425	
	Std. Coil w/o Plenum	110		130		175		200		230	
	Hi-Cap Coil w/o Plenum	120		150		200		230		270	

Notes:

1. Cooling capacity based on inlet air 80 °F DB, 67 °F WB, 45 °F entering water, 55 °F leaving water.
2. Heating capacity based on inlet air 70 °F DB, 180 °F entering water, 150 °F leaving water.
3. All belt drive units supplied with replaceable filter with the exception of model FBH.



Motor Data

TABLE C

DIRECT DRIVE MOTOR DATA

UNIT SIZE		06	08	12	16	20
MOTOR - STD (115V, 60HZ, 1PH)	HP	1/5	1/5	1/2	1/2	5/8
	Quantity	1	1	1	1	1
	RPM High	1050	1010	1050	940	1050
	RPM Medium	925	780	850	725	850
	RPM Low	700	550	650	600	650
	Amps	3.0	3.0	5.0	5.5	8.4
	Power Input - Watts	300	340	550	650	900
MOTOR - OPTIONAL (208-230V, 60HZ, 1PH)	HP	1/5	1/5	1/2	1/2	5/8
	Quantity	1	1	1	1	1
	RPM High	1050	1030	1050	1000	1050
	RPM Medium	850	830	850	800	850
	RPM Low	650	630	650	600	650
	Amps	1.5	1.5	4.0	3.5	5.0
	Power Input - Watts	300	340	825	650	1030
MOTOR - OPTIONAL (277V, 60HZ, 1PH)	HP	1/4	1/4	1/3	1/2	1/2
	Quantity	1	1	1	1	1
	RPM High	1075	1075	1075	1075	1075
	RPM Medium	925	925	975	950	950
	RPM Low	850	850	875	850	850
	Amps	1.3	1.3	1.9	2.2	2.2
	Power Input - Watts	330	330	480	570	570

TABLE D

BELT DRIVE MOTOR DATA

UNIT SIZE		08	12	16	20	30		
NOMINAL CFM		800	1200	1600	2000	3000		
MOTOR - STD (115V/208-230V, 1PH)	Low HP	HP	1/3	1/2	1/2	3/4	1	
		Frame	NEMA 56	NEMA 56	NEMA 56	NEMA 56	NEMA 56	
		Blower RPM	1072 - 1455	1120 - 1520	1200 - 1629	1200 - 1629	1200 - 1629	
		Amps	6.0/3.3/3.0	8.5/4.7/4.3	8.5/4.7/4.3	11.0/6.1/5.5	14.0/7.7/7.0	
	High HP	HP	3/4	3/4	1	1-1/2	1-1/2	
MOTOR - OPTIONAL (208-230V, 460V, 3PH)	Low HP	Frame	NEMA 56	NEMA 56	NEMA 56	NEMA 56	NEMA 56	
		Blower RPM	1072 - 1455	1120 - 1520	1200 - 1629	1200 - 1629	1200 - 1629	
		Amps	11.0/6.1/5.5	11.0/6.1/5.5	14.0/7.7/7.0	21.0/11.6/10.5	21.0/11.6/10.5	
		Amps	1.5/1.4/0.7	2.2/2.0/1.0	2.2/2.0/1.0	3.1/2.8/1.4	3.9/3.5/1.8	
	High HP	HP	3/4	3/4	1	1-1/2	2	1-1/2
Frame	NEMA 56	NEMA 56	NEMA 56	NEMA 56	NEMA 56H	NEMA 56	NEMA 56H	
Blower RPM	1072 - 1455	1120 - 1520	1200 - 1629	1200 - 1629	1200-1629	1200 - 1629	1200-1629	
Amps	3.1/2.8/1.4	3.1/2.8/1.4	3.9/3.5/1.8	5.5/5.0/2.5	6.9/6.2/3.1	5.5/5.0/2.5	6.9/6.2/3.1	

Direct Drive 4-Row Cooling Capacities

TABLE E1

UNIT SIZE	GPM	72 °F DB/60 °F WB Entering Air									72 °F DB/62 °F WB Entering Air								
		40 °F Ent. Water			45 °F Ent. Water			50 °F Ent. Water			40 °F Ent. Water			45 °F Ent. Water			50 °F Ent. Water		
		ΔT	T-btu	S-btu	ΔT	T-btu	S-btu	ΔT	T-btu	S-btu	ΔT	T-btu	S-btu	ΔT	T-btu	S-btu	ΔT	T-btu	S-btu
06	3.5	8.3	14638	14638	6.1	10663	10663	4.0	7039	7039	9.8	17222	14217	7.4	12939	12335	5.0	8759	8759
	4	7.7	15437	15190	5.6	11296	11296	3.7	7506	7506	9.0	18103	14606	6.8	13675	12659	4.7	9367	9367
	4.5	7.1	16103	15515	5.3	11874	11874	3.5	7883	7883	8.4	18833	14931	6.4	14339	12951	4.3	9781	9781
	5	6.6	16636	15774	4.9	12328	12328	3.3	8215	8215	7.8	19487	15223	5.9	14857	13178	4.1	10199	10199
	5.5	6.2	17168	16034	4.6	12720	12720	3.1	8554	8554	7.3	20065	15482	5.6	15301	13373	3.8	10552	10552
08	5	8.1	20217	18897	6.0	14973	14973	4.0	9926	9926	9.5	23720	18285	7.2	18019	15761	5.0	12419	12419
	5.5	7.6	20842	19203	5.6	15515	15515	3.7	10332	10332	8.9	24398	18591	6.8	18630	16029	4.7	12838	12838
	6	7.1	21465	19509	5.3	15982	15982	3.6	10676	10676	8.3	25071	18897	6.4	19240	16296	4.4	13260	13260
	6.5	6.8	22009	19777	5.0	16372	16372	3.4	11026	11026	7.9	25656	19165	6.0	19675	16488	4.2	13686	13686
	7	6.4	22396	19968	4.8	16763	16763	3.2	11310	11310	7.5	26155	19394	5.7	20110	16679	4.0	14027	14002
12	7	8.9	31093	27834	6.6	23220	23220	4.4	15597	15597	10.3	36133	26928	7.9	27800	23196	5.5	19423	19423
	7.5	8.4	31740	28154	6.4	23878	23878	4.3	16098	16098	9.8	36943	27301	7.6	28528	23516	5.3	19902	19731
	8	8.1	32492	28527	6.1	24426	24426	4.1	16503	16503	9.4	37633	27621	7.3	29132	23782	5.1	20384	19944
	8.5	7.8	33027	28794	5.8	24866	24795	3.9	16810	16810	9.0	38320	27941	7.0	29615	23996	4.9	20866	20157
	9	7.4	33560	29060	5.6	25415	25062	3.8	17221	17221	8.6	38888	28207	6.7	30217	24262	4.7	21229	20317
16	9	9.3	41851	38483	6.9	31198	31198	4.6	20952	20952	10.8	48635	37106	8.3	37269	32057	5.7	25856	25856
	10	8.7	43408	39248	6.5	32600	32600	4.4	21926	21926	10.0	50317	37871	7.7	38837	32746	5.4	27042	27042
	11	8.1	44803	39936	6.1	33695	33695	4.1	22777	22777	9.4	51820	38559	7.3	40055	32281	5.1	28066	28003
	12	7.7	46036	40548	5.8	34793	34793	3.9	23640	23640	8.9	53312	39248	6.9	41269	33817	4.8	28924	28386
	13	7.2	47111	41083	5.5	35578	35423	3.7	24223	24223	8.4	54463	39783	6.5	42307	34276	4.6	29785	28768
20	13	8.4	54443	49660	6.3	40976	40976	4.3	27787	27787	9.7	62895	47788	7.4	48524	41385	5.2	34087	34087
	14	8.0	55842	50349	6.0	41976	41976	4.1	28683	28683	9.2	64410	48477	7.1	49642	41877	5.0	34956	34956
	15	7.6	57038	50940	5.7	42978	42978	3.9	29409	29409	8.7	65702	49069	6.8	50983	42468	4.8	35830	35769
	16	7.3	58229	51531	5.5	43982	43982	3.8	30142	30142	8.4	66988	49660	6.5	51876	42862	4.6	36708	36163
	17	7.0	59219	52024	5.3	44786	44786	3.6	30697	30697	8.0	68267	50251	6.2	52990	43355	4.4	37369	36459

TABLE E2

UNIT SIZE	GPM	72 °F DB/64 °F WB Entering Air									75 °F DB/61 °F WB Entering Air								
		40 °F Ent. Water			45 °F Ent. Water			50 °F Ent. Water			40 °F Ent. Water			45 °F Ent. Water			50 °F Ent. Water		
		ΔT	T-btu	S-btu	ΔT	T-btu	S-btu	ΔT	T-btu	S-btu	ΔT	T-btu	S-btu	ΔT	T-btu	S-btu	ΔT	T-btu	S-btu
06	3.5	11.5	20168	13568	8.9	15657	11750	6.3	11096	9933	8.7	15299	15299	6.5	11438	11438	4.5	7844	7844
	4	10.5	21114	13957	8.2	16472	12075	5.9	11742	10193	8.1	16229	16229	6.0	12123	12123	4.2	8403	8403
	4.5	9.7	21974	14314	7.6	17202	12367	5.5	12310	10420	7.5	16962	16962	5.7	12756	12756	3.9	8827	8827
	5	9.0	22671	14606	7.1	17768	12594	5.1	12799	10615	7.0	17563	17408	5.3	13270	13270	3.7	9209	9209
	5.5	8.5	23362	14898	6.7	18332	12821	4.8	13206	10777	6.6	18097	17667	5.0	13723	13723	3.5	9545	9545
08	5	11.0	27525	17559	8.6	21595	15111	6.2	15553	12701	8.5	21308	20822	6.4	16074	16074	4.4	11091	11091
	5.5	10.3	28334	17903	8.1	22352	15417	5.9	16130	12931	8.0	22015	21166	6.1	16689	16689	4.2	11559	11559
	6	9.7	29047	18209	7.6	22917	15646	5.5	16612	13122	7.5	22643	21472	5.7	17153	17153	4.0	11900	11900
	6.5	9.1	29666	18476	7.2	23479	15876	5.2	16998	13275	7.1	23191	21740	5.4	17619	17619	3.8	12316	12316
	7	8.6	30281	18744	6.8	23946	16067	5.0	17383	13428	6.8	23737	22008	5.2	18087	18087	3.6	12597	12597
12	7	11.9	41654	25915	9.4	33042	22290	6.8	24005	18664	9.4	32826	30624	7.1	25035	25035	4.9	17360	17360
	7.5	11.3	42509	26288	9.0	33693	22556	6.6	24678	18931	9.0	33696	31051	6.8	25691	25691	4.8	17956	17956
	8	10.8	43359	26661	8.6	34470	22876	6.3	25216	19144	8.6	34347	31371	6.6	26349	26349	4.6	18358	18358
	8.5	10.3	44082	26981	8.2	35114	23143	6.0	25619	19304	8.2	34996	31690	6.3	26898	26898	4.4	18866	18866
	9	9.9	44681	27248	7.9	35628	23356	5.8	26155	19517	7.9	35642	32010	6.1	27338	27338	4.3	19173	19173
16	9	12.4	55957	35500	9.8	44144	30604	7.1	32076	25785	9.8	44201	42409	7.4	33547	33547	5.2	23407	23407
	10	11.6	57922	36341	9.1	45840	31292	6.7	33425	26320	9.2	45925	43251	7.0	35098	35098	4.9	24509	24509
	11	10.8	59691	37106	8.6	47339	31904	6.3	34582	26779	8.6	47487	44016	6.6	36345	36345	4.6	25493	25493
	12	10.2	61267	37794	8.1	48644	32440	5.9	35545	27162	8.1	48888	44704	6.2	37441	37441	4.4	26351	26351
	13	9.6	62483	38330	7.6	49756	32899	5.6	36507	27544	7.7	49972	45239	5.9	38539	38539	4.2	27074	27074
20	13	11.1	72252	45719	8.8	57066	39414	6.4	41561	33208	8.8	57548	54716	6.8	44082	44082	4.8	31201	31201
	14	10.5	73863	46409	8.3	58520	40005	6.1	42798	33701	8.4	59157	55505	6.5	45275	45275	4.6	32090	32090
	15	10.0	75464	47098	8.0	59969	40596	5.8	43789	34095	8.1	60562	56194	6.2	46473	46473	4.4	32991	32991
	16	9.6	76827	47689	7.6	60932	40990	5.6	44779	34489	7.7	61763	56785	5.9	47474	47474	4.2	33719	33719
	17	9.2	78182	48280	7.3	62132	41483	5.3	45521	34784	7.4	62761	57278	5.7	48478	48478	4.0	34455	34455

Direct Drive 4-Row Cooling Capacities

TABLE E3

UNIT SIZE	GPM	75 °F DB/63 °F WB Entering Air									75 °F DB/64 °F WB Entering Air								
		40 °F Ent. Water			45 °F Ent. Water			50 °F Ent. Water			40 °F Ent. Water			45 °F Ent. Water			50 °F Ent. Water		
		ΔT	T-btu	S-btu	ΔT	T-btu	S-btu	ΔT	T-btu	S-btu	ΔT	T-btu	S-btu	ΔT	T-btu	S-btu	ΔT	T-btu	S-btu
06	3.5	10.2	17860	15753	7.8	13671	13671	5.4	9521	9521	11.0	19306	15461	8.5	14893	13611	6.0	10539	10539
	4	9.4	18819	16175	7.2	14398	14227	5.0	10109	10109	10.1	20306	15882	7.9	15743	13968	5.7	11264	11264
	4.5	8.7	19702	16564	6.7	15131	14552	4.7	10645	10645	9.4	21148	16239	7.3	16440	14260	5.2	11780	11780
	5	8.1	20361	16856	6.3	15719	14812	4.4	11122	11122	8.7	21908	16564	6.8	17061	14519	4.9	12302	12302
	5.5	7.6	21017	17148	5.9	16235	15039	4.2	11467	11467	8.2	22514	16824	6.4	17604	14747	4.6	12677	12670
08	5	9.9	24754	20210	7.6	19116	17724	5.4	13494	13494	10.6	26609	19866	8.3	20822	17418	6.0	14922	14922
	5.5	9.3	25525	20554	7.2	19725	17992	5.1	13987	13987	10.0	27495	20248	7.8	21462	17686	5.6	15457	15162
	6	8.7	26206	20860	6.8	20335	18260	4.8	14486	14486	9.4	28199	20554	7.3	22101	17954	5.3	15996	15391
	6.5	8.3	26884	21166	6.4	20858	18489	4.6	14905	14905	8.8	28812	20822	7.0	22647	18183	5.0	16446	15582
	7	7.8	27390	21396	6.1	21380	18719	4.3	15242	15242	8.4	29421	21090	6.6	23192	18413	4.8	16808	15735
12	7	10.8	37942	29771	8.4	29541	26039	6.0	21084	21084	11.6	40663	29291	9.1	32080	25613	6.6	23287	21934
	7.5	10.3	38763	30144	8.2	30271	26359	5.8	21676	21676	11.0	41510	29665	8.7	32840	25933	6.4	23921	22201
	8	9.9	39580	30518	7.7	30999	26679	5.6	22272	22272	10.6	42352	30038	8.3	33472	26199	6.1	24556	22467
	8.5	9.5	40276	30837	7.4	31605	26946	5.3	22750	22750	10.1	43070	30358	8.0	34229	26519	5.9	25065	22681
	9	9.1	40969	31157	7.1	32210	27212	5.1	23230	23230	9.7	43783	30678	7.7	34731	26732	5.7	25575	22894
16	9	11.3	50889	41032	8.8	39637	36060	6.3	28320	28320	12.1	54469	40267	9.5	42935	35372	6.9	31106	30400
	10	10.6	52932	41950	8.2	41205	36749	5.9	29488	29488	11.3	56583	41185	8.9	44576	36060	6.5	32544	31012
	11	9.9	54453	42639	7.7	42598	37361	5.6	30668	30668	10.6	58329	41950	8.4	46213	36749	6.1	33810	31547
	12	9.3	55965	43327	7.3	43989	37973	5.3	31686	31686	10.0	59889	42639	7.9	47482	37284	5.8	34717	31930
	13	8.8	57300	43939	6.9	45031	38432	5.0	32540	32540	9.4	61265	43251	7.5	48567	37743	5.5	35809	32389
20	13	10.1	66092	52943	7.9	51653	46540	5.7	37125	37125	10.8	70440	51860	8.5	55629	45555	6.2	40679	39250
	14	9.6	67623	53633	7.6	52994	47131	5.4	38196	38196	10.3	72253	52648	8.2	57268	46244	6.0	41831	39742
	15	9.2	69148	54322	7.2	54112	47624	5.2	39274	39274	10.0	73831	53337	7.8	58437	46737	5.7	42989	40235
	16	8.8	70449	54913	6.9	55453	48215	5.0	40141	40141	9.4	75400	54027	7.4	59604	47229	5.5	43917	40629
	17	8.4	71744	55505	6.6	56346	48609	4.8	41012	41012	9.0	76515	54519	7.1	60770	47722	5.3	44849	41023

TABLE E4

UNIT SIZE	GPM	78 °F DB/64 °F WB Entering Air									78 °F DB/65 °F WB Entering Air								
		40 °F Ent. Water			45 °F Ent. Water			50 °F Ent. Water			40 °F Ent. Water			45 °F Ent. Water			50 °F Ent. Water		
		ΔT	T-btu	S-btu	ΔT	T-btu	S-btu	ΔT	T-btu	S-btu	ΔT	T-btu	S-btu	ΔT	T-btu	S-btu	ΔT	T-btu	S-btu
06	3.5	10.6	18631	17321	8.2	14324	14324	5.9	10333	10333	11.4	19961	16997	8.9	15560	15147	6.4	11292	11292
	4	9.8	19666	17775	7.6	15258	15258	5.5	10970	10970	10.5	21044	17451	8.2	16480	15536	6.0	11997	11997
	4.5	9.1	20479	18132	7.1	15984	15984	5.1	11560	11560	9.7	21969	17840	7.6	17250	15861	5.6	12646	12646
	5	8.5	21290	18489	6.6	16569	16412	4.8	12029	12029	9.1	22814	18197	7.2	17946	16153	5.3	13157	14108
	5.5	8.0	21952	18781	6.2	17156	16672	4.5	12504	12504	8.5	23502	18489	6.7	18566	16412	5.0	13675	13675
08	5	10.3	25852	22135	8.1	20197	19649	5.8	14631	14631	11.0	27681	21791	8.7	21861	19343	6.4	16006	16006
	5.5	9.7	26716	22518	7.6	20892	19955	5.5	15199	15199	10.4	28577	22173	8.2	22592	19649	6.0	16622	16622
	6	9.1	27490	22862	7.2	21588	20261	5.2	15691	15691	9.8	29380	22518	7.8	23323	19955	5.7	17154	17154
	6.5	8.6	28175	23168	6.8	22111	20491	5.0	16188	16188	9.2	30089	22824	7.3	23871	20185	5.4	17689	17584
	7	8.2	28772	23436	6.5	22634	20720	4.7	16522	16522	8.8	30707	23091	7.0	24418	20414	5.0	18137	17775
12	7	11.3	39721	32561	8.9	31380	28883	6.5	22952	22952	12.1	42426	32081	9.6	33759	28403	7.2	25107	24777
	7.5	10.8	40671	32988	8.5	32111	29202	6.3	23539	23539	11.5	43408	32508	9.2	34650	28776	6.8	25736	25044
	8	10.3	41499	33361	8.2	32842	29522	6.0	24130	24130	11.0	44263	32881	8.8	35412	29096	6.6	26367	25311
	8.5	9.9	42322	33734	7.9	33572	29842	5.8	24725	24725	10.6	45113	33254	8.5	36173	29416	6.3	27000	25577
	9	9.5	43025	34054	7.6	34180	30109	5.6	25202	25202	10.2	45837	33574	8.2	36806	29682	6.1	27508	25790
16	9	11.8	53272	44959	9.3	41972	39987	6.8	30741	30741	12.6	56987	44270	10.0	45198	39298	7.4	33436	33436
	10	11.1	55507	45953	8.7	43713	40752	6.4	32060	32060	11.8	59127	45188	9.4	47025	40063	7.0	35035	35015
	11	10.4	57217	46718	8.2	45282	41440	6.1	33396	33396	11.1	61073	46030	8.8	48667	40752	6.6	36289	35550
	12	9.8	58916	47483	7.8	46677	42052	5.7	34406	34400	10.4	62654	46718	8.3	50125	41364	6.2	37550	36086
	13	9.2	60267	48095	7.4	47896	42588	5.4	35423	35423	9.9	64225	47407	7.9	51579	41976	5.9	38635	36545
20	13	10.6	69240	58000	8.4	54745	51597	6.2	40328	40328	11.3	73758	57015	9.0	58860	50710	6.8	43991	43991
	14	10.1	71006	58788	8.0	56308	52286	5.9	41597	41597	10.8	75592	57803	8.6	60502	51400	6.4	45131	44898
	15	9.7	72766	59576	7.7	57649	52877	5.7	42663	42663	10.3	77416	58591	8.2	61908	51991	6.2	46277	45390
	16	9.2	74081	60167	7.4	58991	53468	5.5	43737	43737	9.8	78778	59182	7.9	63313	52582	5.9	47428	45883
	17	8.8	75391	60758	7.1	60109	53961	5.2	44601	44601	9.4	80360	59872	7.6	64482	53074	5.7	48351	46277

Direct Drive 4-Row Cooling Capacities

TABLE E5

UNIT SIZE	GPM	78 °F DB/68 °F WB Entering Air									80 °F DB/64 °F WB Entering Air								
		40 °F Ent. Water			45 °F Ent. Water			50 °F Ent. Water			40 °F Ent. Water			45 °F Ent. Water			50 °F Ent. Water		
		ΔT	T-btu	S-btu	ΔT	T-btu	S-btu	ΔT	T-btu	S-btu	ΔT	T-btu	S-btu	ΔT	T-btu	S-btu	ΔT	T-btu	S-btu
06	3.5	14.0	24591	15991	11.3	19863	14238	8.6	15083	12486	10.4	18206	18206	8.0	14100	14100	5.9	10274	10274
	4	12.9	25794	16445	10.4	20923	14628	7.9	15876	12778	9.6	19277	18994	7.5	14982	14982	5.4	10916	10916
	4.5	11.9	26901	16867	9.7	21803	14952	7.4	16672	13070	8.9	20137	19383	7.0	15740	15740	5.1	11520	11520
	5	11.1	27830	17224	9.0	22591	15244	6.9	17292	13297	8.4	20926	19740	6.5	16368	16368	4.8	12017	12017
	5.5	10.4	28584	17516	8.4	23290	15504	6.5	17913	13524	7.8	21572	20033	6.2	16930	16930	4.5	12460	12460
08	5	13.5	33873	20720	11.0	27538	18311	8.4	21096	15939	10.1	25400	23610	7.9	19843	19843	5.8	14505	14505
	5.5	12.6	34851	21103	10.3	28459	18655	7.9	21828	16207	9.6	26329	24030	7.5	20593	20593	5.5	15110	15110
	6	11.9	35725	21447	9.7	29274	18961	7.5	22560	16475	9.0	27087	24375	7.1	21263	21263	5.2	15648	15648
	6.5	11.2	36591	21791	9.2	29984	19228	7.1	23082	16666	8.5	27759	24681	6.7	21851	21851	4.9	16116	16116
	7	10.6	37260	22059	8.7	30589	19458	6.7	23604	16857	8.1	28345	24948	6.4	22357	22233	4.7	16510	16510
12	7	14.6	51318	30535	12.0	42118	26963	9.3	32641	23445	11.2	39215	34723	8.8	30959	30959	6.5	22894	22894
	7.5	13.7	51318	30535	11.5	43102	27336	8.9	33369	23711	10.7	40266	35203	8.5	31785	31364	6.3	23561	23561
	8	13.3	53437	31388	11.0	43941	27656	8.5	34241	24031	10.2	41080	35576	8.1	32612	31738	6.0	24122	24122
	8.5	12.8	54354	31761	10.5	44777	27976	8.2	34821	24244	9.8	41891	35949	7.8	33322	32058	5.8	24687	24687
	9	12.0	55136	32081	10.1	45470	28243	7.9	35545	24511	9.4	42584	36269	7.5	33913	32324	5.6	25256	25256
16	9	15.2	68734	41823	12.5	56314	37080	9.6	43458	32338	11.7	52673	48061	9.2	41538	41538	6.8	30699	30699
	10	14.2	71263	42817	11.6	58353	37845	9.0	45339	33026	10.9	54862	49055	8.7	43383	43383	6.4	32095	32095
	11	13.3	73381	43658	11.0	60380	38610	8.5	46800	33561	10.3	56706	49897	8.1	44899	44542	6.0	33355	33355
	12	12.5	75288	44423	10.3	61991	39222	8.0	48259	34097	9.7	58375	50662	7.7	46419	45231	5.7	34472	34472
	13	11.8	76990	45112	9.8	63594	39834	7.6	49507	34556	9.2	59704	51274	7.3	47602	45766	5.4	35438	35438
20	13	13.6	88514	53764	11.1	72539	47656	8.6	56285	41647	10.5	68548	61995	8.4	54482	54482	6.2	40547	40547
	14	12.9	90771	54651	10.6	74376	48346	8.3	57896	42238	10.0	70491	62882	8.0	55988	55988	5.9	41742	41742
	15	12.3	92515	55340	10.1	76206	49035	7.9	59237	42731	9.6	71999	63571	7.6	57282	56872	5.7	42951	42951
	16	11.8	94494	56128	9.7	77767	49626	7.6	60578	43223	9.2	73504	64261	7.3	58579	57464	5.5	43968	43968
	17	11.3	96215	56818	9.3	79064	50119	7.2	61649	43617	8.8	75003	64951	7.0	59878	58055	5.3	44787	44787

