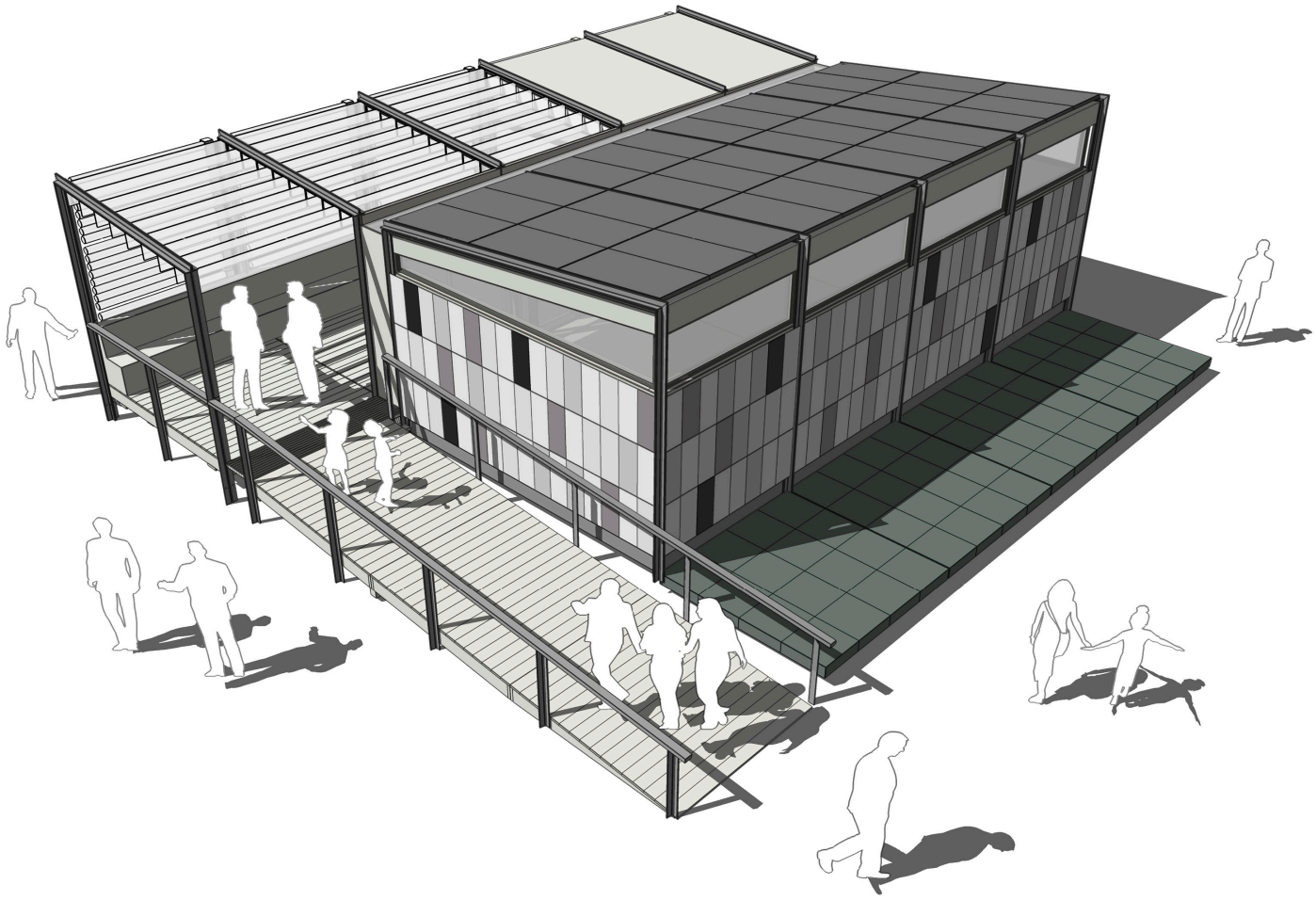


SPECIFICATIONS
UNIVERSITY OF CINCINNATI

AUGUST 7, 2007

[reFORM
SOLAR DECATHLON 2007

TABLE OF CONTENTS

SUMMARY OF CHANGES

Architecture

Tour route is reversed to allow for longer queue lines around the outside of the ramp.
Bedroom closet and closet door are flipped for better circulation.
Updated drawings confirm that house is under 800 square feet.
Absorption unit moved closer to the house.
Battery Barn redesigned
Garden now also on the south side of house to keep people away from Evacuated Tubes
Woven metal mesh now provides barrier between deck and Evacuated Tubes
Most interior finish materials changed.

Electrical System

Now using Sunny Boy & Sunny Island Inverters
Now using Discover Energy AGM Batteries

Plumbing System

Waste line for washing machine is now vented through an air admittance valve

Hydronic System

National Mall water filling requirements have changed from 4 fill locations to 3

STRUCTURAL CALCULATIONS

see Appendix B: Structural Calculations

SOLAR CELL SPECIFICATIONS

Copy of manufacturer's solar cell and module specification sheet

see page A.2

Manufacturer's name and contact information

SunPower Corporation
3939 N. 1st Street
San Jose, California 95134
http://www.sunpowercorp.com
solarna@sunpowercorp.com
(408) 240-5500

Stock number, type, or description

Thirty-six (36) SPR-215 modules

Manufacturer's quote for cell or module area

13.39 square feet per module

Manufacturer's quote for performance

Peak Power: 215 watts / Module Efficiency: 17.3%

Cost (US$) per watt for each cell or module.

$3.50 per watt (includes discount from SunPower)

BATTERY SPECIFICATIONS

Copy of manufacturer's battery specification sheet)

see page A.8

Material Safety Data Sheets (MSDS) obtained from the manufacturer

see page A.99

Manufacturer's name and contact information

Discover Energy
Harris Battery
9038 Sutton Place
Hamilton, Ohio 45011
(513) 942-6290

Stock number, type, or description

EVL16A-A

Module voltage

6VDC

Bus voltage

48VDC

Number of modules to be used in the house

36

Manufacturer's specifications, including capacity (kWh), weight (lb.), and cost (US$)

Capacity per module: 2.34 kWh	Total capacity: 84.24 kWh
Weight per module: 122.8 lb	Total weight: 4,420 lb
Cost per module: $ $828.79	Total cost: $29,836.44

Spill and damage protocols and procedures

see page A.100

COMPLIANCE WITH SOLAR DECATHLON BUILDING CODE

Solar Decathlon Building Code Section 9.7.
Expansion tank volume

$$V_t = \frac{(.0004 * T - .0466) * V_s}{\frac{p_a}{p_f} - \frac{p_a}{p_o}} = \frac{((.0004 * 210.2^o F) - .0466) * 324 gallons}{\frac{14.696 psi}{14.696 psi} - \frac{14.696 psi}{75 psi}} = 15.1 gallons$$

$$Total\,Water\,Volume = 324 gallons + 15.1 gallons = 339.1 gallons$$

The expansion volume plus operating water volume is less than 340 gallons, the maximum capacity of one Bulk Hot Water Storage Tank.

UNLISTED ELECTRICAL COMPONENTS

Rotartica Absorption Chiller Unit

DATA SHEETS FOR MAJOR HOUSE COMPONENTS

MATERIAL SAFETY DATA SHEETS

WATER REQUIREMENTS

Water Delivery

TOTAL - 700 GALLONS TO THREE LOCATIONS:
1. Bulk domestic supply tank (minimum 355 gallons)
2. Temporary supply tank (minimum 325 gallons)
3. Absorption Chiller Flow Rate Control tank (20 gallons)

Hydronic System

345 gallons

Domestic System

355 gallons

APPENDIX A

SPECIFICATION SHEETS / MSDS

SUNPOWER

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 backsheet meets the most stringent safety requirements for high-voltage operation
- A sturdy, black anodized aluminium frame allows modules to be easily roof-mounted with a wide variety of standard mounting systems

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

UL LISTED UL 1703, Class C Fire Rating

IEC 61215, Safety Class II Certified

Document# 001-06638 Rev *B

SunPower Corporation®
1.877.786.0123 Email: sales@sunpowercorp.com www.sunpowercorp.com
Engineered in California

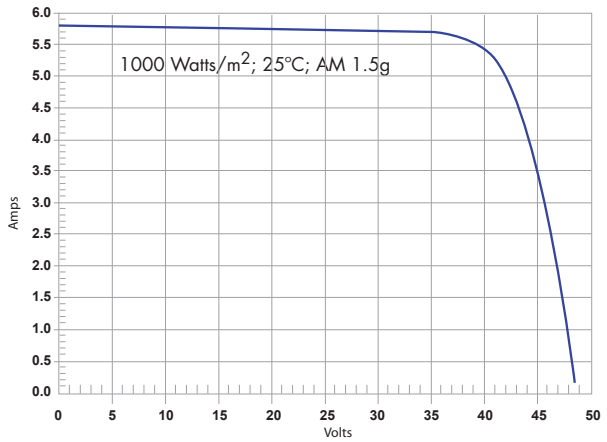
SUNPOWER

SPR-215-BLK
RESIDENTIAL PV MODULE

ELECTRICAL CHARACTERISTICS AT STANDARD TEST CONDITIONS (STC)
STC is defined as: irradiance of 1000W/m^2, 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%
PTC Rating		197.6W

IV CURVE

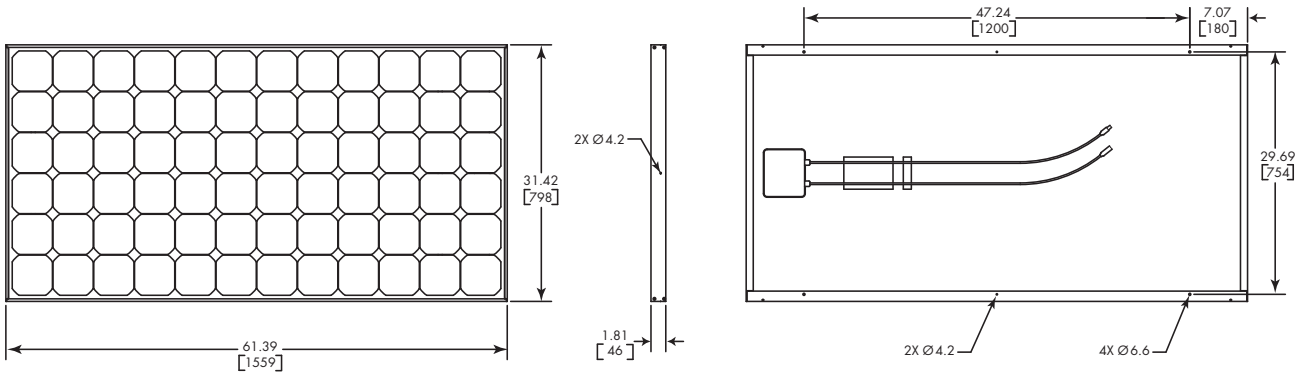


[1] Peak Power Tolerance: +/- 8%
[2] Power guaranteed for 25 years. See SunPower Limited Warranty for details.

MECHANICAL SPECIFICATIONS

Length (mm) x Width (mm)	1559 x 798
Thickness, including junction box (mm)	46
Weight (kg)	15

DIMENSIONS



Document# 001-06638 Rev *B

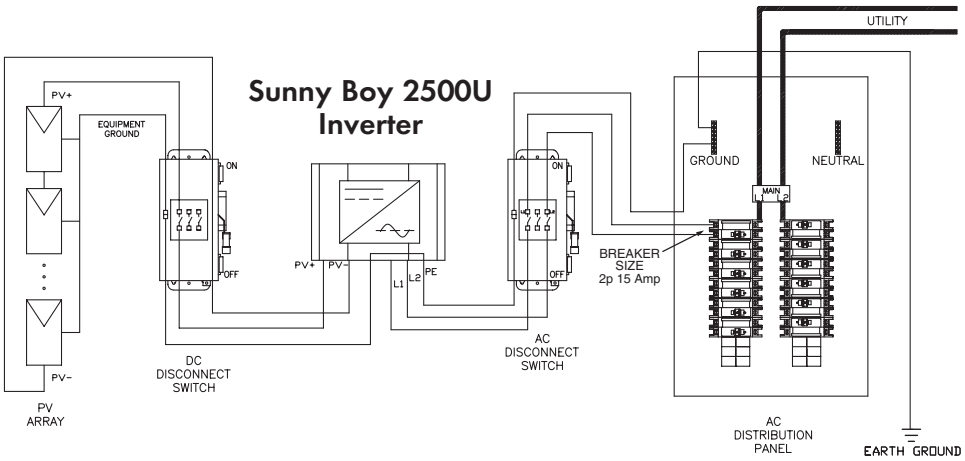
SunPower Corporation®
1.877.786.0123 Email: sales@sunpowercorp.com www.sunpowercorp.com
Engineered in California

Sunny Boy 2500U

The leading grid-tied photovoltaic inverters in Europe and America

- **UL 1741 Listed for grid interactive inverters**
- **5-year comprehensive warranty standard**
- **Rugged NEMA 4X stainless steel enclosure standard**
- **Exceptional reliability and energy capture ratio**
- **Easy to install three-point mounting system**
- **Comprehensive communications and data collection options**
- **SMA's modular string inverter design is expandable to virtually any size system**

The SMA Sunny Boy inverter, the most popular grid-tied photovoltaic inverter in Europe, is now UL 1741 Listed and available in North America. Sunny Boy's extensive track record in some of the world's most demanding markets has made it a favorite among PV professionals everywhere. Over 250,000 Sunny Boy inverters have been installed worldwide. Superior design, rock-solid German engineering and exceptional real-world efficiency have made Sunny Boy the top choice for American solar designers.



Sunny Boy's unsurpassed reliability and efficiency are the result of SMA's manufacturing philosophy that combines simple design with robust execution. SMA's state-of-the-art maximum power point tracking performance results in greater real-world energy capture than any other grid-tied inverter. Sunny Boy's safety and reliability record is also exceptional due, in part, to the inverter's redundant grid monitoring and built-in ground fault detection and interruption protection. The inverter's IGBT power stage generates a nearly perfect sine wave with the lowest harmonic distortion in the industry and meets ultra-strict FCC EMC standards. SMA's unique String Inverter technology makes future system expansion simple. SMA advanced communication options are available to satisfy almost any application.

Specifications

Inverter Technology	Real sine-wave, current source, high frequency PWM
AC Input Voltage	213-262 (240V AC) or 183-229 (208V AC)
AC Input Frequency	59.3 - 60.5 (60Hz) (50Hz also available)
DC Input Voltage	250 - 600V DC
Peak Power Tracking Voltage	234 - 550V DC (at 240V AC)
PV Start Voltage	300V DC
Minimum DC Input Voltage	207 - 256V DC dependent on available line voltage
Maximum Array Input Power	3000W (240V AC)(DC@STC) 2600W (208V AC)(DC@STC)
Maximum AC Power Output	2500W (240V AC) 2100W (208V AC)
Current THD	< 4%
Power Factor	Unity
Peak Inverter Efficiency	94.1%
Cooling	*Convection cooling (no fan)
Maximum AC Output Current	12A
Maximum DC Input Current	12A

DC Voltage Ripple	< 5%
Power Consumption	0.25W nighttime < 7W standby
Ambient Temperature Rating	45°C
Enclosure	NEMA 4X (iP65) Stainless Steel
Dimensions	17.10W x 11.60H x 8.40D in 434W x 295H x 214D mm
Weight	71 lbs (32 kg)
Compliance	United States UL 1741, E210376, UL 1998, IEEE 519, IEEE 929, ANSI C62.41 C1 & C3, FCC part 15 A & B International DIN EN50082 Part 1, 61000-32, 50081, 50014, 600055 Part 2 55011 Group 1 Class B, 50178, 60146 Part 1-1

* Optional external fan (Sunny Breeze) available

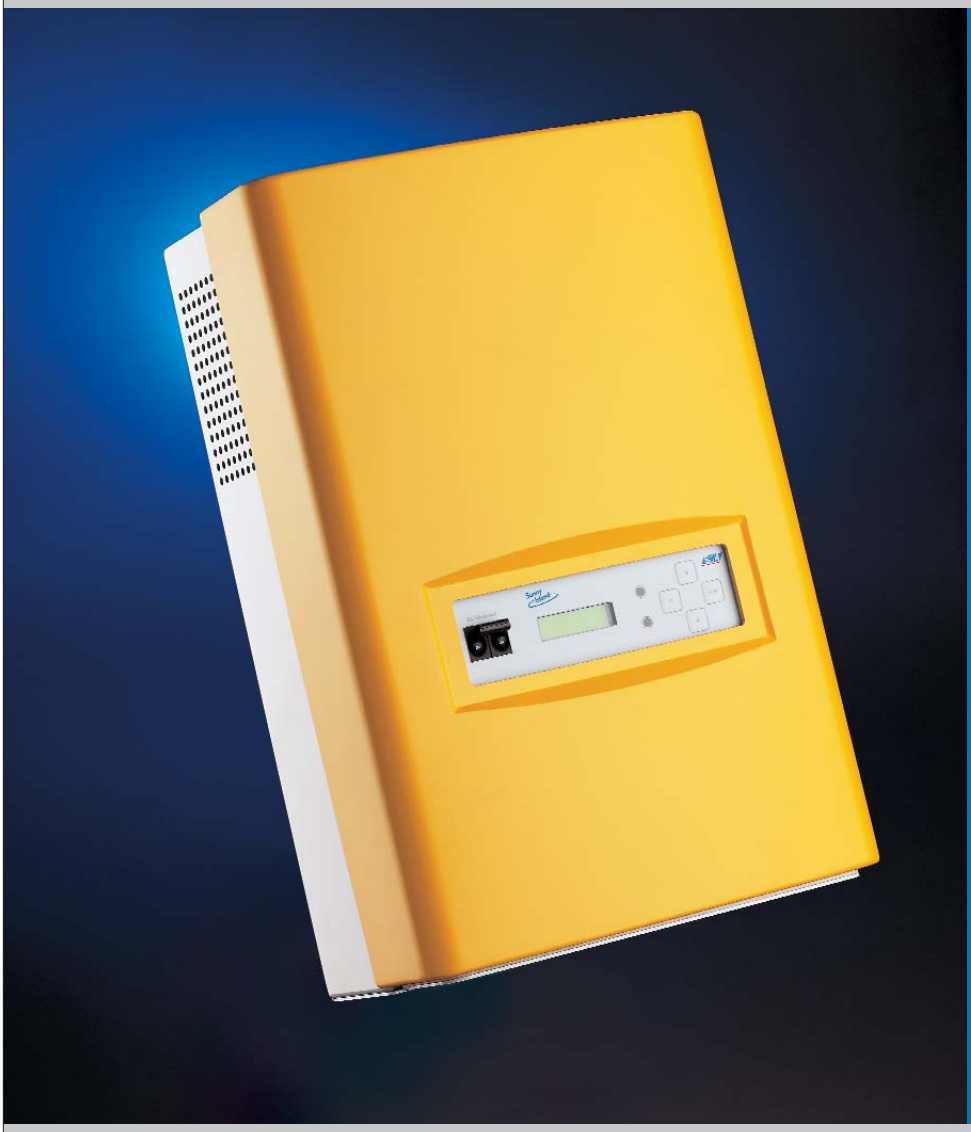
Distributed by:

SMA America, Inc., 12438-C Loma Rica Dr.
Grass Valley, CA. 95945
Tel: 530.273.4895 Fax: 530.274.7271
www.sma-america.com

Solar Today...
Energy Tomorrow

Sunny Island 4248U

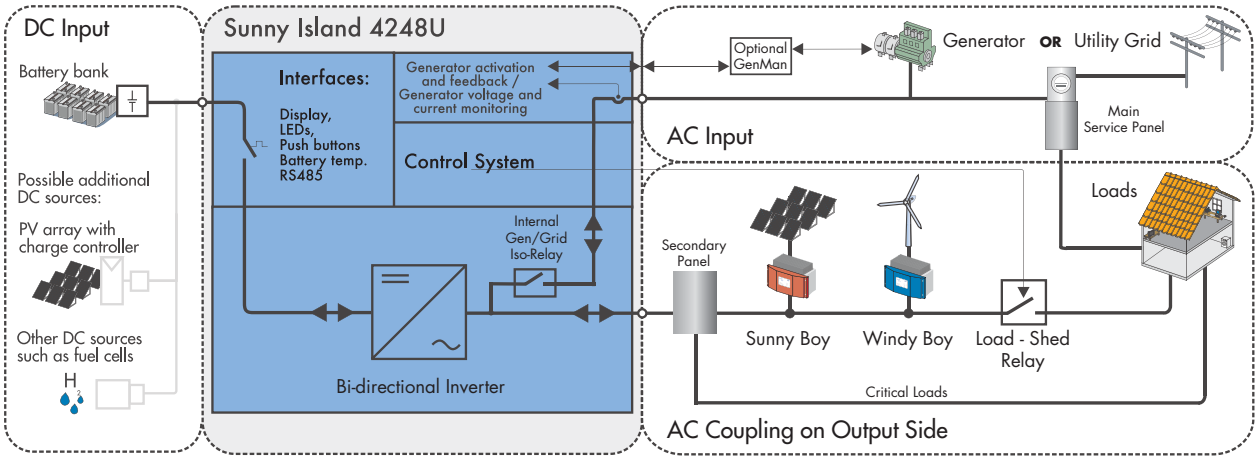
SMA's new off grid inverter - A technological leap into the future



- 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 paralled 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

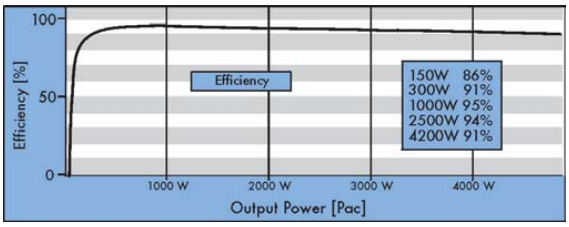
Nom. Battery Voltage:	$V_{DC,nom}$	48 V
Battery Voltage Range:	V_{DC}	41 - 63 V
Nom. AC Voltage:	$V_{AC,nom}$	120 V
AC Voltage Range:	V_{AC}	105 - 132 V
Nom. AC Frequency:	$f_{AC,nom}$	60 Hz
AC Input Charge Current:	$I_{AC,chrg}$	40A @ 25°C 28A @ 45°C
Max. AC pass through current (transfer relay):		60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

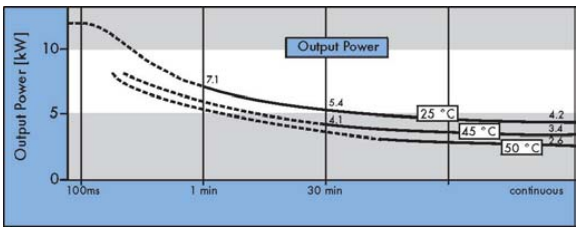
Temperature Range
-20°C to +45°C / -4.0°F to +113.0°F

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)





SMA America, Inc.
12438 Loma Rica Drive
Grass Valley, CA 95945
phone: 530.273.4895
email: info@sma-america.com
www.sma-america.com

Solar Today ...
Energy Tomorrow

EVL16A-A

Features & Benefits

Professional Series EV Advanced AGM Batteries, Designed and Engineered for Dependability in Commercial, Industrial, Public and Private applications; Mobility and Home Medical Equipment (HME) , Broadband and Cable TV (CATV), Uninterruptible Power Supplies (UPS) and Telecommunication, Photovoltaic, Solar and Renewable Energy, Electronic and Security, Marine and RV, Golf and Electric Vehicle, Aerial Lifts and Fork Lifts, Floor Machines and Robotics.

• ***In Doors*** • ***Out Back*** • ***Off Shore*** • ***On Duty***

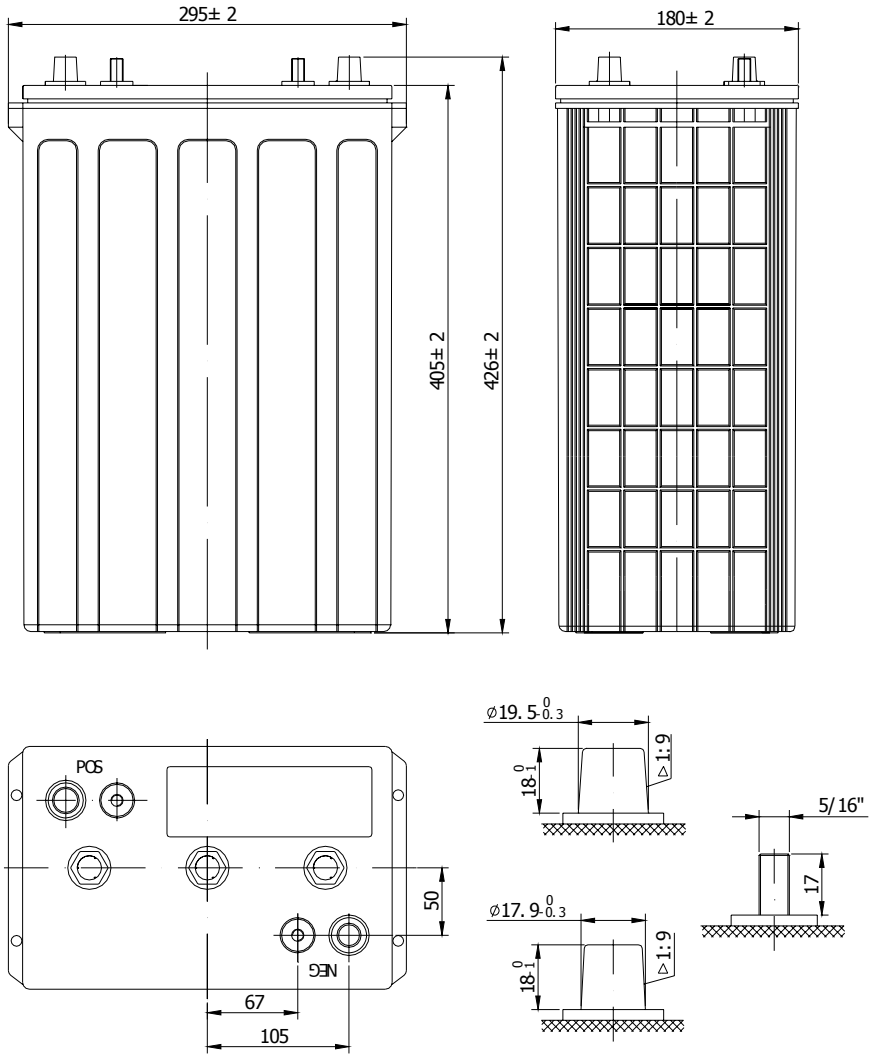
Discover™ Professional Series Batteries have the Features and Benefits that matter to your customers and you!

Advanced AGM

- **Completely sealed valve regulated construction.**
- **Flame arresting pressure regulated safety sealing valves for safety, operating pressure management and protection against atmospheric contamination (excess oxygen being absorbed by negative plates).**
- **Computer-aided 99.994% pure heavy-duty lead calcium grid designs.**
- **Tank formed plates: guarantees evenly formed and capacity matched plates.**
- **Discover™ proprietary Vision Max® Paste Formula.**
- **Anchored plate groups to guard against vibration.**
- **Double insulating Micro porous glass fiber separators.**
- **Measured and Immobilized electrolyte.**
- **Vacuum filling and weighing processes.**
- **Advanced technology for efficient gas recombination of up to 99.9% and freedom from electrolyte maintenance.**
- **Wide range of operating temperatures (-40°F to 140°F) (-60°F to 160°F Gel).**
- **Low self discharge rates (Approx. 1%-3% monthly at 68.F – 77.F)**
- **High impact reinforced strength copolymer polypropylene cases and flat top designed covers that are rugged and vibration resistant.**
- **Thermally welded case to cover bonds that eliminate leakage.**
- **Copper and stainless steel alloy terminals and hardware.**
- **Multi-terminal options.**
- **Terminal protectors.**
- **Removable carry handles.**
- **Industry leading size and performance options.**
- **Classified as "NON-SPILLABLE BATTERY" Not restricted for Air (IATA/ICAO) Provision 67, Surface (DOT-CFR-HMR49)or Water (Classified as non-hazardous per IMDG amendment 27) transportation**
- **Can be used in any orientation – Upside down is not recommended – do not charged up side down!**
- **Compatible with sensitive electronic equipment.**
- **Quality Assurance processes with ISO (4400/992579), QS and TUV Certification EMC tested, CE, ETTS Germany (G4M19906-9202-E-16)**
- **Telcordia and Bellcore compliant**
- **UL recognized and approved components (MH29050).**

Mechanical Characteristics

Industry Type No.	Volts	Standard (optional) Terminals	Dimensions in Inches (mm)				Approx. Weight in Lbs (Kgs)
			L in(mm)	W in(mm)	H in(mm)	TH in(mm)	
L16	6	AM	11.6 (295)	7.1 (180)	15.9 (405)	16.8 (426)	122.8 (55.7)



Electrical Specifications

Ampere Hour Capacity			Minutes of Discharge					R/C	Cranking Amps	
20HR	10HR	5HR	@25A	@56A	@75A	@85A	@100A	@25A	32°F/ 0°C	0°F/ -18°C
* - Performance averages after 15 cycles										
390	360	331	915	374	255	217	168	841		

Constant current discharge ratings-amperes at 20℃(68℉)

End Point Volts/Cell	5min	10min	15min	30min	45min	1h	3h	5h	10h
1.60V	--	--	--	--	236	199	95	67.7	36.3
1.65V	--	--	--	--	224	190	93.7	67.2	36.2
1.70V	--	--	--	--	212	181	92.3	66.7	36.1
1.75V	--	--	--	--	199	171	90.9	66.2	36.0
1.80V	--	--	--	--	186	161	89.5	65.6	35.9

Constant power discharge ratings-watts per cell at 20℃(68℉)

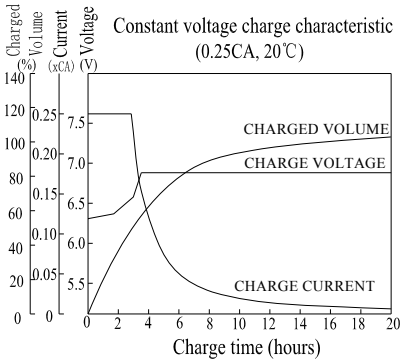
End Point Volts/Cell	5min	10min	15min	30min	45min	1h	2h	3h	5h
1.60V	--	--	--	--	421	358	230	177	118
1.65V	--	--	--	--	404	345	225	175	117
1.70V	--	--	--	--	386	332	220	173	116
1.75V	--	--	--	--	368	319	215	170	115
1.80V	--	--	--	--	350	306	210	167	114

Internal resistance	Fully charged at 20℃: 2.3mOhms		
Self discharge	<3% of capacity per month at 20℃		
Operating temperature range	Discharge	Charge	Storage
	-20～60℃	-10～60℃	-20～60℃
Max. discharge current (20℃)	1650A(5s)		

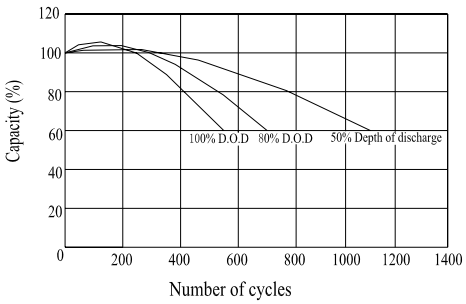
CHARGE METHODS: Constant voltage charging at 20℃(68℉)			
	Max. Charge current	Charge voltage	Temperature compensation
Standby use	$0.3C_{10}A$	6.80~6.90V	-10mV/℃
Cyclic use	$0.3C_{10}A$	7.20~7.35V	-15mV/℃

Charge / Discharge Tables & Graphs

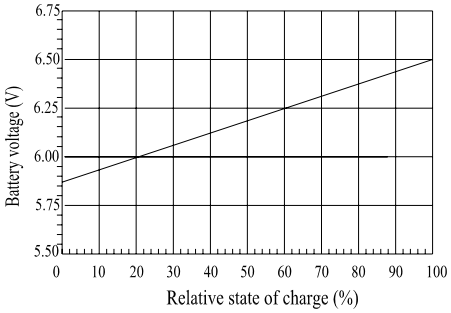
Constant voltage charge characteristic
(0.25CA, 20℃)



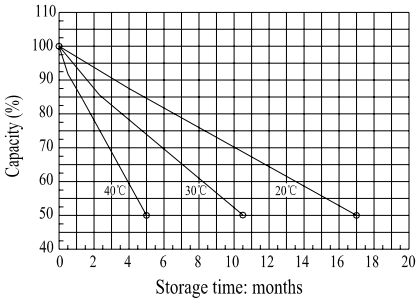
Cycle life in relation to depth of discharge



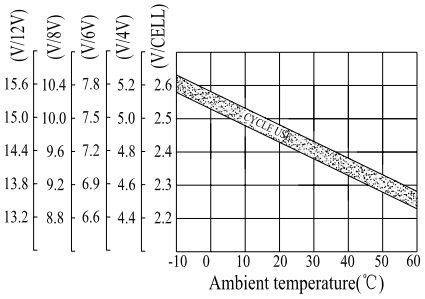
Relationship of OCV and state of charge (20℃)



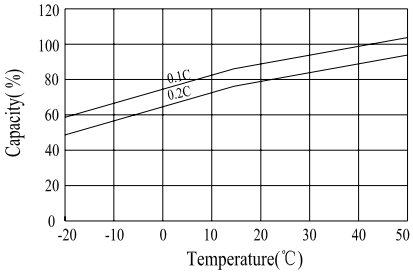
Self-discharge characteristic



Relationship between charging voltage and temperature



Temperature effects on capacity



SEIDO 2 SOLAR COLLECTOR

See the complete technical specifications

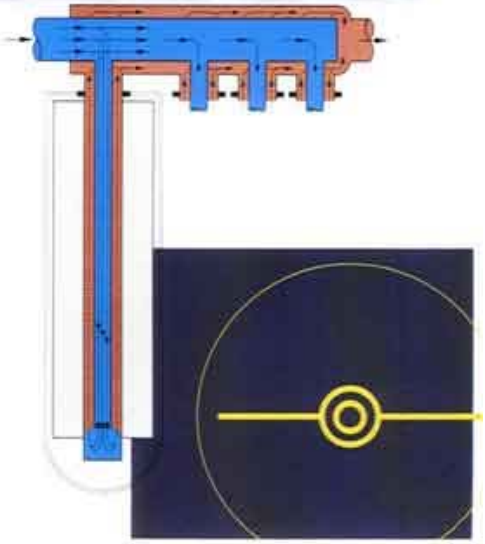
SEIDO 2-8 and 2-16 Collector Modules

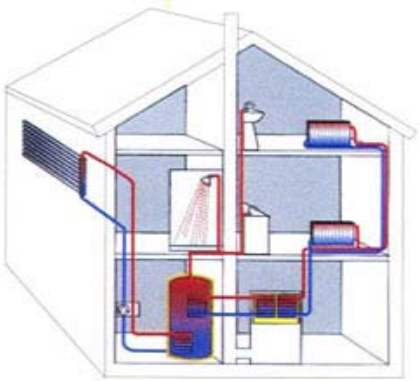
About the Seido 2
The Seido 2 style collectors open up new perspectives for design oriented, open type architecture incorporating modern technology with functionality and style. These tubes can be installed in any orientation from 0 to 90 degrees, making them suitable for flat mounting on roofs or against walls. The heat transfer fluid flows through each tube in a concentric tube arrangement as shown. Collector efficiency is maximized by the direct exchange of heat between absorber and fluid. All tubes require a hard connection to the manifold and are connected in parallel.