TABLE E6

UNIT SIZE	GPM	80 °F DB/67 °F WB Entering Air									80 °F DB/70 °F WB Entering Air								
		40 °F Ent. Water			45 °F Ent. Water			50 °F Ent. Water			40 °F Ent. Water			45 °F Ent. Water			50 °F Ent. Water		
		ΔT	T-btu	S-btu	ΔT	T-btu	S-btu	ΔT	T-btu	S-btu	ΔT	T-btu	S-btu	ΔT	T-btu	S-btu	ΔT	T-btu	S-btu
06	3.5	12.8	22384	17599	10.2	17861	15814	7.6	13295	13295	15.5	27225	16528	12.7	22358	14808	9.9	17405	13088
	4	11.8	23612	18085	9.4	18846	16203	7.1	14153	14153	14.3	28575	17015	11.8	23564	15230	9.2	18434	13445
	4.5	10.9	24671	18507	8.8	19751	16560	6.6	14865	14613	13.2	29823	17469	10.9	24579	15587	8.5	19277	13737
	5	10.2	25562	18864	8.2	20492	16852	6.2	15505	14873	12.3	30793	17826	10.2	25496	15911	8.0	20025	13997
	5.5	9.5	26287	19156	7.7	21151	17112	5.8	15988	15067	11.5	31756	18183	9.5	26227	16171	7.5	20680	14224
08	5	12.4	31059	22615	10.0	25005	20206	7.5	18821	17758	15.0	37518	21468	12.4	31004	19097	9.7	24358	16764
	5.5	11.6	32097	23036	9.4	25878	20550	7.1	19585	18064	14.0	38641	21889	11.6	32074	19479	9.2	25238	17070
	6	11.0	32941	23380	8.9	26652	20856	6.7	20161	18294	13.2	39653	22271	10.9	32925	19785	8.6	26007	17337
	6.5	10.3	33686	23686	8.4	27328	21124	6.4	20739	18523	12.4	40557	22615	10.4	33771	20091	8.2	26665	17567
	7	9.8	34428	23992	8.0	27906	21353	6.1	21318	18752	11.8	41354	22921	9.8	34403	20321	7.8	27321	17796
12	7	13.5	47474	33284	11.0	38483	29658	8.4	29412	26087	16.2	56725	31631	13.5	47271	28112	10.7	37516	24647
	7.5	12.9	48634	33764	10.5	39558	30085	8.0	30223	26406	15.4	57973	32111	12.9	48444	28539	10.2	38431	24967
	8	12.4	49530	34137	10.1	40362	30405	7.7	30900	26673	14.7	59074	32537	12.3	49319	28859	9.8	39343	25287
	8.5	11.6	49530	34137	9.7	41164	30725	7.4	31578	26940	14.1	60167	32964	11.8	50334	29232	9.4	40102	25553
	9	11.4	51307	34883	9.3	41963	31045	7.2	32257	27206	13.5	61116	33337	11.4	51200	29552	9.1	40858	25820
16	9	14.1	63640	45843	11.4	51575	41024	8.7	39185	36128	16.8	75862	43242	14.0	63089	38576	11.1	50047	33986
	10	13.2	66079	46837	10.7	53703	41865	8.2	40914	36817	15.7	78709	44313	13.1	65646	39494	10.4	52024	34675
	11	12.4	68126	47678	10.1	55440	42553	7.7	42458	37428	14.7	81121	45231	12.3	67762	40259	9.8	53777	35287
	12	11.6	69972	48443	9.5	57171	43242	7.3	43812	37964	13.9	83309	46072	11.6	69653	40947	9.2	55525	35899
	13	11.0	71804	49208	9.0	58512	43777	6.9	45170	38499	13.1	85280	46837	10.9	71323	41559	8.7	56851	36358
20	13	12.6	82320	59040	10.3	66828	52833	7.9	51175	46627	15.0	97680	55592	12.5	81245	49583	9.9	64478	43672
	14	12.0	84251	59828	9.8	68568	53523	7.5	52654	47218	14.3	100040	56478	11.9	83441	50371	9.4	66173	44263
	15	11.5	86171	60616	9.4	70305	54213	7.2	54137	47809	13.6	102381	57365	11.4	85353	51060	9.0	67865	44854
	16	11.0	88081	61404	9.0	71790	54804	6.9	55376	48302	13.0	104448	58153	10.9	87256	51750	8.7	69554	45445
	17	10.5	89507	61995	8.6	73025	55296	6.6	56370	48696	12.5	106244	58843	10.4	88880	52341	8.3	70677	45839

Direct Drive 4-Row Cooling Capacities

TABLE E7

UNIT SIZE	GPM	82 °F DB/67 °F WB Entering Air									82 °F DB/69 °F WB Entering Air								
		40 °F Ent. Water			45 °F Ent. Water			50 °F Ent. Water			40 °F Ent. Water			45 °F Ent. Water			50 °F Ent. Water		
		ΔT	T-btu	S-btu	ΔT	T-btu	S-btu	ΔT	T-btu	S-btu	ΔT	T-btu	S-btu	ΔT	T-btu	S-btu	ΔT	T-btu	S-btu
06	3.5	12.5	21892	18850	9.9	17438	17033	7.4	13048	13048	14.2	24892	18168	11.5	20191	16416	8.8	15458	14631
	4	11.5	23092	19337	9.2	18462	17454	6.9	13922	13922	13.1	26273	18688	10.6	21325	16838	8.2	16390	14988
	4.5	10.7	24130	19758	8.6	19335	17811	6.5	14592	14592	12.1	27387	19109	9.9	22371	17227	7.6	17245	15313
	5	10.0	25084	20148	8.1	20133	18136	6.1	15272	15272	11.3	28409	19499	9.2	23155	17519	7.2	17934	15572
	5.5	9.4	25877	20472	7.5	20772	18395	5.7	15807	15807	10.6	29255	19823	8.7	23938	17811	6.7	18540	15799
08	5	12.2	30476	24128	9.8	24457	21680	7.4	18511	18511	13.8	34561	23401	11.3	28296	21030	8.8	21930	18659
	5.5	11.4	31500	24549	9.2	25400	22063	7.0	19238	19238	12.9	35651	23822	10.6	29216	21374	8.3	22749	18965
	6	10.8	32425	24931	8.7	26155	22369	6.6	19880	19806	12.2	36634	24205	10.0	30133	21719	7.8	23467	19233
	6.5	10.2	33254	25276	8.2	26815	22637	6.3	20433	20036	11.5	37512	24549	9.5	30844	21986	7.4	24084	19462
	7	9.7	33896	25543	7.8	27475	22904	6.0	20989	20265	10.9	38288	24855	9.0	31553	22254	7.0	24701	19692
12	7	13.3	46834	35499	10.8	37986	31874	8.3	29051	28249	15.0	52704	34433	12.4	43557	30914	9.7	33980	27342
	7.5	12.8	47982	35979	10.4	38907	32247	7.9	29831	28568	14.3	53919	34913	11.8	44545	31287	9.3	34986	27715
	8	12.2	48996	36405	9.9	39827	32620	7.6	30614	28888	13.7	54991	35339	11.4	45529	31661	8.9	35848	28035
	8.5	11.7	49879	36779	9.5	40614	32940	7.2	31269	29155	13.2	56057	35766	10.9	46509	32034	8.6	36566	28302
	9	11.3	50758	37152	9.2	41399	33260	7.1	31925	29421	12.6	56983	36139	10.5	47207	32300	8.3	37284	28568
16	9	13.9	62828	49021	11.3	50816	44126	8.6	38860	39230	15.6	70522	47338	12.9	58036	42596	10.0	45308	37853
	10	13.0	65234	50016	10.6	52892	44967	8.1	40514	39919	14.6	73278	48409	12.1	60482	43514	9.4	47360	38618
	11	12.2	67439	50934	9.9	54777	45732	7.7	42181	40607	13.7	75619	49327	11.3	62512	44279	8.9	49004	39230
	12	11.5	69264	51698	9.4	56471	46420	7.2	43484	41143	12.9	77745	50169	10.7	64330	44967	8.4	50650	39842
	13	10.9	70896	52387	8.9	57974	47032	6.9	44793	41678	12.2	79662	50934	10.1	65939	45579	8.0	52089	40378
20	13	12.5	81355	63133	10.1	65942	56829	7.8	50842	50622	14.0	91177	60966	11.5	75141	54858	9.1	59066	48849
	14	11.9	83495	64020	9.7	67878	57617	7.4	52255	51213	13.3	93457	61853	11.0	77236	55646	8.6	60646	49440
	15	11.4	85389	64808	9.3	69572	58306	7.1	53676	51804	12.7	95472	62641	10.5	79065	56336	8.3	62227	50031
	16	10.9	87039	65498	8.9	71023	58897	6.8	54866	52297	12.2	97475	63429	10.1	80628	56927	7.9	63546	50524
	17	10.4	88681	66187	8.5	72473	59488	6.6	56059	52790	11.6	99218	64119	9.6	82186	57518	7.6	64866	51016

TABLE E8

UNIT SIZE	GPM	82 °F DB/72 °F WB Entering Air									85 °F DB/67 °F WB Entering Air								
		40 °F Ent. Water			45 °F Ent. Water			50 °F Ent. Water			40 °F Ent. Water			45 °F Ent. Water			50 °F Ent. Water		
		ΔT	T-btu	S-btu	ΔT	T-btu	S-btu	ΔT	T-btu	S-btu	ΔT	T-btu	S-btu	ΔT	T-btu	S-btu	ΔT	T-btu	S-btu
06	3.5	17.1	29914	17033	14.2	24919	15345	11.3	19816	13658	12.1	21240	20678	9.6	16901	16901	7.3	12842	12842
	4	15.7	31512	17584	13.1	26278	15799	10.5	20998	14047	11.2	22541	21230	9.0	18001	18001	6.8	13691	13691
	4.5	14.5	32814	18039	12.2	27435	16189	9.7	21982	14372	10.4	23539	21651	8.4	18894	18894	6.4	14431	14431
	5	13.5	33919	18428	10.9	28393	16513	9.1	22768	14631	9.8	24461	22041	7.8	19646	19646	6.0	15051	15051
	5.5	12.7	34923	18785	10.6	29346	16838	8.6	23552	14891	9.2	25305	22398	7.4	20327	20288	5.7	15611	15611
08	5	16.5	41255	22178	13.8	34685	19883	11.1	27859	17588	11.9	29796	26397	9.5	23925	23911	7.3	18282	18282
	5.5	15.4	42532	22637	13.0	35800	20265	10.4	28781	17894	11.2	30790	26818	9.0	24822	24294	6.9	18951	18951
	6	14.5	43692	23057	12.2	36797	20609	9.8	29585	18162	10.6	31782	27239	8.5	25633	24638	6.5	19629	19629
	6.5	13.7	44632	23401	11.6	37677	20915	9.3	30386	18429	10.0	32590	27583	8.1	26356	24944	6.2	20229	20229
	7	13.0	45566	23746	11.0	38444	21183	8.9	31071	18659	9.5	33307	27889	7.7	26989	25210	5.9	20748	20748
12	7	17.8	62419	32727	15.0	52730	29262	12.2	42726	25849	13.1	45971	38769	10.7	37387	35144	8.2	28660	28660
	7.5	17.0	63719	33207	14.4	53950	29688	11.6	43681	26169	12.6	47220	39302	10.2	38400	35570	7.9	29513	29513
	8	16.2	65008	33686	13.7	55012	30061	11.1	44632	26489	12.0	48214	39729	9.8	39287	35943	7.6	30372	30372
	8.5	15.5	66145	34113	13.2	56067	30434	10.7	45580	26809	11.5	49204	40155	9.4	40174	36316	7.3	30988	30988
	9	14.9	67133	34486	12.6	56967	30754	10.3	46368	27076	11.1	50067	40528	9.1	40933	36636	7.0	31732	31732
16	9	18.5	83371	44661	15.6	70272	40072	12.6	56650	35482	13.7	61599	53636	11.0	49845	48664	8.5	38432	38432
	10	17.3	86550	45809	14.6	72938	40990	11.8	58949	36247	12.8	64121	54707	10.4	52189	49659	8.0	40309	40309
	11	16.2	89064	46726	13.7	75363	41831	11.1	61010	36935	12.1	66453	55701	9.8	53997	50423	7.6	41865	41865
	12	15.2	91551	47644	12.9	77550	42596	10.4	62834	37547	11.4	68416	56543	9.3	55808	51188	7.2	43262	43262
	13	14.4	93603	48409	12.2	79288	43208	9.9	64650	38159	10.7	70014	57231	8.8	57257	51800	6.8	44494	44494
20	13	16.5	107336	57420	13.9	90479	51509	11.2	73256	45697	12.3	80134	69175	10.0	65294	62870	7.8	50631	50631
	14	15.6	109797	58306	13.2	92769	52297	10.7	75030	46288	11.7	82445	70160	9.6	67143	63659	7.4	52164	52164
	15	14.9	112240	59193	12.6	95047	53085	10.3	77095	46977	11.2	84289	70949	9.1	68764	64348	7.1	53489	53489
	16	14.3	114663	60079	12.1	97029	53775	9.8	78566	47470	10.7	86128	71737	8.8	70388	65038	6.8	54824	54824
	17	13.7	116535	60769	11.6	98720	54366	9.4	80326	48061	10.3	87732	72426	8.4	71780	65629	6.6	55943	55943

Direct Drive 4-Row Cooling Capacities

TABLE E9

UNIT SIZE	GPM	85 °F DB/71 °F WB Entering Air									85 °F DB/74 °F WB Entering Air								
		40 °F Ent. Water			45 °F Ent. Water			50 °F Ent. Water			40 °F Ent. Water			45 °F Ent. Water			50 °F Ent. Water		
		ΔT	T-btu	S-btu	ΔT	T-btu	S-btu	ΔT	T-btu	S-btu	ΔT	T-btu	S-btu	ΔT	T-btu	S-btu	ΔT	T-btu	S-btu
06	3.5	15.5	27250	19380	12.7	22352	17627	10.0	17498	15875	18.5	32396	18212	15.6	27312	16557	13.4	23555	15356
	4	14.3	28689	19899	11.8	23624	18082	9.3	18652	16297	17.0	34058	18763	14.3	28720	17011	11.7	23555	15356
	4.5	13.3	29940	20353	11.0	24805	18504	8.7	19548	16621	15.7	35509	19250	13.3	30020	17433	10.9	24472	15648
	5	12.4	31094	20775	10.3	25713	18828	8.1	20359	16913	14.7	36753	19672	12.4	31113	17790	10.3	25387	15940
	5.5	11.6	32064	21132	9.7	26618	19153	7.6	21082	17173	13.7	37892	20061	11.6	32101	18114	9.5	26199	16200
08	5	15.1	37874	24944	12.5	31350	22573	9.9	24823	20240	17.9	44756	23682	15.1	37935	21387	12.4	30981	19131
	5.5	14.2	39112	25403	11.8	32520	22993	9.4	25785	20584	16.8	46195	24179	14.2	39207	21808	11.6	32054	19475
	6	13.4	40238	25824	11.1	33475	23338	8.8	26535	20852	15.8	47401	24600	13.4	40355	22190	11.0	33005	19781
	6.5	12.6	41153	26168	10.5	34320	23644	8.4	27285	21119	14.9	48487	24982	12.7	41382	22534	10.4	33952	20087
	7	12.0	42061	26512	10.0	35057	23911	8.0	27928	21349	14.1	49565	25365	12.0	42176	22802	9.9	34660	20316
12	7	16.5	57789	36690	13.8	48271	33171	11.0	38602	29706	19.3	67793	34930	16.5	57735	31465	13.5	47536	28106
	7.5	15.7	59194	37223	13.2	49444	35598	10.5	39651	30079	18.4	69294	35463	15.7	59158	31945	13.0	48688	28479
	8	15.0	60311	37649	12.6	50613	34024	10.1	40548	30399	17.6	70634	35943	15.1	60414	32371	12.4	49836	28853
	8.5	14.4	61558	38129	11.9	50613	34024	9.7	41445	30719	16.9	71963	36423	14.4	61508	32745	11.9	50816	29173
	9	13.9	62522	38502	11.6	52501	34717	9.4	42192	30985	16.2	73135	36850	13.9	62596	33118	11.5	51793	29492
16	9	17.1	77207	50423	14.3	64417	45757	11.4	51372	41091	20.0	90410	47670	17.1	77038	43157	14.0	63166	38644
	10	16.0	80283	51571	13.4	66963	46675	10.7	53513	41856	18.7	93936	48894	16.0	80032	44151	13.1	65783	39485
	11	15.0	82924	52565	12.6	69285	47517	10.1	55656	42621	17.6	96767	49888	15.0	82545	44992	12.4	68151	40250
	12	14.2	85139	53407	11.9	71386	48282	9.5	57370	43233	16.5	99353	50806	14.1	85039	45834	11.6	70037	40862
	13	13.4	87335	54248	11.2	73267	48970	9.0	58869	43769	15.6	101700	51647	13.4	87064	46522	11.0	71916	41474
20	13	15.3	99820	64939	12.8	83394	58930	10.2	66649	52921	17.8	116135	61196	15.2	98917	55384	12.5	81376	49670
	14	14.6	102196	65826	12.2	85575	59718	9.8	68572	53610	17.0	119263	62279	14.5	101588	56270	11.9	83518	50359
	15	13.9	104558	66713	11.7	87749	60506	9.3	70222	54201	16.2	121803	63166	13.8	103950	57058	11.4	85655	51049
	16	13.3	106905	67599	11.2	89645	61196	9.0	71872	54792	15.5	124323	64053	13.3	106299	57846	10.9	87784	51739
	17	12.8	108720	68289	10.7	91265	61787	8.6	73522	55384	14.9	126548	64841	12.7	108344	58536	10.5	89302	52231

Direct Drive 6-Row Cooling Capacities

TABLE F1

UNIT SIZE	GPM	72 °F DB/60 °F WB Entering Air									72 °F DB/62 °F WB Entering Air								
		40 °F Ent. Water			45 °F Ent. Water			50 °F Ent. Water			40 °F Ent. Water			45 °F Ent. Water			50 °F Ent. Water		
		ΔT	T-btu	S-btu	ΔT	T-btu	S-btu	ΔT	T-btu	S-btu	ΔT	T-btu	S-btu	ΔT	T-btu	S-btu	ΔT	T-btu	S-btu
06	3.5	11.1	19539	17202	8.3	14571	14571	5.5	9614	9614	12.9	22694	16683	10.0	17516	14346	7.0	12207	12010
	4	10.3	20642	17754	7.8	15570	15255	5.2	10412	10412	11.9	23942	17267	9.3	18614	14833	6.5	13086	12399
	4.5	9.6	21603	18241	7.3	16436	15677	4.9	11105	11105	11.1	24966	17754	8.6	19487	15223	6.1	13822	12724
	5	9.0	22489	18695	6.9	17168	16034	4.7	11681	11681	10.3	25840	18176	8.1	20281	15580	5.8	14413	12984
	5.5	8.4	23177	19052	6.4	17764	16326	4.4	12198	12198	9.7	26636	18565	7.6	20926	15872	5.4	15005	13243
08	5	10.2	25446	21498	7.7	19197	18400	5.1	12843	12843	11.8	29573	21001	9.2	23039	17979	6.5	16188	14958
	5.5	9.6	26416	21995	7.3	20060	18821	4.9	13519	13519	11.1	30522	21460	8.7	23890	18362	6.1	16885	15264
	6	9.1	27228	22416	6.9	20764	19165	4.7	14127	14127	10.4	31382	21880	8.2	24651	18706	5.8	17495	15531
	6.5	8.6	27886	22760	6.6	21388	19471	4.5	14664	14664	9.9	32155	22263	7.8	25322	19012	5.6	18106	15799
	7	8.1	28537	23104	6.3	21931	19739	4.3	15127	15127	9.3	32766	22569	7.4	25906	19280	5.3	18630	16029
12	7	10.2	35669	30127	7.7	26842	25755	5.1	17949	17949	11.8	41358	29380	9.2	32252	25169	6.4	22564	20904
	7.5	9.7	36607	30607	7.4	27719	26182	4.9	18579	18579	11.3	42352	29860	8.8	33083	25542	6.2	23416	21277
	8	9.3	37434	31033	7.1	28485	26555	4.8	19215	19215	10.8	43336	30340	8.5	33911	25915	6.0	24026	21543
	8.5	9.0	38254	31460	6.8	29140	26875	4.7	19856	19856	10.4	44095	30713	8.1	34616	26235	5.8	24635	21810
	9	8.6	38966	31833	6.6	29793	27195	4.5	20393	20393	9.9	44847	31086	7.8	35318	26555	5.6	25245	22076
16	9	10.8	48788	41925	8.1	36521	35882	5.3	24077	24077	12.6	56906	40931	9.8	44031	35041	6.8	30650	29151
	10	10.2	50902	42996	7.7	38406	36800	5.1	25700	25700	11.8	59152	42001	9.2	46087	35959	6.5	32386	29916
	11	9.6	52694	43914	7.3	40131	37641	4.9	27052	27052	11.1	61052	42919	8.7	47789	36723	6.1	33780	30528
	12	9.0	54319	44755	6.9	41539	38330	4.7	28268	28268	10.4	62771	43761	8.2	49309	37412	5.8	35001	31063
	13	8.6	55781	45520	6.6	42786	38942	4.5	29341	29341	9.9	64162	44449	7.8	50652	38024	5.6	36222	31598
20	13	10.2	66630	55767	7.7	50427	47689	5.2	33717	33717	11.9	77431	54585	9.3	60280	46606	6.5	42479	38725
	14	9.8	68542	56753	7.4	52036	48477	5.0	35066	35066	11.3	79255	55472	8.8	62026	47394	6.2	43821	39316
	15	9.3	70058	57541	7.1	53442	49167	4.9	36428	36428	10.8	81061	56359	8.5	63546	48083	6.0	45164	39907
	16	8.9	71563	58329	6.8	54844	49857	4.7	37408	37408	10.3	82651	57147	8.1	65057	48773	5.8	46284	40399
	17	8.6	72869	59018	6.6	56042	50448	4.5	38394	38394	9.9	84030	57836	7.8	66132	49266	5.6	47404	40892

TABLE G - Direct Drive Hot Water Heating Capacities

1-ROW COIL

UNIT SIZE	GPM	PD	HIGH FAN SPEED				LOW FAN SPEED			
			CFM	BTU/HR	WTD	LAT	CFM	BTU/HR	WTD	LAT
06	0.50	0.2	840	12035	45.7	82.6	360	9829	37.5	94.0
	1.00	0.7	840	17105	31.9	87.9	360	12915	24.5	101.5
	1.50	1.5	840	19879	25.2	90.8	360	14544	18.4	105.5
	2.00	2.7	840	21893	20.7	92.9	360	15592	14.7	108.1
	2.50	4.1	840	23335	17.7	94.4	360	16288	12.4	109.8
08	1.00	0.7	990	19626	37.1	87.4	480	15663	29.7	98.7
	1.50	1.5	990	23113	29.2	90.5	480	17833	22.5	102.7
	2.00	2.7	990	25493	24.2	92.6	480	19219	18.2	105.2
	2.50	4.1	990	27236	20.6	94.2	480	20203	15.3	107.0
	3.00	5.8	990	28581	18.0	95.4	480	20921	13.2	108.3
12	2.00	2.7	1380	35003	33.1	92.3	675	26693	25.2	104.8
	2.50	4.1	1380	37575	28.5	93.9	675	28164	21.4	106.7
	3.00	5.8	1380	39612	25.0	95.2	675	29291	18.5	108.1
	3.50	7.8	1380	41220	22.3	96.2	675	30158	16.3	109.3
	4.00	10.1	1380	42536	20.1	97.1	675	30859	14.6	110.2
16	2.00	2.7	1980	45793	43.6	90.4	975	35757	33.6	102.2
	3.00	5.8	1980	52723	33.3	93.4	975	39690	25.1	105.8
	4.00	10.1	1980	57202	27.0	95.4	975	42161	19.9	108.0
	5.00	15.4	1980	60320	22.8	96.8	975	43817	16.6	109.5
	6.00	21.9	1980	62638	19.7	97.8	975	45059	14.2	110.6
20	3.00	2.7	2550	58672	37.0	90.2	1250	45329	28.6	101.9
	4.00	4.6	2550	64741	30.5	92.3	1250	48832	23.2	104.3
	5.00	7.1	2550	69047	26.1	93.8	1250	51336	19.4	106.1
	6.00	10.1	2550	72402	22.8	94.9	1250	53116	16.8	107.3
	7.00	13.5	2550	75007	20.3	95.8	1250	54536	14.7	108.3

Notes:

PD - Pressure Drop in Ft of Water. Includes PD, Across Coil Only.

WTD - Water Temperature Drop in °F

LAT - Leaving Air Temperature in °F

Contact factory for hot water capacities at conditions other than those listed.

Above capacities based on:

Entering Water Temperature - 180 °F

Entering Air Temperature - 70 °F

TABLE H - Direct Drive Hot Water Heating Capacities

2-ROW COIL

UNIT SIZE	GPM	PD	HIGH FAN SPEED				LOW FAN SPEED			
			CFM	BTU/HR	WTD	LAT	CFM	BTU/HR	WTD	LAT
06	1.00	0.2	840	27057	51.5	98.3	360	20221	38.2	119.4
	1.50	0.5	840	32287	40.6	103.8	360	22941	28.8	126.0
	2.00	0.8	840	35729	33.9	107.4	360	24645	23.3	130.2
	2.50	1.2	840	38311	29.0	110.1	360	25813	19.6	133.0
	3.00	1.6	840	40284	25.4	112.1	360	26721	16.8	135.2
08	2.00	0.9	990	41282	38.7	106.7	480	30342	28.7	125.5
	2.50	1.3	990	44251	33.6	109.3	480	31988	24.2	128.6
	3.00	1.8	990	46701	29.5	111.5	480	33253	20.9	130.9
	3.50	2.3	990	48609	26.3	113.1	480	34183	18.5	132.6
	4.00	2.9	990	50165	23.8	114.5	480	34945	16.6	134.0
12	3.00	0.8	1380	59452	37.6	107.9	675	43703	27.6	126.9
	3.50	1.0	1380	62534	33.8	109.8	675	45369	24.5	129.1
	4.00	1.3	1380	65091	30.8	111.5	675	46677	22.1	130.8
	4.50	1.6	1380	67235	28.3	112.8	675	47798	20.1	132.2
	5.00	1.9	1380	69081	26.1	114.0	675	48724	18.4	133.4
16	4.00	1.7	1980	86060	40.7	108.2	975	67476	31.9	130.8
	5.00	2.4	1980	92132	34.9	110.9	975	70869	26.9	133.9
	6.00	3.3	1980	96860	30.5	113.0	975	73389	23.2	136.2
	7.00	4.3	1980	100404	27.2	114.6	975	75327	20.4	137.9
	8.00	5.5	1980	103426	24.5	115.9	975	76873	18.2	139.3
20	5.00	1.3	2550	105925	40.0	106.5	1250	77965	29.6	124.8
	6.00	1.8	2550	112292	35.3	108.7	1250	81385	25.7	127.2
	7.00	2.3	2550	117283	31.7	110.4	1250	84054	22.7	129.1
	8.00	2.9	2550	121525	28.7	111.9	1250	86187	20.4	130.6
	9.00	3.5	2550	125095	26.2	113.1	1250	87937	18.5	131.8

Notes:

PD - Pressure Drop in Ft of Water. Includes PD, Across Coil Only.
 WTD - Water Temperature Drop in °F
 LAT - Leaving Air Temperature in °F
 Contact factory for hot water capacities at conditions other than those listed.

Above capacities based on:

Entering Water Temperature - 180 °F
 Entering Air Temperature - 70 °F



Submittal Data Information

301-001

1600 Series Pumps

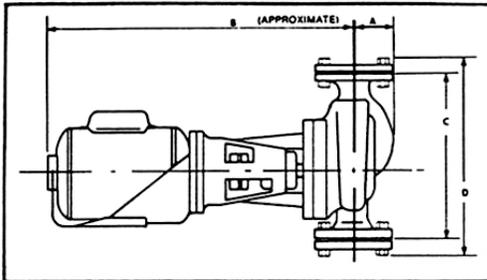
Effective: August 1, 1991

Supersedes: 301-001A Dated 12/31/83

1750 RPM Stock Models

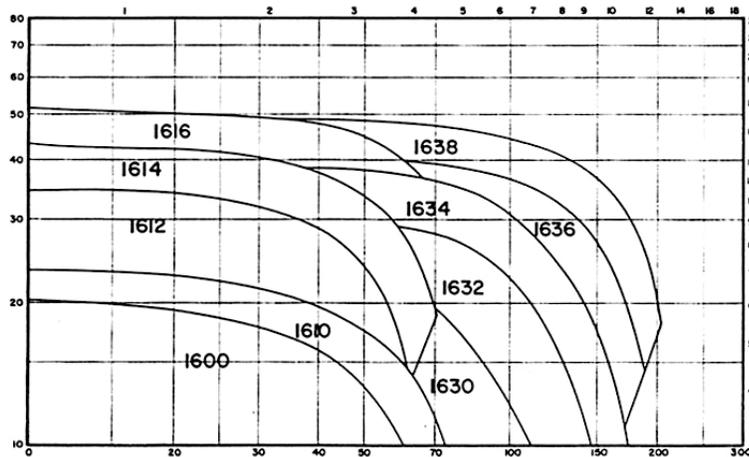
Job: _____ Engineer: _____ Contractor: _____ Rep: _____

ITEM NO.	MODEL NO.	IMP. DIA.	G.P.M.	T. D. H.	H.P.	ELEC. CHAR.



MODEL NO.	Fig. Size	MOTOR DATA			DIMENSIONS			
		HP	60 Hz 1 Ph.	60 Hz 3 Ph.	A	B	C	D
1600	1½"	¼	115V	NOT AVAILABLE	3	16½	10¼	12¼
1610		1/3	115V		3	16½	10¼	12¼
1612	1½"	½	115/230	200 or 230/460	3¾	18½	13½	16¼
1614		¾			3¾	19	13½	16¼
1616	1	3			19	14¼	17¼	
1630	½	3½			18	13½	16¼	
1632	2"	¾			3½	18½	13½	16¼
1634		1			3½	19	13½	16¼
1636		1½			3¾	21	16¼	19¼
1638		2			3¾	23	16¼	19¼

STOCK MODEL QUICK SELECTION CURVES



SPECIFICATIONS:

- MOTORS**
1750 RPM, Three Phase 200V or 230/460 V 60C Sleeve Bearing Motors.
Also available In Single Phase with overload protection except 3 HP (2238 WATTS).
 - BODY**
Cast Iron with flanged in-line connections. Companion flanges are included.
 - IMPELLER**
Cast Bronze, Closed, Dynamically Balanced.
 - DRIVE COUPLING**
Non-Metallic/Vibration Dampening.
 - SHAFT**
Alloy Steel with Cupro-Nickel Sleeve.
 - FRAME**
Ball Bearing Type, Permanently Lubricated. REMOVABLE BEARING CARTRIDGE FITS ALL MODELS.
 - MECHANICAL SEAL**
2 Piece Standard—250°F (121°C) Operating Temp.
Hi-Temp—Extra Cost—300°F (149°C) Operating Temp.
 - WORKING PRESSURE**
175 PSI (1207 kpa) . . . In accordance with ASA B16.1
- NOTE: Flanges are tapped for gauges.

Do it Once. Do it Right.

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Taco (Canada), Ltd., 6180 Ordan Drive, Mississauga, Ontario L5T 2B3 Telephone: (905) 564-9422 Fax: (905) 564-9436

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Visit our website at: www.taco-hvac.com

**Submission Data Information
 Model 0013 Cartridge Circulator**

Features

- Exclusive ACB Anti-Condensate Baffle with Ambient Air Flow-Protects Motor Windings against Condensate Buildup
- High Velocity Performance-Compact Design
- Quiet, Efficient Operation
- Direct Drive-Low Power Consumption
- Unique Replaceable Cartridge Design-Field Serviceable
- Self Lubricating
- No Mechanical Seal
- Unmatched Reliability-Maintenance Free
- Universal Flange to Flange Dimensions
- Cast Iron or Bronze Construction

Materials of Construction

ACB Baffle	Non-Ferrous
Casing (Volute):	Cast Iron or Bronze
Stator Housing:	Aluminum
Cartridge:	Stainless Steel
Impeller:	Non-Metallic
Shaft:	Ceramic
Bearings:	Carbon
O-Ring & Gaskets:	EPDM

Model Nomenclature

- F – Cast Iron, Flanged
 BF – Bronze, Flanged
Variations:
 Z – Zoning Circulator
 J – Bronze Cartridge with Cast Iron Casing

Performance Data

- Flow Range: 0 – 33 GPM
 Head Range: 0 – 33 Feet
 Minimum Fluid Temperature: 40°F (4°C)
 Maximum Fluid Temperature: 230°F (110°C)
 Maximum Working Pressure: 125 psi
 Connection Sizes: 3/4", 1", 1-1/4", 1-1/2" Flanged
- 

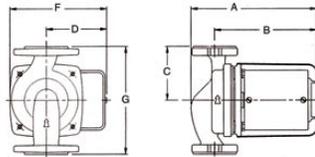
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Application

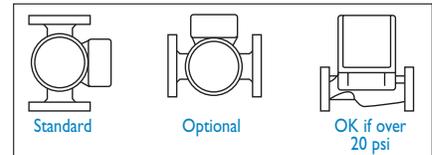
The Taco 0013 is specifically designed for high head / high flow applications in Large Residential and Light Commercial systems. Ideal for high pressure drop Boilers, Fan Coil units, Heat Exchangers, larger Radiant systems, Heat Recovery and Geothermal systems. The Bronze 0013 should be used on open loop systems. The unique replaceable cartridge contains all of the moving parts and allows for easy service instead of replacing the entire circulator. Universal flange to flange dimensions and orientation allows the 0013 to easily replace other models. Compact, low power consumption design makes it ideal for high-efficiency jobs.

Pump Dimensions & Weights

Model	Casing	A		B		C		D		F		G		Ship Wt.	
		in.	mm	in.	mm	in.	mm	in.	mm	in.	mm	in.	mm	lbs.	Kg
0013-F3	Cast Iron	7-3/4	197	6-3/8	162	3-1/4	82	3-3/4	95	6	152	6-1/2	165	12.0	5.5
0013-BF3	Bronze	7-3/4	197	6-3/8	162	3-1/4	82	3-3/4	95	6	152	6-1/2	165	12.0	5.5



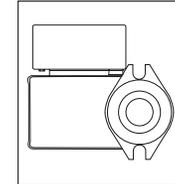
Mounting Positions



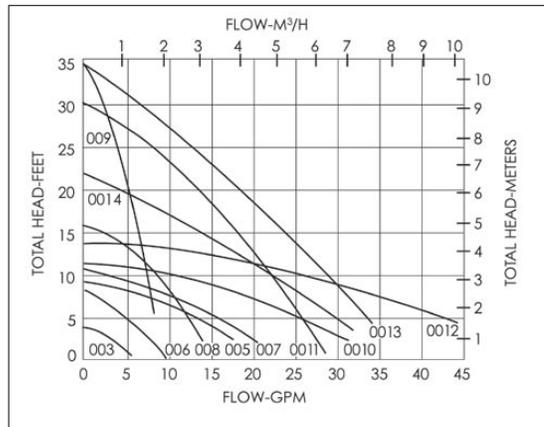
Electrical Data

Model	Volts	Hz	Ph	Amps	RPM	HP
0013-F3	115	60	1	2.0	3250	1/6
0013-BF3	115	60	1	2.0	3250	1/6
Motor Type	Permanent Split Capacitor Impedance Protected					
Motor Options	220/50/1, 220/60/1, 230/60/1, 100/110/50/60/1					

Flange Orientation



Performance Field - 60Hz



HYDRONIC COMPONENTS & SYSTEMS



Taco Inc., 1160 Cranston Street, Cranston, RI 02920 / (401) 942-8000 / Fax (401) 942-2360
 Taco (Canada) Ltd., 6180 Ordan Drive, Mississauga, Ontario L5T 2B3 / (905) 564-9422 / Fax (905) 564-9436
www.taco-hvac.com



Submittal Data Information

101-034

Model 0011 Cartridge Circulator

Effective: June 14, 2007

Supersedes: October 1, 2002

Job: _____ Engineer: _____ Contractor: _____ Rep: _____

ITEM NO.	MODEL NO.	IMP. DIA.	G.P.M.	HEAD/FT.	H.P.	ELEC. CHAR.

Features

- Exclusive ACB Anti-condensate baffle with ambient air flow-Protects motor windings against condensate buildup
- High velocity performance-compact design
- Quiet, Efficient operation
- Direct drive-Low power consumption
- Unique replaceable cartridge design-field serviceable
- Self lubricating
- No mechanical seal
- Unmatched reliability-maintenance free
- Universal flange to flange dimensions
- Cast Iron, Bronze or Stainless Steel construction

Materials of Construction

Casing (Volute): Cast Iron, Bronze or 304 Stainless Steel
 Stator Housing: Aluminum
 Cartridge: Stainless Steel
 Impeller: Non-Metallic
 Shaft: Ceramic
 Bearings: Carbon
 O-Ring & Gaskets: EPDM

Model Nomenclature

F – Cast Iron, Flanged
 BF – Bronze, Flanged
 SF – 304 Stainless Steel, Flanged
Variations:
 Z – Zoning Circulator
 J – Bronze Cartridge with Cast Iron Casing

Performance Data

Flow Range: 0 – 31 GPM
 Head Range: 0 – 31 Feet
 Minimum Fluid Temperature: 40°F (4°C)
 Maximum Fluid Temperature: 230°F (110°C)
 Maximum Working Pressure: 125 psi
 Connection Sizes: 3/4", 1", 1-1/4", 1-1/2" Flanged



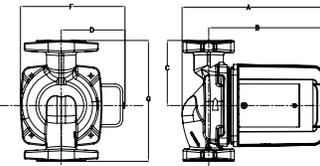
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Application

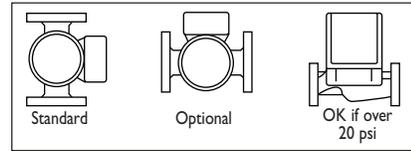
The Taco 0011 is specifically designed for high head / medium flow applications in large residential / light commercial closed loop hydronic heating and chilled water cooling systems. Ideal for high pressure drop boilers, fan coil units, heat exchangers, large radiant heating and heat recovery/geothermal systems. The Bronze or Stainless Steel 0011 can be used on open loop systems. The unique replaceable cartridge contains all of the moving parts and allows for easy service instead of replacing the entire circulator. Universal flange to flange dimensions and orientation allows the 0011 to easily replace other models. Compact, low power consumption design makes it ideal for high-efficiency jobs.

Pump Dimensions & Weights

Model	Casing	A		B		C		D		F		G		Ship Wt.	
		in.	mm	in.	mm	in.	mm	in.	mm	in.	mm	in.	mm	lbs.	Kg
0011-F4	Cast Iron	7-1/2	191	6-1/8	156	3-1/2	89	3-3/8	86	5-5/8	143	6-1/2	165	12.0	5.5
0011-BF4	Bronze	7-1/2	191	6-1/8	156	3-1/2	89	3-3/8	86	5-5/8	143	6-1/2	165	12.0	5.5
0011-SF4	St.Steel	7-1/2	191	6-1/8	156	3-1/2	89	3-3/8	86	5-5/8	143	6-1/2	165	11.0	5.0



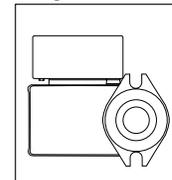
Mounting Positions



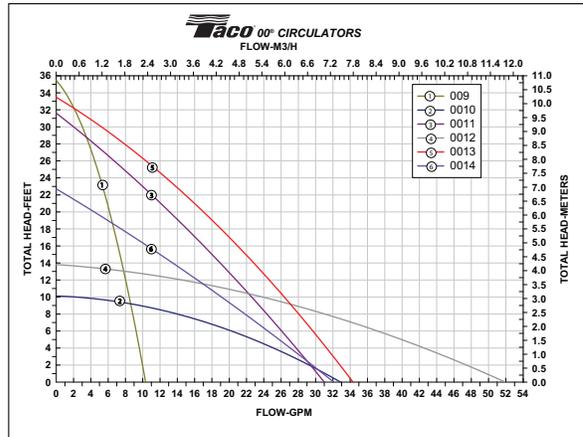
Electrical Data

Model	Volts	Hz	Ph	Amps	RPM	HP
0011-F4	115	60	1	1.76	3250	1/8
0011-BF4/SF4	115	60	1	1.76	3250	1/8
Motor Type	Permanent Split Capacitor Impedance Protected					
Motor Options	220/50/1, 220/60/1, 230/60/1, 100/110/50/60/1					

Flange Orientation



Performance Field - 60Hz



Do it Once. Do it Right.®

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 TACO (Canada), Ltd., 6180 Ordan Drive, Mississauga, Ontario L5T 2B3 Telephone: (905) 564-9422 Fax: (905) 564-9436
 Visit our website at: www.taco-hvac.com

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Submittal Data Information Model 008 Cartridge Circulator

Features

- Standard High Capacity Output-Compact Design
- Quiet, Efficient Operation
- Direct Drive-Low Power Consumption
- Unique Replaceable Cartridge Design-Field Serviceable
- Self Lubricating
- No Mechanical Seal
- Unmatched Reliability-Maintenance Free
- Universal Flange to Flange Dimensions
- Cast Iron or Bronze Construction
- Sweat Connections - Optional

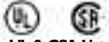
Materials of Construction

Casing (Volute):	Cast Iron or Bronze
Stator Housing:	Steel
Cartridge:	Stainless Steel
Impeller:	Non-Metallic
Shaft:	Ceramic
Bearings:	Carbon
O-Ring & Gaskets:	EPDM

Model Nomenclature

- F – Cast Iron, Flanged
 - BF – Bronze, Flanged
 - BC – Bronze, Sweat Connections
- Variations:**
- Z – Zoning Circulator
 - J – Bronze Cartridge with Cast Iron Casing

Performance Data

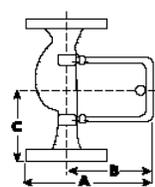
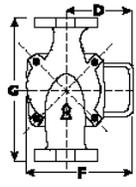
- Flow Range: 0 – 14 GPM
 - Head Range: 0 – 16 Feet
 - Minimum Fluid Temperature: 40°F (4°C)
 - Maximum Fluid Temperature: 230°F (110°C)
 - Maximum Working Pressure: 125 psi
 - Minimum Required Inlet Pressure: 14 psi
 - Connection Sizes: 3/4", 1", 1-1/4", 1-1/2" Flanged, 3/4" Sweat (Bronze)
- 
- UL & CSA Listed
FOR INDOOR USE ONLY

Application

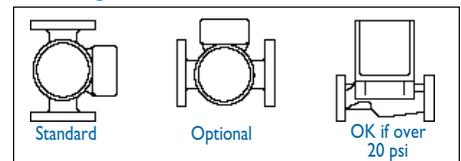
The Taco 008 is designed for a wide range of Residential and Light Commercial higher-head water circulating applications. Typical uses include Hydronic heating, Radiant In-Floor/Panel heating and closed-loop Solar heating systems. The Bronze 008 can be used in higher-head Heat Recovery, Water Source Heat Pump, open-loop Solar heat and Domestic Water Recirculation systems. The unique replaceable cartridge contains all of the moving parts and allows for easy service, instead of replacing the entire circulator. Compact, direct-drive, low power consumption design is ideal for high-efficiency jobs.

Pump Dimensions & Weight

Model	Casing	A		B		C		D		F		G		Ship Wt.	
		in.	mm	in.	mm	in.	mm	in.	mm	in.	mm	in.	mm	lbs.	Kg
008-F6	Cast Iron	6	152	4	102	3-3/16	81	2-15/16	75	4-3/4	121	6-3/8	162	8.0	3.6
008-BF6	Bronze F	6	152	4	102	3-3/16	81	2-15/16	75	4-3/4	121	6-3/8	162	8.0	3.6
008-BC6	Bronze S	5-5/8	143	4-9/16	116	3-3/16	81	2-15/16	75	4-3/4	121	6-3/8	162	8.0	3.6



Mounting Positions



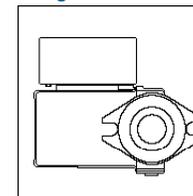
Electrical Data

Model	Volts	Hz	Ph	Amps	RPM	HP
008-F6	115	60	1	.79	3250	1/25
008-BF6	115	60	1	.84	3250	1/25
008-BC6	115	60	1	.84	3250	1/25

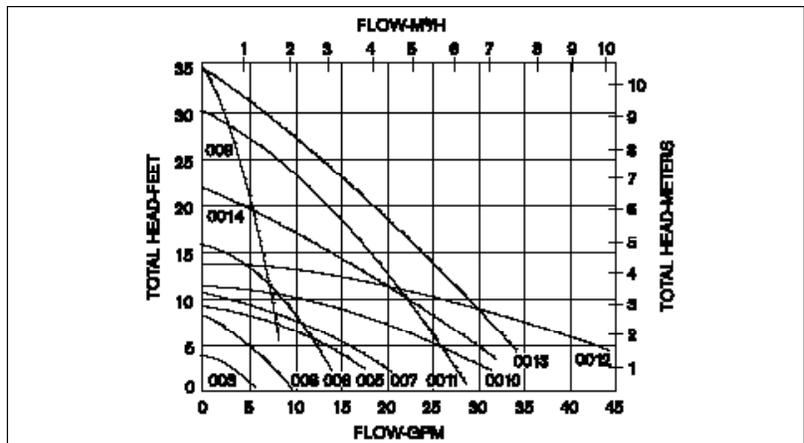
Motor Type: Permanent Split Capacitor
Impedance Protected

Motor Options: 220/50/1, 220/60/1, 230/60/1, 100/110/50/60/1

Flange Orientation



Performance Field - 60Hz



WATER CIRCULATION, FLOW CONTROL, AIR ELIMINATION, FLOW MEASUREMENT/BALANCING, ELECTRONIC CONTROLS

Do it once.
Do it right.



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self-priming cast iron shallow well jet pumps



This product is Listed to UL Standards for Safety by Underwriters Laboratories Inc. (UL) – Indoor/Outdoor use.



The ProJet™ HN models provide excellent performance with good pressure for wells to 25' deep. Self-priming after the priming chamber has been filled with water.

APPLICATIONS

- Water systems and sprinkling... for homes, farms and cottages.

SPECIFICATIONS

Max. Liquid Temperature – 140°F
Max. Inlet Pressure – 50 PSI

- Priming time at 15 feet** – HNC = 1.7; HND = 1.1; HNE = 1.3
- Priming time at 25 feet** – HNC = 4.4; HND = 4.4; HNE = 2.6 (Average minutes to full prime)
- Body** – Close-grained cast iron
- Nozzle** – High strength Lexan®
- Venturi** – Lexan®
- Impeller** – Noryl®
- Diffuser** – Reinforced polypropylene
- Shaft** – One-piece threaded, 416 grade stainless steel
- Base** – Steel, 10 gauge

ORDERING INFORMATION

Catalog Number	HP	Switch Setting	Description	Pipe Tapping Sizes		Motor Voltage	Approx. Wt. Lbs.
				Suct.	Disch.		
HNC	1/2	30-50	Base Mounted Pump	1-1/4"	1"	115/230	47
HND	3/4	30-50	Base Mounted Pump	1-1/4"	1"	115/230	65
HNE	1	30-50	Base Mounted Pump	1-1/4"	1"	115/230	70

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PROJET™ HN SERIES

FEATURES

- Quality Construction** – Close-grained cast iron body, specially treated for corrosion resistance. Drain port provided for easy winterizing.
- Built-in Jet** – High strength Lexan® nozzle and venturi for maximum resistance to corrosion and abrasion. Clean out plug provided for ease of service.
- Noryl® Impeller** – Precision-molded for perfect balance... ultra-smooth for highest performance and efficiency.
- Precision Molded Diffuser** – Pump primes faster, handles more air, with multi-port, precision-molded, reinforced polypropylene diffuser.
- Mechanical Shaft Seal** – Precision lapped and highly polished carbon-ceramic, stainless steel construction. Internal design guarantees continuous water lubrication.
- Motor Windings** – Superior insulation materials protect against excessive moisture and contaminants... assure prolonged motor life.
- Balanced Rotor** – Die cast under high pressures for uniform performance and greater efficiency, dynamically balanced.
- Heavy-duty Ball Bearings** – Shielded, permanently lubricated bearings, extensively tested to ensure extended life and smooth, quiet operation.
- Pump and Motor Shaft** – Stainless steel for maximum corrosion resistance; one-piece threaded shaft for positive impeller drive and alignment.
- UL 778 Approved** – The complete pump assembly passes the strict UL requirements certifying the pump and motor for both indoor and outdoor use.
- Pressure Switch** – Professional quality, allows cut-in and differential adjustments.



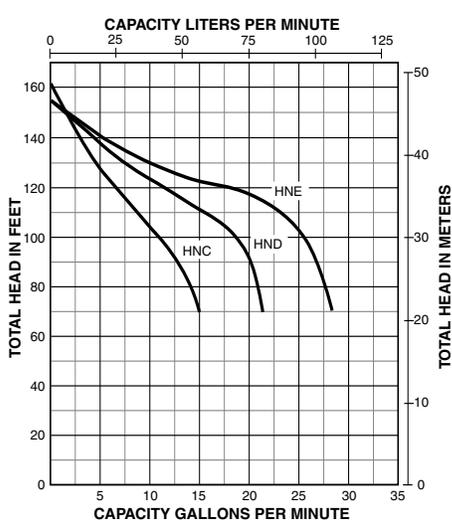
self-priming cast iron shallow well jet pumps

OUTLINE DIMENSIONS

Cat. No.	L	B
HNC	19.7	8.1
HND	22.3	8.0
HNE	23.4	9.0

Dimensions (in inches) are for estimating purposes only.

PUMP PERFORMANCE



2.31 FT. OF HEAD = 1 PSI
1 FT. OF HEAD = .433 PSI

PUMP PERFORMANCE (Capacity in Gallons Per Minute)

Catalog Number	HP	Disch. Pressure PSI	Dynamic Suction Lift					Shut Off Pressure PSI
			5'	10'	15'	20'	25'	
HNC	1/2	30	15.0	13.0	11.6	8.7	6.9	70
		40	12.5	11.4	10.1	8.2	6.8	
		50	8.0	6.8	6.1	4.8	3.5	
HND	3/4	30	21.4	19.1	16.5	13.3	9.5	67
		40	20.8	18.7	15.8	13.2	9.3	
		50	13.5	11.6	10.1	7.4	2.4	
HNE	1	30	28.5	25.0	21.4	17.4	12.6	67
		40	28.3	24.4	21.0	17.2	12.3	
		50	21.5	18.3	10.9	3.1	1.6	

Pump will operate at all depths shown, with pressure switch set at 30-50 PSI. Tested and rated in accordance with Water Systems Council Standards.

NOTE: Pumps installed with a PRO-Source™ tank require a 100 PSI relief valve. Pumps installed with a conventional tank require a 75 PSI relief valve. Relief valve must be capable of relieving entire flow of pump at relief pressure.

Precharged Tank Selection Guide

System Flow Rate (GPM)	ESP I Minimum Running Time to Protect 3/4HP & Smaller Pumps (Approximately One Minute Run Time)			ESP II For Larger Pumps and More Economical Operation (Approximately Two Minutes Run Time)		
	20/40	30/50	40/60	20/40	30/50	40/60
5.0	CA4202	CA4202	CA4202	CA6000	CA8205	CA8205
7.0	CA4202	CA4202	CA6000	CA8205	CA10050	CA12051
10.0	CA6000	CA8205	CA8205	CA12051	CA12051	CA17255
12.0	CA8205	CA10050	CA10050	CA12051	CA17255	CA17255
15.0	CA10050	CA10050	CA12051	CA17255	CA17002	CA22050
20.0	CA12051	CA12051	CA17255	CA22050	CA22050	(2) CA17255
25.0	CA12051	CA17255	CA17002	(2) CA12051	(2) CA17255	(2) CA17002
30.0	CA17255	CA17002	CA22050	(2) CA17255	(2) CA17002	(2) CA22050
35.0	CA17002	CA22050	CA22050	(2) CA17002	(2) CA22050	(2) CA22050
40.0	CA22050	CA22050	(2) CA17255	(2) CA22050	(2) CA22050	(3) CA17002

Vertical Models

Model No.	Dimensions		Total Volume (gals)	Max. Accept. Factor	System Drawdown			Shipping Wt. (Vol.) lbs (cu ft)
	Diameter (ins)	Height (ins)			20/40 (gals)	30/50 (gals)	40/60 (gals)	
CA4202	15 3/8	31 5/8	20.0	0.57	8.0	6.8	5.9	33
CA6000	15 3/8	38 1/4	26.0	0.44	10.5	8.8	7.6	36
CA8003	15 3/8	46 1/2	32.0	0.35	—	10.9	9.4	43
CA8205	22	29 5/8	34.0	1.00	13.7	11.6	10.0	61
CA10050	22	36	44.0	0.77	17.7	15.0	12.9	69
CA12051	22	46 3/4	62.0	0.55	24.9	21.1	18.2	92
CA17255	22	56 3/8	81.0	0.41	32.6	27.5	23.8	103
CA17252	22	62 1/4	86.0	0.39	34.6	29.2	25.3	114
CA17002	26	47 1/4	86.0	0.54	34.6	29.2	25.3	123
CA22050	26	61 7/8	119.0	0.39	47.8	40.5	35.0	166

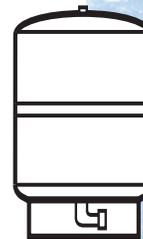
For Models CA4202 through CA8003, Precharge Pressure is 30 PSIG and System Connection is 1" NPTF.

For all other Models, Precharge Pressure is 38 PSIG and System Connection is 1 1/4" NPTF.

* Not recommended.

NOTES: Maximum Operating Temperature: 200° F. Maximum Operating Pressure: 100 psi.

All Models listed above are covered by a 5 year limited warranty. Drawdown is the amount of water delivered by the tank between pump shut-down and pump start-up, and can be affected by various ambient and system conditions including temperature and pressure.