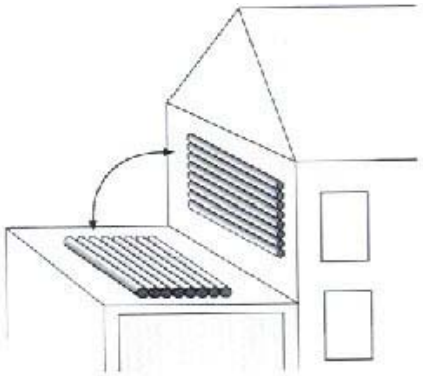
Seido 2 collectors are available in 8- and 16-tube modules.

Solar Collectors – SEIDO 2

- ☐ highly efficient
- ☐ extremely durable
- ☐ compact
- ☐ maintenance free
- ☐ any installation angle





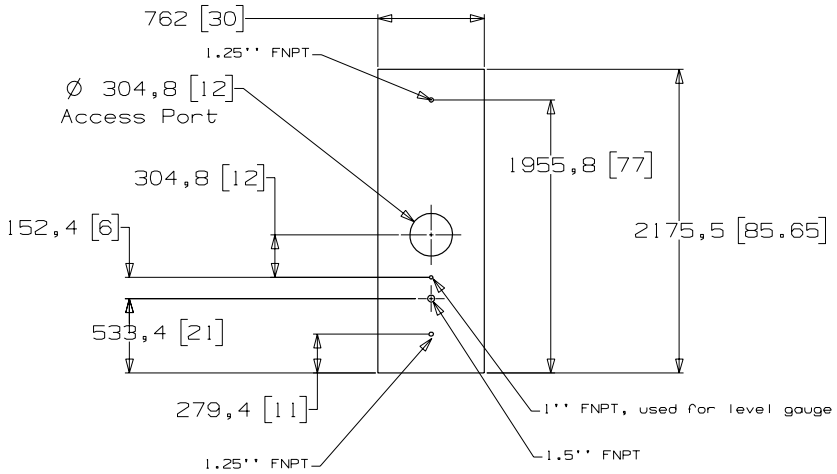


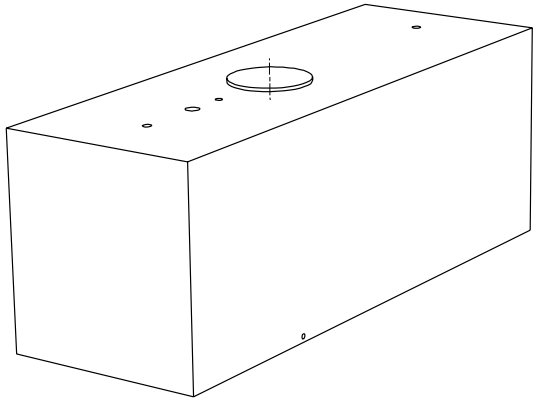
***** DEALER INQUIRIES WELCOME *****

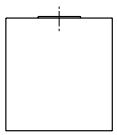
Seido 2 Technical Data	Seido 2-8	Seido 2-16
Design	Evacuated Tube with Flow-Through	Evacuated Tube with Flow-Through
Dimensions (LxWxH)	2110 x 960 x 125 mm	2110 x 1920 x 125 mm
	83 x 38 x 5 inches	83 x 76 x 5 inches
No of Tubes	8	16
Vacuum Tube Glass Material	high quality borosilicate	high quality borosilicate
Wall Thickness	0.098 inches (2.5mm)	0.098 inches (2.5mm)
Tube Outside Diameter	4 inches (100 mm)	4 inches (100 mm)
Tube Length	78.74 inches (2000 mm)	78.74 inches (2000 mm)
Tube Weight	10 lbs (4.5 kg)	10 lbs (4.5 kg)
Hailstone Resistant to	1.378 in (35mm) dia	1.378 in (35mm) dia
Vacuum	< 75^{-7} torr (10^{-5} mbar)	< 75^{-7} torr (10^{-5} mbar)
Collector Surface Area	21.85 ft^2 (2.03 m^2)	43.59 ft^2 (4.05 m^2)
Absorber Surface Area	16.15 ft^2 (1.5 m^2)	32.29 ft^2 (3.0 m^2)
Angle of Inclination	0-90°	0-90°
Module Weight	110 lbs (50 kg)	220 lbs (100 kg)
Pressure drop per module @ 0.22 gpm (50 L/h)	< 1 ft H_2O (30 mbar)	< 1 ft H_2O (30 mbar)
Test Pressure	145 psi (10 bar)	145 psi (10 bar)
Operating Pressure to	87 psi (6 bar)	87 psi (6 bar)
Fluid Content	0.34 gal (1.3 L)	0.68 gal (2.6 L)
Absorber Material	Aluminum	Aluminum
Coating	Aluminumnitride	Aluminumnitride
Absorption Coefficient	> 92%	> 92%
Emission Coefficient	< 8%	< 8%
Max Temperature (module)	374 F (190 C)	374 F (190 C)
Typical Operating Temperature	158-248 °F (70-120 °C)	158-248 °F (70-120 °C)
Stagnation Temperature (pipe)	477 F (247 C)	477 F (247 C)

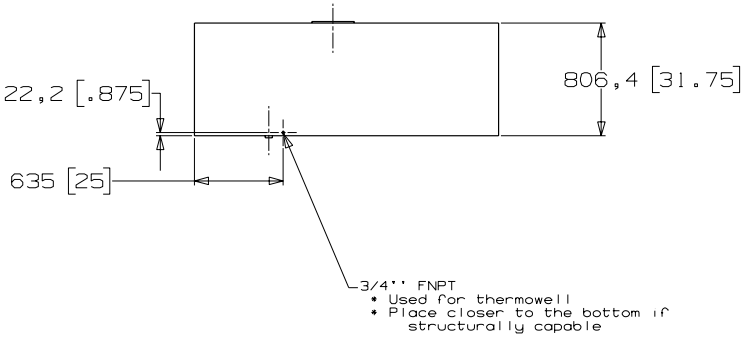
Two (2) Bulk Hot Water Storage Tanks: Standard Specifications
Manufacturer: Modern Welding Company, Owensboro, KY

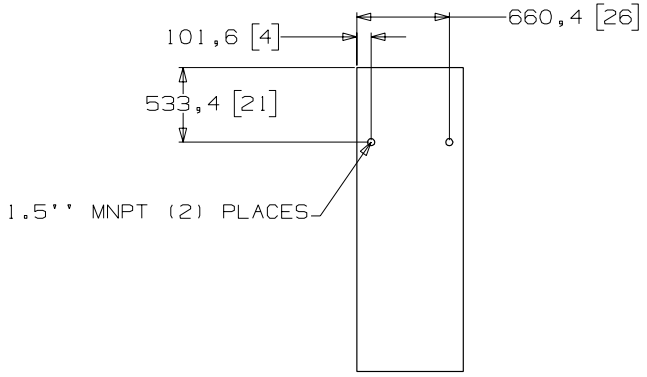
- Single wall above ground stainless steel tank
- Capacity: approximately 340 US Gallons
- Length = 85.65 inches, Width = 30 inches, Height = 31.75 inches
- Operating temperatures: $T_{max} = 99°C$, $T_{min} \approx T_{ambient} \approx 18.34°C$
- One (1) threaded entrance port, location to be determined
- One (1) threaded exit port, location to be determined
- Built per Underwriters Laboratories Standard UL 142 standard
- Modern's standard opening locations and required lifting lugs
- Exterior coated with one (1) coat of standard shop primer and not blast cleaned
- Maximum allowable working pressure of 0.5 psig measured from the top of tank, controlled by breather valve open to the atmosphere
- Emergency pressure relief valve opening
- Support may be two (2) saddles, stabilizers, or skid configuration
- Exterior coated with .25 inch layer of R-14.4/inch ceramic based insulation











Hot Water Tank

Notes:
- Material: Carbon Steel
- Units: mm [inches]
- Standard tolerance: ± 3.175 [.125]
- Wall thickness: 3.175 [.125] (assumes internal structural support is needed)
- Access port seal and mounting scheme to be determined and performed by the manufacturer. Height of port above top of tank is not to exceed 38.1 [1.50]

ROTARTICA			
PRODUCT SPECIFICATIONS			SOLAR Air/Water CHILLER
	Technology	SINGLE-EFFECT LiBr/H20 ABSORPTION	
	Manufacturer	**ROTARTICA**	
	Models	SOLAR 045 and SOLAR 045v	
Product Data	Company	ROTARTICA	
	Product	Air/Water Chiller	
	Nominal cooling power	4.5 kW	
	Powered by	Heated water	
	Absorbent/Refrigerant	LiBr/H2O	
		COLD	**HOT**
Water Circuit	Capacity (kW)	4.5	10.8
	Flow (m3/h)	1.2	2.0
	Loss of head (bar)	0.3	0.8
Circuit Energy Performance	Heat provided to generator (kW) at 90º	6.7	
	Flow (m3/h)	1.2	
	Loss of head (bar)	0.2	
Electricity Supply	Electrical consumption of absorption chiller unit (kW)	0.26	
	Electrical consumption of fan and pump (kW)*	1.2	
	Average power consumed (A)	1.2 (5.5 with pumps and fan)	
Temperatures	Nominal outlet temp	18	46
	AMBIENT	35	
Dimensions	Length (mm)	1050/1092	
	Width (mm)	670/760	
	Height (mm)	865/1150	
	Volume (m3)	0.61/0.95	
	Weight (kg)	240/290	

Installation
Supply of energy through solar panel + boiler (separately or jointly); does not need to be fixed to floor. Water connections: Four 1" connections, exterior installation (SOLAR 045v); six 1" connections, interior installation (SOLAR 045).

Capacity Factor for Installations				
		Type of Installation		
Temp. of supply to generator (of solar panel + auxiliary boiler)	Capacity Factor ARI 560; 2000 Standard	**Int**: fan coil (7-12ºC) **Ext**: Cooling tower (29ºC)	**Int**: radiant floor/ceiling (18-20ºC) **Ext**: dry heat loss (38-42ºC)	**Int**: fan coil (7-12ºC) **Ext**: dry heat loss (38-42ºC)
80º C	0.8	5.6 kW	4.2 kW	2.5 kW
90º C	0.9	6.3 kW	5.5 kW	3.5 kW
100º C	1	7.0 kW	6.8 kW	4.5 kW

C.4.1 test method in Appendix C of the ARI560 Standard, for appliances heated indirectly according to a single-effect system:

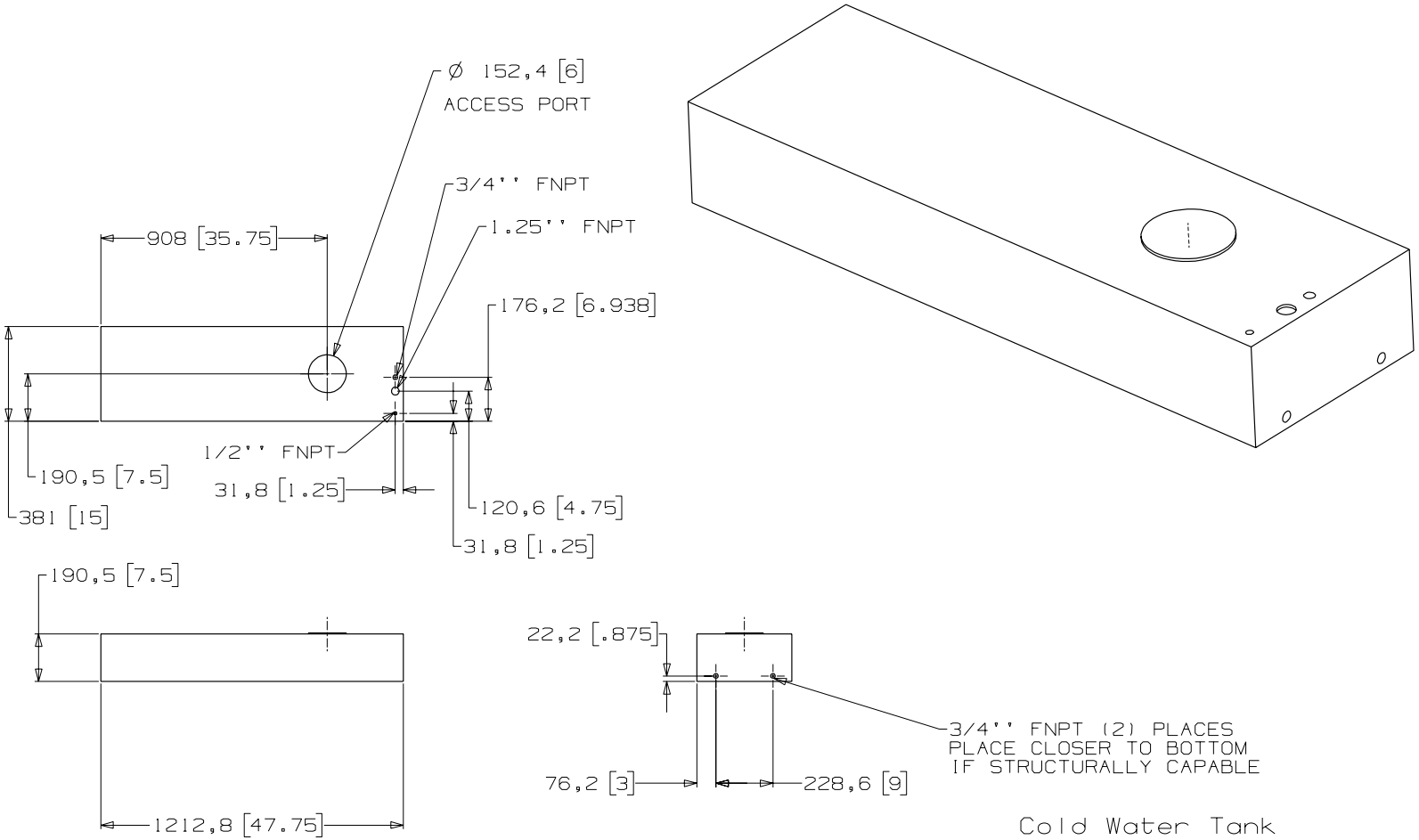
Primary circuit: 90ºC and a flow of 15 l/min. **Cold water circuit**: 18ºC and a flow of 20 l/min. **Hot water circuit**: 39ºC.

NOTE: There is no standard for absorption chiller units NOT comprising a cooling tower. The conditions stated above are applied in its absence.

ROTARTICA S.A. Avda. Cervantes 45, 48970 Basauri (Bizkaia) Tel: (+34) 94 402 51 20 Fax: (+34) 94 402 51 21 www.rotartica.com

Two (2) Cold Water Flow Rate Control Tanks: Standard Specifications
Manufacturer: Modern Welding Company, Owensboro, KY

- Single wall above ground stainless steel tank
- Capacity: approximately 19 US Gallons
- Length = 20 inches, Width = 28 inches, Height = 8 inches
- Operating temperatures: T_{max} = 45°C, T_{min} = 5°C
- One (1) threaded entrance port, location to be determined
- One (1) threaded exit port, location to be determined
- Built per Underwriters Laboratories Standard UL 142 standard
- Modern's standard opening locations
- Exterior coated with one (1) coat of standard shop primer and not blast cleaned
- Maximum allowable working pressure of 0.5 psig measured from the top of tank, controlled by breather valve open to the atmosphere
- Emergency pressure relief valve opening
- Support may be two (2) saddles, stabilizers, or skid configuration
- Exterior coated with .25 inch layer of R-14.4/inch ceramic based insulation



Cold Water Tank

Notes:
- Material: Carbon Steel
- Units: mm [inches]
- Standard tolerance: ± 3.175 [.125]
- Wall thickness: 6.35 [.25]
- Access port seal and mounting scheme to be determined and performed by the manufacturer. Height of port above top of tank is not to exceed 38.1 [1.50]

DIMENSIONAL DATA, RISER SPECIFICATION, FILTER SIZES, ELECTRICAL DATA, CONTROLS

DEMENSIONAL DATA	WIDTH	DEEPTH	HEIGHT	SUPPLY AIR	RETURN AIR	HRV COLLARS	WATER CONNECTIONS	REFRIGERANT CONNECTIONS	
								Suction	Liquid
CONCEALED	17.25	14.5	78	12X12	-	5" DIA	3/4 PIPE	N/A	
MECHANICAL	25	16	59	20X10	16X6	6" DIA	3/4 PIPE	.875 ID	.625 ID

RISER DETAILS

	MATERIAL	DAIMETER	LENGTH	FLARED	INSULATION
CWS	TYPE M COPPER			TOP	1" POLYETHYLENE FOAM PIPE INSULATION
CWR	TYPE M COPPER			TOP	1" POLYETHYLENE FOAM PIPE INSULATION
HWS	TYPE M COPPER			TOP	1" POLYETHYLENE FOAM PIPE INSULATION
HWR	TYPE M COPPER			TOP	1" POLYETHYLENE FOAM PIPE INSULATION
COND	TYPE M COPPER			TOP	NONE

FILTER SPECIFICATIONS

	RET. AIR	OUTISIDE AIR	EXHAUST AIR
CONCEALED	12X16X1	9X11X1	9X11X1
MECHANICAL	16X20X1	9X11X1	9X11X1

ELECTRICAL DATA

	VOLTS	WATTS	MCA
CONCEALED	115	600	20
MECHANICAL	115	700	15

CONTROLS

	POWER	CONDUCTOR WIRES		DESCRIPTION
THERMOSTAT	24 VAC	4	18 GA	HEAT COOL WITH FAN SWITCH
DEHUMIDISTAT	24 VAC	2	18 GA	20-80% MAKE ON RISE
TIMERS	24 VAC	2	18 GA	SPRING WOUND MECHANICAL COUNT DOWN

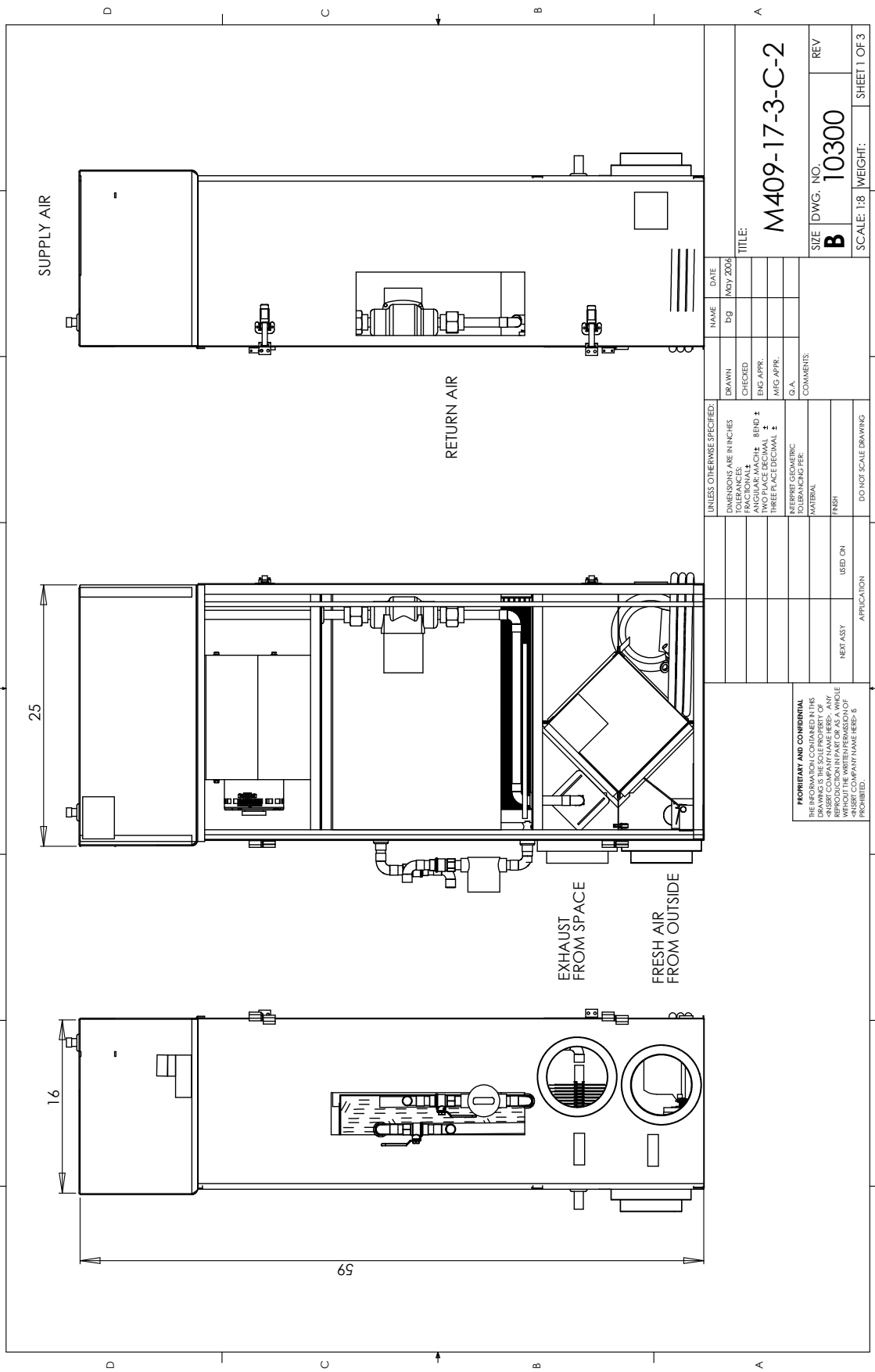
ENERBOSS 400M SERIES ECM FAN COILS - NOMENCLATURE

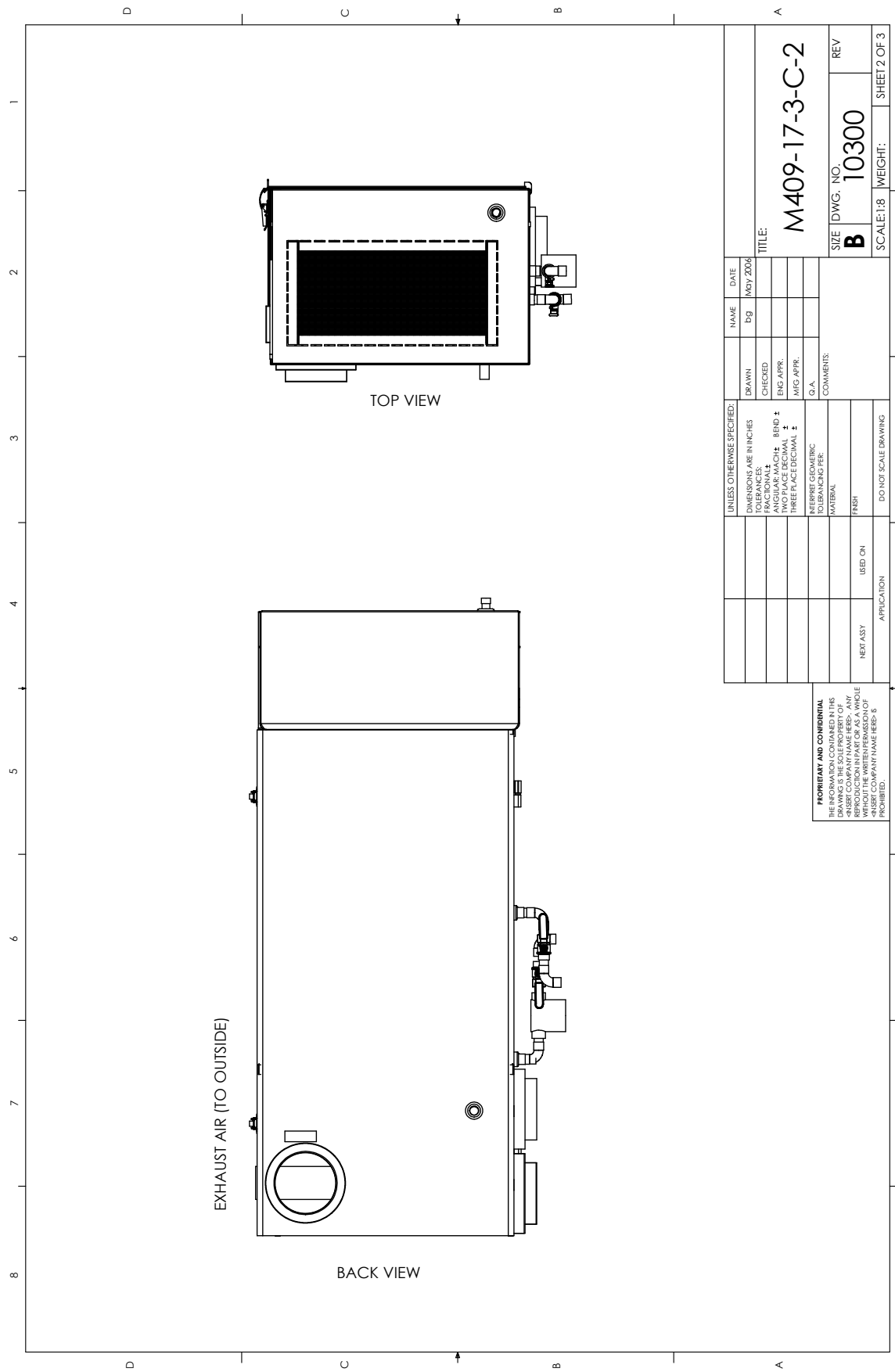
2. MECHANICAL ROOM UNITS - FINISHED CABINET, DUCTED RETURN

	HEATING COIL			COOLING COIL		HRV	HEATING LOOP	COOLING LOOP
M4			-		-	-	-	-
MECHANICAL ROOM INSTALLATION	09	25 MBH		17	CW1 – 17 MBH AT 450 CFM	0 - NO HRV	C - CIRCULATOR PUMP	
	12	39 MBH		22	CW2 – 22 MBH AT 600	1 - POLY	2 - 2 WAY VALVE	2 - 2 WAY VALVE
	18	52 MBH		00	NONE	2 - ALUMINIM	3 - 3 WAY VALVE	3 - 3 WAY VALVE
						3 - ENTHALPY	0 - NONE	0 - NONE

Detailed Coil Data - ENERBOSS 400 SERIES

Coil Construction		MODEL 409	MODEL 412	MODEL 418	MODEL 409			MODEL 412			MODEL 418		
Type		WATER	WATER	WATER	WATER			WATER			WATER		
Fin Height x Finned Length (in)		20 X10	20 x 10	20 x 10	20 X10			20 x 10			20 x 10		
Face Area (sq ft)		1.39	1.39	1.39	1.39			1.39			1.39		
Fins per inch		12.00	12.00	12.00	12.00			12.00			12.00		
Nominal Ton		0.75	1.00	1.50	0.75			1.00			1.50		
Tube OD		3/8	1/2	1/2	3/8			1/2			1/2		
Rows Deep		2	2	3	2			2			3		
Air Side Performance		Cooling	Cooling	Cooling	HEATING			HEATING			HEATING		
Flow	cfm	450	600	650	450	450	450	600	600	600	650	650	650
Continuous low speed		171	228	247									
Entering Air Dry Bulb	F	80.0	80.0	80.0	70	70	70	70	70	70	70	70	70
Entering Air Wet Bulb	F	67.0	67.0	67.0									
Leaving Air Dry Bulb	F	66.3	64.7	61.7	121.7	110.9	100.1	129.4	116.5	103.6	143.4	127.8	112
Leaving Air Wet Bulb	F	61.1	60.9	59.5									
Face Velocity	FPM	324.0	432.0	468.0	324	324	324	432	432	432	468	468	468
Air Side Pressure Drop	inwg	0.17	0.16	0.28	0.09	0.09	0.09	0.12	0.12	0.12	0.21	0.21	0.21
Liquid Side Performance													
Entering Water Temperature	F	45.0	45.0	45.0	180.0	160.0	140.0	180.0	160.0	140.0	180.0	160.0	140.0
Leaving Water Temperature	F	55.0	54.5	53.6	160.4	140.4	120.4	160.4	140.4	120.4	160.4	140.4	120.4
Number of Circuits	ea	2	2	3	2	2	2	2	2	2	3	3	3
Fluid Flow	gpm	1.7	2.4	3.9	2.7	2.1	1.5	4.1	3.2	2.3	5.4	4.3	3.1
Water Pres. Drop	ft	4.67	1.80	2.90	7.55	5.07	3.01	3.48	2.30	1.32	3.10	2.76	1.6
Total Capacity	Btu/hr	8,430	11,690	17,380									
Sensible Capacity	Btu/hr	6,603	9,860	13,543	25,432	20,122	14,793	38,959	30,518	22,044	52,190	41,067	29,874


SUPPLY AIR
RETURN AIR
EXHAUST FROM SPACE
FRESH AIR FROM OUTSIDE
25
16
59
M409-17-3-C-2
10300
B
SCALE: 1:8
WEIGHT:
SHEET 1 OF 3
REV
DRAWN
CHECKED
ENG APPR.
MFG APPR.
Q.A.
COMMENTS:
NAME
DATE
bg
May 2006
UNLESS OTHERWISE SPECIFIED:
DIMENSIONS ARE IN INCHES
TOLERANCES:
FRACTIONAL ±
ANGULAR: MACH ± BEND ±
TWO PLACE DECIMAL ±
THREE PLACE DECIMAL ±
INTERPRET GEOMETRIC
TOLERANCING PER:
MATERIAL
FINISH
DO NOT SCALE DRAWING
NEXT ASSY
USED ON
APPLICATION
PROPRIETARY AND CONFIDENTIAL
THE INFORMATION CONTAINED IN THIS DRAWING IS THE SOLE PROPERTY OF <INSERT COMPANY NAME HERE>. ANY REPRODUCTION IN PART OR AS A WHOLE WITHOUT THE WRITTEN PERMISSION OF <INSERT COMPANY NAME HERE> IS PROHIBITED.