PRO-LINE

DATA SHEET: >gluatmugl< Solar collector



ÖNORM
EN 12975-2

Technical Data:

Collector:

Weight:	24 kg/m ²
Contents:	0,7 l/m ²
Efficiency:	min.: 10 l/m ² h max.: 80 l/m ² h
Sizes :	width x height x depth
Type: 6.3	310 x 205 x 13 cm
Type: 8.4	411 x 205 x 13 cm
Type: 10.5	513 x 205 x 13 cm
Type: 12.6	615 x 205 x 13 cm

Working Pressure:

recommended: 4 bar max. 6 bar

Conversion Factor:*
 $\eta_0 = 0,791$
 $\eta_{0,05} = 0,584$

Heat Lost Coeffiz. :*
 $k_1 = 2,979 \text{ W/m}^2\text{K}$
 $K_2 = 0,029 \text{ W/m}^2\text{K}$
(at v=3m/s wind)

Stagnation temp. :*
208 °C max –temp
(at 1000 W radiation, 30 °C ambient temperature)

*) test certificate: Österreichisches Forschungs- und
Prüfzentrum Arsenal Ges.m.b.H. (ÖNORM EN 12975-2)

Absorber:

Material: Absorber Type Sunstrip

Surface: highly selectively coating

Absorber: $\alpha = 96\%$ (+/- 2%)

Emission: $\varepsilon = 7\%$

Cover: low-iron security glass, 4 mm
Light transmission min. 92 %

Frame: Timber tub with aluminum-EPDM
sealing

Insulation: 70 mm, mineral fiber

Assembling Hints

Connection: Pipe Dimension 28 mm Copper

Joining Installation: Soft-soldering with high -
temperature resistance Solar soft solder (250 °C)
or usage of Solar suitable bolting. Hard-soldering
is not permitted.

Contents-medium: Water with Propylene glycol as
antifreeze. The percentage of the antifreeze is to co-
ordinate with the local minimum temperature.

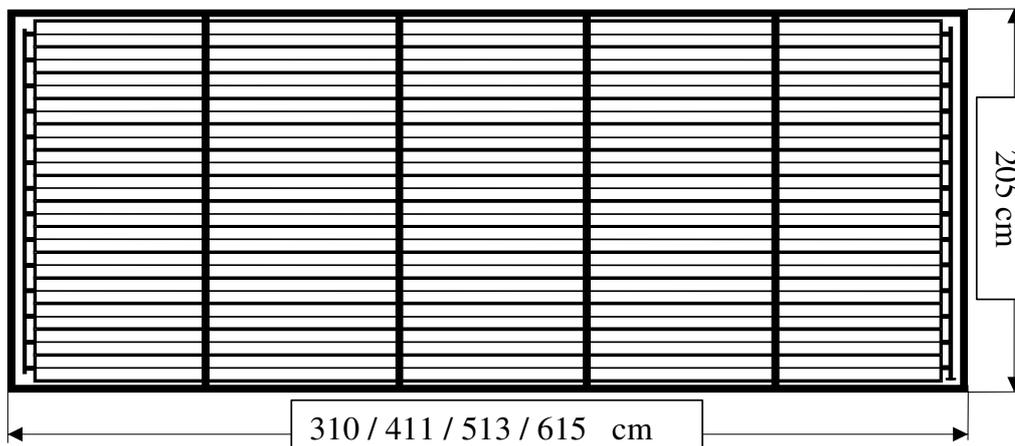
Attachment: When mounted roof-integrated the
collectors are fitted on the roof batten.
When free erected, we recommend the usage of
the original "gluatmugl" rack.

Orientation: "gluatmugl" collectors must be set up with the
water drainage channel at the bottom of the collector.

Further: The timber tub must be protected against
moisture. A metal frame for the timber tub can be
provided if required.
Sensor cable and evacuation has to be used.

Insulation: A max. elongation of 3 mm per meter
absorber is to be considered. The piping has to
ensure the proper elongation of the absorbers.

On roof construction: Notice the safety requirements
for workers and passersby.



Producer:

ökoTech

Production Company for Environmental Technology Ltd.

Subject to change without notice

Version 03/04

Yazaki 5-Ton Absorption Chiller

2006/1/25

ITEM		MODEL		WFC-SC5
Cooling capacity		kW		17.6
Chilled water	Temperature	Inlet	°C	12.5
		Outlet	°C	7.0
	Evaporator pressure loss		k P a	56
	Max operating pressure		k P a	588
	Rated water flow		l/sec	0.77
	Water retention volume		l	8
Cooling water *1	Heat rejection		kW	42.7
	Water temperature	Inlet	°C	31.0
		Outlet	°C	35.0
	Abs. & Cond. pressure loss		k P a	41
	Max operating pressure		k P a	588
	Rated water flow		l/sec	2.55
Water retention volume		l	37	
Heat medium	Heat input		kW	25.1
	Heat medium temperature	Inlet	°C	88
		Outlet	°C	83
		Inlet limit	°C	70 - 95
	Generator pressure loss		k P a	88
	Max operating pressure		k P a	588
	Rated water flow		l/sec	1.20
Water retention volume		l	10	
Electrical	Power source	Voltage	V	AC 85 - 265
		Frequency	Hz	47 - 63
		Phase	ph	1
	Consumption *2		W	48
Control				On - O f f
Dimension	Width		mm	594
	Depth		mm	744
	Height *3		mm	1,736 (1,786)
Piping	Chilled water		A	32
	Cooling water		A	40
	Heat medium		A	40
Weight	Dry weight		kg	365
Cabinet				Weatherproof cabinet suitable for indoor or outdoor application.

*1. Parallel flow : A half of cooling water is provided to Abs. and Cond. each circuit.

*2. Power consumption of Chiller only. (excluding circulating pumps and cooling tower fan)
Power consumption 48w is at standard running condition.
Maximum power consumption of unit would be 72W.

*3. Dimension in() leveling bolt.

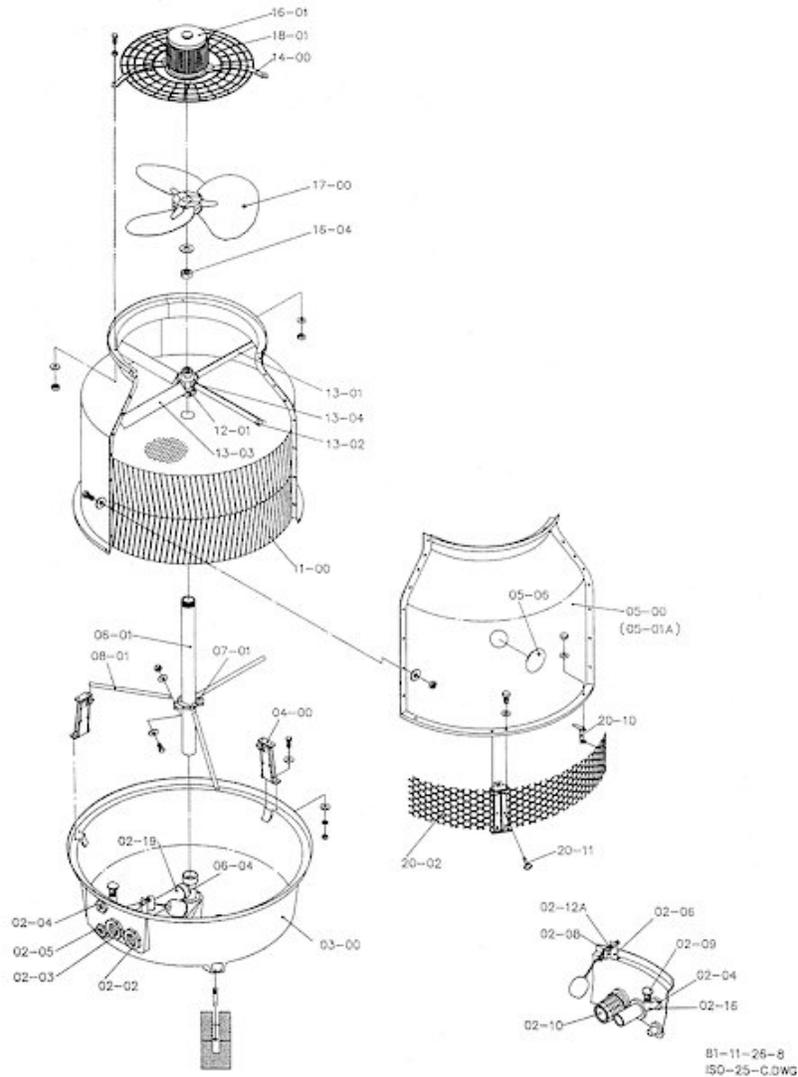
ACTS-15 Specifications

Basic Tower Construction Materials	
Tower support frame assembly:	-
Casing:	FRP
Casing supporter:	Nylon
Cold water basin:	FRP
Filling:	PVC
Filling support:	PVC
Fan guard:	PP
Mechanical equipment support	HDGS
Air inlet louver:	PVC
Structural Details	
Overall diameter:	46 in
Overall height:	59 in
Dry weight:	139 lbs
Operating weight:	536 lbs
Total pump head:	5.3 ft
Design wind load:	30.7 lb/sq ft
Fan Motor	
Number of motors:	one unit per tower
Type:	Induction
Insulation:	E class
Rated HP:	1/4 hp
Voltage and phase:	110/220-1

Piping Connections	
Primary water inlet diameter:	2 in
Primary water outlet diameter:	2 in
Auto fill inlet diameter:	0.5 in
Quick fill inlet diameter:	- in
Overflow outlet diameter:	1 in
Drain diameter:	1 in
Design and Operating Conditions	
Nominal Tons:	15
Tower type:	Counter Flow Induces Draft
Water flow rates:	44 gpm
Hot water temperature:	95° f
Cold water temperature:	85° f
Ambient wet bulb temperature:	75° f
Total fan BHP:	1/4 hp
Drift loss of water flow rates:	0.002%
Evaporation loss of water flow rates:	0.93%
Mechanical Equipment	
Fan unit:	one unit per tower
Type:	Axial Flow
Diameter:	26 3/8 in
Blade material:	Nylon
Hub material:	Nylon
Nominal air volume:	4767 cfm

American Chillers & Cooling Tower Systems

Assembly Diagram

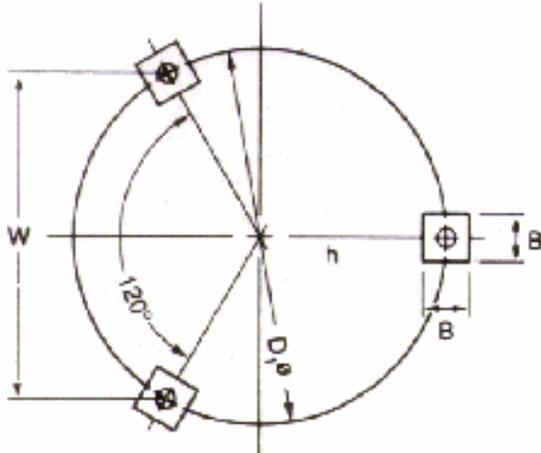


Item No.	Description	Qty
1	Fan Motor	1 pcs
2	V-Belt Reducer	-
3	Motor Frame Assembly	1 set
4	Fan	1 set
5	Fan Guard	1 set
6	Casing	3 pcs
7	Hand Hole	1 pcs
8	Sprinkler Head	1 set
9	Sprinkler Pipe	4 pcs
10	Eliminator	-
11	Tension Device	-
12	Stand Pipe	1 set

Item No.	Description	Qty
13	Filling	1 set
14	Stopper or Column	1 set
15	Filling Supporter	1 set
16	Casing Supporter	3 pcs
17	Inlet Louver	1 set
18	Frame Assembly	-
19	Water Basin	1 pcs
20	Water Sump	-
21	Ladder	-
22	Strainer	1 pcs
23	Flange	-
24	Basin Supporter	-

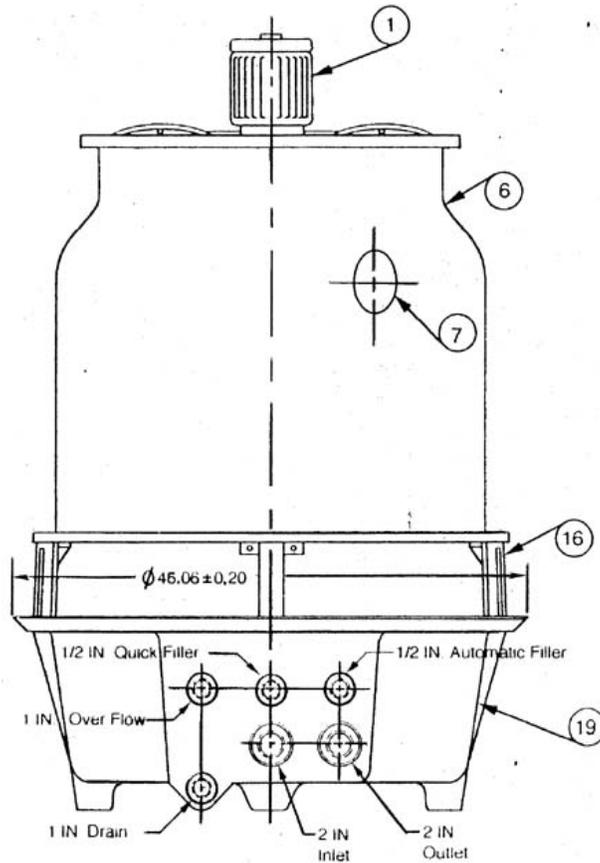
American Chillers & Cooling Tower Systems

Diagram 1



Measurement	Distance (Inches)
D1	35 5/8
W	30
B	8
A	-
h	6
h1	-
C	-
D2	-
Anchor Bolt	
Size (In.)	Length (In.)
0.50	4.75

Diagram 2



American Chillers & Cooling Tower Systems

Diagram 3

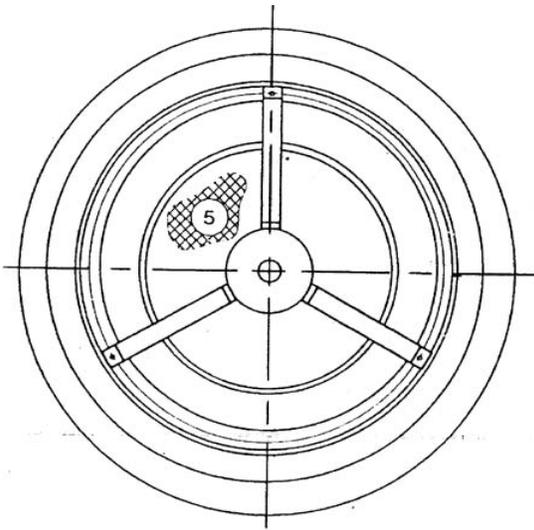


Diagram 4

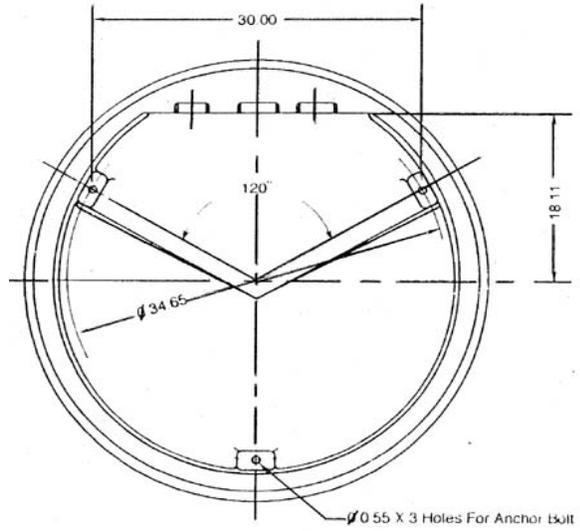
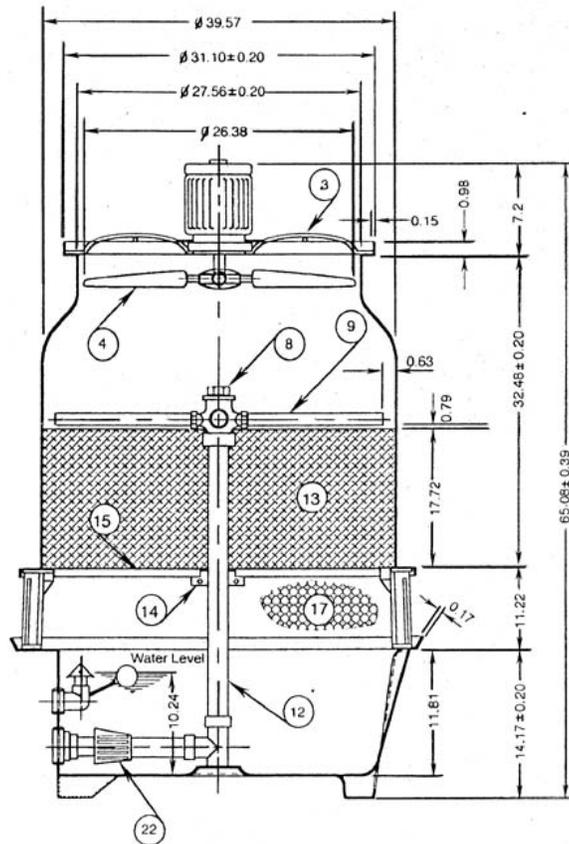


Diagram 5



EV200



Indoor Unit



Specifications

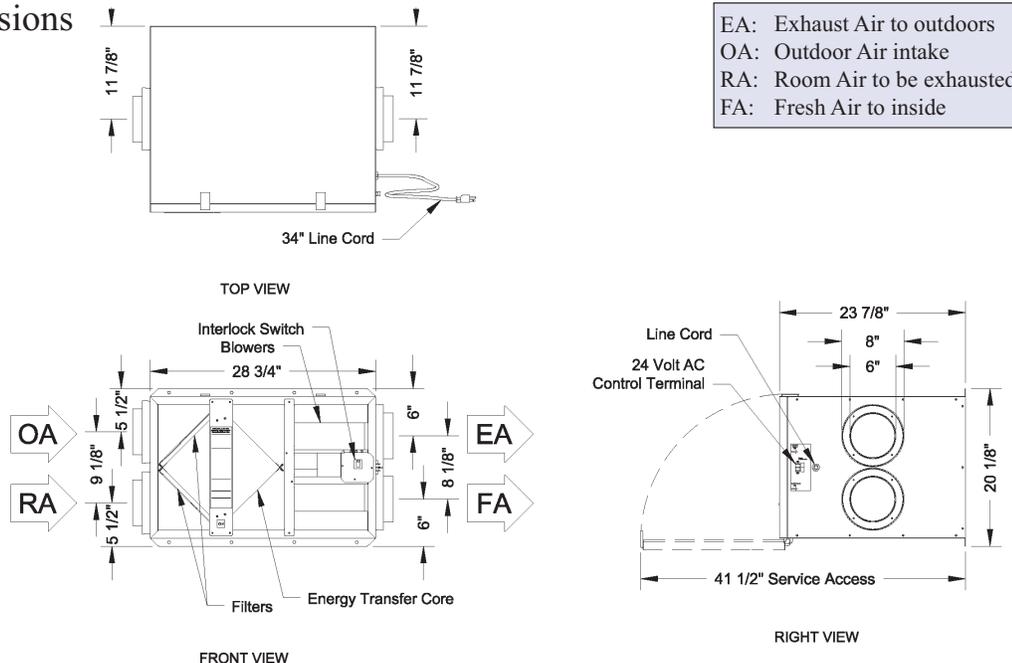
Ventilation Type: Static Plate, Heat and Humidity Transfer				
Typical Airflow Range: 100-200 CFM				
Number Motors: One, 0.1 hp				
V	HZ	Phase	Input Watts	FLA
120	60	Single	157 @ 181 CFM	1.5
Control Voltage: 24 VAC				
Filters: Cleanable, spun polyester media. 10 1/2" x 21 3/4" x 1"				
Weight: 80 lbs (unit), 88 lbs (in carton)				
Shipping Dimensions: 21"W x 32"L x 26 1/2"H				
Options: PT - Percentage timer control PB - Push Button point-of-use controls FM - Percentage timer control with furnace interlock DH24 - Dehumidistat control Wall caps				

G4 Performance

Airflow CFM	ESP in H ₂ O	Temp EFF%	Total EFF% Winter/Summer*
122	0.70	82	74/59
149	0.65	80	72/56
168	0.50	79	70/55
176	0.40	78	69/54
181	0.35	78	69/53
186	0.30	77	68/53
192	0.20	77	68/52
200	0.10	76	67/52

* (See HVI certification report on page 11 for complete certified rating).

Dimensions



EA: Exhaust Air to outdoors
 OA: Outdoor Air intake
 RA: Room Air to be exhausted
 FA: Fresh Air to inside



System Component List

Hydronic Fan Coil Unit	Rittling FDHP 4-row heating coil, 1-row cooling coil, 1/2 hp constant speed fan, 1000 CFM, .6" Static Pressure Loss
Cooling Tower	ACTS-15 Evaporative Cooling Tower, Fan Power: 1/4 hp, 44 GPM, Input temperature: 95F, Output Temperature 85F
Domestic Hot Water tank	Hydronic Specialties SSU-80C, 490 Gal/hour capacity, Output Temperature 140F at 180F Heat Medium Temperature, High Efficiency cupronickel heat exchanger, Includes high capacity water circulator TACO 1400 1/6 hp
Pressure Tank	Amtrol pro-line 32 Gal total capacity, 10 Gal water holding capacity at 30-50 psi
Solar Collectors (2)	SOLID gluatmugl flat-plate (80"x200") 5 lbs/ft ² , 79% efficiency Yazaki WFC-SC5 5 ton capacity. 158F-192F Heat Medium Temperature. 44F Chilled Water Temperature
Absorption Chiller	
Thermal Storage Tank	Trendsetter TS-400 400 Gal Capacity. 70"x38"x52" (LxWxH) Insulated
Energy Recovery Ventilator	RenewAire EV200 Operating Airflow Range: 100-200 CFM .8hp

Ducting

Living room supply 1	10" Diameter Spiral Stainless Steel Round Duct
Living room supply 2	6" Diameter Spiral Stainless Steel Round Duct
Bedroom supply	8"x8" Staibless Steel Rectangular Duct

Living Room return	10" Diameter Flexible Aluminium Duct. Insulated according to California Title 24 regulations
Desk return	10" Diameter Flexible Aluminium Duct. Insulated according to California Title 24 regulations
Bedroom return	9" Diameter Flexible Aluminium Duct. Insulated according to California Title 24 regulations

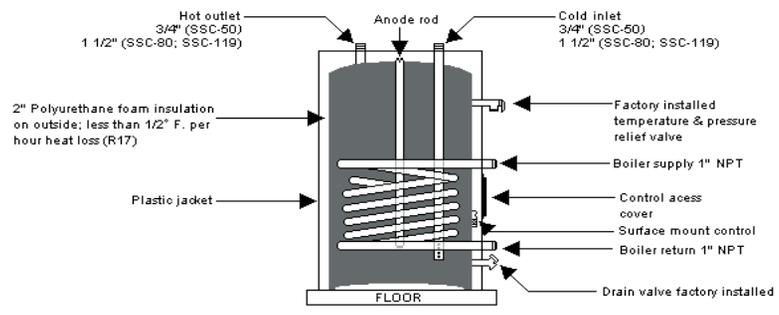
Piping

Domestic Hot Water	1" PEX
Domestic Cold Water	1" PEX
Collector Loop	1" Copper Type L
Chilled Water Loop	1-1/4" CPVC
Condensor Loop	2" PVC Schedule 40
Heating Loop	1-1/2" Copper Tube Type L
Heat Medium Loop	1-1/2" Copper Tube Type L



CUTAWAY ILLUSTRATION

INTRODUCING THE NEW SUPER-STOR CONTENDER



SPECIFICATIONS AND PERFORMANCE RATINGS

MODEL	DIMENSIONS		CAPACITY (US GALLONS)	HEAT EXCHANGER RECOMMENDED.	HEAT EXCHANGER PRESSURE	FIRST HOUR RATINGS*	
	HT.	DIA.		FLOW RATE	DROP (FEET)	140°F	115°F
SSC-50	46 1/2"	23"	50	8 GPM	2.0	160	220
SSC-80	71 1/4"	23"	80	10 GPM	3.2	203	276
SSC-119	67"	28"	119	12 GPM	4.9	308	424

*DOE TEST METHOD BASED ON 90°F. TEMPERATURE RISE, 55°/145° W/ BOILER WATER AT 180°F

TANK SIZE	FLOOR TO BOILER SUPPLY	FLOOR TO BOILER RETURN	FLOOR TO DOMESTIC OUT	FLOOR TO DRAIN VALVE	DOMESTIC CONNECTIONS	TEST PRESSURE	WORKING PRESSURE	SHIPPING WEIGHT
SSC-50	7 3/4"	25 1/2"	49 1/4"	8 1/4"	3/4" NPT MALE	300 PSI	150 PSI	170
SSC-80	8"	25 3/4"	74"	8 1/2"	1 1/2" NPT MALE	300 PSI	150 PSI	232
SSC-119	10 1/2"	21 3/4"	66 1/4"	10 3/4"	1 1/2" NPT MALE	300 PSI	150 PSI	331

NOTE: TANK RECOVERY FROM COLD START WILL BE BETWEEN 10-13 MINUTES WHEN SIZED WITH CORRECT FLOW RATE, BOILER SIZE AND PRESSURE DROP RATINGS FROM LIST IN ABOVE CHART. THE MASS OF THE BOILER WILL EFFECT RECOVERY TIME, MORE BOILER MASS EQUALS LONGER RECOVERY TIME.





PERFORMANCE AND SIZING GUIDELINES

DETERMINE AMOUNT OF DOMESTIC HOT WATER NEEDED, THEN USE THE CHART BELOW TO OPTIMIZE SUPER STOR CONTENDER V.S. BOILER SIZING.

NOTE: MINIMUM BTU/H REQUIRED TO ACHIEVE FIRST HOUR RATING THE MASS OF THE BOILER WILL EFFECT RECOVERY TIME, MORE BOILER MASS EQUALS LONGER RECOVERY TIME.

MODEL	GROSS OUTPUT	140° F 90° F. ΔT	127° F 77° F. ΔT	115° F 65° F. ΔT
SSC-50	88,000	160	188	220
SSC-80	114,000	203	239	276
SSC-119	161,000	308	363	424

NOTE: ABOVE CHART IS BASED ON BOILER SIZE CONFORMING TO THE MINIMUM BTU/H REQUIRED TO ACHIEVE FIRST HOUR RATINGS, OBTAINABLE FROM CHART ABOVE. THE MASS OF THE BOILER WILL EFFECT RECOVERY TIME, MORE BOILER MASS EQUALS LONGER RECOVERY TIME.

REDUCED BOILER INPUT, SIZING GUIDE

	115° F 65° ΔT	140° F 90° ΔT
GROSS OUT	FIRST HOUR RATING	FIRST HOUR RATING
B.T.U.H.	GALLONS	GALLONS

SSC-50		
20,000	79	60
40,000	119	90
60,000	159	121
80,000	208	153
100,000	220	160
120,000	220	160
SSC-80		
20,000	98	73
40,000	136	100
60,000	175	127
80,000	246	181
100,000	258	189
110,000	268	194
120,000	276	203
SSC-119		
40,000	177	128
60,000	215	157
80,000	253	184
108,000	300	210
120,000	330	239
140,000	371	270
154,000	397	293
160,000	424	308



Civil Engineering Specifications

Material Safety Data Sheet

May be used to comply with OSHA's Hazard Communication Standard, 29 CFR 1910.1200. Standard must be consulted for specific requirements.