TOP VIEW
EXHAUST AIR (TO OUTSIDE)
BACK VIEW
M409-17-3-C-2
SIZE B
DWG. NO. 10300
REV
SCALE:1:8
WEIGHT:
SHEET 2 OF 3
DRAWN bg May 2006
CHECKED
ENG APPR.
MFG APPR.
Q.A.
COMMENTS:
UNLESS OTHERWISE SPECIFIED:
DIMENSIONS ARE IN INCHES
TOLERANCES:
FRACTIONAL ±
ANGULAR: MACH ± BEND ±
TWO PLACE DECIMAL ±
THREE PLACE DECIMAL ±
INTERPRET GEOMETRIC
TOLERANCING PER:
MATERIAL
FINISH
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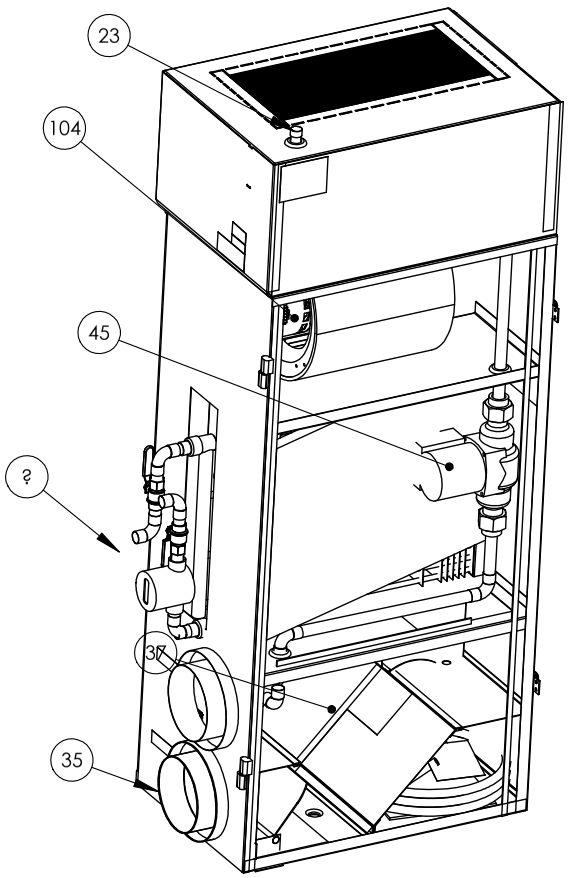


HOT WATER RETRUN, & EA TO OUTSIDE AT BACK

21	HOT WATER IN
110	ECM
61	CIRCULATOR
45	BTU METER
37	EA FROM SPACE
35	OUTSIDE AIR

NEXT ASSY	USED ON	
APPLICATION		

UNLESS OTHERWISE SPECIFIED:
DIMENSIONS ARE IN INCHES
TOLERANCES:
FRACTIONAL ±
ANGULAR: MACH ± BEND ±
TWO PLACE DECIMAL ±
THREE PLACE DECIMAL ±
INTERPRET GEOMETRIC TOLERANCING PER:
MATERIAL
FINISH
DO NOT SCALE DRAWING

	NAME	DATE
DRAWN	bg	May 2006
CHECKED		
ENG APPR.		
MFG APPR.		
Q.A.		

COMMENTS:

TITLE: M409-17-3-C-2

SIZE	DWG. NO.	REV
B	10300	

SCALE: 1:8 | WEIGHT: | SHEET 3 OF 3

warmboard®
RADIANT SUBFLOOR

Any type of flooring can be installed right on top of Warmboard. Even hardwood nails directly to it. And because the tubing is always visible, tubing damage is easily avoided.

A thick aluminum surface is permanently bonded to the plywood, and conducts heat evenly and efficiently from the tubing to the floor surface.

Standard 1/2" PEX tubing installs into Warmboard's channel. The close fit with the channel provides a large thermal contact area with the aluminum surface for efficient heat conduction.

Protective paint cuts glare during installation and helps make chalk lines more visible.

Although it installs like a conventional subfloor, Warmboard is actually a high-performance radiant heating system platform and subfloor all-in-one.

Warmboard's foundation is 1 1/8" ICC approved plywood subfloor.

Approved Tubing List- Pex Aluminum Pex Only

The tubing types/brands listed below are approved for use with Warmboard panels:

Barrier PEX Tubing 1/2" I.D.:

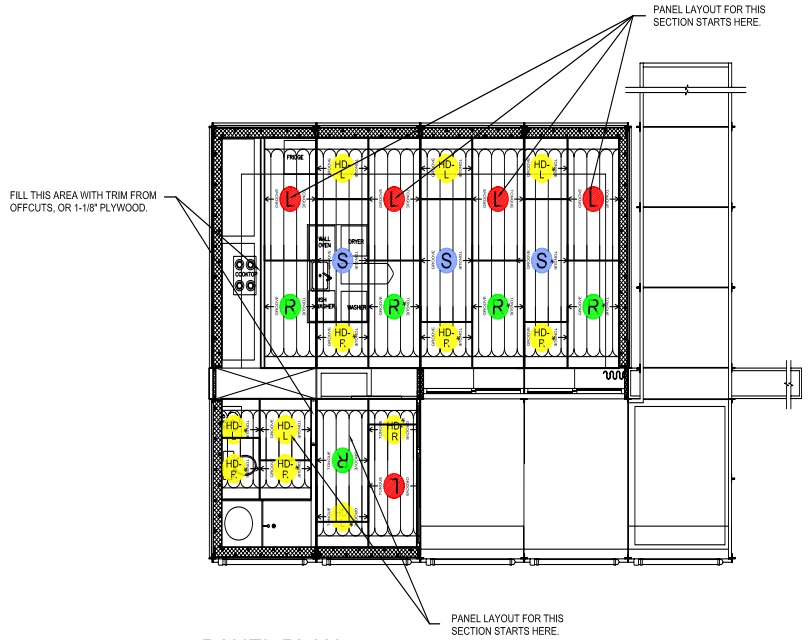
- Kitec- Pex Aluminum Pex
- Weil-McLain- Pex Aluminum Pex
- Uponor Multi-Cor composite tubing(formerly Wirsbo)- Pex Aluminum Pex
- Vangard- Pex Aluminum Pex
- Mr. Pex- Pex Aluminum Pex
- Infloor Heating Systems- Pex Aluminum Pex
- RHT- Pex Aluminum Pex
- Roth- Pex Aluminum Pex
- Aqua- Pex Aluminum Pex
- Watts- Pex Aluminum Pex
- EHT(Efficient Heating Technology)- Pex Aluminum Pex
- Henco- Pex Aluminum Pex

A note about PEX Aluminum PEX:

Other brands of Pex Aluminum Pex may be acceptable, please check with Warmboard's Technical Department. The use of Pex Aluminum Pex does eliminate the need for Silicone during installation.

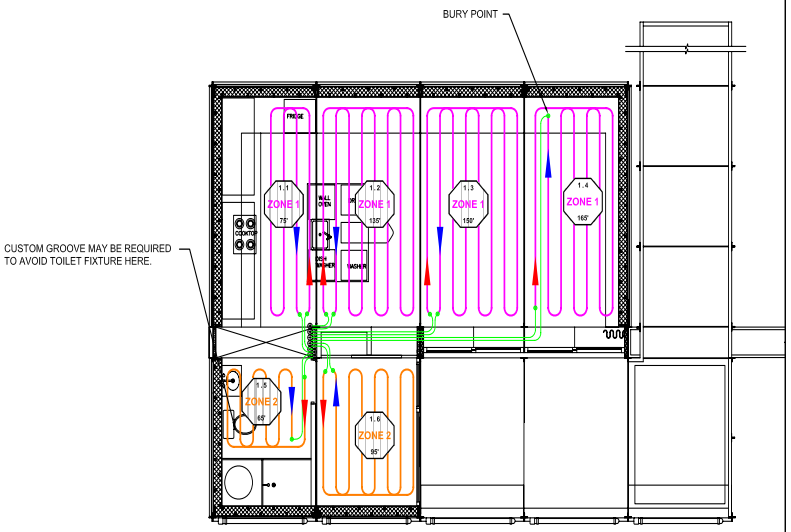
For technical assistance call Warmboard toll-free 1-877-338-5493

University of Cincinnati [re]FORM HOUSE



PANEL PLAN

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



TUBING PLAN

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

PANEL SCHEDULE		
TYPE	QUANTITY	COMMENTS
S	3	1
L	5	1
R	5	1
D	6	1 2
P	0	3

1. ANY PANELS IN THE DRAWING THAT ARE MARKED WITH AN ASTERIX (*) INDICATE A PANEL THAT IS TO BE TRIMMED. A CAREFUL MEASUREMENT SHOULD BE MADE TO GUARENTEE A CORRECT INSTALLATION.
2. DOUBLE PANELS WILL CONSIST OF A "HALF DOUBLE-LEFT" PANEL AND A "HALF DOUBLE-RIGHT" PANEL. ON THE PANEL LAYOUT, YOU MAY SEE A PANEL MARKED AS "HD-L" OR "HD-R." THIS MEANS THAT YOU CUT ONE OF THESE DOUBLE PANELS IN HALF AND USE THE APPROPRIATE SIDE AS MARKED FOR THE INSTALLATION.
3. CONVENTIONAL TONGUE AND GROOVE PLYWOOD PANELS USED TO FILL IN EMPTY SPACES WHERE WARMBOARD MAY NOT BE APPROPRIATE.

WARMBOARD LEGEND	
S STRAIGHT PANEL	TUBING
L LEFT TURN PANEL	BURIED TUBING
R RIGHT TURN PANEL	JOIST
D DOUBLE TURN PANEL	CUSTOM GROOVE
HD-R HALF DOUBLE PANEL-RIGHT TURN	MANIFOLD, LOOP, ZONE, LENGTH; SUPPLY; RETURN
HD-L HALF DOUBLE PANEL-LEFT TURN	MANIFOLD
P CONVENTIONAL PLYWOOD PANEL	

IMPORTANT NOTE: INSULATION BELOW WARMBOARD IS MANDATORY FOR PROPER PERFORMANCE.
AN ASTERISK "*" DENOTES A TRIMMED PANEL.

LOOP SCHEDULE			
ZONE	MANIFOLD	LOOP	LENGTH
ZONE 1	1	1	75'
ZONE 1	1	2	135'
ZONE 1	1	3	150'
ZONE 1	1	4	165'
ZONE 2	1	5	65'
ZONE 2	1	6	95'
		TOTAL	685'

MANDATORY

INSTALLING CONTRACTOR IS RESPONSIBLE TO VERIFY ALL MEASUREMENTS PRIOR TO ANY WARMBOARD INSTALLATION.

FOLLOW ALL WARMBOARD INSTALLATION INSTRUCTIONS AND RPA GUIDELINES.

USE ONLY WARMBOARD APPROVED TUBING.

USE AN APPROPRIATELY WEIGHTED ROLLER TO PRESS TUBING INTO CHANNELS.

QUESTIONS? FOR IMMEDIATE ASSISTANCE
1-877-338-5493 (8am - 5pm PST)

REVISIONS:	BY:
5/7/2007	SN

WARMBOARD, INC.
8035 SOQUEL DR. SUITE 41-A
APTOS, CA 95003
VOICE: (877)338-5493 FAX: (831)685-9279
WWW.WARMBOARD.COM EMAIL: PLANS@WARMBOARD.COM

warmboard® RADIANT SUBFLOOR

UNIVERSITY OF CINCINNATI
JOB # 17738
(SOLAR DECATHALON)

PANEL-TUBE LAYOUT

DATE: 4/27/2007
SCALE: 1/4" = 1'
DRAWN: S. NIEBURGS
REVIEWED: J. M.
SHEET: 1 OF 2

Radiant Floor A.28

Kentucky Tank

Specialty Tanks

Kentucky Tank offers three different types of 'Specialty Tanks'.
The first, Free Standing Tank, makes it possible to leave the tank without a support frame.
The Standing Tank with a frame is made to fit through a conventional doorway.
Low Profile and Box Tanks are designed to fit where height is a factor, their low height makes them easy to transport and perfect to put under a cottage or cabin.

						Premium Weight
Gallon Capacity	Normally in Stock	Width	Height	Length	Fill/Outlet	Item #
300 Free Standing		29"	49"	62"	16"/¼"	41869
375 W/ Frame		30"	60"	62"	16"/¼"	40480
400 Free Standing		29"	65"	62"	16"/¼"	41247
1250 Low Profile		85"	35"	132"	16"/2"	40756
1500 Low Profile		81"	41"	130"	16"/2"	41392
2400 Box		90"	50"	150"	16"/2"	40912

Accessories:

Holding Tank Accessories

Lids
Hose
Valves
Bulkhead Fittings
Bolted Fittings
Cam Action Couplers & Adapters

CORROSION RESISTANT SHALLOW WELL JET/TANK SYSTEM

Corrosion-resistant shallow well jet/tank system is ideal for compact installations where space is at a premium. Pump comes already mounted on tank so installation time is minimum. Also saves purchasing separate hook-up kit. Ideal for shallow well applications with pumping levels of 25′ or less.

Pumps are listed to UL Standards for Safety by Underwriters Laboratories, Inc. Tanks are UL Classified to ANSI/NSF 61, Drinking Water System Components

FP401215H

1/2 HP

1 Year Warranty

Pump Features

- Superior performance at depths to water of 25′ or less
- Capacities up to 8 gallons per minute at 40 PSI
- Fiberglass-reinforced thermoplastic pump housing for the highest corrosion resistance
- Heavy-duty A.O. Smith motor
- Ready-to-install 230 volt motor – see manual for 115 volt conversion
- Self-priming after pump housing is initially filled (Check Valve or Foot Valve required)
- Pressure switch pre-wired with 30-50 PSI pressure setting
- 1-1/4″ NPT suction and 3/4″ NPT discharge pipe sizes
- Serviceable unit

Tank Features

- Pre-charged 15 gallon tank is more efficient than conventional tanks of the same physical size, because it delivers up to twice the amount of water between pump cycles
- Extends pump life; maximum draw down (usable water) is provided consistently on every cycle
- Rugged construction of heavy gauge steel with baked-on finish on outside for maximum corrosion resistance
- Air/water separator eliminates "water logging"
- Water never touches metal components

PERFORMANCE INFORMATION

Model	HP	Motor Voltage	Pressure Switch On	Pressure Switch Off	Gallons per Minute Pumped at Different Depths to Water* 5′	10′	15′	20′	25′	Pressure Shut-Off at Max. Depth
FP401215H	1/2	115/230	30	50	5	5	4.6	4.3	3.2	64 PSI

*All performances shown in gallons per minute at 40 PSI (pounds per square inch) discharge pressure.

VIESMANN

VITOCELL-V 300

Indirect-fired domestic hot water storage tank
53 to 120 USG / 200 to 450 ltr

Technical Data Manual

Model Nos. and pricing: see Price List

53 and 79 USG /
200 and 300 liter capacity

120 USG / 450 liter
capacity

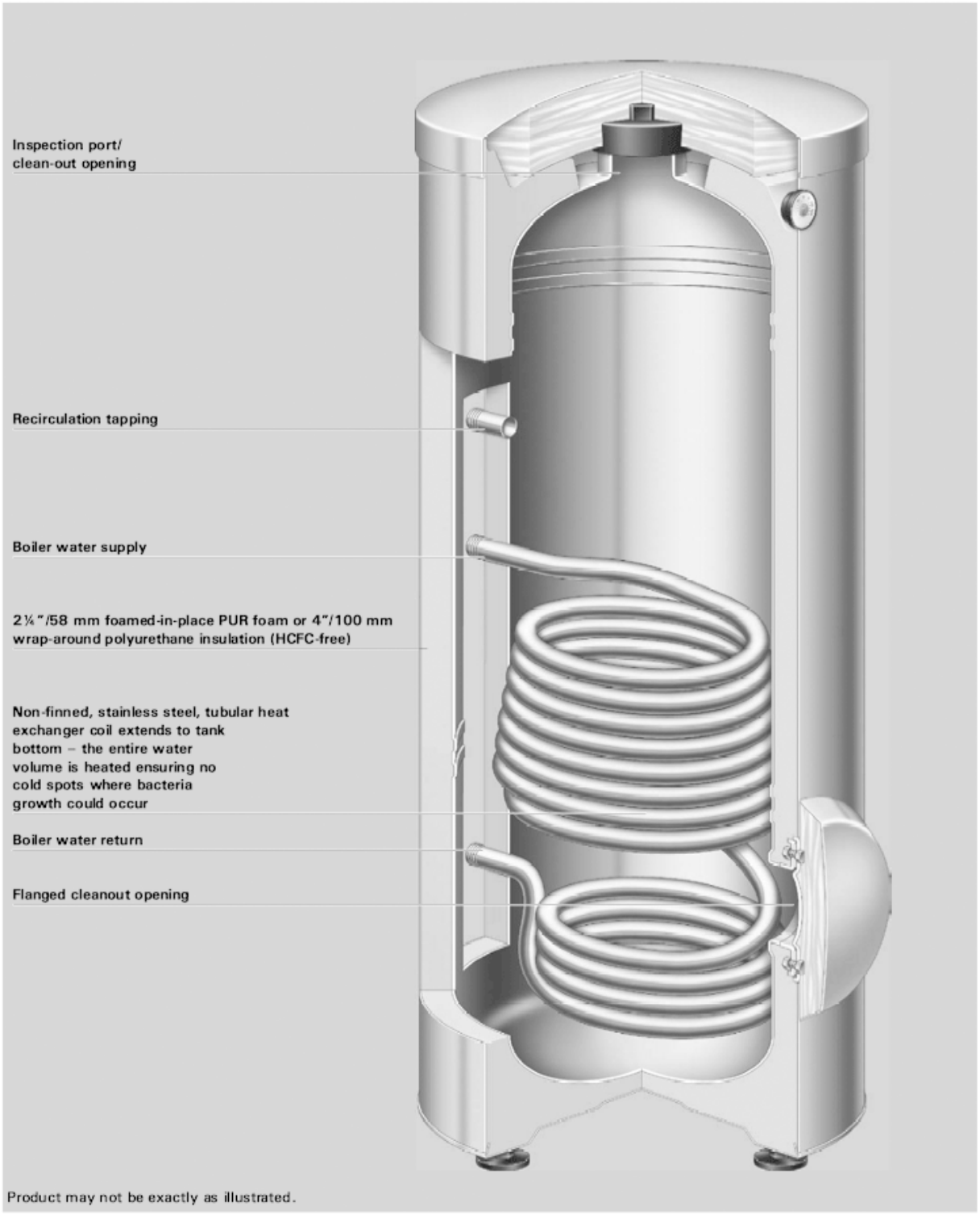
Vitocell-V 300

EVI Series

Vertical indirect-fired domestic hot water storage tank
of high-grade stainless steel

This tank version is not suitable for steam heating applications.

5167 410 v2.1 04/2004


Inspection port/
clean-out opening
Recirculation tapping
Boiler water supply
2¼"/58 mm foamed-in-place PUR foam or 4"/100 mm
wrap-around polyurethane insulation (HCFC-free)
Non-finned, stainless steel, tubular heat
exchanger coil extends to tank
bottom – the entire water
volume is heated ensuring no
cold spots where bacteria
growth could occur
Boiler water return
Flanged cleanout opening
Product may not be exactly as illustrated.

5167 410 v2.1

Vitocell-V 300

Fully hygienic, efficient and economical domestic hot water production with DHW tanks of high-grade stainless steel – vertical version.

The benefits at a glance:

- Corrosion-resistant tank of **high-grade SA 240-316 Ti stainless steel** offers a long service life.
- Fully hygienic due to **high quality homogeneous stainless steel surfaces.**
- The high alloy material is immune to cracking or peeling. The tank stays hygienic and requires only minimum service.
- **Does not require a consumable anode** for corrosion protection.
- The entire water content is heated by a **1¼" / 32 mm diameter stainless steel heat exchanger surface which extends to the bottom of the tank.**
- The positioning of the tubular heat exchanger coil further ensures that 82 to 97% of the tank volume can be drawn at **constant water temperature.**
- The stainless steel heat exchanger coil is self-venting towards the top and self-draining towards the bottom, therefore not susceptible to reduced heat transfer due to air lock or deposits.
- **Universally suitable** – for applications requiring larger quantities of hot water, multiple vertical tanks can be combined via headers to form tank batteries.
- **Standby losses minimized** by 2¼"/ 58 mm highly effective, foamed-in-place or 4"/100 mm wrap-around HCFC-free insulation.
- **Easy transport** into mechanical room due to low weight and compact construction.

5167 410 v2.1

Technical data

For domestic hot water heating applications which utilize modulating and low temperature hot water heating boilers			Suitable for heating systems with: ■max. working pressure on heat exchanger side up to 220 psig at 392°F / 200°C ■max. working pressure on DHW water side of up to 150 psig at 210°F / 99°C		
Storage capacity		USG	53	79	120
		ltr	200	300	450
Recovery rates[*1] with a temperature rise of the domestic hot water from **50 to 140°F / 10 to 60°C** and heating water supply temperature of ..... at the supply flow rate stated below	194°F 90°C	MBH	215	280	276
		GPM	4.7	6.2	6.1
		ltr/h	1084	1410	1393
	176 °F 80°C	MBH	164	201	212
		GPM	3.6	4.5	4.7
		ltr/h	826	1014	1066
	158 °F 70°C	MBH	99	140	147
		GPM	2.1	3.1	3.3
		ltr/h	499	705	739
Supply flow rate for the recovery rates stated		GPM	22.0	22.0	28.6
		m^3/h	5.0	5.0	6.5
Standby losses[*2]		MBH/24 h	5.5	6.8	9.2
Overall dimensions with insulation[*3]					
Overall width	inches		22 7/8	25	36 1/3
	mm		581	633	923
Overall depth	inches		25 ½	27 ¾	38 3/8
	mm		649	704	974
Overall height	inches		56	70	69 ½
	mm		1420	1779	1767
Tilt height	inches		58	71 ¾	66 ½
	mm		1471	1821	1690
Weight		lbs	168	220	245
Tank with insulation		kg	76	100	111
Heating water content		USG	2.64	2.91	4.0
(heat exchanger pipe coil)		ltr	10	11	15.0
Heat exchanger surface area		ft^2	14	16	20.5
		m^2	1.3	1.5	1.9
Connections					
Heating water supply/return		Ø'' (male thread)	1	1	1 ¼
Domestic cold/hot water		Ø'' (male thread)	1	1	1 ¼
Temp. and press. relief valve		Ø'' (male thread)	1	1	1 ¼
Recirculation		Ø'' (male thread)	1	1	1 ¼

*[1] *When planning for the recovery rate as stated or calculated, allow for the corresponding circulation pump. The stated recovery rate is only achieved when the rated output of the boiler is equal to or greater than that stated under "Recovery rates". Please also refer to the corresponding sizing chart at the end of this manual.*

*[2] *Measured values are based on a room temperature of 68 °F / 20 °C and a domestic hot water temperature of 149 °F / 65 °C and can vary by ±5 %.*

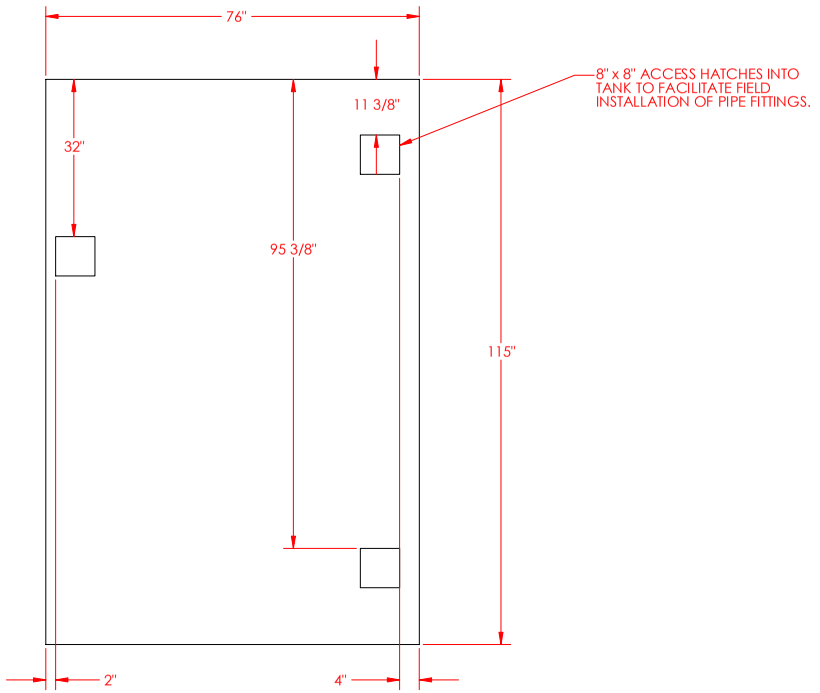
*[3] *For other dimensions, see illustration and table on page 5.*

▶ *For information regarding other Viessmann System Technology componentry, please reference documentation of the respective product.*

5167 410 v2.1

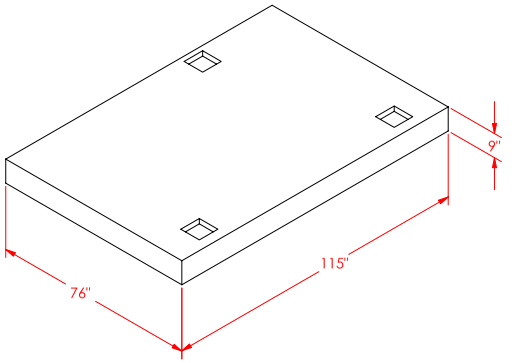
One (1) Grey Water Receiving Tank: Standard Specifications
Manufacturer: Modern Welding Company, Owensboro, KY

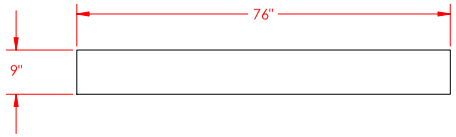
- Single wall above ground stainless steel tank
- Capacity: approximately 349 US Gallons
- Length = 96 inches, Width = 84 inches, Height = 10 inches
- Operating temperatures: $T_{max} = 49°C$, $T_{min} \approx T_{ambient} \approx 18.34°C$
- One (1) threaded entrance port, location to be determined
- One (1) threaded exit port, location to be determined
- Built per Underwriters Laboratories Standard UL 142 standard
- Modern's standard opening locations and required lifting lugs
- Exterior coated with one (1) coat of standard shop primer and not blast cleaned
- Maximum allowable working pressure of 0.5 psig measured from the top of tank, controlled by breather valve open to the atmosphere
- Emergency pressure relief valve opening
- Support may be two (2) saddles, stabilizers, or skid configuration

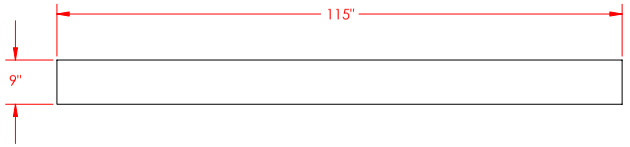


8" x 8" ACCESS HATCHES INTO TANK TO FACILITATE FIELD INSTALLATION OF PIPE FITTINGS.