U.S. Department of Labor

Occupational Safety and Health Administration
(Non-Mandatory Form)
Form Approved:
OMB No. 121B-0072

ULTRATOUCH NATURAL COTTON FIBER INSULATION	Note: Blank spaces are not permitted. If any item is not applicable, or no information is available, the space must be marked to indicate that.
---	---

Section I

Manufacturer's Name BONDED LOGIC, INC.	Emergency telephone Number (480) 812-9114
Address (Number, Street, City, State, and ZIP Code) 411 E. RAY ROAD CHANDLER, AZ 85225	Telephone Number for Information (480) 812-9114
	Date Prepared 7/13/01
	Signature of Preparer (optional)

Section II -- Hazardous Ingredients/Identity Information

Hazard Components (Specific Chemical Identity: Common Name(s))	OSHA DEL	ACGIH+TLV	Other Limits Recommended	% (optional)
RECYCLED FIBER PRODUCTS	N/A	N/A	N/A	
OSHA PARTICULATES NOT OTHERWISE REGULATED -				
BORAX 5 MOL - Sodium Tetraborate Pentahydrate CAS No. 12179-04-3	10 mg/m ³	1 mg/m ³	5 mg/m ³	
BORIC ACID CAS NO: 10043-35-3	15 mg/m ³	10 mg/m ³	N/A	

Section III -- Physical/Chemical Characteristics

Boiling Point	N/A			Specific Gravity (H ₂ O = 1)	N/A
Vapor Pressure (mm Hg)	N/A			Melting Point	N/A
Vapor Density (AIR = 1)	N/A			Evaporation Rate (Butyl Acetate = 1)	N/A
Solubility in Water NONE					
Appearance and Odor COLOR - WHITE/ALUMINIUM - NO ODOR					

Section IV -- Fire and Explosion Hazard Data

Flash Point (Method Used)	N/A	Flammable Limits	N/A	LEL	N/A	UEL	N/A
Extinguishing Media	ANY STANDARD METHOD						
Special Fire Fighting Procedures	NO SPECIAL METHOD - MATERIAL IS TREATED FOR FLAME RESISTANCE						
Unusual Fire and Explosion Hazards	NONE KNOWN						

Section V -- Reactivity Data

Stability	Unstable		Conditions to Avoid	PROLONGED TEMPERATURES EXCEEDING 250°F
	Stable	X		
Incompatibility (Materials to Avoid)	N/A			
Hazardous Decomposition or Byproducts	COMBUSTION PRODUCTS AS FIBER PRODUCTS			
Hazardous Polymerization	May Occur		Conditions to Avoid	N/A
	Will Not Occur	X		

Section VI -- Health Hazard Data

Route(s) of Entry:	Inhalation?	YES	Skin?	NO	Ingestion?	YES
Health Hazards (Acute and Chronic)	NONE KNOWN					

Carcinogenicity:	None Known	NTP?	NO	IARC Monographs?	NO	OSHA Regulated?	NO
------------------	------------	------	----	------------------	----	-----------------	----

Signs and Symptoms of Exposure	NONE KNOWN
--------------------------------	------------

Medical Conditions Generally Aggravated by Exposure	NONE KNOWN
Emergency and First Aid Procedures	INGESTION: IF LARGE AMOUNT IS CONSUMED, SEEK MEDICAL ATTENTION

Section VII -- Precautions for Safe Handling and Use

Steps To Be Taken in Case Material Is Released or Spilled	PICK UP LARGE QUANTITIES AND USE OR DISPOSE
---	---

Waste Disposal Method	IN ACCORDANCE WITH FEDERAL AND/OR STATE REGULATIONS COVERING SOLID WASTE DISPOSAL
Precautions To Be Taken In Handling and Storing	STORE MATERIAL IN DRY PLACE
Other Precautions	NONE REQUIRED

Section VIII -- Control Measures

Respiratory Protection (<i>Specify Type</i>)	OSHA APPROVED AIR MASK			
Ventilation YES	Local Exhaust	YES	Special	NONE
	Mechanical (<i>General</i>)	NO	Other	NONE
Protective Gloves	OPTIONAL	Eye Protection	OPTIONAL	
Other Protective Clothing or Equipment	NOT NORMALLY REQUIRED			
Work/Hygienic Practices	NO SPECIFIC REQUIREMENT - USE COMMON SENSE			

UltraTouch

N A T U R A L C O T T O N - F I B E R I N S U L A T I O N

ULTRATOUCH® INSULATION is a Class-A building material that offers excellent thermal and acoustical performance. Made from natural cotton fibers UltraTouch does not contain fiberglass and won't cause itching or skin irritation.

The natural materials used to manufacture UltraTouch are individually treated with an EPA registered fungal inhibitor that offers excellent protection from mold, mildew, fungus and pests, as well as providing outstanding fire-resistance properties.

PHYSICAL PROPERTIES

PROPERTIES	PERFORMANCE	TEST METHOD
Surface Burning Characteristics (Fire Hazard Classification)	Flame Spread 5 (Class 1) Smoke Developed 35 (Class 1)	ASTM E-84 UL-723
Corrosion Resistance	Passed	ASTM C 739
Fungi Resistance	Passed – No Growth	ASTM C-739
Bacteria Resistance	Passed – No Growth	ASTM C-739
Moisture Absorption	Passed – Less Than 15 %	ASTM C-739
Fire Test of Building Material	Passed – 1 Hour Rating	ASTM E-119 / UL-263

THERMAL/TECHNICAL INFORMATION

* Tested in accordance with ASTM C-518 at a temperature of 75° F. Higher R-values equal greater insulating power.

PRODUCT CODE	R-VALUE*	THICKNESS	WIDTH	LENGTH	SO. FT./BAG	WEIGHT
10000-01316	13	3.5"	16.25"	94"	106.07	48 lbs.
10000-01324	13	3.5"	24.25"	94"	126.63	58 lbs.
10000-01916	19	5.5"	16.25"	94"	53.04	30 lbs.
10000-01924	19	5.5"	24.25"	94"	63.32	35 lbs.
10000-02116	21	5.5"	16.25"	94"	53.04	37 lbs.
10000-02124	21	5.5"	24.25"	94"	63.32	45 lbs.
10000-03024	30	8.0"	24.25"	48"	64.64	57 lbs.

PRODUCT COMPLIANCES

The physical properties of UltraTouch Insulation regularly meet the requirements, specifications, standards and building practices of the following organizations.

Environmental Specification #1350

ICC Evaluation Report #1134

LARR ICC ER #1134

BOCA Building Officials and Code Administrators

CABO Council of American Building Officials

ICBO International Conference of Building Officials

LEED Leadership in Energy and Environmental Design

SBCCI Southern Building Code Congress International

California Bureau of Thermal Insulation Lic. #TI-1367/Reg. # CA-T367AZ



ULTRATOUCH can be used for both interior and exterior walls as well as most ceiling applications. UltraTouch can be installed in either wood or metal framing cavities and between furring channels by using a simple friction fit. The product is safe to handle and install without the need for protective clothing or special respiratory equipment.

- **Environmentally Safe**
- **Class-A Fire Rated**
- **Maximum R-Value**
- **Superior Acoustics**
- **Resists Mold & Mildew**
- **No Formaldehyde**
- **No Itch or Skin Irritation**
- **A LEED Eligible Product**



24053 S. ARIZONA AVE.
CHANDLER, AZ 85248
480-812-9114
480-812-9633 FAX

www.BondedLogic.com



C 1157-03 Compliant

ASTM Test	Result	Method
Time of Set (min)		C191
▪ Initial	46	
Compressive Strength (psi)		C109
▪ 1-Day	5435	
▪ 7-Day	7690	
▪ 28-Day	8370	
Mortar Bar Expansion, 14 Days (%)	.009	C1038
Autoclave Expansion, (%)	0.68	C151

All of the above results meet ASTM C 1157 requirements.

Test methods used were as directed by CalStar Cement and are modified versions of the stated ASTM standards above. CalStar Cement testing laboratory's results were externally validated by CTLI Thompson Materials Engineers, Inc., 22 Lipan Street, Denver, CO 80223. 303-825-0777.



CAL-STAR
CEMENT

Data Sheet

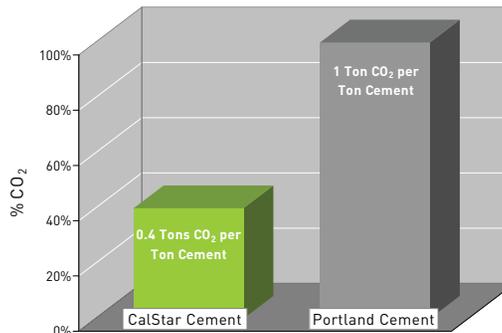
CalStar Cement™

CalStar Cement is high-performance, environmentally sustainable cement designed for general use concrete. CalStar Cement is a high early-strength cement. Applications include form and pour projects, building materials, and flatwork. It is not recommended for underwater or life safety applications.

Environment

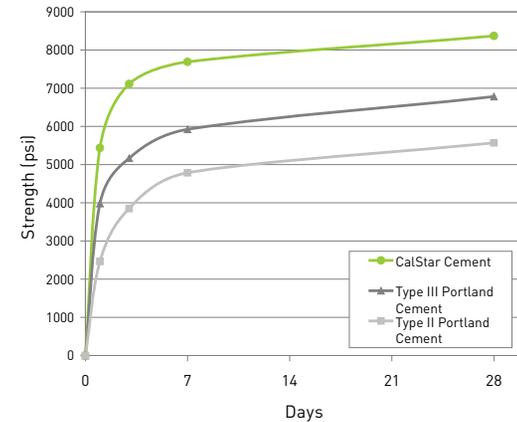
CalStar Cement was designed with the environment in mind. CalStar's novel material system produces **60% less CO₂** and uses **17% less energy** than the manufacture of Portland Cement. CalStar Cement has targeted sustainability by incorporating a high percentage of **recycled material** into our cement.

CalStar Cement Reduces Green House Gasses



Performance

High Early Strength



Results on mortars as per ASTM C 109. Portland Cement Data: Gebhardt, R.F., "Survey of North American Portland Cements: 1994," *Cement, Concrete, and Aggregates*, CCAAGDP, Vol. 17, No.2, Dec 1995, pp. 145-147.

Application

Please read **Application Notes** and **Material Safety Data Sheets** (MSDS) prior to mixing.

Store in a dry place between **68°F and 80°F (20°C to 27°C)**

CalStar Cement has a **30 minute** working time under standard working temperatures (55°-75°F/13°C-24°C). CalStar Cement can and should be dry-cured.

YIELD

50lbs of cement (mix proportions as directed in the **Application Notes**) yields approximately 1.25 cu ft of concrete.

Acceptance Criteria Test Results
for
Solid Section Bamboo I-Joists—Addendum

Prepared by

Mark Aschheim, Ph.D., P.E.

Associate Professor

and

Ray Lam

Civil Engineering Undergraduate

Santa Clara University

July 27, 2007

Tested According to
Proposed Acceptance and Quality Assurance Criteria—Solid Section Bamboo I-Joists
Approved by Thomas Meyers, Solar Decathlon Building Official, on October 12, 2006

Preface

This Addendum provides additional creep test data and addresses the use of ½” thick 3-ply manufactured bamboo panels as webs in place of the proprietary bamboo Oriented Strand Board (OSB) that was the subject of the Report on Acceptance Criteria Test Results for Solid Section Bamboo I-Joists that was issued on March 4, 2007. The change in web material was necessitated by the unavailability of the OSB product at the time of manufacture of the I-Joists. No changes were made to the flange material. Thus, this Addendum provides Acceptance Criteria test results for Shear Specimens and Design Values for shear that may be directly substituted for the information reported for OSB in the original Acceptance Criteria report. Other information provided in that report is still applicable and is not repeated here for brevity.

Specimen Materials

Web material consists of a ½” thick 3-ply bamboo panel that is manufactured for Smith & Fong. This material is commercially available, and is described as “natural flat grain 3-ply 1/2x48x96,” item number BP-1296N-FRE. This material was selected because it was expected to be equivalent or better than the bamboo OSB on the basis of previous tests conducted at Santa Clara University.

Test Results

Shear Specimens: Measured dimensions and ultimate strengths for the four new specimens are provided in Table A1.

Table A1. Test Results for Shear Specimens

Specimen Number	Overall depth, in.	Top Flange		Bottom Flange		Web thickness, in.	Ultimate Strength pounds	Ultimate Shear Strength, psi
		Thickness, in.	Depth, in.	Thickness, in.	Depth, in.			
S5	9.531	2.498	1.505	2.505	1.502	0.502	14,383	2196
S6	9.594	2.499	1.502	2.496	1.503	0.504	14,982	2256
S7	9.531	2.491	1.510	2.501	1.507	0.503	14,577	2224
S8	9.594	2.499	1.501	2.499	1.507	0.502	15,765	2384
Mean Strength, psi								2265
Standard Deviation, psi								83
Coefficient of Variation								0.037

Note the mean shear strength of 2265 psi and coefficient of variation of 0.037 compare favorably to the results for the beams containing OSB webs, for which the mean shear strength was 2116 psi and the coefficient of variation was 0.252.

Failure modes for the 3-ply shear specimens varied.

1. Specimen S5 experienced slip at the vertical joint in the web, followed by horizontal slip (delamination of the horizontal plies) at the location of the 2-1/8” diameter hole. (Figure A1a).

2. Specimen S6 experienced horizontal slip (delamination of the horizontal plies) at the location of the 2-1/8" diameter hole, possibly in conjunction with slip at the vertical joint. (Figure A1b).
3. Specimen S7 experienced failure of the vertical joint in the web; this occurred in conjunction with the web pulling out from the flange at this location. (Figure A1c).
4. Specimen S8 experienced lateral torsional buckling, which led to large out-of-plane deformations of the web along with horizontal cracking in the horizontal plies of the 3-ply web. (Figure A1d).

Flexural Specimens: Two specimens were tested in bending to failure to ensure that the change in web material would not negatively affect flexural strength as previously evaluated.

Table A3. Test Results for Flexural Specimens

Specimen Number	Overall depth, in.	Top Flange		Bottom Flange		Web thickness, in.	Ultimate Strength, pounds
		Thickn ess, in.	Depth, in.	Thickness, in.	Depth, in.		
F7	9.47	2.524	1.494	2.494	1.521	0.503	10,835
F8	9.50	2.495	1.517	2.499	1.498	0.508	9,944
Mean Strength, pounds							10,390

The mean ultimate strength, 10,390 pounds, is 17% larger than the mean strength of 8,854 pounds determined in the original Acceptance Criteria tests of 6 specimens in flexure. Consequently, there is no indication that the use of 1/2" 3-ply material in the webs has a negative influence on flexural strength. Therefore, design moment values have not been changed.

Creep: Specimens F7 and F8 were subjected to creep tests prior to loading to failure.

Creep tests were conducted following the same procedure described in the Report on Acceptance Criteria Test Results for Solid Section Bamboo I-Joists, according to the provisions of §6.5.3. In this case, tests were conducted on beams having 3-ply webs. No change was made to the flange material.

Specifically, each beam was loaded to produce a moment equal to 20% of the allowable moment $0.20(22,033) = 4407$ in-pounds, and this was achieved with a load of 294 pounds. The specimen was then loaded to 1.5 times this level (441 pounds) and held at this load for one hour. The load was then reduced to 294 pounds and held at this reduced load for 15 minutes. Displacements corresponding to these load levels are shown in Table A2. In Table A2, "Total Deflection" is the difference of the displacement after 1 hour at 294 pounds and the initial displacement at 294 pounds. To pass the creep test according to §6.5.3, the specimen must recover 90% of the deflection under 441 pounds within 15 minutes under 294 pounds. Thus, the displacement after 15 minutes at 294 pounds must be less than the "Required Displacement," where the "Required Displacement" is equal to the initial displacement plus 10% of the Total Deflection

It is apparent in Table A2 that both specimens failed the creep tests. Each specimen was able to recover 75% of the deflection (rather than 90%) within the allotted time. Because the beams for the Solar Decathlon house have service load deflections less than 1/3 of allowable deflections,

there is no reason to believe creep will be an issue in this application. More tests should be done to better understand this phenomenon and to identify appropriate creep tests and acceptance criteria for I-beams made of bamboo.

Table A2. Creep Test Results (inches)

Specimen	Initial Displacement at 294 pounds	Displacement after 1 hour at 441 pounds	Displacement after 15 minutes at 294 pounds	Total Deflection	Required Displacement	Amount in Excess
F7	0.1312	0.1510	0.1362	0.0198	<0.1332	0.003
F8	0.2129	0.2327	0.2179	0.0198	<0.2149	0.003

Design Values

Design value for moment strengths determined according to the Analytic Method of §6.3.1 of ASTM D5055 are not affected by the properties of the web. As stated above, there is no indication that design moment values derived from the flexural tests should be reduced due to the use of ½” 3-ply web material.

According to the modified §6.3.2.3, allowable shear strengths are to be determined at the lower 5% tolerance limit at a 95% confidence level divided by 2.37 (rather than using a 75% confidence level). Thus,

$$\tau_s = C \frac{(\tau_e - Ks)}{2.37}$$

where C product of any appropriate special end use reduction factors from Appendix X6, K = factor for one-sided 95% tolerance limit with 95% confidence for a normal distribution, and s = standard deviation. For n = 4, K = 5.415, and the values of Table A1, the allowable shear stress is

$$\tau_s = C \frac{(\tau_e - Ks)}{2.37} = C \frac{(2265 - (5.415)(83))}{2.37} = 766 \text{ psi}$$

Thus, for design, the allowable shear is given by

$$V_{allow} = \tau_s (d_w)(t_w) = 766(9.5 - 1.5 - 1.5)(0.50) = 2490 \text{ pounds}$$

where d_w = depth of the web (not including flanges) and t_w = thickness of the web, with numerical values substituted for the 9.5 inch deep bamboo I-joist.

Experimental data was evaluated to determine the modulus of elasticity and shear modulus, following the method described in the original Acceptance Criteria report. Figure A2(a) shows results from 10 proof tests (in dashed lines) and 6 Acceptance Criteria tests (in solid lines). The scatter in results obtained from the proof tests is attributed to imprecise placement of the loading and support reaction blocks, leading to variability in actual span lengths for the proof tests. Figure A2(b) retains only the results from the 6 Acceptance Criteria tests. The approximate centroid of intersections is used to find $1/G = 7.31 \times 10^{-6}$ and $1/E = 4.88 \times 10^{-7}$, which

corresponds to $G = 136,799$ psi and $E = 2,049,180$ psi. These values are rounded to $E = 2,049,000$ psi and $G = 137,000$ psi .

The original Acceptance Criteria report established moduli for the beams with OSB webs using an identical procedure. In that report, $E = 2,280,000$ psi and $G = 254,000$ psi. This illustrates that the method yields fairly consistent results for the modulus of elasticity, which primarily reflects flange contributions to stiffness. Differences in the shear modulus are attributed to differences in the web material, with the bamboo OSB material being far stiffer than the 3-ply material in shear.

Using the estimated moduli, estimates of the experimental stiffness of the beams were made and are compared with measured stiffnesses in Table A3.

Table A3: Verification of Accuracy of Deflection Estimates Using $E=2,050,000$ psi and $G=137,000$ psi.

Specimen	Experimentally-Determined Stiffness (P/Δ), pounds/in	Estimated Stiffness (P/Δ), pounds/in	Percent Error
Acceptance Criteria Tests			
F7	9,736	9,525	2.16%
F8	9,351	9,590	-2.55%
S5	40,174	39,109	2.65%
S6	39,259	39,654	-1.01%
S7	37,419	39,120	-4.55%
S8	40,120	39,541	1.44%
Mean Error			-0.31%
Proof Tests—Flexural Specimens			
RJ1f	9,204	9,535	-3.59%
RJ2f	8,970	9,535	-6.30%
RJ3f	10,200	9,535	6.52%
RJ4f	10,331	9,535	7.71%
RJ5f	9,346	9,535	-2.02%
Mean Error			0.47%
Proof Tests—Shear Specimens			
RJ1s	41,853	63,579	-51.9%
RJ2s	44,529	63,579	-42.8%
RJ3s	42,794	63,579	-48.6%
RJ4s	54,628	63,579	-16.4%
RJ5s	53,176	63,579	-19.6%
Mean Error			-35.8%

From the data in Table A3, it is apparent that the estimated values of E and G result in very accurate estimates of stiffness for the shear and flexural specimens tested in the Acceptance Criteria tests and for the proof tests of flexural strength. The substantial reduction in accuracy when estimating the stiffness for the proof tests of shear strength is attributed to the sensitivity of

experimental results to the precise location of the loading and support blocks when spans are short. This does not imply inaccuracy in the estimates of E and G.

AC-162 provides design values that reflect duration of load considerations for bamboo. The adjustment factors for duration of load are as follows: 1.0 for permanent loads, 1.25 for normal duration of load (less than 10 years), and 1.5 for wind and seismic.

Although these load duration factors properly could have been applied to the design of the Solar Decathlon bamboo I-joists, they were not, thereby providing additional conservatism in the Solar Decathlon design.



Figure A1a



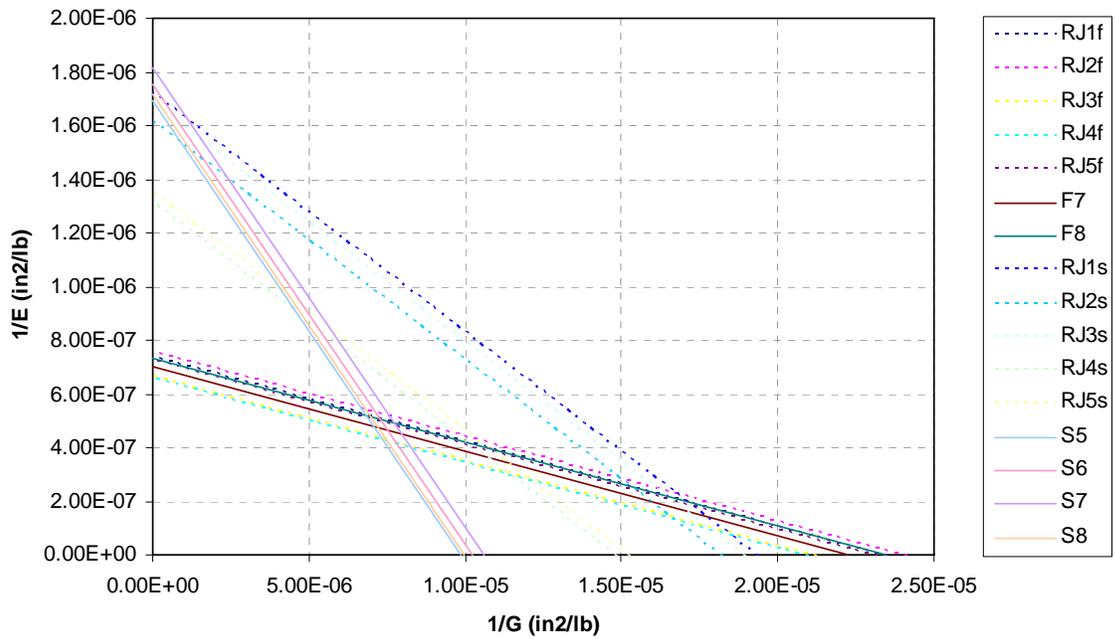
Figure A1b



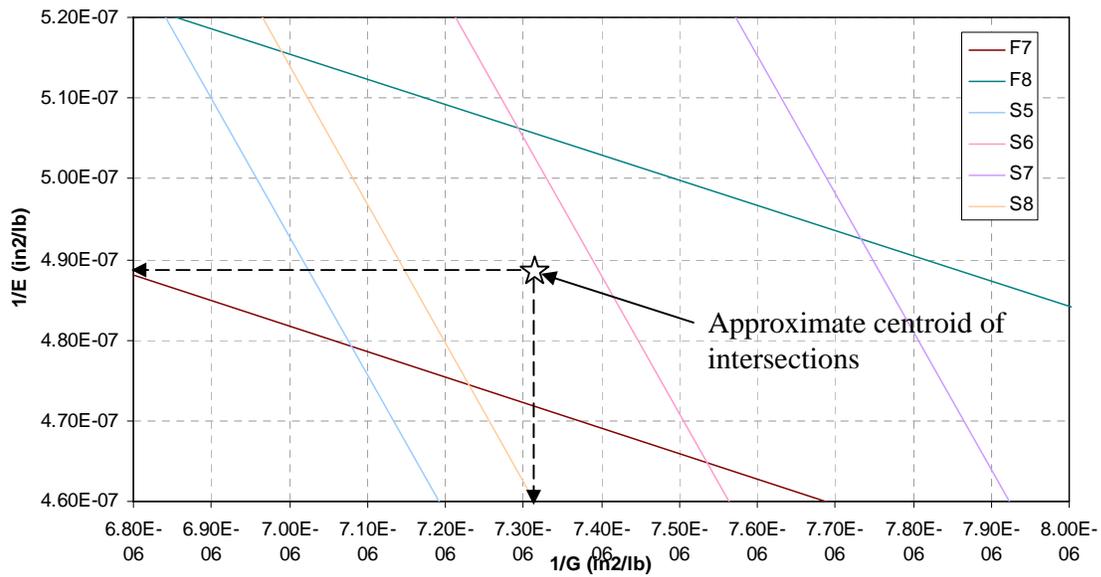
Figure A1c



Figure A1d



(a) General View showing all 6 Acceptance Criteria Tests and 10 QA/QC Tests



(b) Close-up of 6 Acceptance Criteria Tests

Figure A2: Determination of Modulii from Experimental Data

Quality Assurance/Quality Control Tests
for
Solid Section Bamboo I-Joists

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July 27, 2007

Tested According to

Proposed Acceptance and Quality Assurance Criteria—Solid Section Bamboo I-Joists
Approved by Thomas Meyers, Solar Decathlon Building Official, on October 12, 2006

Preface

The *Proposed Acceptance and Quality Assurance Criteria—Solid Section Bamboo I-Joists*, approved by Thomas Meyers, Solar Decathlon Building Official, on October 12, 2006 identifies quality assurance and quality control tests to be done to the materials and beams manufactured for use in the Solar Decathlon house. These tests are reported herein. As explained in the Addendum report, the beams were fabricated using webs made from ½” 3-ply bamboo material in place of the bamboo OSB that had been used originally.

Testing Laboratory and Equipment

All tests were performed at the Structures and Materials Test Laboratory at Santa Clara University. All tests were performed using the 400,000 pound Tinius Olsen universal test machine. Tensile or compressive loads are applied through a hydraulic system that is manually controlled by the machine operator. Calibration of the Tinius Olsen “Super L Universal Testing Machine with Model 290 Display (Serial Number 117680) was last done on April 25, 2006, by Pacific Calibration Services.

Flange Capacity Tests

Ultimate Strengths of flange coupons are reported in Table 1. The mean ultimate strength must not be less than 90% of that determined in the Acceptance Criteria tests.