NOTES:
1) MATERIAL: MILD STEEL, THICKNESS TBD
2) STIFFENERS MAY BE ADDED AS REQUIRED
3) WE REQUEST YOUR ADVICE ON ACCESS HATCH DETAIL







REVISIONS				
ZONE	REV.	DESCRIPTION	DATE	APPROVED

PROPRIETARY AND CONFIDENTIAL
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UNLESS OTHERWISE SPECIFIED:
DIMENSIONS ARE IN INCHES
TOLERANCES:
FRACTIONAL ± 1/8"
ANGULAR: MACH ± BEND ±
TWO PLACE DECIMAL ±
THREE PLACE DECIMAL ±
INTERPRET GEOMETRIC TOLERANCING PER:
MATERIAL --
FINISH --
DO NOT SCALE DRAWING

	DATE	NAME
DRAWN	6/5/07	JDS
CHECKED		
ENG APPR.		
MFG APPR.		
Q.A.		
COMMENTS:		

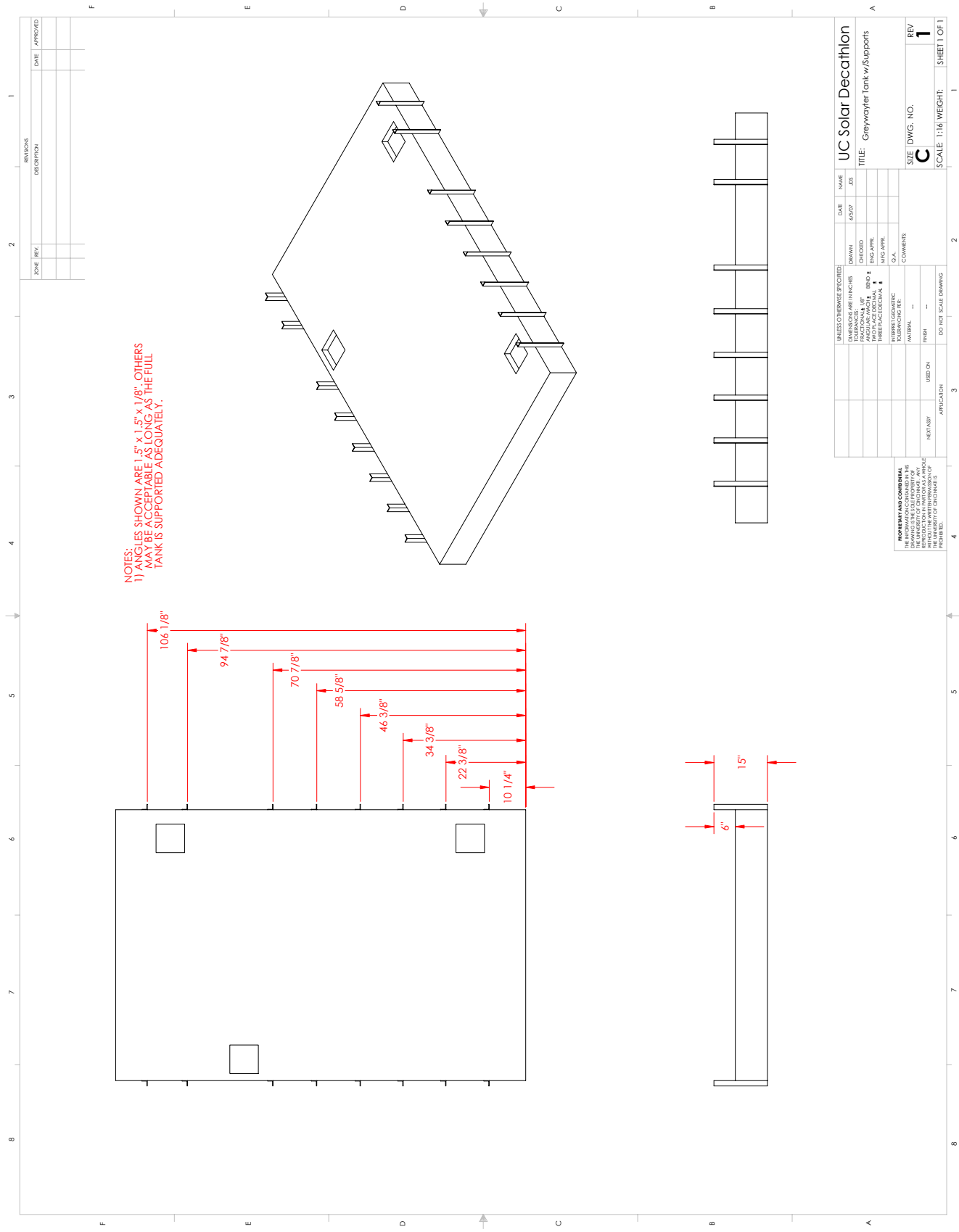
NEXT ASSY | USED ON | APPLICATION

UC Solar Decathlon

TITLE: Greywater Storage Tank

SIZE C | DWG. NO. | REV 1

SCALE: 1:16 | WEIGHT: | SHEET 1 OF 1


NOTES:
1) ANGLES SHOWN ARE 1.5" x 1.5" x 1/8". OTHERS MAY BE ACCEPTABLE AS LONG AS THE FULL TANK IS SUPPORTED ADEQUATELY.
106 1/8"
94 7/8"
70 7/8"
58 5/8"
46 3/8"
34 3/8"
22 3/8"
10 1/4"
15"
6"
UC Solar Decathlon
TITLE: Greywaster Tank w/Supports
SIZE C
DWG. NO.
REV 1
SCALE: 1:16 WEIGHT:
SHEET 1 OF 1

DHC-E Technical Data

Model		DHC-E 8		DHC-E 10	
Phase		1		1	
Voltage	V	208	240	208	240
Wattage	kW	5.4	7.2	7.2	9.6
Amperage	A	26	30	35	40
Min. Required circuit breaker size	A	30	40	40	50
Recemmended wire size	AWG COPPER	10	8	8	8
Maximum temperature increase	@0.75 GPM	49	65	65	87
above ambient water temp.	@1.00 GPM	37	49	49	65
	@1.50 GPM	25	33	33	44
Min. water flow to activate unit	GPM / lmin	0.29 / 1.1		0.29 / 1.1	
Pressure loss in unit	PSI / bar	1.46 / 0.1		1.46 / 0.1	
Weight	LB / kg	5.9 / 2.7			
Nominal water volume	Gal.	0.13 / 0.51			
Working pressure	PSI / bar	150 / 10			
Tested to pressure	PSI / bar	300 / 20			
Water connections		1 / 2" NPT			

35F SEALED
35F-MC MAG-DRIVE

Liquiflo
3-SERIES
ROTOGEAR®
GEAR PUMP

Sealed

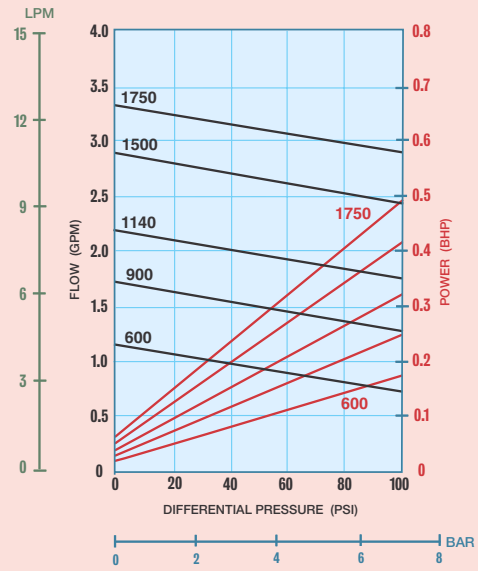
Close Coupled:
Sealed or Mag-Drive

PORT SIZE	1/2" NPT/BSPT/FLG
MAX FLOW	3.4 GPM; 12.9 LPM
MAX DIFFERENTIAL PRESSURE	100 PSI; 7 BAR
MAX DISCHARGE PRESSURE	300 PSI; 20.7 BAR
MAX TEMPERATURE	500˚F; 260˚C
MIN TEMPERATURE	-40˚F; -40˚C
MAX VISCOSITY	100,000* CPS
NPSHR @ 1750 RPM	2 FT; 0.6 M
LIFT (DRY)	4 FT; 1.2 M
WEIGHT (without motor)	
SEALED	3.5 LBS; 1.6 KGS
MAG-DRIVE	32 LBS; 15 KGS

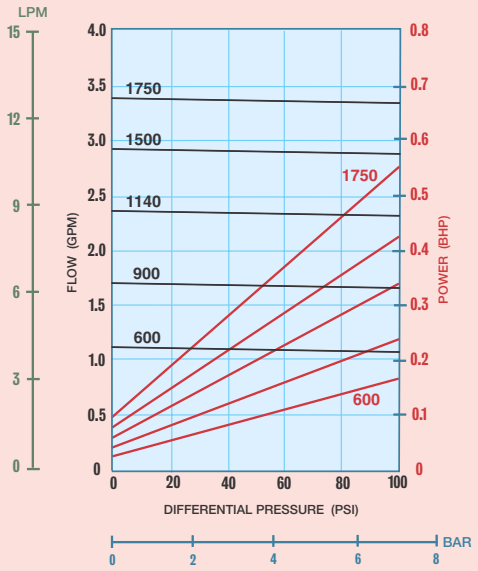
* Higher viscosities possible. Contact factory.

PERFORMANCE CURVES

1 CPS Fluid (Water)

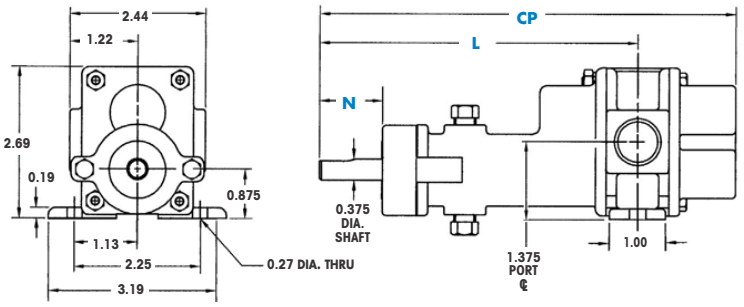


100 CPS Fluid (Oil)



Dimensional Data (inches)

Long-Coupled: 35F Sealed

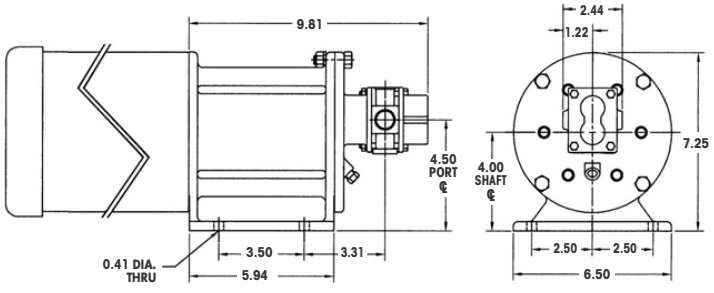


DIMENSION	SEAL CONFIGURATIONS PACKING SINGLE MECHANICAL SEAL DOUBLE MECHANICAL SEAL	EXTERNAL MECHANICAL SEAL	LIP SEAL
CP(1)	7.44	8.56	7.44
N	0.80 (2)	1.42	0.80
L	5.67	6.81	5.67

NOTES: (1) Add .312 inches for Bearing Flush Plug.
(2) Minimum dimension.

Dimensional Data (inches)

Close-Coupled: 35F-MC & 35F Sealed



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General Information
- Overview
- Specifications
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- Parts List
- Drawings
- Product Literature

More Information
- Locate Distributor
- Baldor Sales Offices

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AC Motors | Inverter Duty |

Product Overview: IDNM3538

Click for Larger Image

Catalog Number: IDNM3538
Description: .5HP,1725RPM,3PH,60HZ,56C,3516M,TENV,F1
Ship Weight: 32 lbs.
List Price: $392
Multiplier Symbol: E2

View Specifications

FEATURES

- Motors include provisions for encoder feedback mounting when used with closed loop velocity or position motor controls
- Meets NEMA MG 1, Part 31

APPLICATIONS

Conveyors, pumps, fans, metal processing, compressors, test stands, and material handling equipment. Designed for inverter or vector applications where up to a 1000:1 constant torque speed range is required.

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AC Motors | Inverter Duty |

Specifications: IDNM3538

Catalog Number:	IDNM3538
Specification Number:	35T995-1802G1
Horsepower:	.5 TE
Voltage:	230/460
Hertz:	60
Phase:	3
Full Load Amps:	1.6/.8
Usable at 208 Volts:	N/A
RPM:	1725
Frame Size:	56C
Service Factor:	1.00
Rating:	40C AMB-CONT
Locked Rotor Code:	N/A
NEMA Design Code:	B
Insulation Class:	H
Full Load Efficiency:	75.5
Power Factor:	N/A
Enclosure:	N/A
Baldor Type:	3516M
DE Bearing:	6205
ODE Bearing:	6203
Electrical Specification Number:	35WG1802
Mechanical Specification Number:	35T995
Base:	RG
Mounting:	F1

* For certified information, contact your local Baldor office.

37F SEALED
37F-MC MAG-DRIVE

Liquiflo
3-SERIES
ROTOGEAR®
GEAR PUMP

Sealed

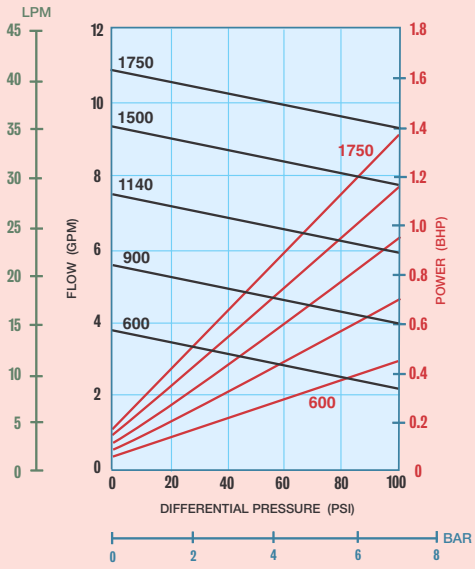
Close Coupled:
Sealed or Mag-Drive

PORT SIZE	3/4" NPT/BSPT/FLG
MAX FLOW	10.7 GPM; 40.5 LPM
MAX DIFFERENTIAL PRESSURE	100 PSI; 7 BAR
MAX DISCHARGE PRESSURE	225 PSI; 15.5 BAR
MAX TEMPERATURE	500˚F; 260˚C
MIN TEMPERATURE	-40˚F; -40˚C
MAX VISCOSITY	100,000* CPS
NPSHR @ 1750 RPM	5.2 FT; 1.6 M
LIFT (DRY)	7 FT; 2.1 M
WEIGHT (without motor)	
SEALED	6.5 LBS; 3 KGS
MAG-DRIVE	36 LBS; 16 KGS

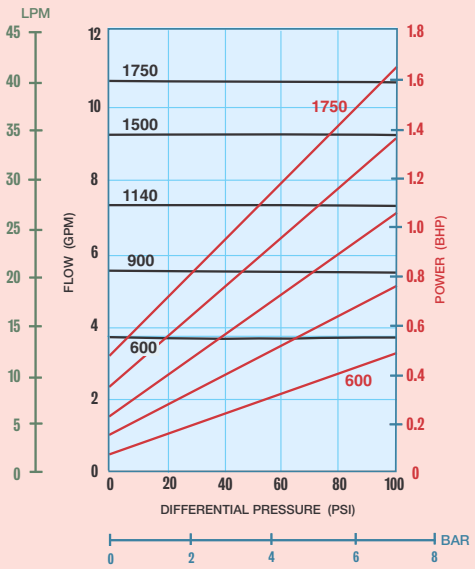
* Higher viscosities possible. Contact factory.

PERFORMANCE CURVES

1 CPS Fluid (Water)

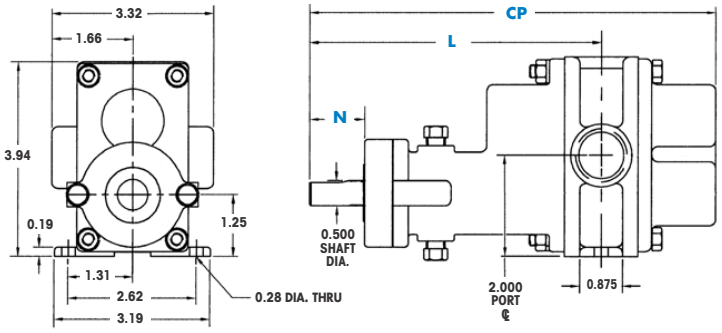


100 CPS Fluid (Oil)



Dimensional Data (inches)

Long-Coupled: 37F Sealed

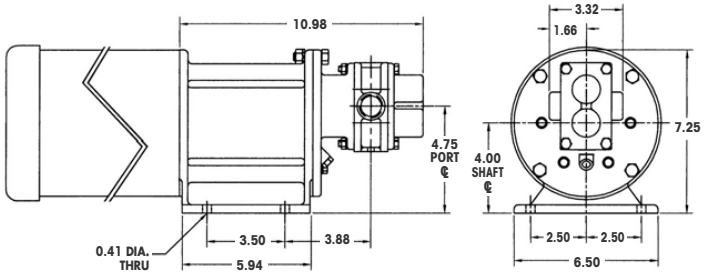


DIMENSION	SEAL CONFIGURATIONS PACKING / SINGLE MECHANICAL SEAL / DOUBLE MECHANICAL SEAL	EXTERNAL MECHANICAL SEAL	LIP SEAL
CP(1)	8.31	10.44	8.31
N	0.81(2)	2.31	0.81
L	5.98	8.10	5.98

NOTES: (1) Add .312 inches for Bearing Flush Plug.
(2) Minimum dimension.

Dimensional Data (inches)

Close-Coupled: 37F-MC & 37F Sealed



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AC Motors | Inverter Duty |

Product Overview: IDNM3581T

Click for Larger Image

Catalog Number: IDNM3581T
Description: 1HP,1725RPM,3PH,60HZ,143TC,0524M,TENV,F1
Ship Weight: 59 lbs.
List Price: $893
Multiplier Symbol: E2

View Specifications | View Operation Manual

FEATURES

- Motors include provisions for encoder feedback mounting when used with closed loop velocity or position motor controls
- Meets NEMA MG 1, Part 31

APPLICATIONS

Conveyors, pumps, fans, metal processing, compressors, test stands, and material handling equipment. Designed for inverter or vector applications where up to a 1000:1 constant torque speed range is required.

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AC Motors | Inverter Duty |

Specifications: IDNM3581T

Catalog Number:	IDNM3581T
Specification Number:	05E534W017G2
Horsepower:	1 TE
Voltage:	230/460
Hertz:	60
Phase:	3
Full Load Amps:	3.2/1.6
Usable at 208 Volts:	N/A
RPM:	1725
Frame Size:	143TC
Service Factor:	1.00
Rating:	40C AMB-CONT
Locked Rotor Code:	N/A
NEMA Design Code:	B
Insulation Class:	H
Full Load Efficiency:	81.5
Power Factor:	N/A
Enclosure:	N/A
Baldor Type:	0524M
DE Bearing:	6205
ODE Bearing:	6203
Electrical Specification Number:	05WGW017
Mechanical Specification Number:	05E534
Base:	RG
Mounting:	F1

* For certified information, contact your local Baldor office.

39R SEALED
39R-MC MAG-DRIVE

Liquiflo
3-SERIES
ROTOGEAR®
GEAR PUMP

Sealed

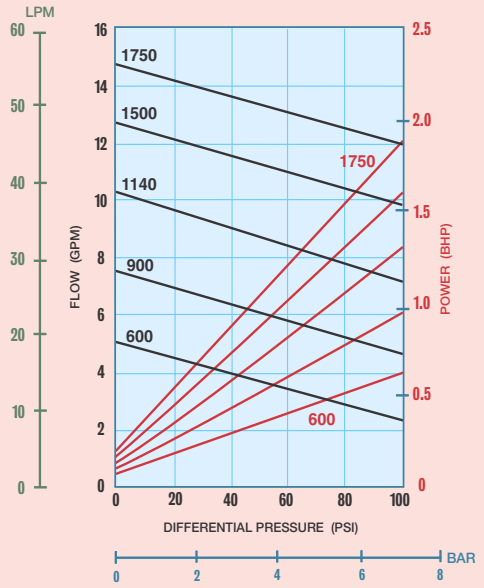
Close Coupled:
Sealed or Mag-Drive

PORT SIZE	1" NPT/BSPT/FLG
MAX FLOW	15 GPM; 57 LPM
MAX DIFFERENTIAL PRESSURE	100 PSI; 7 BAR
MAX DISCHARGE PRESSURE	225 PSI; 15.5 BAR
MAX TEMPERATURE	500˚F; 260˚C
MIN TEMPERATURE	-40˚F; -40˚C
MAX VISCOSITY	100,000* CPS
NPSHR @ 1750 RPM	4 FT; 1.2 M
LIFT (DRY)	6 FT; 1.8 M
WEIGHT (without motor)	
SEALED	8 LBS; 3.6 KGS
MAG-DRIVE	38 LBS; 17 KGS

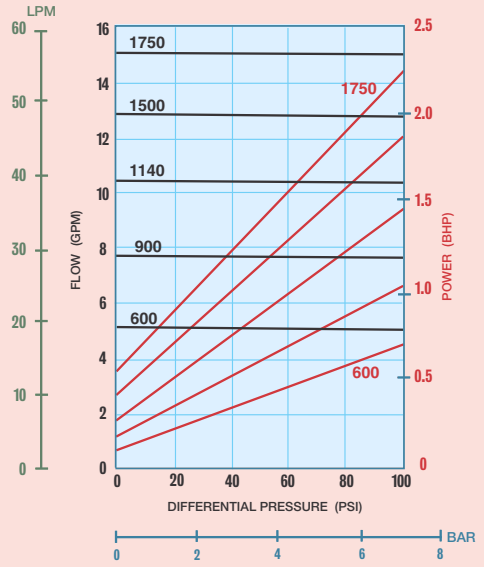
* Higher viscosities possible. Contact factory.

PERFORMANCE CURVES

1 CPS Fluid (Water)

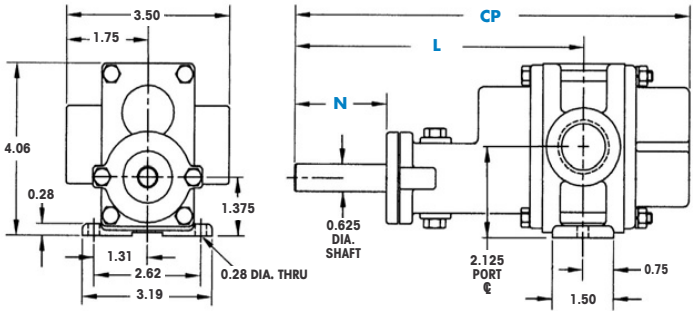


100 CPS Fluid (Oil)



Dimensional Data (inches)

Long-Coupled: 39R Sealed

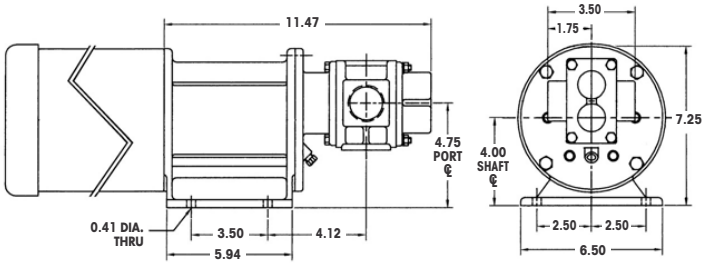


DIMENSION	SEAL CONFIGURATIONS PACKING SINGLE MECHANICAL SEAL DOUBLE MECHANICAL SEAL	EXTERNAL MECHANICAL SEAL	LIP SEAL
CP(1)	9.69	9.69	9.69
N	1.68 (2)	1.44	1.68
L	7.09	7.09	7.09

NOTES: (1) Add .312 inches for Bearing Flush Plug.
(2) Minimum dimension.

Dimensional Data (inches)

Close-Coupled: 39R-MC & 39R Sealed



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- Baldor Sales Offices

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AC Motors | Inverter Duty |

Product Overview: IDNM3587T

Click for Larger Image

Catalog Number: IDNM3587T
Description: 2HP,1740RPM,3PH,60HZ,143TC,0535M,TENV,F1
Ship Weight: 64 lbs.
List Price: $1,029
Multiplier Symbol: E2

View Specifications | View Operation Manual

FEATURES

- Motors include provisions for encoder feedback mounting when used with closed loop velocity or position motor controls
- Meets NEMA MG 1, Part 31

APPLICATIONS

Conveyors, pumps, fans, metal processing, compressors, test stands, and material handling equipment. Designed for inverter or vector applications where up to a 1000:1 constant torque speed range is required.

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AC Motors | Inverter Duty |

Specifications: IDNM3587T

Catalog Number:	IDNM3587T
Specification Number:	05E534W611
Horsepower:	2 TE
Voltage:	230/460
Hertz:	60
Phase:	3
Full Load Amps:	5.4/2.7
Usable at 208 Volts:	N/A
RPM:	1740
Frame Size:	145TC
Service Factor:	1.00
Rating:	40C AMB-CONT
Locked Rotor Code:	N/A
NEMA Design Code:	B
Insulation Class:	H
Full Load Efficiency:	84
Power Factor:	N/A
Enclosure:	N/A
Baldor Type:	0535M
DE Bearing:	6205
ODE Bearing:	6203
Electrical Specification Number:	05WGW611
Mechanical Specification Number:	05E534
Base:	RG
Mounting:	F1

* For certified information, contact your local Baldor office.

ASCO® Red-Hat®

Normally Closed or Normally Open

Steam and Hot Water Valves

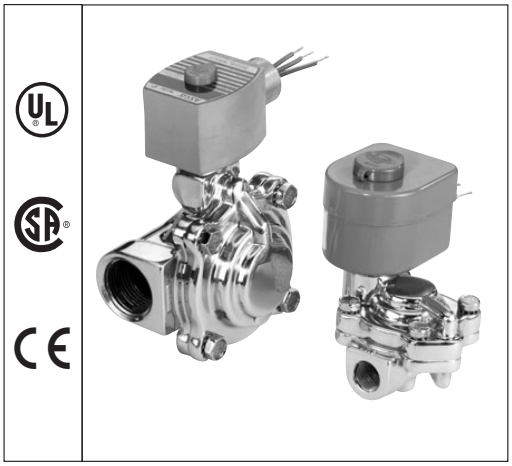
Brass or Stainless Steel Bodies
1/8" to 2 1/2" NPT

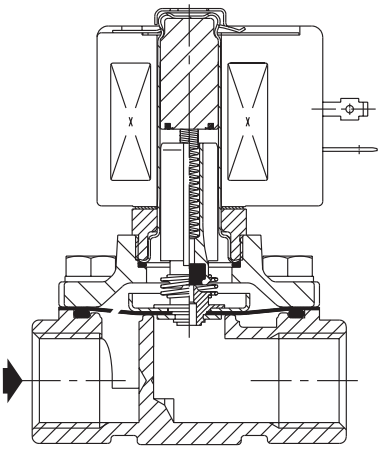
NC NO

2/2 SERIES Hot Water/ Steam

Features

- Handle the challenges of high-temperature fluids.
- PTFE and EPDM discs, stainless steel seats, plus high-temperature coils, help provide long, reliable service life.
- Wide range of valve constructions, including Straight Through and Slow Closing, with Normally Closed and Normally Open operation.
- Specify these valves for the high-temperature applications found in laundries, molding, steam atomization, sterilizers, autoclaves, and many others.
  - Series 8263: direct acting miniature valves.
  - Series 8267: direct acting straight through, self-cleaning design.
  - Series 8210/8222: pilot operated diaphragm valves.
  - Series 8220: heavy-duty, pilot operated piston valves have stainless steel pistons.
  - Series 8221: slow-closing, anti-water hammer design.
  - Series 8222: pilot operated diaphragm and piston valves. Y-body floating piston design.





8210

Construction

Valve Parts in Contact with Fluids		
Common Parts		
Body	Brass	Stainless Steel
Core Tube	305 Stainless Steel	
Core and Plugnut	430F Stainless Steel	
Springs	302 Stainless Steel	
Shading Coil	Copper	Silver
8210HW Series		
Seals, Discs, and Diaphragms	EPDM	
8263 Series		
Seals	PTFE	
Disc	EPDM or PTFE	
8220/8221 Series		
Piston	Stainless Steel	
Discs	EPDM or PTFE	
Seals	EPDM, PTFE	
8222 Series		
Seals, Discs, and Diaphragms	EPDM and/or PTFE	
Piston	Brass or PTFE	
8267 Series		
Seals	FKM, PTFE	
Disc	Stainless Steel	
Seat	Glass-Filled PTFE	

Electrical

See individual valve series in General Service Section for details.

Solenoid Enclosures

Standard: Red-Hat II - Watertight, Types 1, 2, 3, 3S, 4, and 4X; Red-Hat - Type 1.
Optional: Red-Hat II - Explosionproof and Watertight, Types 3, 3S, 4, 4X, 6, 6P, 7, and 9; Red-Hat - Explosionproof and Raintight, Types 3, 7, and 9. (To order, add prefix "EF" to catalog number.)
See Optional Features Section for other available options.

Nominal Ambient Temperature Ranges:

Red-Hat II/
Red-Hat AC: 32˚F to 125˚F (0˚C to 52˚C)

Red-Hat II DC: 32˚F to 104˚F (0˚C to 40˚C)
Red-Hat DC: 32˚F to 77˚F (0˚C to 25˚C)
(104˚F/40˚C occasionally)

Refer to Engineering Section for details.

Approvals:

Most are UL listed, CSA certified, and meet applicable CE directives. *Contact ASCO for details.*

Important: Explosionproof Catalog Numbers EF8210HW, EF8220, EF8221, and EF8263 are not UL listed. They are suitable for Types 4, 7 (C and D), and 9 (E and F) only, and have a temperature range code of T3A.

7.37 R2

ASCO®

Specifications (English units)

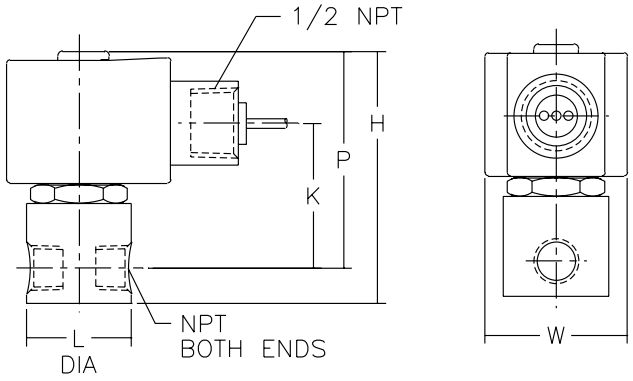
Pipe Size (ins.)	Orifice Size (ins.)	Cv Flow Factor	Operating Pressure Differential (psi) Hot Water Min. ④	Hot Water Max. AC	Hot Water Max. DC	Max. Fluid Temp. °F Hot Water AC	Hot Water DC	Brass Body Catalog Number	Brass Body Constr. Ref. No.	AC Watt Rating/ Class of Coil Insulation AC	AC Watt Rating/ Class of Coil Insulation DC
HOT WATER SERVICE ONLY - NORMALLY CLOSED (Closed when de-energized), EPDM Diaphragm											
3/8	5/8	3	0 ③	100	40	210	150	8210G93HW	32	10.1/F	11.6/F
3/8	5/8	3	5	125	100	210	150	8210G1HW	33	6.1/F	11.6/F
1/2	5/8	4	0 ③	100	40	210	150	8210G94HW	32	10.1/F	11.6/F
1/2	5/8	4	5	125	100	210	150	8210G2HW	33	6.1/F	11.6/F
3/4	3/4	5	0 ③	100	40	210	150	8210G95HW	34	10.1/F	11.6/F
3/4	3/4	5	5	125	100	210	150	8210G9HW	35	6.1/F	11.6/F
SLOW CLOSING - NORMALLY CLOSED (Closed when de-energized), EPDM Disc											
3/8	9/16	3	5 ②	150	-	210	-	8221G1HW	36	6.1/F	-
1/2	9/16	3.5	5 ②	150	-	210	-	8221G3HW	36	6.1/F	-
3/4	3/4	5.5	5 ②	150	-	210	-	8221G5HW	36	6.1/F	-
1	1	11.5	5 ②	150	-	210	-	8221G7HW	38	6.1/F	-
1 1/4	1 1/8	13	5 ②	150	-	210	-	8221G9HW	39	6.1/F	-
1 1/2	1 1/4	24	5 ②	150	-	210	-	8221G11HW	40	6.1/F	-
2	1 3/4	36	5 ②	150	-	210	-	8221G13HW	41	6.1/F	-
2 1/2	1 3/4	38	5 ②	150	-	210	-	8221G15HW	42	6.1/F	-
SLOW CLOSING - NORMALLY OPEN (Open when de-energized), EPDM Disc											
3/8	9/16	3	5 ②	150	-	210	-	8221G21HW	43	16.1/F	-
1/2	9/16	3.5	5 ②	150	-	210	-	8221G23HW	43	16.1/F	-
3/4	3/4	5.5	5 ②	150	-	210	-	8221G25HW	44	16.1/F	-
1	1	11.5	5 ②	150	-	210	-	8221G27HW	45	16.1/F	-
1 1/4	1 1/8	13	5 ②	150	-	210	-	8221G29HW	46	16.1/F	-
1 1/2	1 1/4	24	5 ②	150	-	210	-	8221G31HW	47	16.1/F	-
2	1 3/4	36	5 ②	150	-	210	-	8221G33HW	48	16.1/F	-
2 1/2	1 3/4	38	5 ②	150	-	210	-	8221G35HW	49	16.1/F	-

Pipe Size (ins.)	Orifice Size (ins.)	Cv Flow Factor	Operating Pressure Differential (psi) Min. ④	Max. Steam	Max. Hot Water	Max. Fluid Temp. °F Steam	Hot Water	Brass Body Catalog Number	Brass Body Constr. Ref. No.	Stainless Steel Body Catalog Number	Stainless Steel Body Constr. Ref. No.	AC Watt Rating/ Class of Coil Insulation
DIRECT ACTING - NORMALLY CLOSED (Closed when de-energized), Stainless Steel Seat, EPDM ⑤, or PTFE Disc												
1/8	1/8	.34	0	50	-	298	-	8263G52 ⑤	1	-	-	6.1/F
1/8	1/8	.34	0	90	-	331	-	8263G58	1	-	-	6.1/F
1/4	1/8	.34	0	50	-	298	-	8263G53 ⑤	2	-	-	6.1/F
1/4	1/8	.34	0	90	-	331	-	8263G59	2	-	-	6.1/F
1/4	5/32	.52	0	110	110	344	210	8263G300	3	-	-	10.1/H
1/4	7/32	.72	0	70	70	316	210	8263G301	3	-	-	10.1/H
1/4	9/32	.85	0	60	-	307	-	8263G303	3	-	-	17.1/H
3/8	1/8	.36	0	125	125	353	210	8263G304	3	8263G318	31	10.1/H
3/8	5/32	.52	0	110	110	344	210	8263G305	3	8263G319	31	10.1/H
3/8	7/32	.72	0	70	70	316	210	8263G306	3	8263G320	31	10.1/H
3/8	9/32	.85	0	60	-	307	-	8263G308	3	8263G321	31	17.1/H
PILOT OPERATED - NORMALLY CLOSED (Closed when de-energized)												
1/4	3/8	1.2	1	80	-	324	-	8222G68	4	-	-	6.1/F
1/4	3/8	1.2	1	125	-	353	-	8222G70	4	-	-	6.1/H
3/8	3/8	2.5	1	80	-	324	-	8222G64	4	-	-	6.1/F
3/8	3/8	2.5	1	125	-	353	-	8222G74	4	-	-	6.1/H
3/8	5/8	3.0	5 ①	50	150	300	210	8220G1	5	-	-	10.1/F
3/8	5/8	3.0	5 ①	125	150	353	210	8220G19	5	-	-	10.1/H
3/8	5/8	3.0	0	125	-	353	-	8222G1	6	-	-	17.1/H
3/8	5/8	3.0	0	50	-	300	-	8222G93	7	-	-	10.1/F
1/2	3/8	2.5	1	80	-	324	-	8222G66	4	-	-	6.1/F
1/2	3/8	2.5	1	125	-	353	-	8222G76	4	-	-	6.1/H
1/2	1/2	3.6	2	125	-	353	-	8222G47	9	-	-	10.1/H
1/2	5/8	4.0	0	50	-	300	-	8222G94	7	8222G60	28	10.1/F
1/2	5/8	4.0	0	125	-	353	-	8222G2	6	8222G87	29	17.1/H
1/2	5/8	4.0	5 ①	50	150	300	210	8220G3	5	-	-	10.1/F
1/2	5/8	4.0	5 ①	125	150	353	210	8220G21	5	-	-	10.1/H

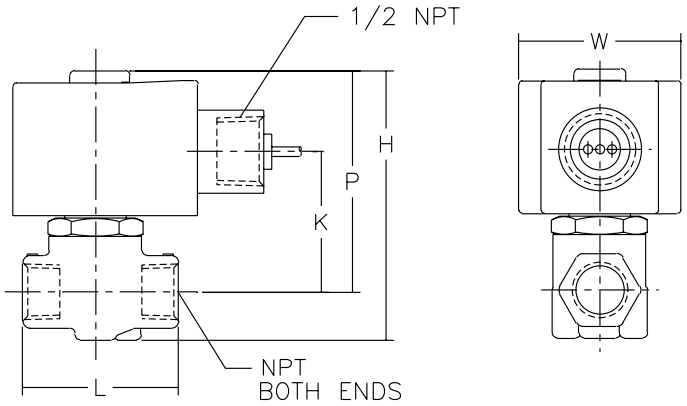
Dimensions: inches (mm)

Const. Ref. No.		H	K	L	P	W
1	**ins.**	2.52	1.30	Ø 1.19	2.16	1.69
	mm	64	33	Ø 30	55	43
2	**ins.**	3.01	1.73	Ø 1.25	2.59	1.69
	mm	76	44	Ø 32	66	43
3	**ins.**	3.25	1.70	1.88	2.67	1.95
	mm	83	43	48	68	50
4	**ins.**	4.17	3.25	2.28	3.63	1.69
	mm	106	83	58	92	43
5	**ins.**	4.05	2.52	2.75	3.48	2.28
	mm	103	64	70	88	58
7	**ins.**	3.84	2.31	2.75	3.28	2.29
	mm	98	59	70	83	58
8	**ins.**	4.34	2.68	2.81	3.65	2.28
	mm	110	68	71	93	58
9	**ins.**	4.81	3.62	2.75	4.01	1.95
	mm	122	92	70	102	50
10	**ins.**	4.14	2.47	2.81	3.44	2.29
	mm	105	63	71	87	58
12	**ins.**	4.81	3.63	2.75	4.01	1.95
	mm	122	92	70	102	50
32	**ins.**	3.84	2.31	2.75	3.28	2.29
	mm	98	59	70	83	58
33	**ins.**	3.36	1.94	2.75	2.80	2.28
	mm	85	49	70	71	58
34	**ins.**	4.13	2.47	2.81	3.44	2.29
	mm	105	63	71	87	58
35	**ins.**	3.66	2.10	2.81	2.96	2.28
	mm	93	53	71	75	58

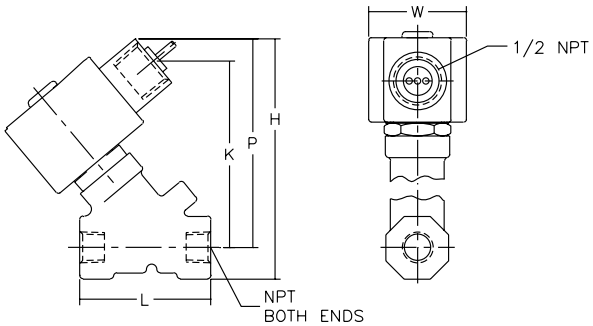
Constr. Ref. 1, 2



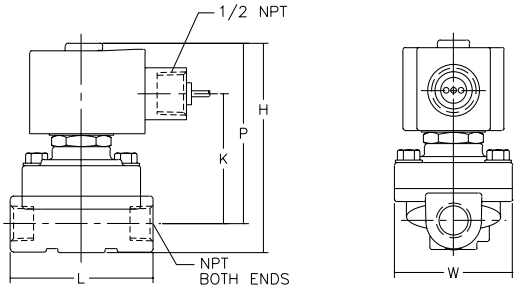
Constr. Ref. 3



Constr. Ref. 4, 9, 12



Constr. Ref. 5, 7, 8, 10, 32-35



7.42 R2

Honeywell

SUBMITTAL DATA/INSTRUCTION SHEET SD/IS 150	EFFECTIVE March 3, 2004 Supercedes JUNE 1, 2002

SPARCOMIX™ AM SERIES™

ANTI-SCALD PROPORTIONAL THERMOSTATIC MIXING AND DIVERTING VALVE PATENTED, WITH DUAL ASSE 1016 AND 1017 CERTIFICATION and IAPMO APPROVAL IN ONE VALVE

SUBMITTAL DATA APPROVAL SHEET

For:_____
Job:_____
Date submitted: _____by: _____
Date approved: _____by: _____
Model number: _____quantity: _____
Model number: _____quantity: _____
Model number: _____quantity:

INSTALLER

1. Write hand wheel setting on CAUTION label and sign in space provided.
2. Attach CAUTION label to SparcoMix Valve.
3. Explain CAUTION label to owner.
4. Deposit this instruction sheet with owner.

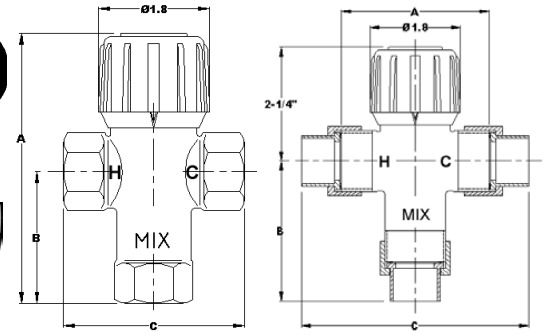
ASSE 1016 APPLICATIONS-POINT OF USE:

Individual showers, baths, or a combination of both, automatic faucets, nursing homes, public facilities and wherever ASSE 1016 valves are required.

ASSE 1017 APPLICATION-SOURCE OF HOTWATER:

MASTER MIXING OR DIVERTING Any application requiring accurate control of water temperature based on mixing of hot and cold water such as:

- ☐ Domestic Water
- ☐ Space Heating
- ☐ Radiant Heating
- ☐ Public Facilities
- ☐ Nursing Homes
- ☐ Greenhouses
- ☐ Photo Processing
- ☐ Solar Hot Water
- ☐ Heat Pump Systems
- ☐ Hydronic Heat
- ☐ Combo Heating
- ☐ Industrial Applications



PRODUCT INFORMATION:

PRODUCT NUMBER	SIZE	MAX FLOW * GPM	Cv	TEMP. RANGE	A	B	C	WT. LBS.	CERT. TO ASSE STD
AM100-1 AM101-1 AM102-1	1/2" 3/4" 1"	8 12 16	3.2 3.8 4.3	100-145 °F	5.0	2.7 2.7 2.7	3.0 3.0 3.3	1.2 1.3 1.6	1016 AND 1017
AM100-US-1 AM101-US-1 AM102-US-1	1/2" 3/4" 1"	8 12 16	3.9 3.9 3.9	100-145 °F	3.15	2.7 2.9 3.5	4.4 4.9 6.1	1.6 1.7 1.9	1016 AND 1017
AM100-UT-1 AM101-UT-1 AM102-UT-1	1/2" 3/4" 1"	8 12 16	3.9 3.9 3.9	100-145 °F	3.15	2.9 3.8 3.9	4.8 6.5 7.0	1.8 2.1 2.3	1016 AND 1017
AM100B-1 AM101B-1 AM102B-1	1/2" 3/4" 1"	8 12 16	3.2 3.8 4.3	60-100 °F	5.0	2.7 2.7 2.7	3.0 3.0 3.3	1.2 1.3 1.6	N/A
AM100B-US-1 AM101B-US-1 AM102B-US-1	1/2" 3/4" 1"	8 12 16	3.9 3.9 3.9	60-100 °F	3.15	2.7 2.9 3.5	4.4 4.9 6.1	1.6 1.7 1.9	N/A
AM100B-UT-1 AM101B-UT-1 AM102B-UT-1	1/2" 3/4" 1"	8 12 16	3.9 3.9 3.9	60-100 °F	3.15	2.9 3.8 3.9	4.8 6.5 7.0	1.8 2.1 2.3	N/A
AM100C-1 AM101C-1 AM102C-1	1/2" 3/4" 1"	8 12 16	3.2 3.8 4.3	80-120 °F	5.0	2.7 2.7 2.7	3.0 3.0 3.3	1.2 1.3 1.6	1016 AND 1017
AM100C-US-1 AM101C-US-1 AM102C-US-1	1/2" 3/4" 1"	8 12 16	3.9 3.9 3.9	80-120 °F	3.15	2.7 2.9 3.5	4.4 4.9 6.1	1.6 1.7 1.9	1016 AND 1017
AM100C-UT-1 AM101C-UT-1 AM102C-UT-1	1/2" 3/4" 1"	8 12 16	3.9 3.9 3.9	80-120 °F	3.15	2.9 3.8 3.9	4.8 6.5 7.0	1.8 2.1 2.3	1016 AND 1017
AM100R-US-1 AM101R-US-1 AM102R-US-1	1/2" 3/4" 1"	8 12 16	3.9 3.9 3.9	80-180 °F	3.15	2.7 2.9 3.5	4.4 4.9 6.1	1.6 1.7 1.9	N/A
AM100R-UT-1 AM101R-UT-1 AM102R-UT-1	1/2" 3/4" 1"	8 12 16	3.9 3.9 3.9	80-180 °F	3.15	2.9 3.8 3.9	4.8 6.5 7.0	1.8 2.1 2.3	N/A

*Maximum recommended flow rate.
Connections **-US** models: Union Sweat;**-UT** models: Union NPT (Female). All other valves are NPT (Female).

SPECIFICATION:

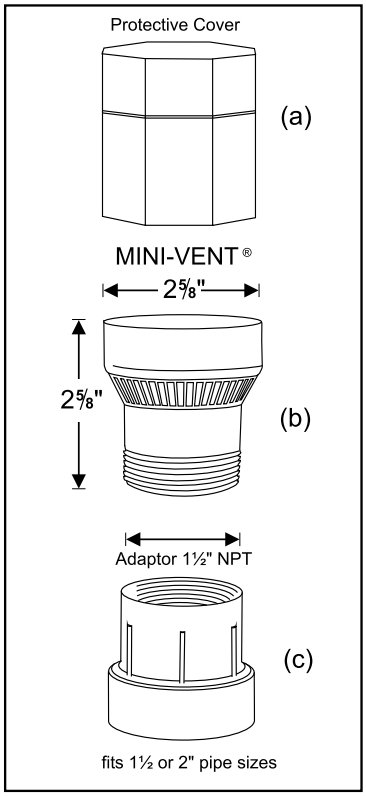
- **Dual certification ASSE 1016 – T and ASSE 1017**
- **IAPMO Approved**
- Constant water temperature under different operating conditions.
- Proportional valve (simultaneous control of hot and cold water).
- Anti-scald, Anti-chill thermal shock protection at correct setting.
- Temperature high limit or low limit range restriction, (Except R models).
- Nickel plated brass/bronze construction, EPDM o-rings.
- Straight thru design (hot and cold at same level).
- Maximum working pressure 150 psi (1034 kPa).
- Maximum hot water supply temperature 212 ° F (100ºC).
- Designed for easy maintenance and element replacement. See page 6.
- Union Sweat, Union Threaded, and NPT (Female) connections available, 1/2" through 1".
- **Teflon® coated spool and body to prevent mineral buildup and extend life.**
- Minimum required temperature difference between hot and mix 3°F.
- **Patent No. 6,079,625**
- **Made in USA.**

FEATURES:

- Energy savings through lower supply temperatures.
- Dual purpose mixing or diverting valve.
- **NRECA and Gas Research Institute recommended.**
- Trapping valve not recommended.

*Teflon is a registered trademark of Dupont

Specification Sheet / MINI-VENT®



Manufacturer: Studor®, Inc.
Item #: 20301 (PVC Connector)
20300 (ABS Connector)

Model: MINI-VENT®
Connection Size: 1½"-2"

General:

An air admittance valve shall be acceptable as a vent termination for any individual vent, common vent, circuit vent, loop vent, island fixture vent, vent stack or stack vent that is provided to prevent siphonage of a fixture trap. An air admittance valve can be used as an alternative to extending a vent through the roof (or sidewall) to the open atmosphere.

Location:

A. The MINI-VENT® should be located a minimum of 4" above the weir of the fixture trap for single fixture and branch venting and 6" above the flood level of the highest fixture for stack venting.
B. Each valve should be installed in an accessible location.

Installation:

A. The valve should be connected to the piping in accordance with the manufacturer's installation instructions.
B. The valve should be installed in the vertical, upright position after rough-in and pressure testing of the DWV system.
C. A minimum of one vent shall extend to the open atmosphere for every building drainage system.
D. The valve should not be installed as a vent terminal for any special(chemical) waste system or in supply and return air plenums.
E. The valve may be installed on sewer ejectors, if installed according to engineer design and prior local code approval.
F. For installation in areas with temperature ranges between -40°F and +150°F.

Features:

A. Screening on the inside and outside of the valve to protect the sealing membrane from insects and debris.
B. Protective cover for the air intake and additional insulation against extreme temperatures.
C. Ability to divert condensation away from the sealing membrane.
D. Lifetime Warranty.

Materials:

(a) Polystyrene
(b) ABS (acrylonitrile butadiene styrene) valve with elastromeric membrane
(c) ABS or PVC Adaptor

Performance Standards:

- ASSE 1051 (revised 2002) single fixture and Branch type AAVs
- ASSE 1050 (revised 2002) Stack Type AAVs
- NSF Standard 14 (Plastic Components)

Code Approvals:

- International Plumbing Code (IPC) 2003 Edition
- Southern Building Code Council International (SBCCI) 1994 Edition
- Building Official Code Administration (BOCA) 1993 Edition
- International Residential Code (IRC) 2003 Edition
- Uniform Plumbing Code (UPC) Section 301.2 Alternative Materials and Methods 2003 Edition

Listings:

- ASSE Seal of Approval
- National Evaluation Services (NES-592)
- NSF International (NSF Standard 14)
- NSF International (ASSE Performance Standard 1051 and ASSE 1050)
- IAMPO Classified Marking, file No. C-3803
- Warnock Hersey (ITS - Intertek Testing Services)

Sizing Chart

Horizontal Branch Size	Max DFUs
1½"	3
2"	6
3"	20
4"	160
Stack Size	**Max DFUs**
1½"	8
2"	24

THE MAYTAG HOME

Washers

Maytag® Washers

COLORS

White - $779.00
MAH2400AWW

DIMENSIONS

Width: 23-3/4"

Height: 33-1/2"

Depth: 25-1/2"

model **MAH2400AWW**

KEY BENEFITS

Wash/Rinse Options

- **Five water temperature combinations**
- **Delay Start option - delays starting the machine by up to 19 hours so you can run it while you're away**
- **22 custom cycles - designed for all types of loads and fabrics, from extra-dirty to extra-delicate**
- **Extra Rinse, Rinse Only and Rinse & Spin options**
- **Extra Rinse option - ensures removal of residue and detergents; great for sensitive skin**
- **Cotton Sturdy, Wrinkle Control, Delicates, Hand Washables and Quick cycles**

Performance

- **High-efficiency - high-efficiency wash system saves up to $145 per year***
- **Flexible installation - fits flush in tight spaces, under counters or stacked to take up even less floor space**
- **1,200-rpm spin speed - removes more water so clothes require less time in the dryer**
- **ENERGY STAR® qualified - exceeds federal energy-efficiency standards**
- **IntelliFill™ water level control - automatically matches water level to load size**
- **Automatic temperature control - ensures correct water temperature for maximum cleaning**

Interior

- **Commercial-quality stainless steel wash basket - tough enough to stand up to everyday laundry; includes lifetime warranty**
- **TurboClean wash system - cleans without an agitator; washtub gently tumbles clothes through a pool of detergent and water**
- **Large interior capacity - easily handles your everyday-sized loads; handles up to 16 bath towels in a single load**
- **Detergent, bleach and fabric softener dispensers - dispense additives at just the right time in the cycle for best results**
- **No agitator - less wear and tear on clothes, so they look newer longer**
- **Self-cleaning lint filter system - prevents lint and dirt from reentering the tub and redepositing on clothes**

Exterior

- **Large door opening - easy to load and unload with the front-load design and large door opening**
- **Compact exterior - washer measures just 23 1/2" wide, 24" deep and 33 1/4" high; with 7/8" adjustable leveling legs.**

This model has been tested using the 2004 test procedure.
Compare only with models displaying this statement.

ENERGYGUIDE

Clothes Washer

Capacity: Standard

Models: **Maytag**

MAH2400*

Compare the energy use of this clothes washer only with other models tested using the 2004 procedure.

This Model Uses

170 kWh/year

ENERGY STAR
A symbol of energy efficiency

EPA DOE
SAVING THE EARTH. SAVING YOUR MONEY.

Energy use (kWh/year) range of all similar models

Uses Least Energy	Uses Most Energy
113	680

kWh/year (kilowatt-hours per year) is a measure of energy (electricity) use. Your utility company uses it to compute your bill. Only standard size clothes washers are use in this scale.

Clothes washers using more energy cost more to operate.

This model's estimated yearly operating cost is:

$15

when used with an electric water heater

$9

when used with a natural gas water heater

Based on eight loads of clothes a week and a 2004 U.S. Government national average cost of 8.60¢ per kWh for electricity and 91.0¢ per therm for natural gas. Your actual operating cost will vary depending on your local utility rates and use of the product.

THE MAYTAG HOME

Dryers

Maytag® Dryers

COLORS

White - $569.00
MDE2400AYW

DIMENSIONS

Width: 23-3/4"

Height: 33-1/2"

Depth: 23-3/4"

model **MDE2400AYW**

KEY BENEFITS

Performance

- **Large interior capacity - easily handles your everyday-sized load; handles up to 16 bath towels in a single load**
- **GentleBreeze™ drying system - uses powerful airflow and gentle temperatures for fast, efficient drying**
- **Commercial-quality stainless steel dryer drum - tough enough to stand up to everyday laundry; includes lifetime warranty**

Installation

- **Flexible installation - fits flush in tight spaces, under counters or stacked to take up even less floor space**
- **Stacking kit available - allows you to stack the dryer on top of the washer to take up even less floor space**

Exterior

- **Compact exterior - dryer measures just 23 1/2" wide, 23 3/4" deep and 34 1/4" high; with 7/8" adjustable leveling legs**
- **Large door opening with reversible door - easy to load and unload with the front-load design and large door opening**

Drying Options

- **Thirteen dryer cycles - including Wrinkle Prevent cycle for wet items and Wrinkle Release cycle for dry items**
- **Auto Dry, Damp Dry, Air Fluff and Time Dry cycles**
- **Cool Down option**
- **Three temperature settings**
- **Auto Dry dryness control**

Control Panel

- **Electronic controls - make it easy to select the perfect cycle for the type of load you're drying**
- **Time remaining indicator - see at a glance where your load is in the cycle and how much time is remaining**
- **Musical end-of-cycle chime - melodious chime alerts you when the dry cycle is complete**

Built-To-Last™ Features

- **Maytag dependability - depend on quality parts and features to keep your dryer working for years**

Helpful Shopping Information

To find the dryer that's best for you, consider:

- Is its capacity large enough for now? Ten years from now? Think about changes in your household that could affect how much laundry your family generates. If you do lots of laundry, consider a larger capacity so that you can dry fewer loads.

THE MAYTAG HOME

Refrigerators

Top Freezer Refrigerators

model **MTB1895AEW**

KEY BENEFITS

Refrigerator

- **Removable egg cradle**
- **Slide-out Spill-Catcher™ shelves - sealed edges contain spills for quick and easy cleanup**
- **Sealed FreshLock crispers with humidity control - for fresh fruits and vegetables**
- **Covered dairy compartment**
- **Refrigerator light**
- **Sealed glass crisper shelves**
- **Pick-off gallon-plus door bins - store gallon jugs and 2-liter bottles**

Performance

- **Cool Flow™ ventilation - centrally located, fan-assisted vents provide even, dependable cooling throughout the fresh food and freezer compartments**
- **Automatic moisture control - keeps the exterior free of condensation**
- **ENERGY STAR qualified - meets 2004 federal energy standards**
- **QuietSeries 200 sound silencing system - for extra-quiet performance**

Freezer

- **Tilt-out wire freezer door basket**
- **Full-width shelf**
- **Freezer light**
- **Includes two ice cube trays and ice bucket**
- **Automatic ice maker option available**

Exterior

- **Reversible door - to accommodate any kitchen layout**
- **Fits in 30" space - just right for kitchen of any size**
- **Contoured doors for a smooth, stylish appearance**

Capacity

- **18 cu. ft. capacity**

Built-To-Last™ Features

- **No Clean™ commercial-duty condenser - never needs cleaning in normal home use**
- **Easy-roll wheels**
- **Strongbox™ door hinges - for better durability**

COLORS

Black - $699.00
MTB1895AEB

Bisque - $699.00
MTB1895AEQ

Stainless Steel - $849.00
MTB1895AES

White - $699.00
MTB1895AEW

DIMENSIONS

Width: 29-5/8"

Height: 66-5/8"

Depth: 31-7/16"

Based on standard U.S. Government tests

ENERGYGUIDE

Refrigerator-Freezers
with Automatic Defrost
with Top Mounted Freezer
without Through-The-Door Ice Service

Capacity: 18.1 cubic feet

Models: Maytag
MTB1895AE*

Compare the energy use of this Refrigerator with others before you buy.

This Model Uses
409 kWh/year

ENERGY STAR
A symbol of energy efficiency

EPA DOE
SAVING THE EARTH. SAVING YOUR MONEY.

Energy use (kWh/year) range of all similar models

Uses Least Energy		Uses Most Energy
414	The estimated annual energy consumption of this model was not available at the time this range was published.	489

kWh/year (kilowatt-hours per year) is a measure of energy (electricty) use. Your utility company uses it to compute your bill. Only models with 16.5 to 18.4 cubic feet and above features are used in this scale.

Refrigerators using more energy cost more to operate. This model's estimated yearly operating cost is:

$34

Based on a 2001 U.S Government national average cost of 8.29¢ per kWh for electricity. Your actual operating cost will vary depending on your local utility rates and your use of the product.

THE MAYTAG HOME

Dishwashers

Maytag® Jetclean® II Two-Rack Dishwashers

COLORS

Black - $899.00
MDB8951AWB

Bisque - $899.00
MDB8951AWQ

Stainless Steel - $999.00
MDB8951AWS

White - $899.00
MDB8951AWW

DIMENSIONS

Width: 23-7/8"

Height: 33-1/2"

Depth: 23-7/8"

model **MDB8951AWW**

KEY BENEFITS

Racking Options

- **Removable upper rack makes room for extra-tall items in the bottom rack**
- **Adjustable upper rack - personalize the dishwasher to fit your unique loading needs**
- **Deluxe nylon DuraGuard® racks protect dishes and resist rust for long life**
- **Ball tip tines treat dishes gently and prevent scratching**
- **Upper and lower high-side Stack Rack shelves - for maximum loading versatility**
- **Deluxe Split & Fit™ silverware basket splits into two halves for flexibility**
- **Cup clips hold lightweight plastic items and cooking utensils in place**
- **Fold-Away™ tines fold up or down to customize rack space**
- **Convertible bowl tines convert to hold large or small bowls securely in place, so they won't tip and fill with water**
- **Auxiliary basket for cooking utensils, silverware and more**

Performance/Sound

- **QuietSeries™ 400 sound package - our quietest dishwasher ever (55 db Sound Power; 47 db Sound Pressure)**
- **ENERGY STAR® model - our most efficient lineup of dishwashers ever**

Interior

- **Stainless steel interior - resists odors, spots, stains . . . even corrosion**
- **Three wash arms and five wash cycles to power away even stubborn soil**
- **Tallest tall tub with largest usable capacity* - space for 14 place settings**

Cycles/Cleaning Option

- **160-Degree Wash raises temperature in the final rinse to 160° Fahrenheit**
- **ToughScrub™ Plus option softens and removes tough, dried-on, baked-on foods by adding heat and wash time to the cycle**
- **Automatic temperature control assures proper hot water temperatures to activate detergents**
- **Hi Temp Wash option - additional rinse improves results in hard water situations**
- **Auto Clean cycle adjusts cleaning cycle according to how clean or how dirty dishes are by using the Precision Clean™ sensor**

Based on standard U.S. Government tests

ENERGYGUIDE

Dishwashers
Capacity: Standard

Models: Maytag
MDB8951AW*

Compare the energy use of this Dishwasher with others before you buy.

This Model Uses
346 kWh/year

ENERGY STAR
A symbol of energy efficiency

EPA DOE
SAVING THE EARTH. SAVING YOUR MONEY.

Energy use (kWh/year) range of all similar models

Uses Least Energy	Uses Most Energy
194	531

kWh/year (kilowatt-hours per year) is a measure of energy (electricty) use. Your utility company uses it to compute your bill. Only standard size dishwashers are used in this scale.

Dishwashers using more energy cost more to operate. This model's estimated yearly operating cost is:

$31 When used with an electric water heater
$25 When used with a natural gas water heater

Based on four washloads a week and a 2004 U.S. Government national average cost of 8.60¢ per kWh for electricity and 91.0¢ per therm for natural gas. Your actual operating cost will vary depending on your local utility rates and your use of the product.

THE MAYTAG HOME

Wall Ovens

Maytag® Electric Wall Ovens

COLORS

Black - $1,189.00
MEW6527DDB

Stainless Steel - $1,499.00
MEW6527DDS

White - $1,189.00
MEW6527DDW

DIMENSIONS

Width: 26-3/4"

Height: 28-1/4"

Depth: 24-7/16"

model **MEW6527DDW**

KEY BENEFITS

Oven

- **Precision Cooking™ System - Uniform baking and browning; great results, even with multiple-rack baking**
- **Self-cleaning oven with adjustable cleaning levels - match cleaning level to food buildup in the oven**
- **EvenAir™ convection - uses a third element and fan to keep oven temperature consistent**
- **Auto conversion - automatically converts cook time or temperature in selected convection mode for dependable results**
- **Four rack positions for extra cooking flexibility**
- **Three heavy-duty oven racks including one Create-A-Space™ half-rack**
- **Automatic oven light - easy viewing with oven door open or closed**
- **Dual-control bake/broil elements - cycle on and off to keep oven temperature consistent**
- **Six-Pass™ broil element - food broils evenly for delicious results**

Exterior

- **Towel bar door handle**
- **Super size oven window**
- **Glass front oven door**
- **Quiet door hinges**

Control Panel

- **Keep Warm™ setting - keeps food warm until ready to serve**
- **Control lockout options - for added safety and cleaning convenience**
- **Cook & Hold setting - automatically reduces oven temperature to keep food warm up to one hour**
- **Favorite setting - allows a recipe's cook time and temperature to be preprogrammed**
- **Delay-start oven control - for the convenience of baking when you're not at home**
- **Electronic clock with timer - easy to read and operate**
- **Precision touch electronic controls - easy to use, with more options and precise settings to ensure delicious results**
- **Sabbath Mode option - overrides automatic 12-hour shutoff feature**

Helpful Shopping Information

THE MAYTAG HOME

Cooktops

Maytag® Electric Cooktops

model **MEC5430BDW**

KEY BENEFITS

Performance

- **Responsive Performance - Insta-Heat™ radiant elements heat to a bright glow within seconds**
- **9"/6" Dual Element - match cooking surface to pan size for more even heat distribution**
- **Element-In-Use And Hot-Surface Indicator Lights - tell if surface is hot or element is on**
- **Four Insta-Heat™ Radiant Elements - heat to a bright glow within seconds**

Exterior

- **Sleek Look - frameless design provides a stylish seamless look on your countertop**
- **Black With Stainless Steel Accents Available**

Controls

- **Easy-Grasp Pull-Off Control Knobs - for easy cleanup**

Built-To-Last™ Features

- **Easy Cleanup - glass-ceramic surface and Easy-Grasp pull-off control knobs**
- **Glass-Ceramic Surface - roomy cooking space that is easy to clean**

COLORS

Black - $619.00
MEC5430BDB

Stainless Steel - $779.00
MEC5430BDS

White - $619.00
MEC5430BDW

DIMENSIONS

Width: 29-15/16"

Height: 4-1/8"

Depth: 21"

Helpful Shopping Information

To find the cooktop that's best for you, consider:

- What type of cooktop do you prefer? Gas or electric?
- What kind of cooking surface do you prefer? If you want an electric model, would you rather have electric coils or a smooth glass surface? If you prefer a gas model, would you prefer a porcelain-enamel or tempered-glass surface?
- What cooktop width best fits your kitchen - 30", 36" or either?
- What kinds of food do you normally cook, and for how many people? Do you ever cook several things at once or cook for large groups? If you want an electric cooktop, have you ever wished you had one more element (five vs. four) so you could cook more at once?
- If you want an electric cooktop, would you like a light that shows you which elements are hot?
- If you want a gas cooktop, would it be handy to have a burner with extra heating power (which would be helpful with canning, searing or quick water heating)?
- Is easy cleanup important to you? If you prefer an electric cooktop, would you rather have coil elements that remove for cleaning or a glass cooktop that wipes clean? If you prefer a gas cooktop, would easy-to-clean lift-off burner caps save you time?