Table 1. Flange Capacity Test Results

Specimen	Width, in.	Thickness, in.	Offset Distance, in.	Ultimate Strength, pounds	Ultimate Strength, psi
I1	2.513	1.490	23.69	18,602	4968
I2	2.504	1.489	23.69	19,849	5324
I3	2.507	1.494	23.81	19,892	5311
I4	2.503	1.499	24.38	23,227	6191
I5	2.497	1.493	23.89	21,984	5897
Mean Ultimate Strength, psi					5538
Standard Deviation, psi					494
Coefficient of Variation					0.0892

The mean ultimate strength determined in the Acceptance Criteria tests is 4011 psi. The standard deviation is 756 psi. Clearly, 5538 psi exceeds $0.90(4011) = 3610$ psi. Thus, the flange material is considered adequate.

Moment and Shear Tests

I-joists sampled from the production run were subjected to bending and shear tests. Five joists were tested, complying with the minimum sample size requirement. Each I-joist was subjected to a proof load of 150% of the design moment capacity and 150% of the design shear capacity.

The design moment was 22,033 in-pounds. The proof moment was $1.5(22,033) = 33,050$ in-pounds. Thus, with a shear span of 30" (and a distance of 30" between load points), the required shear was $33,050/30 = 1102$ pounds. The corresponding proof load is $2(1102) = 2203$ pounds.

The design shear for the beams made with 1/2" 3-ply bamboo webs was 2490 pounds. The proof shear was $1.5(2490) = 3735$ pounds, and the proof load was $2(3735) = 7470$ pounds. This was achieved by having shear spans of 8" and a distance of 30" between load points. The moment achieved in this configuration, 29,880 in-pounds, is less than the proof moment.

Data from these tests was continuously recorded. The tests were discontinued when the load exceeded the required proof load. Peak loads achieved for each test are given in Table 2.

Table 2: Moment and Shear Test Results

Specimen	Proof Load in Flexure, pounds	Proof Load in Shear, pounds
RJ1	2213	7474
RJ2	2249	7559
RJ3	2401	7477
RJ4	2240	8064
RJ5	2280	7503

All joists withstood loads in excess of the required proof loads (2203 and 7470 pounds, respectively). No signs of failure, including visible evidence and cracking or popping sounds, were apparent during any tests.

Re-evaluation of Structural Capacities

The modulus of elasticity and shear modulus was determined considering all tests for beams made with the 1/2" 3-ply web material. Details are provided in the Addendum report. These moduli are used in deflection estimates in the revised structural design calculations, which show the bamboo I-joists to have adequate stiffness and strength.

STRUCTURAL
CALCULATIONS
FOR
SANTA CLARA UNIVERSITY'S
ENTRY IN
2007 SOLAR DECATHLON

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7/28/07

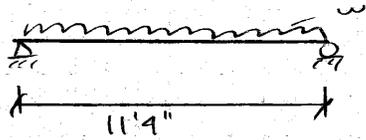
GL1

GRAVITY LOADSLIVE

FLOOR 50 psf
 ROOF 20 psf

DEAD

	<u>IN TRANSIT</u>	<u>FULLY CONFIGURED</u>
• ROOF		
ROOFING MEMBRANE	2.0 psf	
FOAM ROOFING @ 3.0pcf	1.5	
5/8" T-11 SHEATHING	2.8	
2 1/2" x 9 1/2" BAMBOO I JOIST @ 24"	1.5	
LIGHTING / MISC	2.0	
SOLAR PANELS & SUPPORTS		7.0
	<u>9.8 psf</u>	<u>16.8 psf</u>
• FLOOR		
5/8" BAMBOO FLOORING	2.2 psf	
1/2" PLYWOOD	1.6	
2x10 JOISTS @ 16"	2.6	
INSULATION	3.0	
MECH. EQUIP & BATTERIES		12000 #
	<u>9.4 psf</u>	<u>9.4 psf + 12k</u>
• EXTERIOR WALL		
3/8" RAINSCREEN w/ 1x2 BATTENS @ 12"	3.0 psf	
1/2" PLYWOOD	1.6	
2x6 @ 16"	1.5	
5/8" QUIET ROCK	2.7	
ULTRATOUCH INSULATION	0.5	
	<u>9.3 psf</u>	<u>9.3 psf</u>
• INTERIOR WALL		
5/8" QUIET ROCK (2x2.7)	5.4 psf	
2x4 @ 16"	1.0 psf	
	<u>6.4 psf</u>	<u>6.4 psf</u>

ROOF JOISTS BAMBOO I-JOISTS @ 24"

$$w = (16.8 + 20) \left(\frac{24}{12} \right) = 73.6 \text{ plf}$$

$$M_{\text{max}} = wL^2/8 = (73.6)(11.33)^2/8 = 1181 \text{ #}\cdot\text{ft} = 14,171 \text{ #}\cdot\text{in}$$

$$M_{\text{allow}} = 22,033 \text{ #}\cdot\text{in}$$

$$\underline{14,171 < 22,033 \text{ #}\cdot\text{in} \text{ OK}}$$

$$V_{\text{max}} = wL/2 = (73.6)(11.33)/2 = 417 \text{ #}$$

$$V_{\text{allow}} = 2490 \text{ #}$$

$$\underline{417 < 2490 \text{ #} \text{ OK}}$$

$$\Delta_{\text{max}} = \frac{5wL^4}{384EI} + \frac{V_{\text{max}} \left(\frac{L}{2} \right) \left(\frac{L}{2} \right)}{GA_{\text{web}}}$$

$$= \frac{5(73.6)(11.33)^4(12)^3}{384(2050000)(123.34)} + \frac{(417) \left(\frac{11.33}{2} \right) \left(\frac{11.33}{2} \right) (12)}{(137,000)(0.5 \times 6.5)}$$

$$= 0.1079 + 0.0318$$

$$= 0.140 \text{ ''}$$

$$\Delta_{\text{allow}} = L/180 = 11.33 \times 12/180 = 0.755 \text{ ''}$$

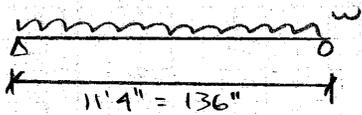
$$\underline{0.140 < 0.755 \text{ ''} \text{ OK}}$$

No. 937 811E
 Engineers Computation Pad
STAEDTLER

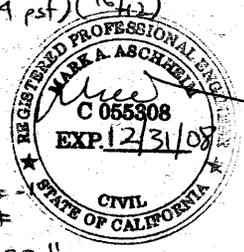
FLOOR JOISTS 2x10 DF #2+

$I = 98.9 \text{ in}^4$
 $S = 21.4 \text{ in}^3$
 $A = 13.9 \text{ in}^2$

o LIVING SPACE (@ 16" O.C.)



$w = (50 + 10.9 \text{ psf})(16/12)$
 $= 80.5 \text{ plf}$



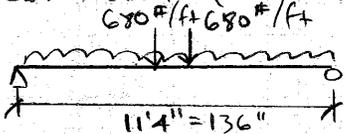
$M_{max} = wL^2/8 = (80.5 \text{ plf})(136/12)^2/8 = 1292 \text{ #}$
 $V_{max} = wL/2 = (80.5 \text{ plf})(136/12)/2 = 456 \text{ #}$
 $\Delta_{max} = \frac{5wL^4}{384EI} = \frac{5(80.5 \text{ plf})(136/12)^4 (12)^3}{384(1600000 \text{ psi})(98.9 \text{ in}^4)} = 0.189 \text{ ''}$

$C_d = 1.25 (D+U) \quad F_b = (875 \text{ psi})(1.25) = 1094 \text{ psi}$
 $M_{allow} = F_b S = (1094 \text{ psi})(21.4 \text{ in}^3) = 23412 \text{ #-in} = 1951 \text{ #-ft}$
 $1292 < 1951 \text{ #-ft OK}$

$F_v = 170 \text{ psi}$
 $V_{allow} = (F_v A) (2/3) = (170 \text{ psi})(13.9 \text{ in}^2)(2/3) = 1575 \text{ #}$
 $456 < 1575 \text{ # OK}$

$\Delta_{LL} < L/360 = 136/360 = 0.378 \text{ ''}$
 $0.189 < 0.378 \text{ '' OK}$

o MECH ROOM (DOUBLED, @ 8" O.C.)



$w = (50 + 11.3 \text{ psf})(1') = 61.3 \text{ plf / ft}$

$M = (61.3 \text{ plf})(11.33)^2/8 + (680 \text{ #})(11.33/2) = 4836 \text{ #-ft}$
 $V = 61.3(11.33)(1/2) + 680 = 1027 \text{ #}$
 $\Delta = \frac{5wL^4}{384EI} + \frac{PL^3}{48EI} = \frac{5(61.3)(11.33)^4 (12)^3}{384(1600000)(98.9)(4)} + \frac{680(136)^3}{48(1.666)(98.9)(4)}$
 $= 0.0359 + 0.0563 = 0.092 \text{ ''}$

$C_d = 0.9 (D) \quad F_b = 875(0.9) = 788 \text{ psi}$
 $M_{allow} = F_b S = 788(21.4)(4) = 67453 \text{ #-in} = 5621 \text{ #-ft}$
 $4836 < 5621 \text{ #-ft OK}$

$F_v = 170 \text{ psi}$
 $V_{allow} = (F_v A) (2/3) = (170)(13.9)(4)(2/3) = 6301 \text{ #}$
 $1027 < 6301 \text{ # OK}$

$\Delta_{LL+DL} < L/360 = 136/360 = 0.378 \text{ ''}$
 $0.092 < 0.378 \text{ '' OK}$

LATERAL LOADS

WASHINGTON, D.C.

SANTA CLARA, CA

WIND - BASIC WIND SPEED
(V_{35}) PER 2006 IRC

100 mph

85 mph

SEISMIC - SEISMIC DESIGN
CATEGORY PER 2006 IRC

A

E*

* DESIGN TO BE DONE PER 2006 IRC / ASCE 7-05, SDC D

∴ GOVERNING WIND IS FOR D.C.
" SEISMIC " " SANTA CLARA.

WIND LOADS - D.C. (2006 IRC / ASCE 7-05)

BASIC WIND SPEED, $V_{35} = 100$ mph

EXPOSURE C

IMPORTANCE I = 1.00

$K_{zt} = 1.00$

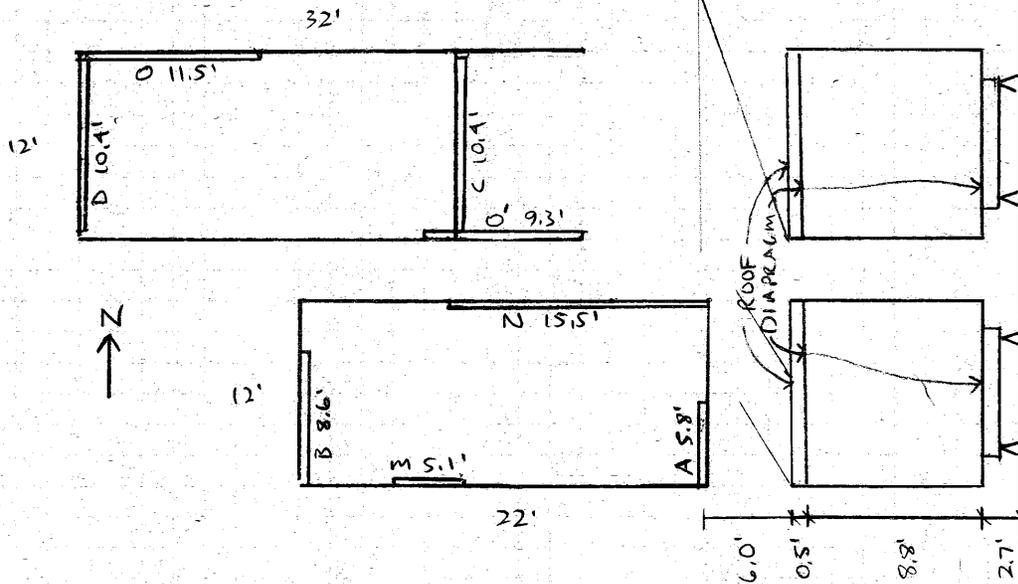
HEIGHT & EXPOSURE ADJUSTMENT - 15' ⇒ $\lambda = 1.21$

COMPONENT & CLADDING LOADS FOR 30' MEAN ROOF HEIGHT, B

ELEMENT	ZONE	EFFECTIVE WIND AREA	Fact 30 100 mph	
ROOF/PANEL 10-30°	1	10 ft ²	10.4 -16.5	
	1	20	10 -16.0	
	1	50	10 -15.4	
	1	100	10 -14.9	
	2	10	10.4 -34.8	
	2	20	10 -31.5	
	2	50	10 -27.3	
	2	100	10 -24.1	
	3	10	10.4 -34.8	
	3	20	10 -31.5	
	3	50	10 -27.3	
	3	100	10 -24.1	
	WALL	4	10	18.0 -19.5
		4	20	17.2 -18.7
		4	50	16.1 -17.6
4		100	15.3 -16.8	
5		10	18.0 -24.1	
5		20	17.2 -22.5	
5		50	16.1 -20.3	
	5	100	15.3 -18.7	

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LATERAL FORCE RESISTING SYSTEM



EACH PORTION DESIGNED TO CARRY GRAVITY & LATERAL FORCES TRIBUTARY TO IT.

WIND FORCES

$$P_s = \lambda k_{zt} I P_{s30}$$

FOR 20° ROOF ANGLE, $V_{35} = 100 \text{ mph}$ P_{s30} VALUES ARE

A: 22.0 B: -5.8 C: 14.6 D: -3.2,
E: -19.1 F: -13.3 G: +13.3 H: -10.1 EOH: -26.7 GOH: -20.9

32' PORTION

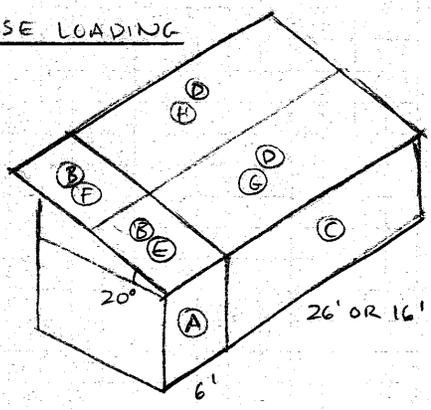
22' PORTION

$a = \text{MIN} (10\% \text{ OF LEAST HORIZONTAL DIMENSION}, 0.4h), > 1\% \text{ LHD}, 3'$

$$a = \begin{matrix} \text{MIN} \left[\begin{matrix} 0.10(12') = 1.2' \\ 0.40(15') = 6' \end{matrix} \right. \\ > 0.04(12') = 0.48' \\ > \underline{\underline{3'}} \end{matrix}$$

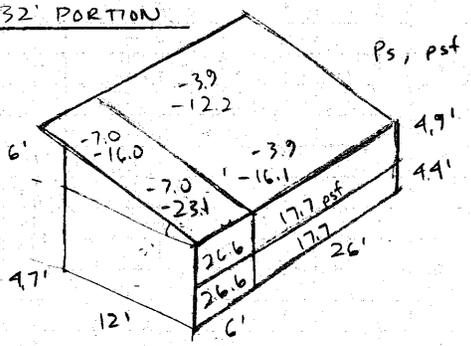
$$a = \begin{matrix} \text{MIN} \left[\begin{matrix} 0.10(12') = 1.2' \\ 0.40(15') = 6' \end{matrix} \right. \\ > 0.04(12') = 0.48' \\ > \underline{\underline{3'}} \end{matrix}$$

TRANSVERSE LOADING

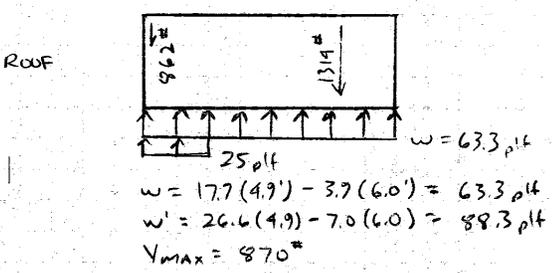


$$\begin{aligned}
 P_s &= \lambda k_{ze} I P_{s30} \\
 &= (1.21)(1.0)(1.0) P_{s30} \\
 &= 1.21 P_{s30}
 \end{aligned}$$

32' PORTION

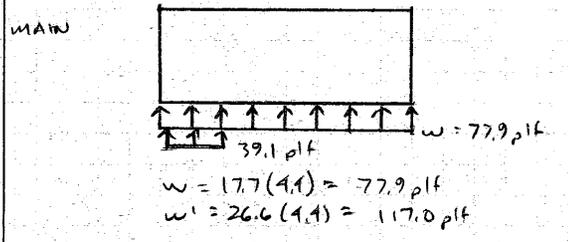


LATERAL



VERTICAL

MAX UPLIFT = 23.1 psf
 ROOF D.L. = 26.7 psf.
 ROOF + CLADDING + WALLS.
 PROVIDE SUFFICIENT D.L.
 TO RESIST UPLIFT.
 SIMPSON HARDWARE TO PROVIDE
 CONTINUOUS LOAD PATH TO
 FOOTINGS.



SEISMIC FORCES

$$E = p Q_E \pm 0.2 S_{DS} D$$

$$V = C_s W$$

$$C_s = \frac{S_{DS}}{R/I}$$

$$C_s = \frac{1.00}{6^{1/2}/1.0} = 0.154$$

$$V_{32} = 0.154 (46.0) = 7.08 \text{ k}$$

$$V_{22} = 0.154 (25.2) = 3.91 \text{ k}$$

$$p = 1.3$$

$$S_s = 1.50 g$$

$$\text{SITE CLASS D} \Rightarrow F_a = 1.0$$

$$S_{ms} = F_a S_s = 1.50 g$$

$$S_{DS} = 2/3 S_{ms} = 1.00 g$$

$$S_1 = 0.60 g \quad F_v = 1.5$$

$$S_{m1} = 0.60 (1.5) = 0.90 g \quad S_{D1} = 2/3 S_{m1} = 0.60 g$$

OCCUPANCY CATEGORY I $I = 1.0$

$S_{DS} \Rightarrow$ SDC D

$S_{D1} \Rightarrow$ SDC D \therefore SDC D

LIGHT FRAMED WALLS SHEATHED WITH WOOD PANELS $\Rightarrow R = 6^{1/2}$

$$k = 1.0$$

LEVEL	w_i	h_i	$w_i h_i^k$
ROOF	17.5 k	11.5'	201
MAIN	28.5 k	2.7'	77
	46.0 k		278

C_{vx}	F_x
0.723	5.12 k
0.277	1.96 k
1.000	7.08 k

32' BUILDING

LEVEL	w_i	h_i	$w_i h_i^k$
ROOF	13.0 k	11.5'	150
MAIN	12.2 k	2.7'	33
	25.2 k		183

C_{vx}	F_x
0.820	3.21 k
0.180	0.70 k
1.000	3.91 k

22' BUILDING

32' BUILDING

$$\begin{aligned} w_{\text{ROOF}} &= (26.7 \text{ psf})(12)(32) + \\ &= (16.9 \text{ psf})(0.5 + 8.8/2)(32+12)(2) \\ &= 17540 \text{ lb} \\ &= 17.5 \text{ k} \end{aligned}$$

$$\begin{aligned} w_{\text{MAIN}} &= (10.4 \text{ psf})(12)(32) + \\ &= (16.9 \text{ psf})(8.8/2)(32+12)(2) + \\ &= 12000 + 10,000 (32/54) \\ &= 28463 \text{ lb} = 28.5 \text{ k} \end{aligned}$$

22' BUILDING

$$\begin{aligned} w_{\text{ROOF}} &= (26.7)(12)(22) + \\ &= (16.9 \text{ psf})(0.5 + 8.8/2)(22+12)(2) + \\ &= (5.6 \text{ psf})(8.8/2)(14') \\ &= 13024 \text{ lb} = 13.0 \text{ k} \end{aligned}$$

$$\begin{aligned} w_{\text{MAIN}} &= (10.4)(12)(22) + \\ &= (16.9)(8.8/2)(22+12)(2) + \\ &= (5.6)(8.8/2)(14') + 10000 (22/54) \\ &= 12,221 \text{ lb} = 12.2 \text{ k} \end{aligned}$$

A COMPARISON WITH WIND FORCES (PAGE LL3) SHOWS SEISMIC CLEARLY GOVERNS IN BOTH DIRECTIONS, FOR BOTH PORTIONS OF THE BUILDING.

LL 4.1

2006 International Building Code
Zip Code = 95053
Spectral Response Accelerations Ss and S1
Ss and S1 = Mapped Spectral Acceleration Values
Site Class B - Fa = 1.0 , Fv = 1.0
Data are based on a 0.01 deg grid spacing

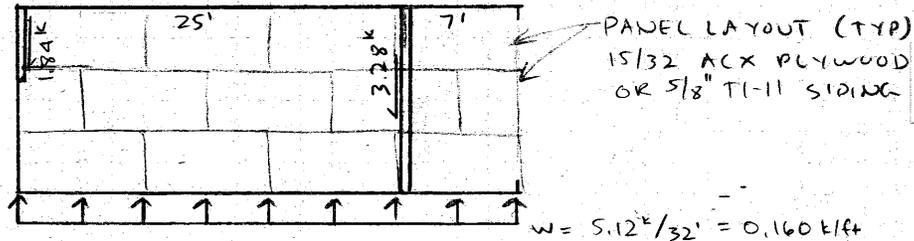
Period (sec)	Centroid Sa (g)	
0.2	1.500	Ss, Site Class B
1.0	0.600	S1, Site Class B

Period (sec)	Maximum Sa (g)	
0.2	1.500	Ss, Site Class B
1.0	0.600	S1, Site Class B

Period (sec)	Minimum Sa (g)	
0.2	1.500	Ss, Site Class B
1.0	0.600	S1, Site Class B

HORIZONTAL DIAPHRAGMSROOF (32' PORTION)

° DIAPHRAGM



$$V_{\max} = 3.28^k - 0.160(7) = 2.16^k$$

FOR ASD DESIGN OF DIAPHRAGMS, USE $0.7E$ & $p = 1.0$
 \Rightarrow UNIT SHEAR $= v = (0.70)(2.16^k)/12' = 0.126 \text{ k/ft}$

USE UNBLOCKED DIAPHRAGM (CASE I)

15/32" ACX PLYWOOD OR 5/8" T-11 SIDING

16 GA. 1-3/4" STAPLES @ 6" ON SUPPORTED EDGES

" " " " @ 12" ALONG INTERMEDIATE MEMBERS

STAPLES HAVE 7/16" CROWNS, INSTALLED PARALLEL TO
 THE LONG DIRECTION OF FRAMING MEMBERS

YALLOW IN 15/16" PLYWOOD = 140 plf > 126 plf OK

ABOVE IS ADEQUATE FOR BOTH DIRECTIONS AND
 BOTH PORTIONS.

° COLLECTORS :

$$\text{LARGEST POSSIBLE COLLECTOR FORCE} \\ = 5.12^k \left(\frac{25}{32} \right) \left(\frac{1}{2} \right) = 2.00^k$$

THIS IS WELL WITHIN THE CAPACITY OF A DOUBLE
 TOP PLATE.

° CHORDS :

$$M^- = (0.160 \text{ k/ft})(7')^2/2 = 3.92 \text{ k-ft}$$

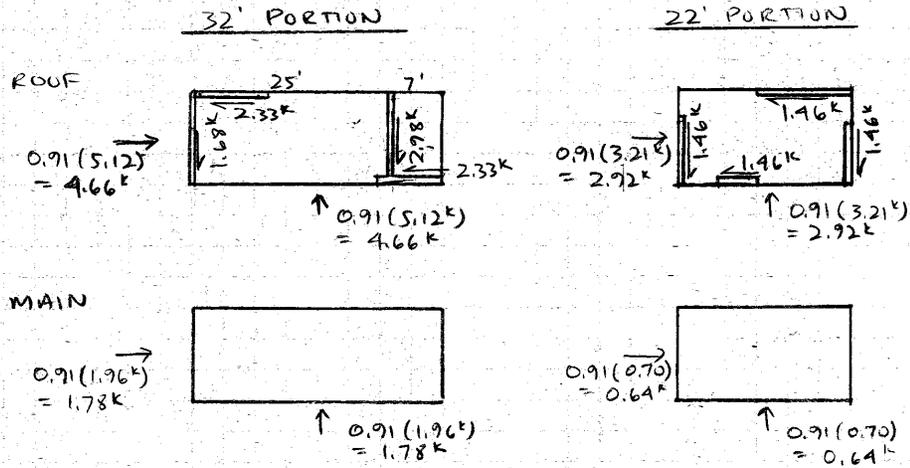
$$M^+ = (0.160)(25)^2/8 - 1/2(3.92) = \underline{10.5 \text{ k-ft}}$$

$$T = C = \frac{10.5 \text{ k-ft}}{11.5'} = 0.92^k$$

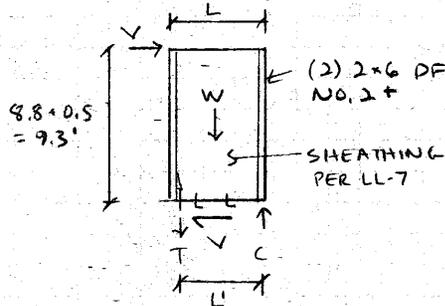
THIS IS WELL WITHIN THE CAPACITY OF A DOUBLE
 TOP PLATE CHORD.

SHEAR WALLS

o FORCE DISTRIBUTION (FOR ASD: $0.7(p Q_E) = 0.7(1.3) Q_E = 0.91 Q_E$)



o WALL DESIGN - ANCHORAGE



* W ASSUMED = 0 TO ESTIMATE TENSILE FORCES CONSERVATIVELY

HDC5/22-SDS2.5 HAS ALLOWABLE TENSION LOAD OF 4870# = 4.87k

MUDSILL SHALL BE CONTINUOUS OVER WALL LENGTH.