Design Stresses

Grade	Orientation	G Shear Modulus of Elasticity (psi)	E Modulus of Elasticity (psi)	F_b Flexural Stress[1] (psi)	F_t Tension Stress[2] (psi)	$F_{c\perp}$ Compression Perpendicular to Grain[3] (psi)	$F_{c\|\|}$ Compression Parallel to Grain (psi)	F_v Horizontal Shear Parallel to Grain (psi)	SG Equivalent Specific Gravity[4]
TimberStrand® LSL									
1.3E	Beam/Column	81,250	1.3×10^6	1,700	1,075	680	1,400	400	0.50[5]
	Plank	81,250	1.3×10^6	1,900[6]	1,075	435	1,400	150	0.50[5]
1.55E	Beam	96,875	1.55×10^6	2,325	1,070[7]	800	2,050	310[7]	0.50[5]
Microllam® LVL									
1.9E	Beam	118,750	1.9×10^6	2,600	1,555	750	2,510	285	0.50
Parallam® PSL									
1.8E	Column	N.A.	1.8×10^6	2,400	N.A.	N.A.	2,500	N.A.	0.50
2.0E	Beam	125,000	2.0×10^6	2,900	2,025	750	2,900	290	0.50

(1) For 12" depth. For other depths, multiply F_b by the appropriate factor as follows:

- For TimberStrand® LSL, multiply by $\left[\frac{12}{d}\right]^{0.092}$
- For Microllam® LVL, multiply by $\left[\frac{12}{d}\right]^{0.136}$
- For Parallam® PSL, multiply by $\left[\frac{12}{d}\right]^{0.111}$

(2) F_t has been adjusted to reflect the volume effects for most standard applications.

(3) $F_{c\perp}$ shall not be increased for duration of load.

(4) For lateral connection design only.

(5) Specific gravity of 0.58 may be used for bolts installed perpendicular to face and loaded perpendicular to grain.

(6) Value shown is for thickness up to 3½".

(7) Value shown accounts for large hole capabilities. See **Allowable Holes** on page 36.

Beam

Plank

General Assumptions for iLevel™ Trus Joist® Residential Beams

- Lateral support is required at bearing and along the span at 24" on-center, maximum.
- Bearing lengths are based on each product's bearing stress for applicable grade and orientation.
- All members 7¼" and less in depth are restricted to a maximum deflection of 5/16".
- Beams that are 1¾" x 16" and deeper require multiple plies.
- No camber.
- Tables on pages 8-15 include load reductions applied in accordance with code.

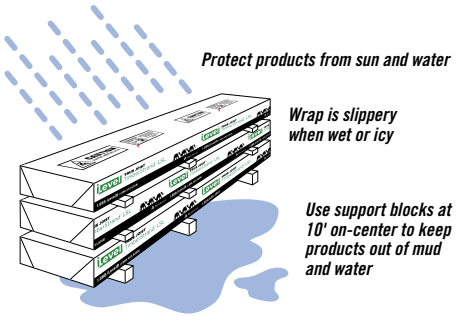
For applications not covered in this brochure, contact your iLevel representative.

See pages 38 and 39 for multiple-member beam connections.

Column

TimberStrand® LSL, Microllam® LVL, and untreated Parallam® PSL are intended for dry-use, untreated applications

Product Storage



General Notes

- Table is based on:
  - Uniform loads (beam weight considered) and the more restrictive of simple or continuous span.
  - Deflection criteria of L/240 total load and L/360 live load.
- For live load deflection limits of L/240 or L/480, multiply live load values by 1.5 or 0.75, respectively. The resulting live load shall not exceed the total load shown.

*Also see **How to Use this Table** on page 16 and **General Assumptions** on page 5.*

TimberStrand® LSL: Floor—100% (PLF) *continued*

Span	Condition	The 1.55E TimberStrand® LSL Beam								
		1¾" Width			3½" Width			5¼" Width (2- or 3-ply)		
		9½"	11⅞"	14"	9½"	11⅞"	14"	9½"	11⅞"	14"
3'	Total Load	3,166	4,192	4,192	6,332	8,384	8,384	9,499	12,577	12,577
	Live Load L/360	*	*	*	*	*	*	*	*	*
	Min. End/Int. Bearing (in.)	3.4/8.5	4.5/11.3	4.5/11.3	3.4/8.5	4.5/11.3	4.5/11.3	3.4/8.5	4.5/11.3	4.5/11.3
4'	Total Load	2,006	2,836	3,142	4,012	5,673	6,284	6,018	8,510	9,427
	Live Load L/360	*	*	*	*	*	*	*	*	*
	Min. End/Int. Bearing (in.)	2.9/7.2	4.1/10.2	4.5/11.3	2.9/7.2	4.1/10.2	4.5/11.3	2.9/7.2	4.1/10.2	4.5/11.3
5'	Total Load	1,467	2,004	2,512	2,934	4,009	5,024	4,401	6,014	7,537
	Live Load L/360	*	*	*	*	*	*	*	*	*
	Min. End/Int. Bearing (in.)	2.6/6.6	3.6/9.0	4.5/11.3	2.6/6.6	3.6/9.0	4.5/11.3	2.6/6.6	3.6/9.0	4.5/11.3
6'	Total Load	1,152	1,549	1,952	2,305	3,098	3,904	3,458	4,648	5,857
	Live Load L/360	1,048	*	*	2,097	*	*	3,146	*	*
	Min. End/Int. Bearing (in.)	2.5/6.2	3.3/8.3	4.2/10.5	2.5/6.2	3.3/8.3	4.2/10.5	2.5/6.2	3.3/8.3	4.2/10.5
7'	Total Load	845	1,262	1,570	1,691	2,524	3,141	2,536	3,786	4,711
	Live Load L/360	699	1,250	*	1,399	2,501	*	2,098	3,752	*
	Min. End/Int. Bearing (in.)	2.1/5.3	3.2/7.9	3.9/9.9	2.1/5.3	3.2/7.9	3.9/9.9	2.1/5.3	3.2/7.9	3.9/9.9
8'	Total Load	646	990	1,313	1,292	1,981	2,626	1,938	2,971	3,939
	Live Load L/360	487	886	*	974	1,773	*	1,462	2,660	*
	Min. End/Int. Bearing (in.)	1.9/4.7	2.8/7.1	3.8/9.4	1.9/4.7	2.8/7.1	3.8/9.4	1.9/4.7	2.8/7.1	3.8/9.4
9'-6"	Total Load	448	700	960	897	1,401	1,920	1,346	2,101	2,880
	Live Load L/360	302	560	870	605	1,121	1,740	907	1,681	2,610
	Min. End/Int. Bearing (in.)	1.5/3.9	2.4/6.0	3.3/8.2	1.5/3.9	2.4/6.0	3.3/8.2	1.5/3.9	2.4/6.0	3.3/8.2
10'	Total Load	387	631	865	775	1,263	1,731	1,162	1,894	2,597
	Live Load L/360	261	487	760	523	974	1,520	785	1,462	2,280
	Min. End/Int. Bearing (in.)	1.5/3.5	2.3/5.7	3.1/7.8	1.5/3.5	2.3/5.7	3.1/7.8	1.5/3.5	2.3/5.7	3.1/7.8
12'	Total Load	228	434	599	456	868	1,198	685	1,302	1,797
	Live Load L/360	155	293	464	311	587	928	467	881	1,393
	Min. End/Int. Bearing (in.)	1.5/3.5	1.9/4.7	2.6/6.5	1.5/3.5	1.9/4.7	2.6/6.5	1.5/3.5	1.9/4.7	2.6/6.5
14'	Total Load	144	278	438	288	556	876	433	834	1,314
	Live Load L/360	99	189	302	199	379	605	299	569	907
	Min. End/Int. Bearing (in.)	1.5/3.5	1.5/3.6	2.2/5.6	1.5/3.5	1.5/3.6	2.2/5.6	1.5/3.5	1.5/3.6	2.2/5.6
16'-6"	Total Load	87	170	277	174	341	554	262	512	831
	Live Load L/360	61	118	189	123	236	379	185	354	569
	Min. End/Int. Bearing (in.)	1.5/3.5	1.5/3.5	1.7/4.2	1.5/3.5	1.5/3.5	1.7/4.2	1.5/3.5	1.5/3.5	1.7/4.2
18'-6"	Total Load	60	120	197	121	241	395	182	362	592
	Live Load L/360	44	84	136	88	169	273	132	254	410
	Min. End/Int. Bearing (in.)	1.5/3.5	1.5/3.5	1.5/3.5	1.5/3.5	1.5/3.5	1.5/3.5	1.5/3.5	1.5/3.5	1.5/3.5
20'	Total Load		94	156	94	189	312	142	284	468
	Live Load L/360		67	109	70	135	218	105	202	327
	Min. End/Int. Bearing (in.)		1.5/3.5	1.5/3.5	1.5/3.5	1.5/3.5	1.5/3.5	1.5/3.5	1.5/3.5	1.5/3.5
24'	Total Load		52	88	50	105	177	76	158	265
	Live Load L/360		39	64	40	79	128	61	118	192
	Min. End/Int. Bearing (in.)		1.5/3.5	1.5/3.5	1.5/3.5	1.5/3.5	1.5/3.5	1.5/3.5	1.5/3.5	1.5/3.5
28'	Total Load			53		62	107		93	160
	Live Load L/360			40		50	81		75	122
	Min. End/Int. Bearing (in.)			1.5/3.5		1.5/3.5	1.5/3.5		1.5/3.5	1.5/3.5

* Indicates **Total Load** value controls.

ABOUT THIS GUIDE

The residential products in this guide are intended for use in single-family dwellings and are readily available through our nationwide network of distributors and dealers.
For information on using these products in multi-family dwellings, contact your iLevel representative.

For commercial applications such as retail stores, office buildings, schools, restaurants, hotels, and nursing homes, please refer to the *TJI® L65, L90, H90 Trus Joist® Commercial Specifier's Guide* (Reorder #1062). Commercial products are typically designed, manufactured, and sold for each specific job.

For more information on any iLevel™ product, please call **1-888-453-8358**.

Design Properties (100% Load Duration)

Depth	TJI®	Basic Properties				Reaction Properties		
		Joist Weight (lbs/ft)	Maximum Resistive Moment(1) (ft-lbs)	Joist Only EI x 10^6 (in.^{2}-lbs)	Maximum Vertical Shear (lbs)	1¾" End Reaction (lbs)	3½" Intermediate Reaction (lbs)	
							No Web Stiffeners	With Web Stiffeners
9½"	110	2.3	2,380	140	1,220	885	1,935	N.A.
	210	2.6	2,860	167	1,330	980	2,145	N.A.
	230	2.7	3,175	183	1,330	1,035	2,410	N.A.
11⅞"	110	2.5	3,015	238	1,560	885	1,935	2,295
	210	2.8	3,620	283	1,655	980	2,145	2,505
	230	3.0	4,015	310	1,655	1,035	2,410	2,765
	360	3.0	6,180	419	1,705	1,080	2,460	2,815
	560	4.0	9,500	636	2,050	1,265	3,000	3,475
14"	110	2.8	3,565	351	1,860	885	1,935	2,295
	210	3.1	4,280	415	1,945	980	2,145	2,505
	230	3.3	4,755	454	1,945	1,035	2,410	2,765
	360	3.3	7,335	612	1,955	1,080	2,460	2,815
	560	4.2	11,275	926	2,390	1,265	3,000	3,475
16"	210	3.3	4,895	566	2,190	980	2,145	2,505
	230	3.5	5,440	618	2,190	1,035	2,410	2,765
	360	3.5	8,405	830	2,190	1,080	2,460	2,815
	560	4.5	12,925	1,252	2,710	1,265	3,000	3,475

(1) **Caution: Do not** increase joist moment design properties by a repetitive member use factor.

TJI® joists are intended for dry-use applications

General Notes

- Design reaction includes all loads on the joist. Design shear is computed at the inside face of supports and includes all loads on the span(s). Allowable shear may sometimes be increased at interior supports in accordance with ICC ES ESR-1153, and these increases are reflected in span tables.
- The following formulas approximate the uniform load deflection of Δ (inches):

For TJI® 110, 210, 230, and 360 Joists

$$\Delta = \frac{22.5\ wL^4}{EI} + \frac{2.67\ wL^2}{d \times 10^5}$$

For TJI® 560 Joists

$$\Delta = \frac{22.5\ wL^4}{EI} + \frac{2.29\ wL^2}{d \times 10^5}$$

w = uniform load in pounds per linear foot
L = span in feet
d = out-to-out depth of the joist in inches
EI = value from table above

Material Weights

(Include TJI® weights in dead load calculations—see **Design Properties** table at left for joist weights)

Floor Panels

Southern Pine

½" plywood 1.7
⅝" plywood . . . . . 2.0 psf
¾" plywood . . . . . 2.5 psf
1⅛" plywood . . . . . 3.8 psf
½" OSB . . . . . 1.8 psf
⅝" OSB . . . . . 2.2 psf
¾" OSB . . . . . 2.7 psf
⅞" OSB . . . . . 3.1 psf
1⅛" OSB . . . . . 4.1 psf

Based on: Southern pine – 40 pcf for plywood, 44 pcf for OSB

Roofing

Asphalt shingles . . . . . 2.5 psf
Wood shingles . . . . . 2.0 psf
Clay tile . . . . . 9.0 to 14.0 psf
Slate (⅜" thick) . . . . . 15.0 psf

Roll or Batt Insulation (1" thick):

Rock wool . . . . . 0.2 psf
Glass wool . . . . . 0.1 psf

Floor Finishes

Hardwood (nominal 1") . . . . . 4.0 psf
Sheet vinyl . . . . . 0.5 psf
Carpet and pad . . . . . 1.0 psf
¾" ceramic or quarry tile . . . . . 10.0 psf

Concrete:

Regular (1") . . . . . 12.0 psf
Lightweight (1") . . . . . 8.0 to 10.0 psf
Gypsum concrete (¾") . . . . . 6.5 psf

Ceilings

Acoustical fiber tile . . . . . 1.0 psf
½" gypsum board . . . . . 2.2 psf
⅝" gypsum board . . . . . 2.8 psf
Plaster (1" thick) . . . . . 8.0 psf

Code Evaluations: See ICC ES ESR-1153 and ICC ES ESR-1387

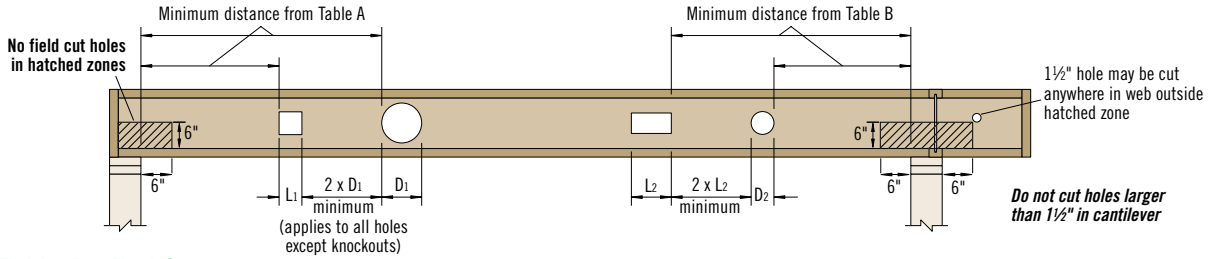


Table A—End Support

Minimum distance from edge of hole to inside face of nearest end support

Depth	TJI®	Round Hole Size									Square or Rectangular Hole Size								
		2"	3"	4"	5"	6½"	7"	8⅞"	11"	13"	2"	3"	4"	5"	6½"	7"	8⅞"	11"	13"
9½"	110	1'-0"	1'-6"	2'-0"	2'-6"	5'-0"					1'-0"	1'-6"	2'-6"	3'-6"	4'-6"				
	210	1'-0"	1'-6"	2'-0"	3'-0"	5'-0"					1'-0"	2'-0"	2'-6"	4'-0"	5'-0"				
	230	1'-0"	2'-0"	2'-6"	3'-6"	5'-6"					1'-0"	2'-0"	3'-0"	4'-6"	5'-0"				
11⅞"	110	1'-0"	1'-0"	1'-0"	1'-0"	2'-6"	2'-6"	5'-0"			1'-0"	1'-0"	1'-6"	2'-6"	4'-6"	4'-6"	6'-0"		
	210	1'-0"	1'-0"	1'-0"	1'-6"	2'-6"	3'-0"	5'-6"			1'-0"	1'-0"	2'-0"	3'-0"	5'-0"	5'-6"	6'-6"		
	230	1'-0"	1'-0"	1'-0"	2'-0"	3'-0"	3'-6"	6'-0"			1'-0"	1'-0"	2'-0"	3'-0"	5'-6"	5'-6"	7'-0"		
	360	1'-0"	1'-0"	1'-6"	2'-6"	4'-6"	5'-0"	7'-0"			1'-0"	1'-0"	2'-6"	4'-0"	6'-6"	6'-6"	7'-6"		
	560	1'-0"	1'-0"	1'-6"	3'-0"	5'-0"	5'-6"	8'-0"			1'-0"	2'-0"	3'-6"	5'-0"	7'-0"	7'-6"	8'-0"		
14"	110	1'-0"	1'-0"	1'-0"	1'-0"	1'-0"	1'-0"	2'-6"	5'-0"		1'-0"	1'-0"	1'-0"	1'-6"	3'-6"	4'-0"	6'-0"	8'-0"	
	210	1'-0"	1'-0"	1'-0"	1'-0"	1'-0"	1'-6"	3'-0"	6'-0"		1'-0"	1'-0"	1'-0"	2'-0"	4'-0"	4'-6"	6'-6"	8'-6"	
	230	1'-0"	1'-0"	1'-0"	1'-0"	1'-6"	2'-0"	3'-6"	6'-6"		1'-0"	1'-0"	1'-0"	2'-0"	4'-0"	5'-0"	7'-0"	9'-0"	
	360	1'-0"	1'-0"	1'-0"	1'-0"	2'-6"	3'-0"	5'-6"	8'-0"		1'-0"	1'-0"	1'-0"	2'-6"	5'-6"	6'-6"	8'-0"	9'-6"	
	560	1'-0"	1'-0"	1'-0"	1'-0"	2'-6"	3'-0"	6'-0"	9'-0"		1'-0"	1'-0"	1'-6"	3'-6"	6'-6"	7'-0"	9'-0"	10'-0"	
16"	210	1'-0"	1'-0"	1'-0"	1'-0"	1'-0"	1'-0"	1'-6"	3'-6"	6'-0"	1'-0"	1'-0"	1'-0"	1'-0"	2'-6"	3'-6"	6'-6"	8'-0"	10'-6"
	230	1'-0"	1'-0"	1'-0"	1'-0"	1'-0"	1'-0"	2'-0"	4'-0"	6'-6"	1'-0"	1'-0"	1'-0"	1'-0"	3'-0"	3'-6"	7'-0"	9'-0"	11'-0"
	360	1'-0"	1'-0"	1'-0"	1'-0"	1'-0"	1'-0"	3'-0"	6'-0"	9'-0"	1'-0"	1'-0"	1'-0"	1'-0"	4'-0"	5'-0"	9'-0"	10'-0"	11'-6"
	560	1'-0"	1'-0"	1'-0"	1'-0"	1'-0"	1'-0"	3'-0"	6'-6"	10'-0"	1'-0"	1'-0"	1'-0"	1'-6"	5'-0"	6'-0"	10'-0"	11'-0"	12'-0"

Table B—Intermediate or Cantilever Support

Minimum distance from edge of hole to inside face of nearest intermediate or cantilever support

Depth	TJI®	Round Hole Size									Square or Rectangular Hole Size								
		2"	3"	4"	5"	6½"	7"	8⅞"	11"	13"	2"	3"	4"	5"	6½"	7"	8⅞"	11"	13"
9½"	110	1'-6"	2'-6"	3'-0"	4'-0"	7'-6"					1'-6"	2'-6"	3'-6"	5'-6"	6'-6"				
	210	2'-0"	2'-6"	3'-6"	4'-6"	7'-6"					2'-0"	3'-0"	4'-0"	6'-0"	7'-0"				
	230	2'-6"	3'-0"	4'-0"	5'-0"	8'-0"					2'-6"	3'-0"	4'-6"	6'-6"	7'-6"				
11⅞"	110	1'-0"	1'-0"	1'-6"	2'-6"	4'-0"	4'-0"	8'-0"			1'-0"	1'-6"	2'-6"	4'-0"	6'-6"	7'-0"	9'-0"		
	210	1'-0"	1'-0"	2'-0"	3'-0"	4'-6"	5'-0"	9'-0"			1'-0"	2'-0"	3'-0"	4'-6"	7'-6"	8'-0"	10'-0"		
	230	1'-0"	2'-0"	2'-6"	3'-6"	5'-0"	5'-6"	9'-6"			1'-0"	2'-6"	3'-6"	5'-0"	8'-0"	8'-6"	10'-0"		
	360	2'-0"	3'-0"	4'-0"	5'-6"	7'-0"	7'-6"	11'-0"			2'-0"	3'-6"	5'-0"	7'-0"	9'-6"	9'-6"	11'-0"		
	560	1'-6"	3'-0"	4'-6"	5'-6"	8'-0"	8'-6"	12'-0"			3'-0"	4'-6"	6'-0"	8'-0"	10'-6"	11'-0"	12'-0"		
14"	110	1'-0"	1'-0"	1'-0"	1'-0"	2'-0"	2'-6"	4'-6"	8'-0"		1'-0"	1'-0"	1'-0"	2'-6"	5'-0"	6'-0"	9'-0"	12'-0"	
	210	1'-0"	1'-0"	1'-0"	1'-0"	2'-6"	3'-0"	5'-0"	9'-0"		1'-0"	1'-0"	2'-0"	3'-6"	6'-0"	7'-0"	10'-0"	12'-6"	
	230	1'-0"	1'-0"	1'-0"	2'-0"	3'-0"	3'-6"	5'-6"	10'-0"		1'-0"	1'-0"	2'-6"	4'-0"	6'-0"	7'-6"	10'-6"	13'-0"	
	360	1'-0"	1'-0"	2'-0"	3'-6"	5'-6"	6'-0"	8'-6"	12'-6"		1'-0"	2'-0"	4'-0"	5'-6"	9'-0"	10'-0"	12'-0"	14'-0"	
	560	1'-0"	1'-0"	1'-6"	3'-6"	5'-6"	6'-6"	9'-6"	13'-6"		1'-0"	3'-0"	5'-0"	7'-0"	10'-0"	11'-0"	13'-6"	15'-0"	
16"	210	1'-0"	1'-0"	1'-0"	1'-0"	1'-0"	1'-0"	3'-0"	5'-6"	9'-6"	1'-0"	1'-0"	1'-0"	2'-0"	4'-6"	5'-6"	9'-6"	12'-6"	15'-6"
	230	1'-0"	1'-0"	1'-0"	1'-0"	1'-6"	2'-0"	4'-0"	6'-6"	10'-6"	1'-0"	1'-0"	1'-0"	2'-6"	5'-0"	6'-0"	10'-6"	13'-0"	16'-0"
	360	1'-0"	1'-0"	1'-0"	1'-0"	3'-0"	4'-0"	6'-6"	10'-0"	13'-6"	1'-0"	1'-0"	2'-0"	4'-0"	7'-6"	8'-6"	13'-0"	14'-6"	17'-0"
	560	1'-0"	1'-0"	1'-0"	1'-0"	2'-6"	3'-6"	7'-0"	11'-0"	15'-0"	1'-0"	1'-0"	3'-6"	5'-6"	9'-0"	10'-0"	14'-6"	16'-0"	18'-0"

Rectangular holes based on measurement of longest side.

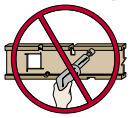
How to Use These Tables

1. Using **Table A—End Support, Table B—Intermediate or Cantilever Support**, or both, determine the hole shape/size and select the TJI® joist and depth.
2. Scan horizontally until you intersect the correct hole size column.
3. Measurement shown is minimum distance from edge of hole to support.
4. Place the hole so that the required minimum distance from the end **and** the intermediate or cantilever support is maintained.

General Notes

- Holes may be located vertically anywhere within the web. Leave ⅛" of web (minimum) at top and bottom of hole.
- Knockouts are located in web at approximately 12" on-center; they do not affect hole placement.
- For simple span (5' minimum) uniformly loaded joists meeting the requirements of this guide, one maximum size round hole may be located at the center of the joist span **provided that no other holes occur in the joist.**
- Distances are based on the maximum uniform loads shown in this guide. For other load conditions or hole configurations, use TJ-Beam® software or contact your iLevel representative.

DO NOT cut or notch flange.



DO NOT cut holes in cantilever reinforcement.

ROOF SPAN TABLE

Maximum Horizontal Clear Spans—Roof

O.C. Spacing	Depth	TJI®	Design Live Load (LL) and Dead Load (DL) in PSF											
			Non-Snow (125%)				Snow Load Area (115%)							
			20LL + 15DL		20LL + 20DL		25LL + 15DL		30LL + 15DL		40LL + 15DL		50LL + 15DL	
			Low	High	Low	High	Low	High	Low	High	Low	High	Low	High
16"	9½"	110	19'-3"	17'-2"	18'-4"	16'-3"	18'-5"	16'-6"	17'-9"	15'-11"	16'-7"	15'- 0"	15'-6"	14'-3"
		210	20'-5"	18'-2"	19'-5"	17'-3"	19'-6"	17'-6"	18'-9"	16'-11"	17'-7"	15'-11"	16'-7"	15'-1"
		230	21'-0"	18'-9"	20'-0"	17'-9"	20'-2"	18'-0"	19'-4"	17'-5"	18'-1"	16'-4"	17'-1"	15'-6"
	11⅞"	110	23'-0"	20'-6"	21'-11"	19'-5"	22'-0"	19'-9"	20'-11"	19'-1"	19'- 0"	17'-11"	17'-6"	16'-11"
		210	24'-4"	21'-9"	23'-3"	20'-7"	23'-4"	20'-11"	22'-5"	20'-2"	20'-10"	19'- 0"	19'-2"	18'-0"
		230	25'-1"	22'-5"	23'-11"	21'-3"	24'-1"	21'-7"	23'-1"	20'-10"	21'-7"	19'-7"	20'-3"	18'-7"
		360	27'-9"	24'-9"	26'-5"	23'-5"	26'-7"	23'-10"	25'-6"	23'- 0"	23'-11"	21'-7"	22'-7"	20'-6"
		560	31'-11"	28'-6"	30'-5"	27'- 0"	30'-7"	27'-5"	29'-5"	26'-5"	27'-6"	24'-10"	26'- 0"	23'-7"
	14"	110	26'-3"	23'-5"	25'- 0"	22'-2"	24'-1"	22'-6"	22'-9"	21'-9"	20'-8"	19'-11"	19'-1"	18'-5"
		210	27'-9"	24'-9"	26'-5"	23'-5"	26'-5"	23'-9"	25'- 0"	22'-11"	22'-8"	21'-7"	20'-11"	20'-3"
		230	28'-7"	25'-6"	27'-2"	24'-2"	27'-4"	24'-6"	26'-4"	23'-8"	23'-11"	22'-3"	22'-0"	21'-1"
		360	31'-6"	28'-2"	30'-0"	26'-8"	30'-2"	27'-1"	29'-0"	26'-1"	27'-2"	24'-7"	25'-8"	23'-4"
		560	36'-3"	32'-4"	34'-6"	30'-7"	34'-8"	31'-1"	33'-4"	30'-0"	31'-2"	28'-3"	29'-6"	26'-9"
	16"	210	30'-9"	27'-5"	29'-4"	26'- 0"	28'-3"	26'-5"	26'-9"	25'-6"	24'-3"	23'-4"	22'-4"	21'-8"
		230	31'-8"	28'-3"	30'-2"	26'-9"	29'-10"	27'-2"	28'-2"	26'-3"	25'-7"	24'-7"	23'-7"	22'-10"
		360	34'-11"	31'-2"	33'-3"	29'-6"	33'-5"	30'- 0"	32'-2"	28'-11"	30'-1"	27'-2"	26'- 0"	25'-10"
		560	40'-1"	35'-9"	38'-2"	33'-11"	38'-4"	34'-5"	36'-11"	33'-2"	34'-6"	31'-3"	31'-8"	29'-8"
19.2"	9½"	110	18'-1"	16'-1"	17'-3"	15'-3"	17'-4"	15'-6"	16'-8"	15'- 0"	15'-5"	14'-1"	14'-2"	13'-4"
		210	19'-2"	17'-1"	18'-3"	16'-2"	18'-4"	16'-5"	17'-8"	15'-10"	16'-6"	14'-11"	15'-7"	14'-2"
		230	19'-9"	17'-7"	18'-10"	16'-8"	18'-11"	16'-11"	18'-2"	16'-4"	17'- 0"	15'-4"	16'-1"	14'-7"
	11⅞"	110	21'-7"	19'-3"	20'-7"	18'-3"	20'-3"	18'-6"	19'-1"	17'-11"	17'-4"	16'-8"	16'- 0"	15'-5"
		210	22'-11"	20'-5"	21'-10"	19'-4"	21'-11"	19'-8"	20'-11"	18'-11"	19'-0"	17'-10"	17'-6"	16'-11"
		230	23'-7"	21'-1"	22'-6"	19'-11"	22'-7"	20'-3"	21'-8"	19'-6"	20'-0"	18'-4"	18'-5"	17'-5"
		360	26'-1"	23'-3"	24'-10"	22'-0"	24'-11"	22'-4"	24'- 0"	21'-7"	22'-5"	20'-3"	21'-2"	19'-3"
		560	30'- 0"	26'-9"	28'-7"	25'-4"	28'-8"	25'-9"	27'-7"	24'-10"	25'-9"	23'-4"	24'-4"	22'-2"
	14"	110	24'-6"	22'- 0"	22'-9"	20'-10"	22'-0"	20'-11"	20'-9"	19'-10"	18'-10"	18'-2"	17'- 0"	16'-10"
		210	26'-0"	23'-3"	24'-10"	22'-0"	24'-2"	22'-4"	22'-10"	21'-7"	20'-8"	19'-11"	18'-10"	18'-5"
		230	26'-10"	23'-11"	25'-7"	22'-8"	25'-5"	23'-0"	24'-0"	22'-3"	21'-10"	20'-11"	20'-1"	19'-5"
		360	29'-7"	26'-5"	28'-2"	25'-0"	28'-4"	25'-5"	27'-3"	24'-6"	25'-6"	23'-1"	21'-7"	21'-8"
		560	34'-0"	30'-4"	32'-5"	28'-9"	32'-7"	29'-2"	31'-4"	28'-2"	29'-3"	26'-6"	26'-5"	25'-2"
	16"	210	28'-8"	25'-9"	26'-9"	24'-5"	25'-10"	24'-6"	24'-5"	23'-4"	22'-1"	21'-4"	18'-10"	19'-8"
		230	29'-9"	26'-7"	28'-2"	25'-2"	27'-3"	25'-6"	25'-9"	24'-7"	23'-4"	22'-6"	21'-2"	20'-9"
		360	32'-10"	29'-3"	31'-3"	27'-9"	31'-5"	28'-2"	30'-2"	27'-2"	25'-7"	25'-3"	21'-7"	21'-8"
		560	37'-8"	33'-7"	35'-10"	31'-10"	36'-0"	32'-4"	34'-8"	31'-2"	31'-3"	29'-4"	26'-5"	25'-5"
24"	9½"	110	16'-9"	14'-11"	15'-11"	14'-2"	16'-0"	14'-4"	15'-2"	13'-10"	13'-9"	13'-0"	12'-8"	12'-3"
		210	17'-9"	15'-10"	16'-11"	15'- 0"	17'- 0"	15'-3"	16'-4"	14'-8"	15'-1"	13'-10"	13'-11"	13'-1"
		230	18'-3"	16'-4"	17'-5"	15'-5"	17'-6"	15'-8"	16'-10"	15'-2"	15'-8"	14'-3"	14'-8"	13'-6"
	11⅞"	110	20'-0"	17'-10"	18'-9"	16'-11"	18'-1"	17'-2"	17'-1"	16'-4"	15'-6"	14'-11"	13'-7"	13'-10"
		210	21'-2"	18'-11"	20'-2"	17'-11"	19'-10"	18'-2"	18'-9"	17'-7"	17'- 0"	16'-4"	15'-0"	15'-2"
		230	21'-10"	19'-6"	20'-10"	18'-5"	20'-11"	18'-9"	19'-9"	18'-1"	17'-11"	17'- 0"	16'-6"	16'- 0"
		360	24'-1"	21'-6"	23'- 0"	20'-5"	23'-1"	20'-8"	22'-2"	20'- 0"	20'-5"	18'-9"	17'-3"	17'-4"
		560	27'-9"	24'-9"	26'-5"	23'-6"	26'-7"	23'-10"	25'-6"	23'- 0"	23'-10"	21'-7"	21'-1"	20'-3"
	14"	110	21'-10"	20'-4"	20'-4"	19'-1"	19'-8"	18'-8"	18'-7"	17'-9"	16'-0"	16'-3"	13'-7"	14'-2"
		210	24'- 0"	21'-6"	22'-4"	20'-5"	21'-7"	20'-6"	20'-4"	19'-6"	17'-10"	17'-9"	15'-0"	15'-8"
		230	24'-10"	22'-2"	23'-7"	21'- 0"	22'-9"	21'-4"	21'-6"	20'-6"	19'-6"	18'-9"	16'-11"	16'-7"
		360	27'-5"	24'-6"	26'-1"	23'-2"	26'-3"	23'-6"	25'-0"	22'-8"	20'-5"	20'-2"	17'-3"	17'-4"
		560	31'-6"	28'-1"	30'- 0"	26'-8"	30'-2"	27'-0"	29'- 0"	26'-1"	24'-11"	23'-7"	21'-1"	20'-3"
	16"	210	25'-8"	23'-11"	23'-11"	22'-4"	23'-1"	21'-11"	21'-9"	20'-10"	17'-10"	18'-3"	15'-0"	15'-8"
		230	27'-1"	24'-7"	25'-2"	23'-3"	24'-4"	23'-1"	23'- 0"	22'- 0"	20'-0"	19'-4"	16'-11"	16'-7"
		360	30'-4"	27'-1"	28'-11"	25'-8"	28'-2"	26'-1"	25'-0"	24'-1"	20'-5"	20'-2"	17'-3"	17'-4"
		560	34'-10"	31'-2"	33'-2"	29'-6"	33'-4"	29'-11"	30'-6"	28'-3"	24'-11"	23'-7"	21'-1"	20'-3"

See page 17 for General Notes and information on how to use this table

Roof—115% and 125% Load Duration (PLF)

Depth	TJI®	Roof Joist Horizontal Clear Span																		
		6'			8'			10'			12'			14'			16'		
		Total Load		Defl.	Total Load		Defl.	Total Load		Defl.	Total Load		Defl.	Total Load		Defl.	Total Load		Defl.
		Snow 115%	Non-Snow 125%	Live Load L/240	Snow 115%	Non-Snow 125%	Live Load L/240	Snow 115%	Non-Snow 125%	Live Load L/240	Snow 115%	Non-Snow 125%	Live Load L/240	Snow 115%	Non-Snow 125%	Live Load L/240	Snow 115%	Non-Snow 125%	Live Load L/240
9½"	110	289	314	*	218	237	*	175	190	*	146	159	155	109	118	101	83	91	69
	210	321	349	*	242	263	*	194	211	*	162	176	*	131	142	118	100	108	81
	230	360	392	*	272	295	*	218	237	*	182	198	196	145	158	128	112	118	88
11⅞"	110	289	314	*	218	237	*	175	190	*	146	159	*	125	136	*	106	115	*
	210	321	349	*	242	263	*	194	211	*	162	176	*	139	151	*	122	132	*
	230	360	392	*	272	295	*	218	237	*	182	198	*	156	170	*	137	149	146
	360	368	400	*	277	301	*	223	242	*	186	202	*	159	173	*	140	152	*
	560	449	488	*	338	368	*	272	295	*	227	246	*	195	212	*	170	185	*
14"	110	289	314	*	218	237	*	175	190	*	146	159	*	125	136	*	110	119	*
	210	321	349	*	242	263	*	194	211	*	162	176	*	139	151	*	122	132	*
	230	360	392	*	272	295	*	218	237	*	182	198	*	156	170	*	137	149	*
	360	368	400	*	277	301	*	223	242	*	186	202	*	159	173	*	140	152	*
	560	449	488	*	338	368	*	272	295	*	227	246	*	195	212	*	170	185	*
16"	210	321	349	*	242	263	*	194	211	*	162	176	*	139	151	*	122	132	*
	230	360	392	*	272	295	*	218	237	*	182	198	*	156	170	*	137	149	*
	360	368	400	*	277	301	*	223	242	*	186	202	*	159	173	*	140	152	*
	560	449	488	*	338	368	*	272	295	*	227	246	*	195	212	*	170	185	*

Depth	TJI®	Roof Joist Horizontal Clear Span																		
		18'			20'			22'			24'			26'			28'		
		Total Load		Defl.	Total Load		Defl.	Total Load		Defl.	Total Load		Defl.	Total Load		Defl.	Total Load		Defl.
		Snow 115%	Non-Snow 125%	Live Load L/240	Snow 115%	Non-Snow 125%	Live Load L/240	Snow 115%	Non-Snow 125%	Live Load L/240	Snow 115%	Non-Snow 125%	Live Load L/240	Snow 115%	Non-Snow 125%	Live Load L/240	Snow 115%	Non-Snow 125%	Live Load L/240
9½"	110																		
	210	77	77	58															
	230	84	84	63															
11⅞"	110	84	91	82															
	210	101	109	96	82	89	71												
	230	112	121	105	91	98	78	75	79	59									
	360	124	135	*	112	122	103	102	105	78	82	82	61						
	560	152	165	*	137	148	*	124	135	117	114	122	91	97	97	73	79	79	59
14"	110	98	106	*	80	87	*												
	210	108	118	*	97	105	103	80	87	79									
	230	122	132	*	107	117	112	89	96	86	75	81	67						
	360	124	135	*	112	122	*	102	111	*	93	101	88	86	94	70	76	76	57
	560	152	165	*	137	148	*	124	135	*	114	124	*	105	114	104	98	106	85
16"	210	108	118	*	97	106	*	89	96	*	77	83	*						
	230	122	132	*	110	119	*	100	108	*	85	93	90		79	72			
	360	124	135	*	112	122	*	102	111	*	93	101	*	86	94	*	80	87	76
	560	152	165	*	137	148	*	124	135	*	114	124	*	105	114	*	98	106	*

* Indicates that **Total Load** value controls.

Slope Factors

Slope	2½ in 12	3 in 12	3½ in 12	4 in 12	4½ in 12	5 in 12	6 in 12	7 in 12	8 in 12	9 in 12	10 in 12	11 in 12	12 in 12
Factor	1.021	1.031	1.042	1.054	1.068	1.083	1.118	1.158	1.202	1.250	1.302	1.357	1.414

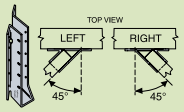
How to Use These Tables

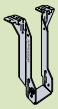
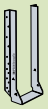
1. Calculate actual total load in pounds per linear foot (plf).
2. Select appropriate **Roof Joist Horizontal Clear Span**. For slopes greater than 2" per foot, approximate the increased dead load by multiplying the joist horizontal clear span by the **Slope Factor** above.
3. Scan down the column to find a TJI® joist that meets or exceeds actual total load. **Total Load** values are limited to deflection of L/180. For stiffer deflection criteria, use the **Live Load** L/240 values.

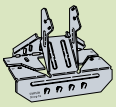
General Notes

- Tables are based on:
  - Uniform loads.
  - No composite action provided by sheathing.
  - More restrictive of simple or continuous span.
  - Minimum roof surface slope of ¼" in 12".
- **Total Load** limits joist deflection to L/180.

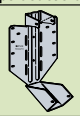
FRAMING CONNECTORS (SIMPSON STRONG-TIE™)

Joist		Single Joist—Top Flange				Single Joist—Face Mount[1]				Face Mount Skewed 45° Joist Hanger[1]			
													
Depth	TJI®	Hanger	Capacity (lbs)	Nailing		Hanger	Capacity (lbs)	Nailing		Hanger	Capacity (lbs)	Nailing	
				Header	Joist			Header	Joist			Header	Joist
9½"	110	ITT9.5	935	10d	10d x 1½"	IUS1.81/9.5	935	10d	N.A.	***SUR/L1.81/9***	1,125	16d	10d x 1½"
	210	ITT2.1/9.5	1,030	10d	10d x 1½"	IUS2.06/9.5	935	10d	N.A.	***SUR/L2.1/9***	1,230	16d	10d x 1½"
	230	ITT359.5	1,075	10d	10d x 1½"	IUS2.37/9.5	935	10d	N.A.	***SURI/LI3510/12***	1,225	16d	10d x 1½"
11⅞"	110	ITT11.88	950	10d	10d x 1½"	IUS1.81/11.88	950	10d	N.A.	***SUR/L1.81/11***	1,215	16d	10d x 1½"
	210	ITT2.1/11.88	1,045	10d	10d x 1½"	IUS2.06/11.88	1,045	10d	N.A.	***SUR/L2.1/11***	1,305	16d	10d x 1½"
	230	ITT3511.88	1,095	10d	10d x 1½"	IUS2.37/11.88	1,095	10d	N.A.	***SURI/LI3510/12***	1,310	16d	10d x 1½"
	360	ITT3511.88	1,140	10d	10d x 1½"	IUS2.37/11.88	1,140	10d	N.A.	***SURI/LI3510/12***	1,355	16d	10d x 1½"
	560	ITT411.88	1,300	10d	10d x 1½"	IUS3.56/11.88	1,330	10d	N.A.	***SUR/L410***	1,495	16d	10d x 1½"
14"	110	ITT14	950	10d	10d x 1½"	IUS1.81/14	950	10d	N.A.	***SUR/L1.81/11***	1,215	16d	10d x 1½"
	210	ITT2.1/14	1,045	10d	10d x 1½"	IUS2.06/14	1,045	10d	N.A.	***SUR/L2.1/11***	1,305	16d	10d x 1½"
	230	ITT3514	1,095	10d	10d x 1½"	IUS2.37/14	1,095	10d	N.A.	***SURI/LI3514/20***	1,310	16d	10d x 1½"
	360	ITT3514	1,140	10d	10d x 1½"	IUS2.37/14	1,140	10d	N.A.	***SURI/LI3514/20***	1,355	16d	10d x 1½"
	560	ITT414	1,300	10d	10d x 1½"	IUS3.56/14	1,330	10d	N.A.	***SUR/L414***	1,460	16d	10d x 1½"
16"	210	ITT2.1/16	1,045	10d	10d x 1½"	IUS2.06/16	1,045	10d	N.A.	***SUR/L2.1/11***	1,045	16d	10d x 1½"
	230	MIT3516	1,215	10d	10d x 1½"	IUS2.37/16	1,095	10d	N.A.	***SURI/LI3514/20***	1,310	16d	10d x 1½"
	360	MIT3516	1,260	10d	10d x 1½"	IUS2.37/16	1,140	10d	N.A.	***SURI/LI3514/20***	1,355	16d	10d x 1½"
	560	MIT416	1,460	10d	10d x 1½"	IUS3.56/16	1,330	10d	N.A.	***SUR/L414***	1,460	16d	10d x 1½"

Joist		Double Joist—Top Flange				Double Joist—Face Mount[1]			
									
Depth	TJI®	Hanger	Capacity (lbs)	Nailing		Hanger	Capacity (lbs)	Nailing	
				Header	Joist			Header	Joist
9½"	110	MIT49.5	2,000	16d	10d x 1½"	MIU49	1,860	16d	10d x 1½"
	210	MIT4.28/9.5	2,000	16d	10d x 1½"	MIU4.28/9	1,860	16d	10d x 1½"
	230	MIT359.5-2	2,000	16d	10d x 1½"	MIU4.75/9	1,860	16d	10d x 1½"
11⅞"	110	MIT411.88	2,000	16d	10d x 1½"	MIU411	2,130	16d	10d x 1½"
	210	MIT4.28/11.88	2,000	16d	10d x 1½"	MIU4.28/11	2,130	16d	10d x 1½"
	230	MIT3511.88-2	2,000	16d	10d x 1½"	MIU4.75/11	2,130	16d	10d x 1½"
	360	MIT3511.88-2	2,000	16d	10d x 1½"	MIU4.75/11	2,130	16d	10d x 1½"
	560	***WPI411.88-2***	2,925	16d	10d x 1½"	***HU412-2***	2,145	16d	10d x 1½"
14"	110	MIT414	2,000	16d	10d x 1½"	MIU414	2,170	16d	10d x 1½"
	210	MIT4.28/14	2,000	16d	10d x 1½"	MIU4.28/14	2,350	16d	10d x 1½"
	230	MIT3514-2	2,000	16d	10d x 1½"	MIU4.75/14	2,395	16d	10d x 1½"
	360	MIT3514-2	2,000	16d	10d x 1½"	MIU4.75/14	2,395	16d	10d x 1½"
	560	***WPI414-2***	2,925	16d	10d x 1½"	***HU414-2***	2,680	16d	10d x 1½"
16"	210	LBV4.28/16	2,035	16d	10d x 1½"	MIU4.28/16	2,350	16d	10d x 1½"
	230	LBV3516-2	2,035	16d	10d x 1½"	MIU4.75/16	2,435	16d	10d x 1½"
	360	LBV3516-2	2,035	16d	10d x 1½"	MIU4.75/16	2,525	16d	10d x 1½"
	560	***WPI416-2***	2,925	16d	10d x 1½"	***HU414-2***	2,680	16d	10d x 1½"

Joist	Variable Slope Seat Connector[2]			
				
TJI®	Hanger	Capacity (lbs)	Nailing	
			Header	Joist
110	VPA25	1,050	10d	10d x 1½"
210	VPA2.1	1,230	10d	10d x 1½"
230	VPA35	1,230	10d	10d x 1½"
360	VPA35	1,230	10d	10d x 1½"
560	VPA4	1,230	10d	10d x 1½"

Hanger information on these two pages was provided by either Simpson Strong-Tie™ or USP Structural Connectors™. For additional information, please refer to their literature.

Joist	Variable Slope Seat Joist Hanger[1][3]				
					
TJI®	Hanger	Capacity (lbs)		Nailing	
		Sloped Only	Sloped and Skewed	Header	Joist
110	***LSSUI25***	1,110	995	10d	10d x 1½"
210	***LSSU2.1***	1,110	995	10d	10d x 1½"
230	***LSSUI35***	1,110	995	10d	10d x 1½"
360	***LSSUI35***	1,110	995	10d	10d x 1½"
560	***LSSU410***	1,725	1,625	16d	10d x 1½"

General Notes

Bold italic hangers require web stiffeners.

Capacities will vary with different nailing criteria or other support conditions; contact your iLevel representative for assistance.

- Hanger capacities shown are either joist bearing capacity or hanger capacity—whichever is less. Joist end reaction must be checked to ensure it does not exceed the capacity shown in the tables.
- All capacities are for downward loads at 100% duration of load.
- Fill all round, dimple, and positive angle nail holes.
- Use sloped seat hangers and beveled web stiffeners when TJI® joist slope exceeds ¼" per foot.
- Leave 1/16" clearance (⅛" maximum) between the end of the supported joist and the header or hanger.

See additional notes on page 23

EMEGA FOAM

TECHNICAL DATA SHEET

0.5 LB BIO- SPRAY FOAM SYSTEM

EMEGA FOAM 0.5 lb Bio-Spray Foam System, is a two part Polyurethane Bio based Spray Foam System that utilizes water for it's blowing agent. In this way EMEGA FOAM is using one of the most environmental sound foam system that is in the market today.

Our products are also available in several reactivity profiles so that no matter what the season is, we have a foam with the proper speed of reactivity for you. Please call us for details, and asked about our winter speed systems.

Typical uses for EMEGA FOAM 0.5 lb Bio-Spray Foam System, are new home construction for the side walls, underside of the roof deck, crawl spaces, attics in older homes for adding more insulation, tanks, metal agricultural buildings, refrigeration storage units, and many others.

PHYSICAL PROPERTY	TEST NUMBER	DATA
Density	ASTM D1620	0.5 lb/cubic feet
"R" Value	ASTM C-177	3.6 per inch
Compressive Strength	ASTM D-1621	10 PSI
Perm Rating	ASTM C-155	1.8
Flame Spread	ASTM E-84	< 18
Smoke Development	ASTM E-84	<350

Storage: Both Components "A" and Component "B" should be stored in the unopened containers at a minimum of 50° F, the temperature should not exceed 100°F during storage.

Heat, Air & Moisture Control

Walls • Ceilings • Attics • Floors • Basements • Foundations

SEALS AND STRENGTHENS WALLS

PROFESSIONAL INSTALLERS

Gold Star℠ certified contractors are experienced and highly trained professionals that can advise you on insulation methods to maximize the energy efficiency of your home. They offer a life time warranty* for your InsulStar insulation. For the names of Gold Star℠ certified insulation contractors and more information, call us or visit our Website.

TYPICAL PHYSICAL PROPERTIES

Description:	Closed-cell spray polyurethane foam insulation
Closed-cell content:	Greater than 90%
Density:	2.0 lb./cu.ft. nominal
Compressive strength:	32 psi nominal
Tensile strength:	45 psi nominal
R-value:	R-14 at 2 inches nominal
Anti-bacterial:	Yes
Fire rating:	Class 1
Flame spread:	<25 (ASTM E84)
Smoke development:	<450 (ASTM E84)
Code compliant:	Yes**

Numerical flame spread and smoke development ratings are not intended to reflect hazards presented by this, or any other material, under actual fire conditions.

U.S. GREEN BUILDING COUNCIL MEMBER

*Warranty available through Gold Star℠ certified insulation contractors upon request and approval of specifications.
**InsulStar® complies with the provisions of the International Building Code (IBC), International Residential Code (IRC), and Uniform Building Code (UBC).

Toll Free: 1-866-678-5283 (866-NSULATE)
Website: www.InsulStar.com

A Product of

NCFI POLYURETHANES

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NCFI since 1964 • Barnhardt Mfg. Co. since 1900

Fixed Frame Direct Set

Glazing Performance
Total Unit

Product	Type of Glazing	U-Factor[1]	Solar Heat Gain Coefficient	% Visible Light Transmission	Meets U.S. ENERGY STAR® Performance Criteria in Region Shown[2]			
					N	NC	SC	S
Architect Series®	**WITH INTEGRAL GRILLES**							
	5/8" clear IG with 3 mm glass	0.51	0.61	65				
	5/8" argon-filled Low-E² IG with 3 mm glass	0.33	0.33	57				
	5/8" Low-E² HA IG with 3 mm glass	0.37	0.33	57				
	5/8" Low-E² IG with 5 mm bronze/3 mm Low-E	0.40	0.29	37				
	5/8" Low-E² IG with 5 mm gray/3 mm Low-E	0.40	0.27	32				
	5/8" Low-E² IG with 5 mm green/3 mm Low-E	0.40	0.32	50				
Architect Series Hurricane-Shield® Impact-Resistant	**WITH REMOVABLE OR NO GRILLES**							
	9/16" SGP clear single-laminated	0.87	0.62	74				
	9/16" SGP single-laminated Low-E	0.87	0.45	62				
	9/16" SGP bronze single-laminated	0.87	0.51	45				
	9/16" SGP gray single-laminated	0.87	0.48	37				
	9/16" SGP green single-laminated	0.87	0.48	63				
	1-1/4" SGP air-filled Low-E² laminated IG	0.34	0.39	58				
	1-1/4" SGP clear air-filled laminated IG	0.46	0.53	66				
	1-1/4" SGP bronze air-filled Low-E² laminated IG	0.32	0.28	36				
	1-1/4" SGP gray air-filled Low-E² laminated IG	0.32	0.25	29				
	1-1/4" SGP green air-filled-filled Low-E² laminated IG	0.32	0.30	49				
	CURVED SHAPES WITH INTEGRAL GRILLES							
	9/16" SGP clear single-laminated	0.87	0.56	66				
	9/16" SGP bronze single-laminated	0.87	0.46	41				
	9/16" SGP gray single-laminated	0.87	0.43	34				
	9/16" SGP green single-laminated	0.87	0.44	56				
	9/16" SGP single-laminated Low-E	0.87	0.40	56				
	1-1/8" SGP clear air-filled IG	0.49	0.48	60				
	1-1/8" SGP bronze air-filled Low-E IG	0.36	0.26	32				
	1-1/8" SGP gray air-filled Low-E IG	0.36	0.24	26				
	1-1/8" SGP green air-filled Low-E IG	0.36	0.28	44				
	1-1/8" SGP air-filled Low-E IG	0.36	0.35	52				
	ANGLED AND RECTANGULAR SHAPES							
	9/16" PVB/SGP clear single-laminated impact	0.87	0.63	74				
	9/16" PVB/SGP bronze single-laminated impact	0.87	0.51	45				
	9/16" PVB/SGP gray single-laminated impact	0.87	0.48	38				
	9/16" PVB/SGP green single-laminated impact	0.87	0.48	63				
	9/16" PVB/SGP single-laminated impact with Low-E	0.87	0.45	62				
	1-1/4" SGP argon-filled impact-resistant clear	0.45	0.53	66				
	1-1/4" SGP air-filled impact-resistant bronze	0.32	0.28	36				
	1-1/4" SGP air-filled impact-resistant gray	0.32	0.25	29				
	1-1/4" SGP air-filled impact-resistant green	0.32	0.30	49				
	1-1/4" SGP air-filled impact-resistant Low-E	0.29	0.38	58				
ProLine®	**WITH SIMULATED DIVIDED LIGHT**							
	5/8" clear IG with 3 mm glass	0.50	0.68	72				
	with grilles-between-the-glass	0.51	0.61	65				
	5/8" argon-filled Low-E² IG with 3 mm glass	0.31	0.37	63				
	with grilles-between-the-glass	0.33	0.33	57				
	5/8" air-filled with 5 mm bronze/3 mm Low-E	0.39	0.32	42				
	with grilles-between-the-glass	0.40	0.29	37				
	5/8" air-filled IG with 5 mm gray/3 mm Low-E	0.39	0.29	35				
	with grilles-between-the-glass	0.40	0.27	32				
	5/8" air-filled IG with 5 mm green/3 mm Low-E	0.39	0.35	55				
	with grilles-between-the-glass	0.40	0.32	50				

(1) Glazing performance values are calculated based on NFRC 100.

(2) Climate Zones: N = Northern, NC = North/Central, SC = South/Central, S = Southern. For more information, see the ENERGY STAR guidelines.

For center-glass values, see Volume 1, Section C.

R-Value = 1/U-Factor

FIXED FRAME DIRECT SET

Aluminum EnduraClad® Exterior
Rectangular and Angled Shapes
Interior Glazed
Detailed Product Descriptions

Frame

- Select woods, water-repellent, preservative-treated in accordance with WDMA I.S.-4.
- Interior exposed surfaces are [Pine] [Mahogany] [Alder] [Douglas Fir].
- Exterior surfaces are clad with aluminum.
- Components are assembled with screws, staples, and concealed corner locks.
- Overall frame depth is 5" (127 mm) for a wall depth of 3-11/16" (94 mm).
- Optional factory-applied jamb extensions available.

Glazing System

- Quality float glass complying with ASTM C 1036.
- Custom and high altitude glazing available.
- Urethane-glazed clear single-light with removable wood stops.

– or –

- Urethane-glazed dual-seal insulating glass [clear] [argon-filled multi-layer Low-E coated] [[bronze] [gray] [green] air-filled multi-layer Low-E coated] with removable wood stops.

– or –

- Impact-Resistant
  - Urethane-glazed 1-1/4" SGP [annealed] [heat strengthened] dual-seal impact-resistant insulating glass(2). Laminated exterior light is [clear] [bronze] [gray] [green]. Interior tempered light is [clear] [multi-layer Low-E coated].

  – or –

  - Urethane-glazed 9/16" SGP laminated glass [hard coat Low-E] [bronze] [gray] [green].

  – or –

  - Urethane-glazed 7/16" PVB laminated glass [clear] [hard coat Low-E] [bronze] [gray] [green].

Exterior

- Exterior aluminum surfaces are finished with EnduraClad® multi-stage finish system.
- Color is [white] [tan] [brown] [feature(1)] [custom(1)].

– or –

- Exterior aluminum surfaces are finished with EnduraClad Plus 70% fluoropolymer-based multi-stage finish system.
- Color is [white] [tan] [brown] [feature(1)] [custom(1)].

Interior

- [Unfinished, ready for site finishing] [Factory-primed with one coat acrylic latex] [Factory pre-finished white (only available in sizes < 36 ft^2 frame size)].

Optional Products

Grilles

- Removable Grilles
  - [3/4" Regular] [1-1/4" [Regular] [Colonial]] [2" [Regular] [Colonial]] profile with Traditional pattern that has removable solid pine wood bars steel-pinned at joints and fitted to glass stops with steel clips and tacks.
  - Surfaces [unfinished, ready for site finishing] [factory-primed].

  – or –

- Grilles-Between-the-Glass
  - Insulating glass contains 3/4" contoured aluminum grilles permanently installed between two panes of glass.
  - Grilles match factory pre-finished white interior.
  - Exterior grilles match exterior cladding color.
  - Grille pattern is [Traditional (customer defined lites wide and high)] [Prairie (matches companion unit)].

(1) Contact your local Pella representative for current color options.
(2) Insulating glass with multi-layered Low-E coated glass is argon-filled.

SLIDING CONTEMPORARY

Glazing Performance
Total Unit

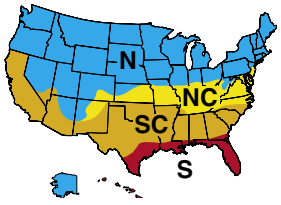
Product	Type of Glazing	U-Factor$_1$	Solar Heat Gain Coefficient	% Visible Light Transmission	Meets U.S. ENERGY STAR® Performance Criteria in Region Shown$_2$			
					N	NC	SC	S
Designer Series® Clad	**DOUBLE-PANE GLAZING**							
	3 mm clear with 3 mm clear HGP	0.49	0.55	58				
	3 mm clear with 3 mm Low-E HGP	0.40	0.52	53				
	3 mm SolarE™ with 3 mm clear HGP	0.40	0.35	38				
	3 mm bronze with 3 mm clear HGP	0.49	0.45	44				
	3 mm bronze with 3 mm Low-E HGP	0.40	0.41	40				
	3 mm gray with 3 mm clear HGP	0.49	0.42	39				
	3 mm gray with 3 mm Low-E HGP	0.40	0.38	36				
	TRIPLE-PANE GLAZING							
	5/8" argon-filled Low-E^2 IG with 3 mm clear HGP	0.28	0.28	46				
	5/8" argon-filled Low-E^2 IG with 3 mm Low-E HGP	0.26	0.26	42				
	5/8" bronze IG with 3 mm clear HGP	0.32	0.23	31				
	5/8" gray IG with 3 mm clear HGP	0.32	0.21	26				
	5/8" green IG with 3 mm clear HGP	0.32	0.25	41				
	5/8" bronze IG with 3 mm Low-E HGP	0.29	0.21	28				
	5/8" gray IG with 3 mm Low-E HGP	0.29	0.19	24				
	5/8" green IG with 3 mm Low-E HGP	0.29	0.23	37				
	5/8" Low-E^2 HA IG with 3 mm clear HGP	0.31	0.28	46				
	5/8" Low-E^2 HA IG with 3 mm Low-E HGP	0.28	0.26	43				
	5/8" Low-E^2 HA IG with 4 mm clear HGP	0.31	0.28	47				
	5/8" Low-E^2 HA IG with 4 mm Low-E HGP	0.28	0.26	42				
ProLine® Clad	3/4" clear IG with 3 mm glass	0.49	0.58	61				
	with grilles-between-the-glass	0.49	0.51	53				
	3/4" argon-filled Low-E^2 IG with 3 mm glass	0.33	0.31	53				
	with grilles-between-the-glass	0.33	0.27	46				
	3/4" clear IG with 4 mm glass	0.49	0.56	60				
	with grilles-between-the-glass	0.50	0.49	52				
	3/4" argon-filled Low-E^2 IG with 4 mm glass	0.33	0.31	53				
	with grilles-between-the-glass	0.35	0.28	46				

(1) Glazing performance values are calculated based on NFRC 100.

(2) Climate Zones: N = Northern, NC = North/Central, SC = South/Central, S = Southern. For more information, see the ENERGY STAR guidelines.

For center-glass values and total unit values that include window fashions, see Volume 1, Section C.