SIMPSON HD MUDSILL TYPE ANCHOR BOLT ANCHORS

WALL	V	L	L'	W*	T	C	MUDSILL TYPE	ANCHOR BOLT	ANCHORS
A	1.46k	5.8'	5.5'	0	2.5k	2.5k	HDC5/22	5/8" φ	(2) 5/8" φ MIN.
B	1.46k	8.6'	8.3'	0	1.6k	1.6k	-	-	& NO MORE THAN 6' ON CENTER
C	2.98k	10.4'	10.1'	0	2.7k	2.7k	-	-	⚡
D	1.68k	10.4'	10.1'	0	1.5k	1.5k	-	-	⚡
M	1.46k	5.1'	4.8'	0	2.8k	2.8k	⚡	-	⚡
N	1.46k	15.5'	15.2'	0	0.9k	0.9k	-	-	⚡
O	2.33k	14.5'	11.2'	0	1.9k	1.9k	-	-	⚡
O'	2.33k	9.3'	9.0'	0	2.4k	2.4k	-	-	⚡

WALL DESIGN - SHEATHING

WALL	V	L	N	SHEATHING	NAILING AT PANEL EDGES
A*	1.46k	5.8'	252 plf	15/32 ACX PLYWOOD ↓	8d @ 3" $N_{ALLOW} = 490 \text{ plf}$
B	1.46k	8.6'	170		8d @ 4" $N_{ALLOW} = 380 \text{ plf}$
C*	2.98k	10.4'	287		8d @ 3" $N_{ALLOW} = 490 \text{ plf}$
D	1.68k	10.4'	162		8d @ 4" $N_{ALLOW} = 380 \text{ plf}$
M*	1.46k	5.1'	286		8d @ 3" $N_{ALLOW} = 490 \text{ plf}$
N	1.46k	15.5'	94		8d @ 4" $N_{ALLOW} = 380 \text{ plf}$
O*	2.33k	11.5'	203		8d @ 3" $N_{ALLOW} = 490 \text{ plf}$
P*	2.33k	9.3'	251		8d @ 3" $N_{ALLOW} = 490 \text{ plf}$

- NAILING TO INTERMEDIATE FRAMING SPACED AT 6" CENTERS
- 8d NAILS MAY BE 2 1/2" x 0.131" COMMON OR 2 1/2" x 0.113" GALV. BOX.

* USE 3x6 STUDS AT EDGES OF ADJOINING PANELS, OR DOUBLED 2x6 STUDS NAILED TO EACH OTHER WITH 16d AT 6"

ALL SHEATHING NOT PART OF DESIGNATED SHEAR WALLS SHALL BE NAILED WITH 8d NAILS @ 6" AT PANEL EDGES, AND AT 12" ON INTERMEDIATE SUPPORTS.

NOTE: SIMPSON PHD-6 - SDS3 HOLD-DOWNS MAY BE SUBSTITUTED FOR HDL 5/22 SDS 2.5

NAILING - SILL PLATE TO RIM JOIST

$$Z = 141 \# \quad C_D = 1.6 \text{ WIND \& SEISMIC}$$

$$Z' = 141(1.6) = 226 \#$$

WALL	V	LENGTH	SILL TO RIM NAILING
A	1.46k	5.8'	16 @ 8" = 339 plf
B	1.46k	8.6	16 @ 8"
C	2.98k	10.4	16 @ 8"
D	1.68k	10.1	16 @ 16" = 170 plf
M	1.46k	5.1	16 @ 8"
N	1.46k	15.5	16 @ 16"
O	2.33k	11.5	16 @ 8"
O*	233k	9.3	16 @ 8"

$$16 \text{ @ } 16" \text{ CARRIES } 226 (12/16) = 170 \#/\text{ft}$$

$$16 \text{ @ } 8" \text{ CARRIES } 339 \#/\text{ft}$$

FRAMING CLIPS - BLOCKING TO DOUBLE TOP PLATE

A35 CLIPS: 450# CAPACITY FOR WIND & SEISMIC:

LONGITUDINAL:

32' PORTION HAS 16 CLIPS $\rightarrow 16(450) = 7200 \#$ ADEQUATE FOR TOP PLATE TO COLLECT LOADS.

TRANSVERSE:

OVER WALL C, USE 8 CLIPS

\therefore OVER ALL WALLS USE A35 CLIPS @ 24" CENTERS OVER FULL LENGTH, EXCEPT FOR WALL C AS ABOVE.

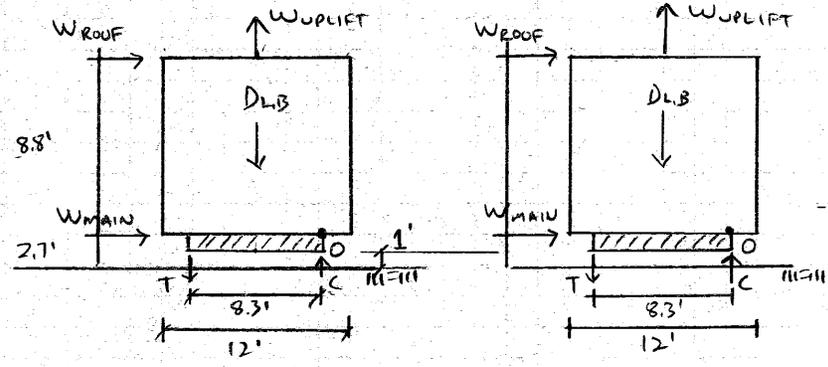
OVERTURNING STABILITY - WASHINGTON D.C.

CALCULATE FACTOR OF SAFETY WITH A LOWER BOUND ESTIMATE OF DEAD LOAD -

STAEDTLER® No. 937 811E
 Engineer's Computation Pad

32' PORTION

22' PORTION



$$\begin{aligned}
 W_{ROOF} &= 63.3(32) + 25(6) = 2176^{\#} \\
 W_{MAIN} &= 77.9(32) + 39.1(6) = 2727^{\#} \\
 W_{UPLIFT} &= (16.1 + 12.2)(1/2)(16.7)(26) \\
 &\quad + (23.1 + 16.0)(1/2)(16.7)(6) \\
 &= 8103^{\#}
 \end{aligned}$$

$$\begin{aligned}
 W_{ROOF} &= 63.3(22) + 25(6) = 1543^{\#} \\
 W_{MAIN} &= 77.9(22) + 39.1(6) = 1948^{\#} \\
 W_{UPLIFT} &= (16.1 + 12.2)(1/2)(16.7)(16) \\
 &\quad + (23.1 + 16.0)(1/2)(16.7)(6) \\
 &= 5740^{\#}
 \end{aligned}$$

$$\begin{aligned}
 DLB &= (19.7 + 4)(12)(32) + \\
 &\quad (8.9 + 4)(0.5 + 8.8/2)(32 + 12)(2) + \\
 &\quad (10.4)(12)(32) + \\
 &\quad (8.9 + 4)(8.8/2)(32 + 12)(2) + \\
 &\quad 5000(32/51) = 26615^{\#} \\
 &= 26.6k
 \end{aligned}$$

$$\begin{aligned}
 DLB &= (19.7 + 4)(12)(22) + \\
 &\quad (8.9 + 4)(0.5 + 8.8/2)(22 + 12)(2) + \\
 &\quad (10.4)(12)(22) + \\
 &\quad (8.9 + 4)(8.8/2)(22 + 12)(2) + \\
 &\quad 5000(22/51) = 20462^{\#} \\
 &= 20.5k
 \end{aligned}$$

$$\begin{aligned}
 M_{OT0} &= 2.18(8.8) + 8.10(8.3/2) \\
 &= 52.8 k\text{-ft}
 \end{aligned}$$

$$\begin{aligned}
 M_{OT0} &= 1.51(8.8) + 5.71(8.3/2) \\
 &= 37.4 k\text{-ft}
 \end{aligned}$$

$$\begin{aligned}
 M_{RES} &= 26.6(8.3/2) + T(8.3) \\
 &= 110 + 8.3T
 \end{aligned}$$

$$\begin{aligned}
 M_{RES} &= 20.5(8.3/2) + T(8.3) \\
 &= 85.1 + 8.3T
 \end{aligned}$$

FACTOR OF SAFETY FOR OVERTURNING = M_{RES}/M_{OT} , WITH $T=0$

$$\begin{aligned}
 110/52.8 &= \underline{2.08} \\
 85/37.4 &= \underline{2.27}
 \end{aligned}$$

∴ CHASSIS SUPPORTS & FOUNDATION NEED ONLY TRANSMIT COMPRESSION.

COMPONENT & CLADDING LOADS

$$p_{net} = \lambda \cdot k_{ze} \cdot I \cdot p_{net30}$$

$$= 1.21 (1.00)(1.00) p_{net30} = 1.21 p_{net30}$$

USE EFFECTIVE AREAS = $L^2/3$ WHERE L = SPAN LENGTH.

RAINSCREEN CLADDING

ANY PANEL TO RESIST $p_{net} = 1.21(24.1 \text{ psf}) = \underline{29.2 \text{ psf}}$
IN SUCTION OR PRESSURE (ZONE ⑤ VALUES)

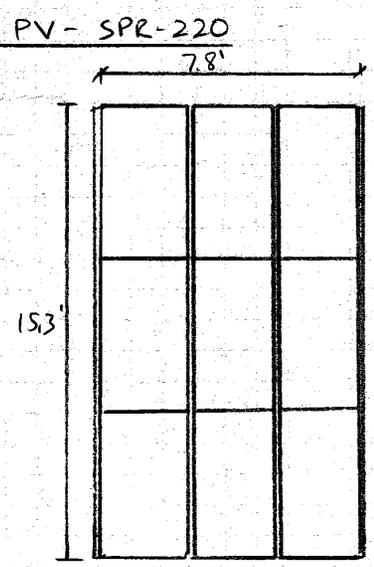
FOR EXAMPLE, 1x8 PANEL ANCHORED WITH 4 CLIPS,
EACH CLIP TO CARRY $29.2(4)(8)(1/4) = 234 \#$

SOLAR PANELS

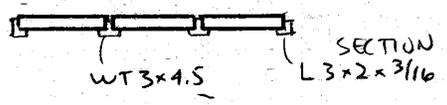
ANY PANEL TO RESIST PRESSURES FOR ZONE ③ -
 $p_{net} = 1.21(34.8 \text{ psf}) = \underline{42.1 \text{ psf}}$ NORMAL TO SURFACE

SOLAR PANEL SUPPORTS

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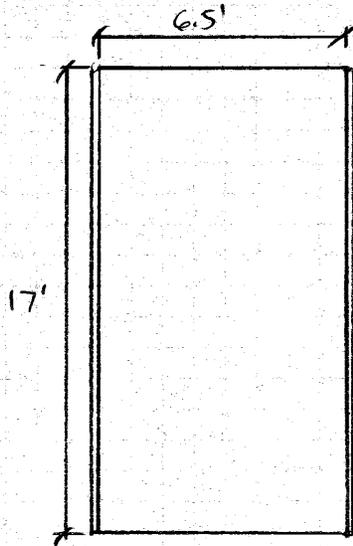


15.3' / PANEL = 33# EACH PANEL
 PANELS BOLT TO ANGLES & TEES
 PER MANUFACTURER'S
 SPECIFICATION
 $w = 99\# / 15.3' = 6.5 \text{ plf} - \text{PANELS}$

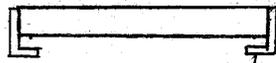


SINGLE ANGLE: $\Delta < L/360 = 15.3' \times 12'' / 360 = 0.51''$
 $A = 5 - L^4 / 384 EI$ $I > (5 (6.5/12) (15.3) ^4) / 384 (29,000,000) (0.51) (12^3)$
 $I > 0.27 \text{ in}^4$
 USE WT 3x4.5 $I_{xx} = 0.950 \text{ in}^4 > 0.27 (2) = 0.54 \text{ in}^4$
 USE L 3x2x3/16 $I_{xy} = 0.842 \text{ in}^4 > 0.27 \text{ in}^4$

THERMAL - SOLARSA



PLAN



SECTION

L 4x3x1/4 w = 5.8 plf

240 lb = 530[#] OPER. WEIGHT.

PANELS BOLT TO ANGLES
PER MANUFACTURER'S
SPECIFICATION

$$w = 530/17 = 31.2 \text{ plf}$$

SINGLE ANGLE : $\Delta < L/360 = 17(12)/360 = 0.57''$

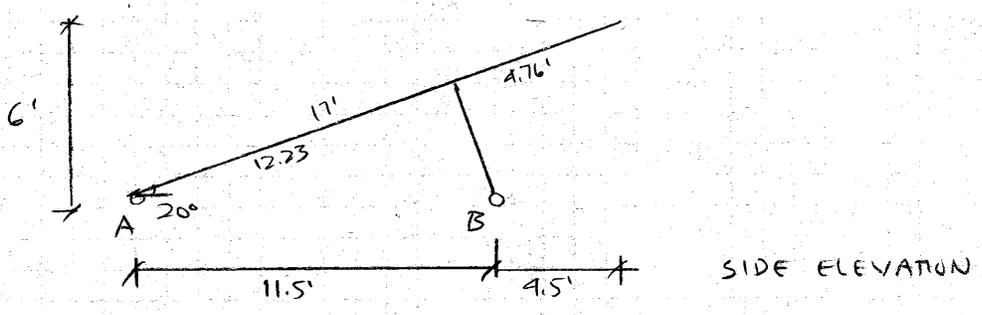
$$\Delta = 5wL^4 / 384EI \quad I > \left(5(31.2/2)(17)^4 / 384(29,000,000)(0.57) \right) 12^3$$

$$> 1.77 \text{ in}^4$$

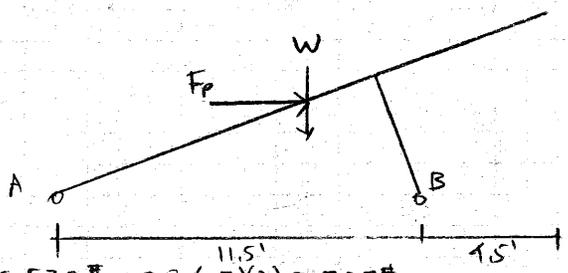
USE L 4x3x1/4 $I_{xx} = 2.77 \text{ in}^4$

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STAEDTLER®

LOADS



CANTILEVER $M = (31.2 \text{ plf})(\frac{1}{2})(4.76 \cos 20^\circ)^2 / 2 = 156 \text{ #-ft} = 1.88 \text{ k-in}$
 $S_{req} = M / f_b \approx 1.88 / 20 = 0.094 \text{ in}^3$
 $L \times 3 = \frac{1}{4} - S_x = 1.00 \text{ in}^2 \text{ OK}$



$W = 530 \text{ #} + 5.8 (17)(2) = 727 \text{ #}$
 $F_{p \text{ MAX}} = 1.6 S_{DS} I_p W_p = 1.6 (1.00)(1.00)(727 \text{ #}) = 1164 \text{ #}$

$E = p Q E \pm 0.2 S_{DS} D ; p = 1.0 \text{ FOR COMPONENTS } S_{DS} = 1.00$

ASD COMBINATIONS!

- (I) $D + 0.7E \Rightarrow 1.14D + 0.7QE$
- (II) $D + 0.75(0.7E) + 0.75SL + 0.75SL_r \Rightarrow 1.105D + 0.525QE$
- (III) $0.6D + 0.7E \Rightarrow 0.46D + 0.7QE$

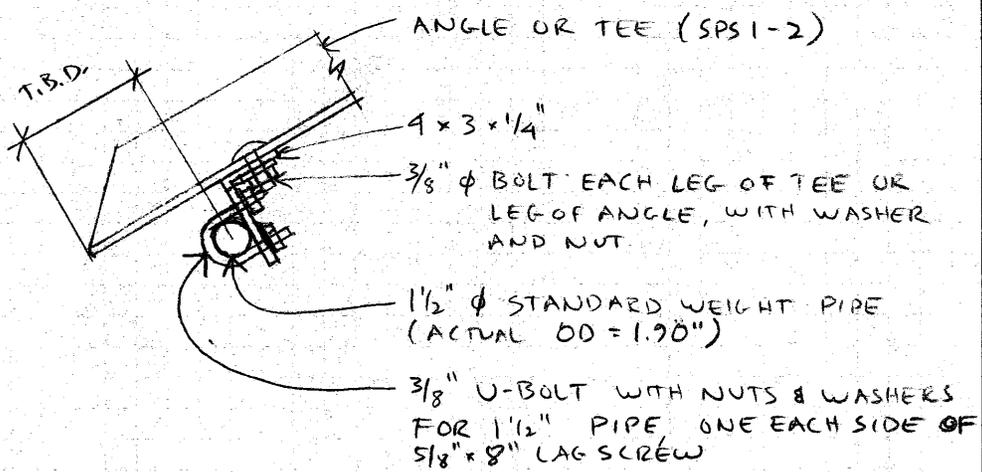
MAX $R_{By} = 1.14(1164)(\frac{16}{2}) / 11.5 + 0.7(1164 \text{ #})(3 / 11.5) = 1136 \text{ #}$
 $R_{Bx} = 0.7(1164 / 2) = 407 \text{ #}$

MIN $R_{Ay} = 0.46(727)(\frac{35}{11.5}) - 0.7(1164)(3 / 11.5) = -110 \text{ # (T)}$
 $R_{Ax} = 407 \text{ #}$

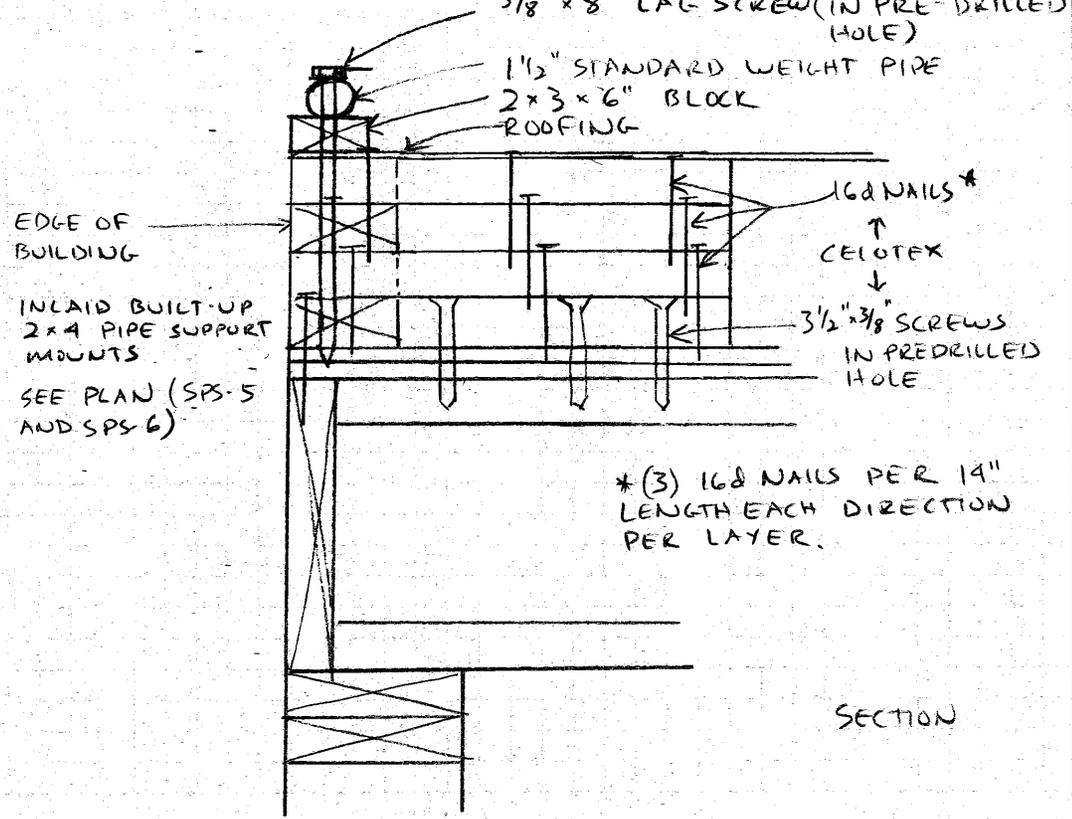
SOLAR PANEL SUPPORT FRAMING

BASE DETAIL - LOWER SUPPORT

◦ TO PANEL ANGLE



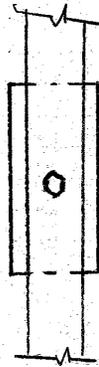
◦ TO ROOF ANCHORAGE



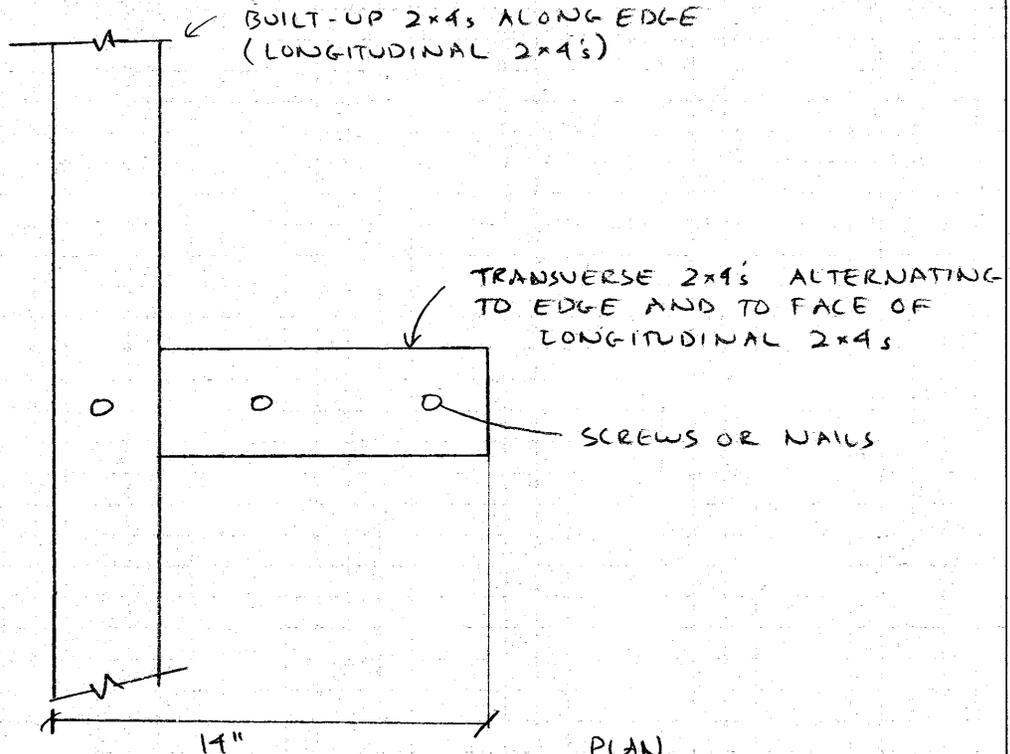
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No. 937 811E
Engineer's Computation Pad

STAEDTLER®



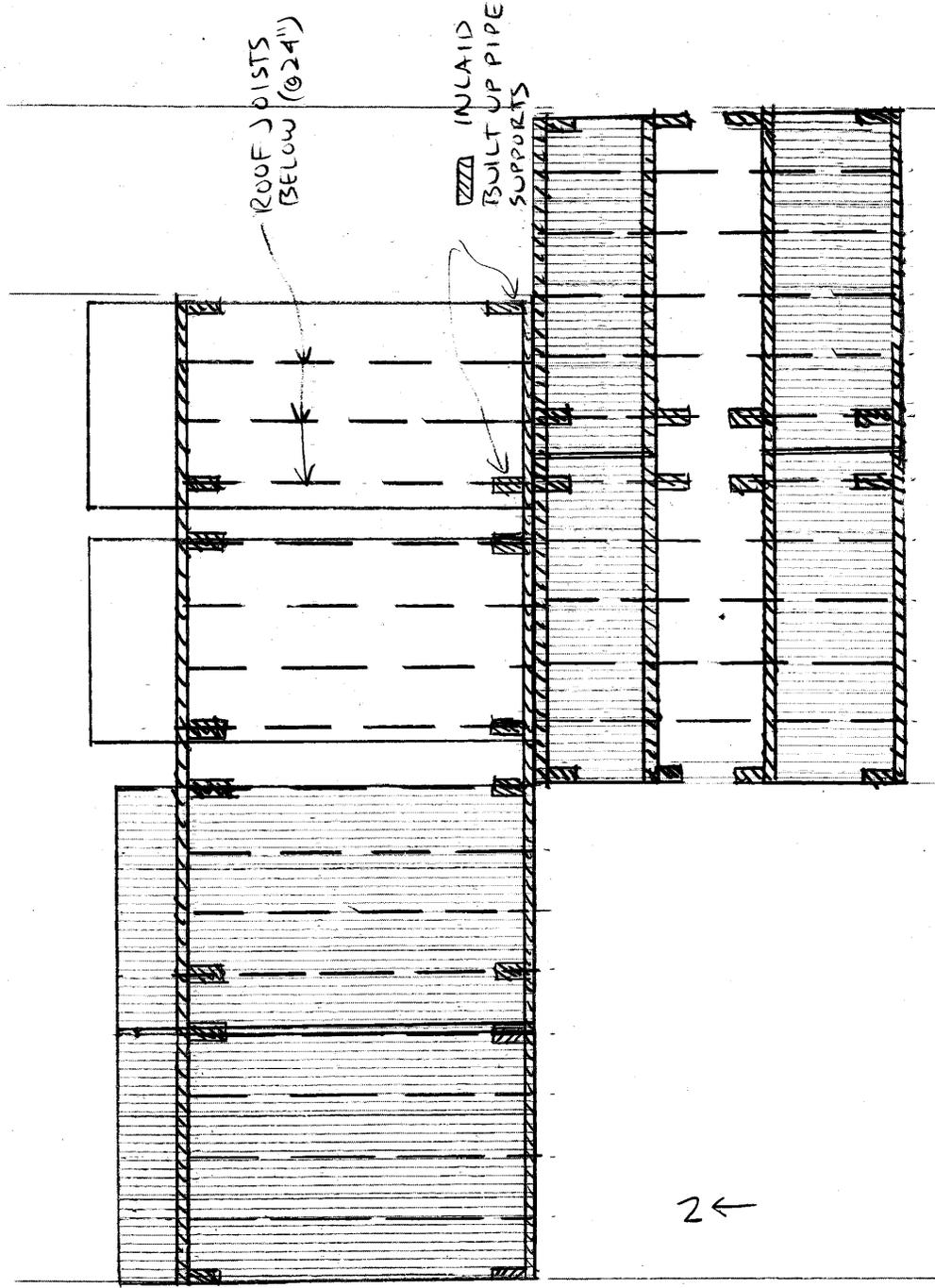
PLAN
PIPE BOLTED
THROUGH BLOCK



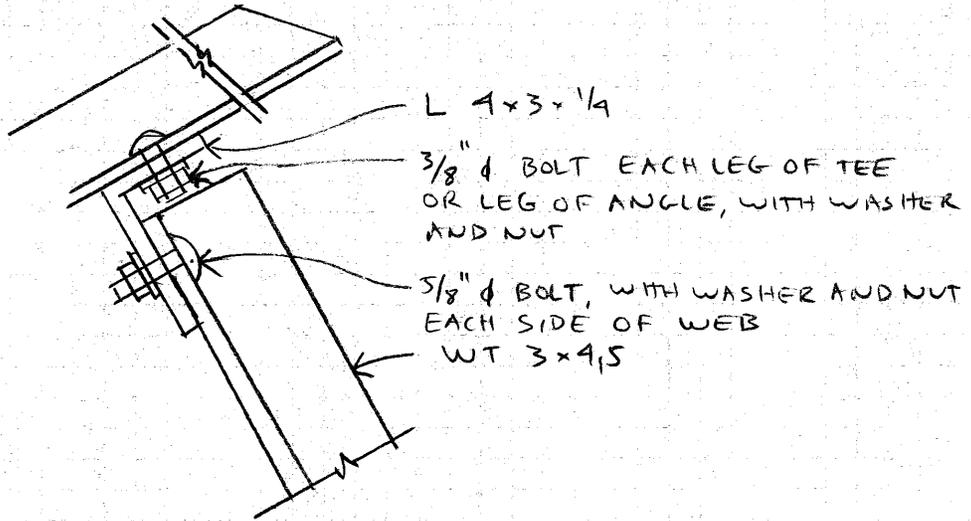
PLAN
INLAID BUILT-UP 2x4
PIPE SUPPORT MOUNTS

LOCATE TRANSVERSE 2x4s OVER ROOF I-JOISTS

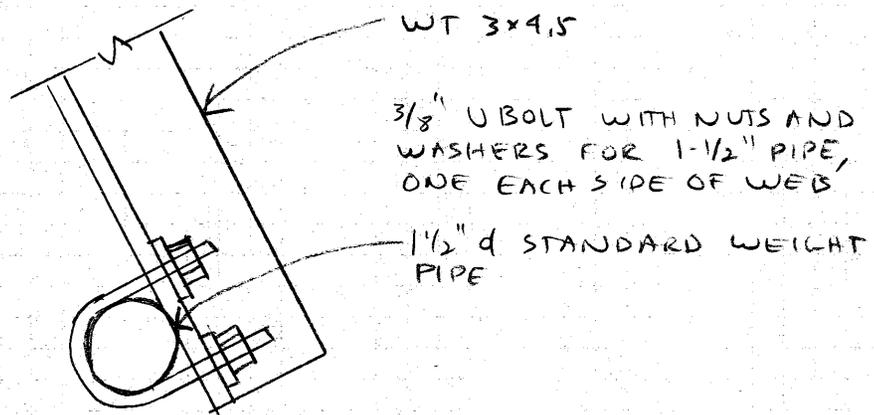
SPS
6



TOP DETAIL

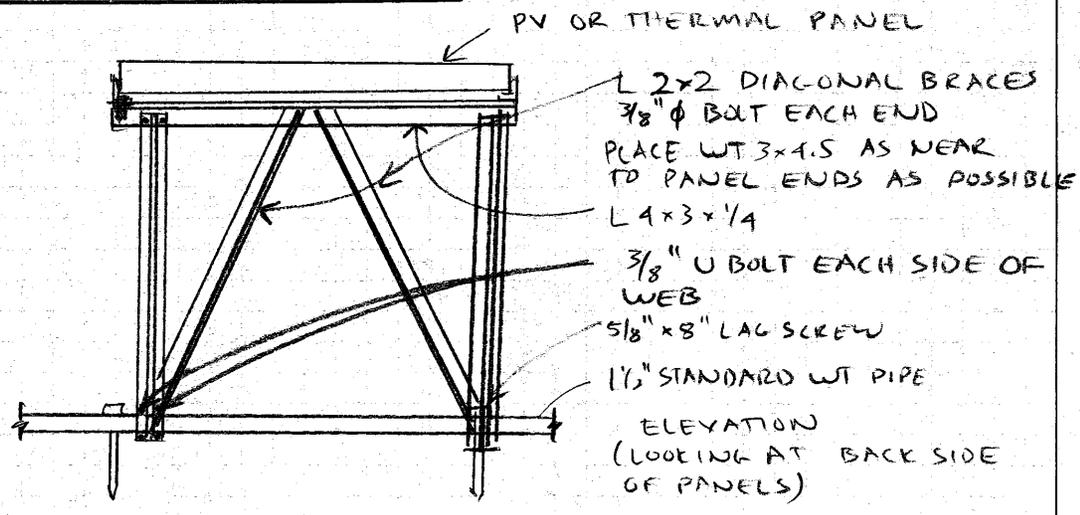


BASE DETAIL - UPPER SUPPORT



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BRACING ON BACK SIDE



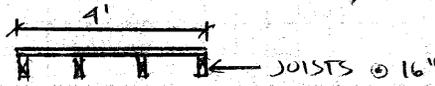
EXTERIOR DECKS

DECKING 2x4 OR 2x6 NO. 2*

USE JOISTS @ 16" CENTERS.
ADEQUATE BY INSPECTION

PANELIZED CONSTRUCTION - JOISTS DF NO 1

USE FULL LENGTH MODULES, 3-6' IN WIDTH



MAX LOAD = 100 psf LL, 10 psf DL
MAX SPAN = 12' → 2x12 JOISTS S = 31.64 in³

$$M_{max} = (100 + 10)(14/12)(12)^2/8 = 2640 \text{ #-1}$$

$$f_b = M/S = 2640(12)/31.64 = 1001 \text{ psi}$$

$$F_b' = F_b (C_D)(C_M)(C_t)(C_L)(C_F)(C_V)(C_i)$$

$$= (1000 \text{ psf})(1.0)(1.0)(1.0)(1.0)(1.0)(1.15)(1.0) = 1150 \text{ psf}$$

$$f_b = 1001 \text{ psi} < F_b' = 1150 \text{ psi OK}$$

$$\Delta = \frac{5(100+10)(14/12)(144)^4/12}{384(1700,000)178} = 0.23" < L/360 = 0.40" \text{ OK}$$

SHEAR OK BY INSPECTION.

MAX SPAN = 10' → 2x10 JOISTS S = 21.3 in³

$$M_{max} = (100+10)(14/12)(10)^2/8 = 1833 \text{ #-1}$$

$$f_b = M/S = 1833(12)/21.3 = 1032 \text{ psi}$$

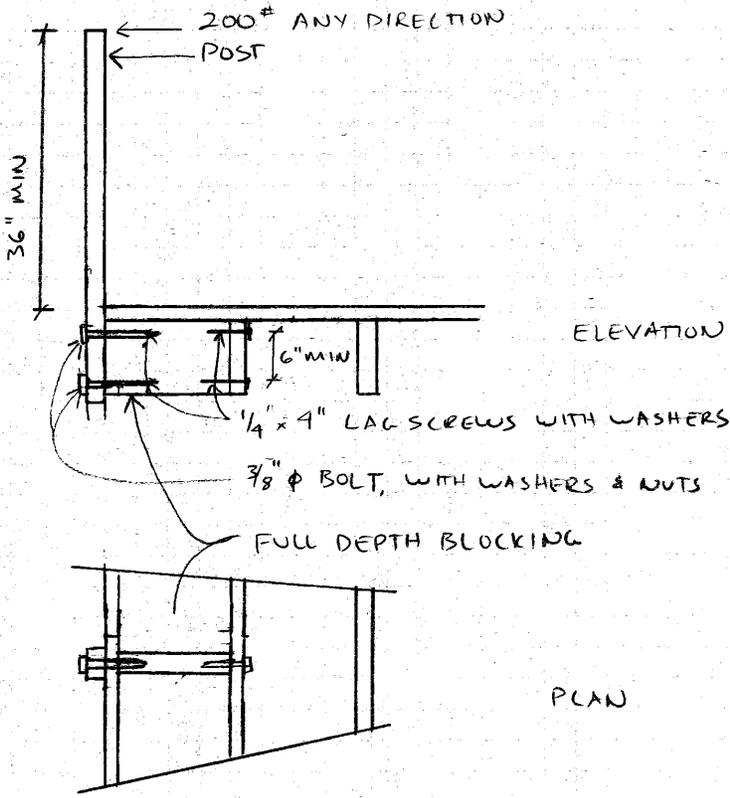
$$f_b = 1032 < F_b' = 1150 \text{ psi OK}$$

$$\Delta = 0.23(10/12)^4 = 0.11 \text{ in} < L/360 = 0.33" \text{ OK}$$

SHEAR OK BY INSPECTION.

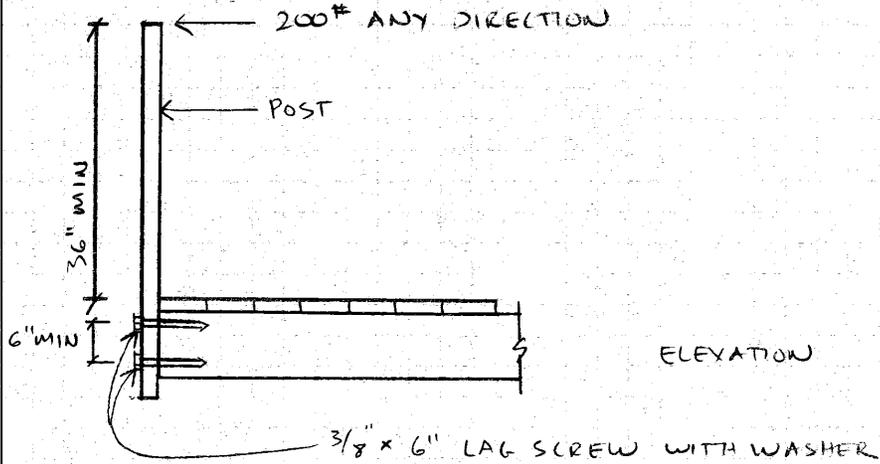
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Engineer's Computation Pad

RAILINGS - JOISTS PARALLEL TO EDGE OF DECK



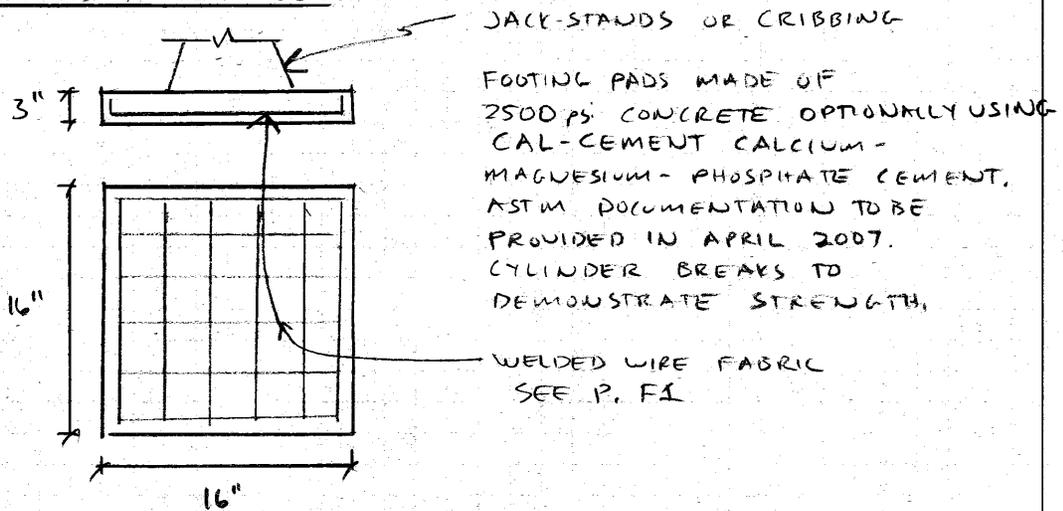
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RAILINGS - JOISTS PERPENDICULAR TO EDGE OF DECK



ELEVATION

BEAMS & FOOTINGS

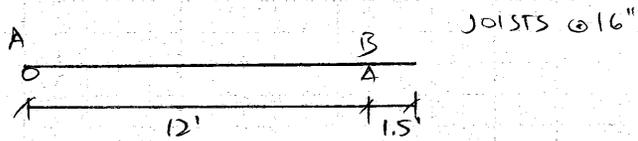


FOOTING PAD WEIGHT = $150 (16/12) (16/12) (2/12) = 44 \#$

ALLOWABLE BEARING PRESSURE = 1500 psf

" LOAD = $1500 (16/12) (16/12) = 2667 \#$

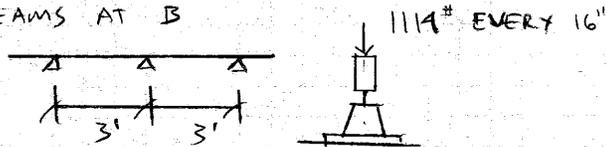
NET " " = $2667 - 44 = 2623 \#$



$$\text{REACTION AT B} = (100 + 10)(16/12)(13.5)^2 / 2(12) = 1114 \#$$

$$\therefore \text{NEED FOOTINGS @ } (2623 \# / 1114)(16/12) = 3.1 \text{ ft.}$$

BEAMS AT B



$$V_{\text{max}} = 2623 \# / 2 = 1314 \# \quad \text{USE (2) } 2 \times 8 \text{ DF NO. 1}$$

$$F_v = 180 \text{ psi}$$

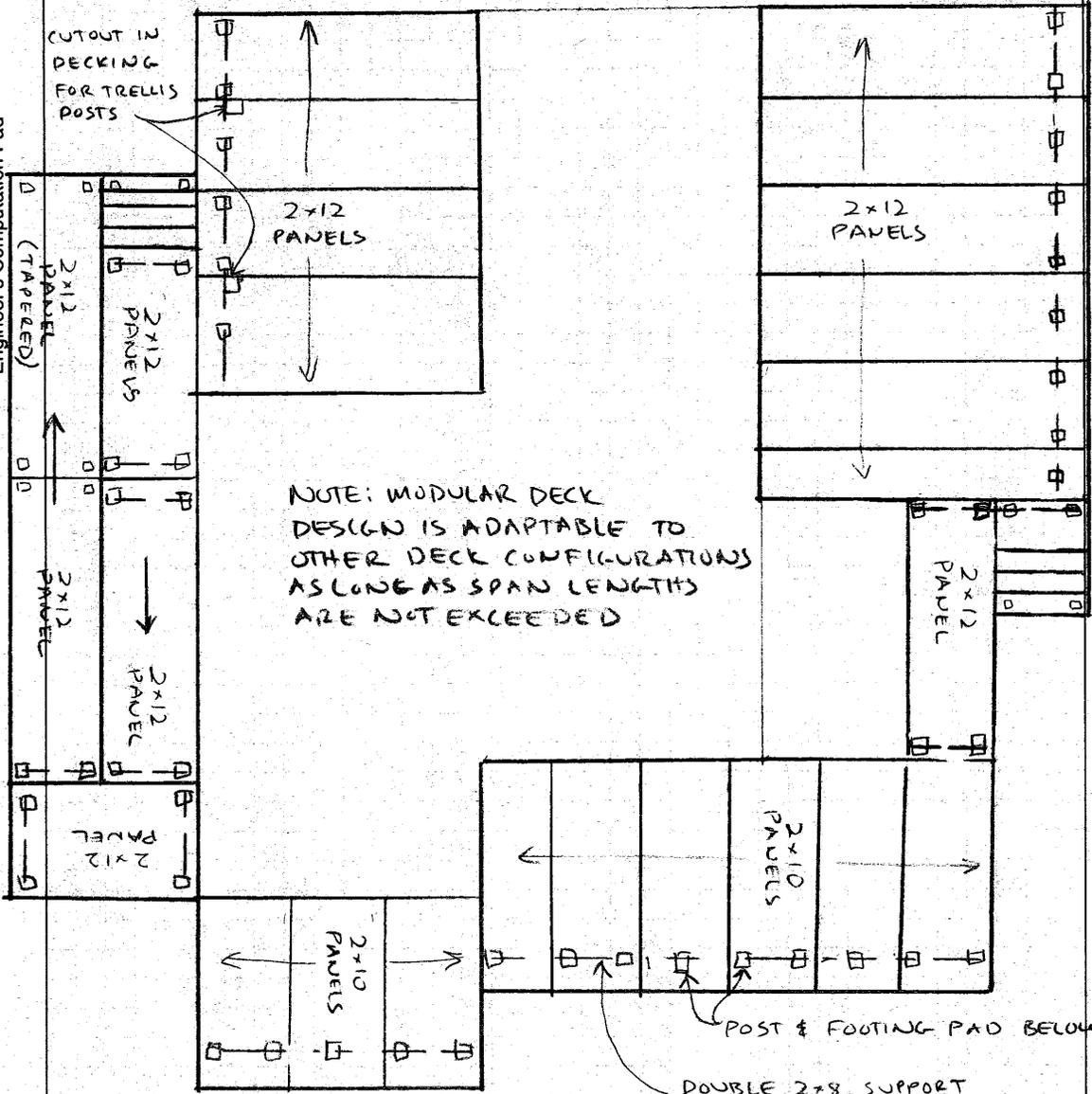
$$F_v = F_u (C_p)(C_m)(C_t)(C_i) \\ = (180 \text{ psi})(1.00)(1.00)(1.00)(1.00) = 180 \text{ psi}$$

$$f_v = 1.5(1314 \#) / 2(1.5 \times 7.25) = 91 \text{ psi} < 180 \text{ psi OK.}$$

LAYOUT



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NOTE: MODULAR DECK
DESIGN IS ADAPTABLE TO
OTHER DECK CONFIGURATIONS
AS LONG AS SPAN LENGTHS
ARE NOT EXCEEDED

DOUBLE 2x8 SUPPORT
BEAM INSET NOT MORE
THAN 1'4" FROM OUTSIDE
EDGE - TYPICAL

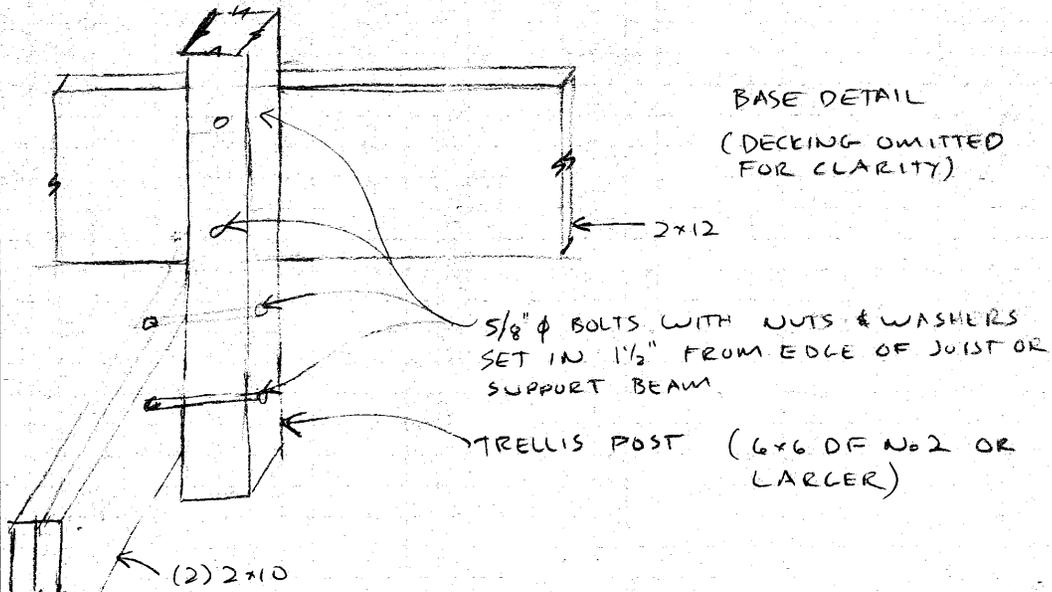
BOLT ADJACENT PANELS TOGETHER
THROUGH EDGE JOISTS USING 3/8" ϕ
BOLTS WITH NUTS AND WASHERS -
MINIMUM 2 BOLTS AND NO
FURTHER THAN 4' CENTERS AT
EACH PANEL TO PANEL JOINT.

SUPPORT AT FACE OF
BUILDING FROM CHASSIS
OR USING DOUBLED 2x8
SUPPORT BEAM INSET
NOT MORE THAN 1' FROM
EDGE OF BUILDING.

TRELLIS FRAMEWORK

SECURE TRELLIS POSTS AT BASE WITH (2) 5/8" ϕ BOLTS THROUGH 2x12 PANEL EDGE JOIST, AND (2) 5/8" ϕ BOLTS THROUGH DOUBLED 2x10 SUPPORT BEAMS.

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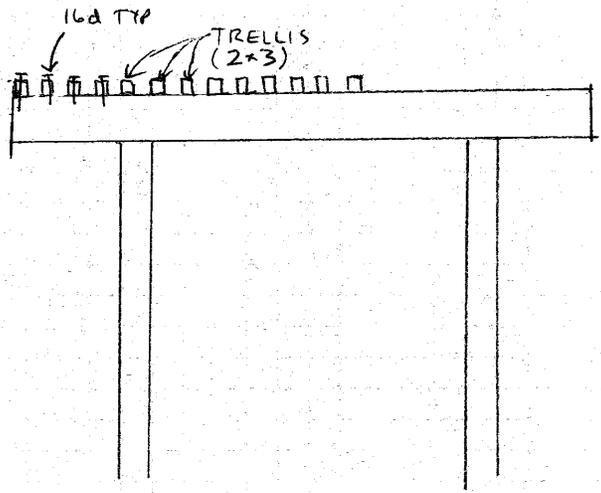


BASE DETAIL
(DECKING OMITTED FOR CLARITY)

5/8" ϕ BOLTS WITH NUTS & WASHERS SET IN 1 1/2" FROM EDGE OF JOIST OR SUPPORT BEAM.

TRELLIS POST (6x6 OF No 2 OR LARGER)

(2) 2x10



MISSION STYLE DETAILS PER ARCHITECT

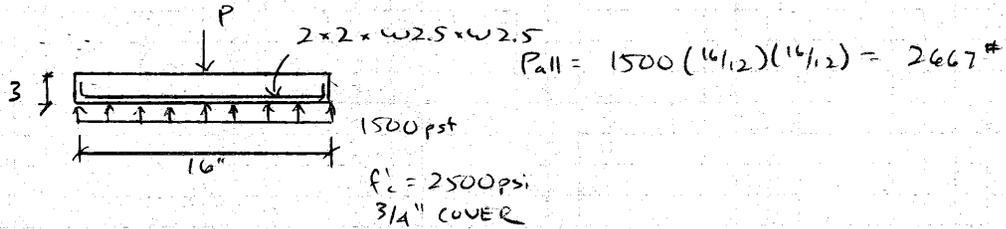
1/2" ϕ OR LARGER BOLTS OR LAG SCREWS TO CONNECT BEAM TO EACH COLUMN, REQUIRES ENGINEER'S APPROVAL.

TRELLIS FRAME (NO SCALE)

FOOTINGS

ALLOWABLE BEARING PRESSURE = 1500 psf
 1/3 INCREASE FOR WIND & EQ ⇒ 2000 psf

USE 16" x 16" x 2" CONCRETE PADS OPTIONALLY MADE WITH CAL-CEMENT. ASTM DATA TO BE PROVIDED IN APRIL 2007. CYLINDER BREAKS TO DEMONSTRATE AT LEAST 2500 psi COMP. STRENGTH.



16" WIDE BEAM
 $M_{allow} = 1500 (16/12)(8/12) = 1333 \#-1$

TYPICAL LIVE / DEAD = $(50(12)(54)/1000) / 34.1k = 0.95$
 ASSUME 1.0

$$1.2(D) + 1.6(L) = 2.8D \Rightarrow \text{AVG} = \frac{2.8D}{2.0} = 1.4$$

$$P_{ult} = 1.4(2667) = 3734 \#$$

$$M_{ult} = 1.4(1333) = 1866 \#-1 = 22.4 k\text{-in}$$

ASSUME $j = 0.9$
 COVER = 3/4"

$$T_s = M_u / \phi / j d = 22.4 / 0.9 / 0.9(2.5) = 11.06 k$$

$$A_s = T_s / f_y = 11.06 / 65 \text{ ksi} = 0.170 \text{ in}^2 / 16"$$

$$= 0.128 \text{ in}^2 / 12"$$

ASTM A-185 ⇒ $f_y = 65 \text{ ksi}$

USE 2x2x42.5x42.5 WELDED WIRE FABRIC
 $A_s = 0.15 \text{ in}^2 / \text{ft}$ $d = 3 - 3/4 - 0.178/2 = 2.16"$

$$\phi M_n = 0.9(0.15)(65)(2.16) \left(1 - 0.59 \frac{0.15(65)}{12(2.16)(2.5)} \right)$$

$$= 17.3 \text{ k-in / ft}$$

$$= 23.0 \text{ k-in / 16"}$$

$22.4 k\text{-in} < 23.0 k\text{-in}$ OK

LOADS

GRAVITY : ASSUMING 10^k CHASSIS, AND EXCLUDING BATTERIES :

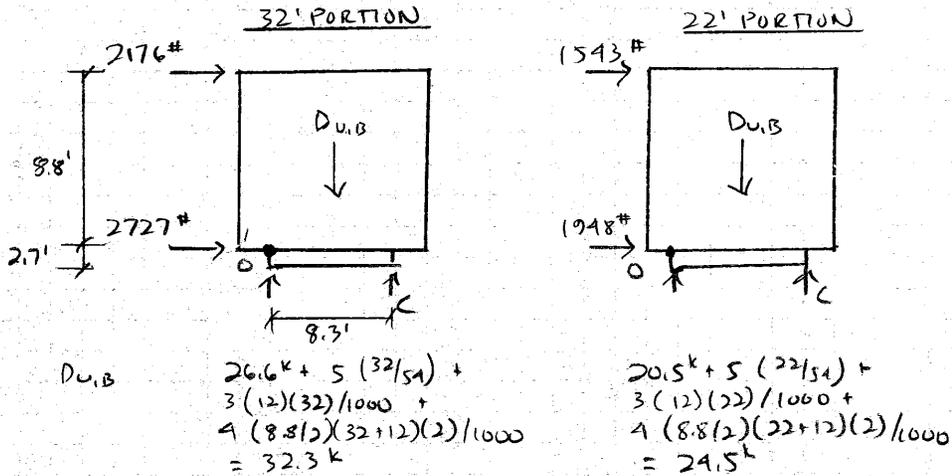
ROOF :	26.7 psf (12)(54) =	17301
FLOOR :	10.4 psf (12)(54) =	6739
WALLS :	16.9 psf (32+12+22+12)(2)(10) =	26364
	5.6 (14)(10) =	784
CHASSIS :		<u>10000</u>
		61188

AT 2667 #/FTG, THIS REQUIRES 23 FOOTINGS.

BATTERIES (240 #)(30 BATTERIES) = 7200 #
OR 3 FOOTINGS.

LATERAL - WASHINGTON D.C.

CALCULATE OT COMPRESSION WITH UPPER BOUND ESTIMATE OF WEIGHT. REFER TO P. LL8



$\sum M_o = 0$

$\Rightarrow C = \frac{(2176(8.8) + 32.3(8.3/2))}{8.3} = 18.5k$
 $\frac{(1543(8.8) + 24.5(8.3/2))}{8.3} = 13.9k$

AT Pallow = (2667)(1.333) = 3556 # PER FOOTING, NEED ALONG EDGE
 $18.5/3.56 = 5.19 \rightarrow 6$ FTGS $13.9/3.56 = 3.9 \rightarrow 4$ FTGS.

GRAVITY LOADS CLEARLY CONTROL. USE
 $23 (32/54) + 3 = 17$ $23 (22/54) = 10$

F3

PIERS OVER PADS: USE CENTRAL PIERS INC. LARGE SEISMIC PIER. ULTIMATE LATERAL CAPACITY = 2423#

32' PORTION: $1.6W = 1.6(2176 + 2727) = 4903\#$
USE 4 SEISMIC PIERS, CAPACITY = $4(2423) = 9692\#$

$4903\# < 9692\#$ OK

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