R-Value = 1/U-Factor



SLIDING CONTEMPORARY

Aluminum EnduraClad® Exterior Detailed Product Descriptions

Frame

- Select softwood, water-repellent, preservative-treated in accordance with WDMA I.S.-4.
- Interior exposed surfaces are clear pine.
- Exterior surfaces are clad with aluminum at the head and jambs.
- Solid extruded aluminum sill. Finish is brown EnduraClad® with oak insert at threshold.
- Factory-installed fold-out installation fins with flexible fin corners.
- Fin position accommodates standard 4-9/16" (116 mm) wall depths.
- Frame depth is 5-7/8" (149 mm).

Door Panels

- Select softwood, water-repellent, preservative-treated in accordance with WDMA I.S.-4.
- Interior exposed surfaces are veneered with clear pine with no visible fastener holes.
- Exterior surfaces are clad with aluminum.
- Panel rails are three-ply construction, randomly finger-jointed blocks laminated with water-resistant glue and pine-veneered on both sides.
- Corners are urethane-sealed and secured with metal fasteners.
- Bottom rail has ACQ preservative-treated core with end grain sealer and primed exterior surface.
- Panel thickness is 2-1/16" (52 mm).
- Vent panels have two adjustable sealed electroplated steel ball-bearing rollers with organic coating, set on stainless steel track, standard.

– or –

- Two adjustable corrosion-resistant stainless steel ball-bearing rollers; out-of-unit option.

Weather Stripping

- Tri-durometer extruded polymer with bulb at head, jambs and threshold. Corners are welded.
- Dual durometer extruded polymer with bulb at vent interlocker.

Glazing System

- Quality fully-tempered float glass complying with ASTM C 1048.
- Double-Pane Glazing
  - Exterior single light Polyurethane Reactive Hotmelt (PUR)-glazed [clear] [SolarE™] [bronze] [gray] [green].
  - Interior hinged glass panel set in veneer covered aluminum frame, fitted to panel with continuous gasket seal, [clear] [Low-E] [obscure].
  - Airspace is 1-9/16".

– or –

- Triple-Pane Glazing
  - Exterior dual-seal insulating glass, Polyurethane Reactive Hotmelt (PUR)-glazed [argon-filled multi-layer Low-E coated] [[bronze] [gray] [green] air-filled multi-layer Low-E coated].
  - High altitude insulating glass is available.
  - Interior hinged glass panel set in veneer covered aluminum frame, fitted to panel with continuous gasket seal [clear] [Low-E] [obscure].
  - Airspace is 1-3/32".

Interior

- [Unfinished, ready for site finishing] [Factory-primed with one coat acrylic latex].

Exterior

- Exterior aluminum surfaces are finished with EnduraClad multi-stage finish system.
- Color is [white] [tan] [brown] [feature$_1$] [custom$_1$].

– or –

- Exterior aluminum surfaces are finished with EnduraClad Plus 70% fluoropolymer-based multi-stage finish system.
- Color is [white] [tan] [brown] [feature$_1$] [custom$_1$].

Hardware

- Interior handle and thumb lock finish are [Endura Hardware™ collection bright brass] [Endura Hardware collection satin nickel] [baked enamel, champagne] [baked enamel, white] [oil-rubbed bronze].
- Exterior handle finish is baked enamel, color to match door cladding.
- Keylock with Schlage® configured C-K keyway pinlock cylinder. Finish is [bright brass] [oil-rubbed bronze] [stainless steel].
- Dual-point lock hardware is electroplated steel with stainless steel strikes suitable for seacoast applications.
- The foot bolt is a champagne finish.
- Interior and exterior screen handle finish will match the interior door handle finish.

Optional Products

Grilles

- Removable Between-Glass Grilles
  - 3/4" profile with [Traditional] [Prairie] [Cross] [Top Row] [New England] patterns that are a contoured aluminum grille installed on the edge of the hinged glass panel.
  - Interior [unfinished, ready for site finishing] [white (for white exterior units only)].
  - Exterior finish will match exterior color cladding.
- Removable Grilles (for transom units)
  - 3/4" Regular profile with Traditional pattern that is removable solid pine wood bars steel-pinned at joints and fitted to sash with steel clips and tacks.

Insect Screen

- Black Fiberglass
  - Vinyl-coated 18/16 mesh fiberglass flat screen cloth complying with ASTM D 3656 and SMA 1201, set in aluminum frame fitted to outside of window, supplied complete with all necessary hardware.
  - Self-closing screen assembly is top-hung on two adjustable nylon rollers installed on room side of door panels.
  - Screen frame exterior is painted to match exterior color.
  - Screen frame interior is unfinished, ready for site finishing.

– or –

- Rolscreen® Retractable
  - Self-storing, rolling, black vinyl-coated 18/16 mesh fiberglass screen cloth complying with ASTM D 3656 and SMA 1201 mounted behind overhead cover.
  - Cover finish is clear pine veneer wrapped over extruded aluminum. Available on two-panel sliding patio doors.

Window Fashions

- Slimshade® Blinds$_1$
  - 15 mm aluminum slat [tilt-only] [bottom-up] blinds with polyester cord ladder.
  - Installed on the hinged glass panel and controlled by built-in operating mechanism.

– or –

- Cellular Fabric Shades$_1$
  - Spun bond Polyethylene Terephthalate (PET) cellular fabric, 11/16" in width, hidden polyester cord [bottom-up] [top-down].
  - Installed on the hinged glass panel and controlled by built-in operating mechanism.

– or –

- Decorative Panels$_1$
  - Installed on the hinged glass panel.
  - 1/4" wide polycarbonate extrusion, or 1/8" polyester laminated PETG sheets with various interlayer materials.

(1) Contact your local Pella sales representative for current designs and color options.

MINI-STRIP (T5)

MS

PRODUCT HIGHLIGHTS

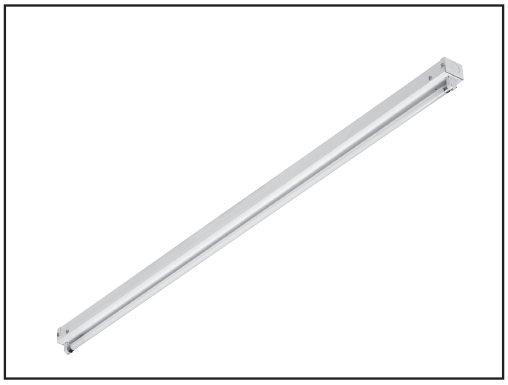
- Small cross sectional area
- Slim high-efficiency T5 lamps
- Top access ballast cover
- Fold down sockets
- Broad reflector options available

CONSTRUCTION - Fixture housing, lampholder/ballast cover and end plates constructed of die-formed, code-gauge steel.

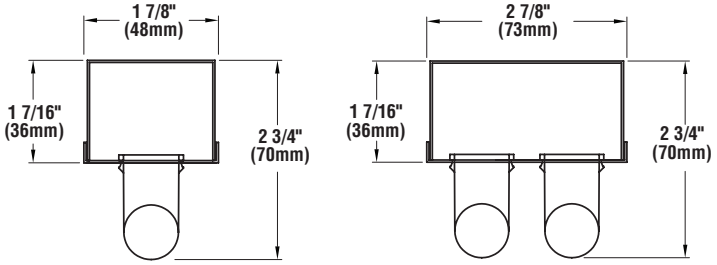
ELECTRICAL - All devices UL/CUL listed. Suitable for damp locations. Damp location emergency pack must be specified separately. Ballasts are energy-saving, solid-state electronic. Ballasts and lampholders replaceable without removing from ceiling. Discrete voltage must be specified for emergency pack options when wired with flex.

FINISH - All metal parts painted after fabrication following treatment with phosphate rust inhibitor. Finish coating of housing reflecting surfaces is with white, high reflectance (minimum 92%) polyester powder.

PHOTOMETRICS - Please visit our web site at **www.lsi-industries.com** for detailed photometric data.



CHANNEL SERIES



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LUMINAIRE ORDERING INFORMATION

Prefix	Lamps	Lamp Type	Ballasts	Options	Voltage
MS	1 2	14 - 14W 21" 21 - 21W 33"* 24 - 24W HO 22" 28 - 28W 45"* 39 - 39W HO 33"* 54 - 54W HO 45"* Note: For tandem configurations suffix number above with "-2"	SS5 - T5 Instant Start SS5R - T5 Rapid Start SS5D - T5 Dimming SS5HO - T5HO Rapid Start	F - Fusing SR - Symmetrical Reflector (specify unit) AR - Asymmetrical Reflector (specify unit) PM - Prewired Plug-in Assembly (specify circuitry. See Options/Accessories Section) EM - Emergency Pack	120 - 120V 277 - 277V 347 - 347V UE - Universal Electronic (120-277V)

MS 1 21 SS5R EM UE

EXAMPLE OF A TYPICAL ORDER

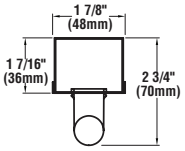
LSI Industries™ A Company with a Smart Vision

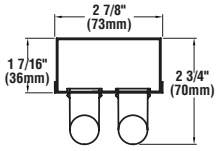
Project Name _____ **Fixture Type** _____

Catalog # _____

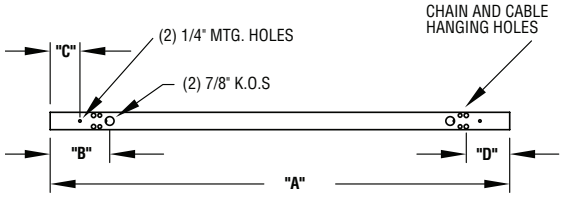
MS

DIMENSIONS



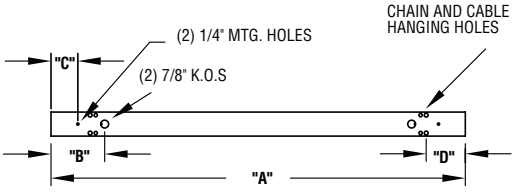


MOUNTING



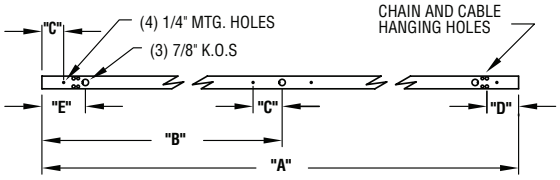
CATALOG NUMBER	"A" DIM.	"B" DIM.	"C" DIM.	"D" DIM.
MS-114 AND MS-124	22 3/4"	1 1/4"	2 1/2'	2 1/2"
MS-121 AND MS-139	37 17/32"	6"	3"	4 3/8"
MS-128 AND MS-154	46 5/16"	6"	3"	4 3/8"

1 LAMP 14 TO 54 WATT



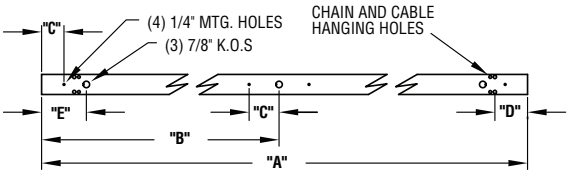
CATALOG NUMBER	"A" DIM.	"B" DIM.	"C" DIM.	"D" DIM.
MS-214 AND MS-224	22 3/4"	1 1/4"	2 1/2'	2 1/2"
MS-221 AND MS-239	37 17/32"	6"	3"	4 3/8"
MS-228 AND MS-254	46 5/16"	6"	3"	4 3/8"

2 LAMP - 14 TO 54 WATT



CATALOG NUMBER	"A" DIM.	"B" DIM.	"C" DIM.	"D" DIM.	"E" DIM.
MS-121-2 AND MS-139-2	69 1/16"	37 17/32"	3"	4 3/8"	6"
MS-128-2 AND MS-154-2	92 5/8"	46 5/16"	3"	4 3/8"	6"

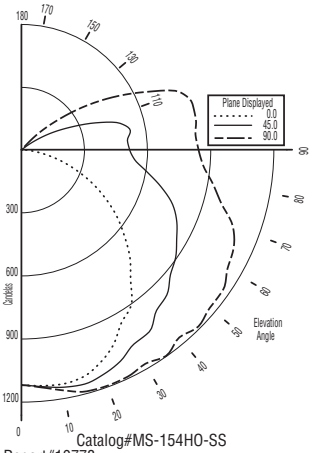
1 LAMP TANDEM - 21 TO 54 WATT



CATALOG NUMBER	"A" DIM.	"B" DIM.	"C" DIM.	"D" DIM.	"E" DIM.
MS-221-2 AND MS-239-2	69 1/16"	37 17/32"	3"	4 3/8"	6"
MS-228-2 AND MS-254-2	92 5/8"	46 5/16"	3"	4 3/8"	6"

2 LAMP TANDEM 21 TO 54 WATT

PHOTOMETRICS



Catalog#MS-154HO-SS
Report#10778
Spacing Criterion 1.28 (0-180) x 1.60 (90-270)
Yearly Cost of 1000 Lumens, 3000 Hours of 0.08 KWH = 3.08

Vertical Degree	Horizontal Angle 0	45	90
0	786	786	786
10	794	805	816
20	759	798	838
30	666	749	825
40	565	700	818
50	447	648	820
60	321	597	793
70	187	536	750
80	66	424	647
90	0	360	590
100	0	368	590
110	0	262	562
120	0	107	350
130	0	0	147
140	0	0	0
150	0	0	0
160	0	0	0
170	0	0	0
180	0	0	0

Efficiency 91.30%

LER FS-78

Zonal Lumen Summary

Zone	Lumens	%Lamp	%Fixt
0-30	662.71	13.3	14.5
0-40	1120.86	22.4	24.6
0-60	2190	43.8	48
0-90	3595.82	71.9	78.8
90-120	872.18	17.4	19.1
90-130	952.61	19.1	20.9
90-150	967.41	19.3	21.2
90-180	967.41	19.3	21.2
0-180	4563.23	91.3	100

Coefficients Of Utilization - Zonal Cavity Method
Effective Floor Cavity Reflectance 0.20

RC	80				70				50		
RW	70	50	30	10	70	50	30	10	50	30	10
0	104	104	104	104	99	99	99	99	91	91	91
1	91	86	81	76	87	82	77	73	74	70	67
2	82	73	65	59	77	69	63	57	63	57	53
3	74	63	54	48	70	60	52	46	54	48	43
4	67	55	46	39	63	52	44	38	48	41	35
5	61	49	40	33	58	46	38	32	42	35	30
6	56	43	35	28	53	41	33	28	38	31	26
7	52	39	31	25	49	37	30	24	34	27	22
8	48	35	27	22	46	34	26	21	31	25	20
9	45	32	25	19	43	31	24	19	28	22	18
10	42	30	22	17	40	28	22	17	26	20	16

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Project Name _____ **Fixture Type** _____

Catalog # _____

B228PUNV-C

APPLICATION and PERFORMANCE SPECIFICATION

Description: Electronic ballast(s) for **(1/2) F28T5** or (1/2) F35T5 or (1/2) F21T5 or (1/2) F14T5

- Line Voltage: 120 - 277 vac, ±10%, 50/60Hz
- Series Lamp Operation
- Auto Reset after Lamp Replacement
- Programmed Rapid Start
- Active Power Factor Correction
- End of Lamp Life Shutdown Circuitry

Model	Line Volts	No. of Lamps	Lamp Type	Input Watts	Nominal Line Amps	Ballast Factor	Power Factor	Haromonic Total	Crest Factor
B228PUNV-C	120	2	**F28T5**	66	0.55	1.00	> 0.98	< 10%	< 1.7
	120	1	**F28T5**	33	0.28	1.00	> 0.98	< 10%	< 1.7
	277	2	**F28T5**	64	0.23	1.00	> 0.98	< 10%	< 1.7
	277	1	**F28T5**	33	0.12	1.00	> 0.95	< 10%	< 1.7
	120	2	F35T5	81	0.67	1.00	> 0.98	< 10%	< 1.7
	120	1	F35T5	40	0.34	1.00	> 0.98	< 10%	< 1.7
	277	2	F35T5	78	0.28	1.00	> 0.98	< 10%	< 1.7
	277	1	F35T5	40	0.15	1.00	> 0.95	< 10%	< 1.7
	120	2	F21T5	49	0.41	1.00	> 0.98	< 10%	< 1.7
	120	1	F21T5	25	0.21	1.03	> 0.98	< 10%	< 1.7
	277	2	F21T5	48	0.18	1.00	> 0.98	< 10%	< 1.7
	277	1	F21T5	25	0.10	1.03	> 0.95	< 15%	< 1.7
	120	2	F14T5	34	0.28	1.00	> 0.98	< 10%	< 1.7
	120	1	F14T5	18	0.15	1.05	> 0.98	< 10%	< 1.7
	277	2	F14T5	34	0.13	1.00	> 0.95	< 10%	< 1.7
	277	1	F14T5	18	0.07	1.05	> 0.90	< 15%	< 1.7

Application and Peformance Specification Information Subject to Change without Notification.

Performance:
- Meets ANSI Standard C82.11-1993
- Meets ANSI Standard C62.41-1991
- Meets FCC Part 18 (Class A) for EMI and RFI Non-Consumer Limits

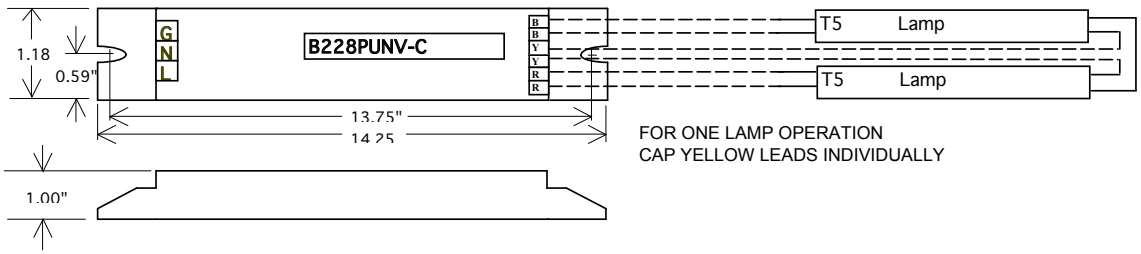
Application:
- Minimum Starting Temperature: 0 °F, -18 °C
- Maximum Ambient Temperature: 104 °F, 40°C
- Maximum Case Temperature(tc): 167 °F, 75 °C
- Sound Rating: Class A
- Remote Mounting: 18 ft.
- Wire Trap, Plug-in Connectors are Standard
- Leadwire Option Available

Safety:
- No PCB's
- UL listed (Class P, Type 1 Outdoor)
- CSA Certified

Physical Parameters

	Inches	Metric
• Mounting Length: (Center to Center)	13.75" +/- 0.01"	349.3 mm
• Overall Length:	14.25" +/- 0.01"	362 mm
• Width:	1.18" + 0.03"/- 0.02"	30 mm
• Height:	1.00" + 0.04"/- 0.01"	25.4 mm
• Weight:	1 lbs.	0.4 kg
• Carton Quantity:	10 pieces	

Manufactured in North America



FOR ONE LAMP OPERATION
CAP YELLOW LEADS INDIVIDUALLY

1-800-BALLAST

Ground to Case or Input Terminal (G)
www.universalballast.com

February 2004

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TO MARKET
3844 N. W. 8th Street
Oklahoma City, Oklahoma
73107
1(866) 772-4772

SPECIFICATIONS, BENEFITS & ENVIRONMENTAL INFORMATION

To Market | ATMOSPHERE RECYCLED RUBBER FLOORING I

STRAIGHT EDGE VERSES INTERLOCK
All Atmosphere™ colors and patterns are available in both interlock and straight edge formats. Interlocking tiles are easy-to-install. Interlocking tiles can be removed, replaced or flipped over for double life of the mats. No adhesive is required, allowing for completely a green installation and providing substantial savings in adhesive and labor installation costs.

SPECIFICATIONS

Product Name:	Atmosphere™ Recycled Rubber Flooring
Straight Edge Mat Size:	38"x38" Thickness: 5/32" (4mm) (Also available in 6mm, 8mm, and 10mm) Weight: 1 lb. Per square foot Square Foot/Tile: 10.02 square feet
Interlock Mat Size:	37"x37" Thickness: 5/16" (8mm) (Also available 10mm) Weight: 2 lbs. Per square foot Square Foot/Tile: 9.50 square feet
Composition:	Recycled Tire Rubber Granules SBR (Styrene-Butadlene Rubber) and colored EPDM (Ethylene-Propylene Diene Monomer)
Abrasion Resistance:	ASTM-C501 0.502 grams / 1000 cycles ±5mg
Density (pcf):	ASTM-D3676 66 lbs. / cubic foot
Shore Hardness:	ASTM-D2240 65
Static Load Limit:	ASTM-F970-87 0.0% residual compression
Compression:	ASTM-D395 9.7%
Critical Radiant Flux:	ASTM-E-648-94A - Class I / Class II (Port Authority of NY and NJ)

BENEFITS & ENVIRONMENTAL INFORMATION

- Environmentally-responsible, recyclable and sustainable product
- Excellent indoor air quality (IAQ)
- Little or no volatile organic compounds (VOCs)
- Strictly enforced environmental technologies do not pollute the air, ground or water.
- Will not promote microbial or fungal growth.
- Manufactured from post-consumer, recycled tire rubber, along with EPDM colored rubber
- Homogeneously mixed
- "60,000 mile floor™," providing exceptional durability and performance
- Superior resilience and comfort under foot
- Anti-fatigue
- Extraordinary vibration dampening qualities for foot and rolling traffic noise
- Outstanding slip resistance, wet or dry
- Superior stain resistance
- Easy to install and maintain
- Unlimited design flexibility for end-use applications in office, educational, institutional, health care and retail environments.
- Custom options including special color blends, are available upon request, as well as individual logo or graphic designs utilizing in-house, state-of-the-art water-jet technology.

Indoor Air Quality:	VOC Emissions Passes - Washington State
Acoustic Rating:	Superior
Elongation at Break:	ASTM-D412 120%
Tensile Strength:	ASTM-D412 290.2 lbs. / square inch
Coefficient of Friction: (James test method)	ASTM-D2047-93 1.04 Dry 1.05 Wet
Accelerated Floor Trafficking:	5 – no change in performance
Stain Resistance:	ASTM-D543 No change (ammonia, bleach, rust, grass, coffee, fruit juice, cola, ink, lipstick)
Custom:	Atmosphere™ Recycled Rubber Flooring is available in custom logos, geometric and graphic designs, with no size or design limitations. For details utilizing this in-house CAD and water-jet technology, please see your To Market sales representative.

WARRANTY

Installation and maintenance procedures must be followed exactly as specified in the To Market, Atmosphere Recycled Rubber Flooring Installation Guide and Maintenance Guide. To Market will not responsible for claims arising from failure to follow installation or maintenance procedures from use of non-specified materials. Any resulting claim would not be considered a manufacturer's defect and would be the responsibility of the installation contractor. Surface features called blade marks, rock lines or striations, as well as small particles of white wall appearing in the black rubber, are not considered a manufacturer's defect and are inherent to the manufacturing process using recycled rubber materials. Tile thickness may vary ± .5mm due to tolerances within the manufacturing process.

To Market warrants ATMOSPHERE RECYCLED RUBBER FLOORING to be free of manufacturing defects in material or workmanship for a period of two years. This warranty is in lieu of all other warranties, express or implied, including warranties of merchantability or of fitness for a particular purpose. For any claim, please contact your To Market Sales Representative through your installation contractor.

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SPECIFICATIONS, BENEFITS & ENVIRONMENTAL INFORMATION

To Market | ATMOSPHERE 3

EARTHSHAPES™ COLLECTION: Structure, Discovery and Exploration

STRAIGHT EDGE VERSES INTERLOCK
All Atmosphere™ colors and patterns are available in both interlock and straight edge formats. Interlocking tiles are easy-to-install. Interlocking tiles can be removed, replaced or flipped over for double life of the mats. No adhesive is required, allowing for completely a green installation and providing substantial savings in adhesive and labor installation costs.

SPECIFICATIONS

Product Name:	Atmosphere® 3 – Earthshapes™ Collection: Structure, Discovery and Exploration
Straight Edge Tile Size:	38" x 38" Thickness: 5/32" (4 mm) Also available in 6 mm, 8 mm, and 10 mm Weight: 1 lb./square foot Square Foot/Tile: 10.02 square feet
Interlock Tile Size:	37"x37" Thickness: 5/16" (8 mm) A lso available 10 mm Weight: 2 lbs./square foot Square Foot/Tile: 9.50 square feet
Composition (To Market proprietary combination*):	100% Post-Consumer Recycled Tire Rubber SBR Granules (Styrene-Butadlene Rubber) 100% Post-Industrial Colored EPDM (Ethylene-Propylene Diene Monomer) * AFTA® 2005
Abrasion Resistance:	ASTM-C501 0.502 grams / 1000 cycles ±5mg
Density (pcf):	ASTM-D3676 66 lbs. / cubic foot
Shore Hardness:	ASTM-D2240 65

BENEFITS & ENVIRONMENTAL INFORMATION

- Environmentally-responsible, recyclable and sustainable product
- Excellent indoor air quality (IAQ)
- Little or no volatile organic compounds (VOCs)
- Strictly enforced environmental technologies do not pollute the air, ground or water.
- Will not promote microbial or fungal growth.
- Manufactured from post-consumer, recycled tire rubber, along with EPDM colored rubber
- Homogeneously mixed "60,000 mile floor™," providing exceptional durability and performance
- Superior resilience and comfort under foot
- Anti-fatigue
- Extraordinary vibration dampening qualities for foot and

Static Load Limit:	ASTM-F970-87 0.0% residual compression
Compression:	ASTM-D395 9.7%
Critical Radiant Flux:	ASTM-E-648-94A Class I / Class II See your To Market (Port Authority of NY and NJ) Sales Representative for details.
Indoor Air Quality:	VOC Emissions Passes - Washington State
Acoustic Rating:	Superior
Elongation at Break:	ASTM-D412 120%
Tensile Strength:	ASTM-D412 290.2 lbs. / square inch
Coefficient of Friction: (James test method)	ASTM-D2047-93 1.04 Dry 1.05 Wet
Accelerated Floor Trafficking:	5 – no change in performance
Stain Resistance:	ASTM-D543 No change (ammonia, bleach, rust, grass, coffee, fruit juice, cola, ink, lipstick)
Custom:	Custom colors, logo or graphic designs. See your sales representative for details.

rolling traffic noise

- Outstanding slip resistance, wet or dry
- Superior stain resistance
- Easy to install and maintain
- Unlimited design flexibility for end-use applications in office, educational, institutional, health care and retail environments.
- Custom options including special color blends, are available upon request, as well as individual logo or graphic designs utilizing in-house, state-of-the-art water-jet technology.

WARRANTY

Installation and maintenance procedures must be followed exactly as specified in the To Market, Atmosphere Recycled Rubber Flooring Installation Guide and Maintenance Guide. To Market will not responsible for claims arising from failure to follow installation or maintenance procedures from use of non-specified materials. Any resulting claim would not be considered a manufacturer's defect and would be the responsibility of the installation contractor. Surface features called blade marks, rock lines or striations, as well as small particles of white wall appearing in the black rubber, are not considered a manufacturer's defect and are inherent to the manufacturing process using recycled rubber materials. Tile thickness may vary ± .5mm due to tolerances within the manufacturing process.

To Market warrants ATMOSPHERE RECYCLED RUBBER FLOORING to be free of manufacturing defects in material or workmanship for a period of two years. This warranty is in lieu of all other warranties, express or implied, including warranties of merchantability or of fitness for a particular purpose. For any claim, please contact your To Market Sales Representative through your installation contractor.

Cembonit Flat Sheet

		Sand	Pearl	Flint
Tensile Strength	lbs./sq. inch	1750	1750	1900
Compressive Strength	lbs./sq. inch	13000	13000	14000
Flexural Strength (modulus of rupture)	lbs.sq. inch	3500	3500	3800
Modulus of Elasticity	lbs./sq. inch	2.2×10^6	2.2×10^6	2.0×10^6
Weight	lbs./sq.ft./mm of thickness	0.35	0.33	0.35
Moisture Movement				
30-90% RH	inches/ft.	0.018	0.018	0.024
Wet/Dry	inches/ft.	0.030	0.030	0.054
Water Vapor Transmission				
Wet Cup	grain/h/sq.ft.	4.8	4.8	2.4
Dry Cup	grain/h/sq.ft.	24.8	24.8	12.4
Alkalinity	pH	8 - 10	8 - 10	8 - 10
Max. Temperature, Continuous	op	300	300	300
Flame Spread		0	0	0
Smoke		0	0	0

-The data are generated by conversion from European standards and are not necessarily compatible and 100% comparable with ASTM standards.

-"Fuel contributed" has been eliminated from the ASTM E84 standard.

Solid Surfacing

TECHNICAL DATA

RECOMMENDED APPLICATION

Formica® Solid Surfacing is a solid homogeneous material suitable for many functional and decorative applications. It is a fully densified composite of modified resin and mineral filler. The product is available in the following forms:

- Sheet stock in 1/4" (6.4mm) and 1/2" (12.7mm).
- Kitchen sinks, single and double bowl designs
- Vanity bowls
- Edge strips and windowsills

Formica® Solid Surfacing is ideally suited for domestic use in the kitchen and bathroom. It is also widely specified for a full range of uses in offices, banks, restaurants, hospitals and other commercial applications.

FABRICATION AND ASSEMBLY

Refer to the *Formica® Solid Surfacing Fabrication Guide* for full information on working with Formica® Solid Surfacing. Follow accepted standard practices and safety procedures.

Limitations

Formica® Solid Surfacing is not recommended for certain applications, which include: exposure to heat sources that may elevate material temperature above 175°F (79°C), including hot pads for cookware, as excessive heat may cause stress fractures; below-grade wall surfacing, if moisture can affect the adhesive bond; exterior use, due to the possibility of some color change caused by exposure to direct sunlight. The 1/4" (6.4mm) thick material should not be used for countertops or other horizontal applications. Exposure to certain strong chemicals may be harmful; refer to the *Use and Care* section for specific recommendations. Do not allow dry ice to come in contact with Formica Solid Surfacing sheets or sinks.

Storage

Formica® Solid Surfacing sheets should be stored horizontally on the shipping skids. If the skids are stacked, limit the stack to three (3) skids high and only stack skids of the same size. Store the skids Formica Solid Surface on a flat horizontal surface or support with at least three (3) cantilever rack arms. If sheets are stored individually, they should be stored flat horizontally and well supported to prevent sagging and warping. Do not put long sheets on top of shorter sheets. Formica Solid surface should not be stored vertically; this can cause warping within the sheet.

- Formica® Solid Surfacing kitchen sinks and vanity bowls may be stacked up to six (6) boxes high of the same size.

Preconditioning

Formica® Solid Surfacing sheets, sinks, bowls and adhesives should be 65°F (18°C) or warmer prior to fabrication.

Substrates and Supports

Formica® Solid Surfacing sheets for horizontal surfaces such as countertops should be supported every 18" (457mm) for 1/2" (12.7mm) thickness. Do not use 1/4" (6.4mm) thick sheets for horizontal applications.

- Do not use a full wood underlayment as a support for horizontal sheets.
- Restrict unsupported overhang to 6" (152.4mm) for 1/2" (12.7mm) thick Formica® Solid Surfacing sheets.
- Do not use particle board.

Adhesives
For seams and drop edges, use Formica® Solid Surfacing Seaming Cartridge.

Wood and wood veneer inserts (as in some drop-edge designs) can be bonded to Formica® Solid Surfacing with clear epoxy adhesive or clear silicone sealant.

When attaching Formica® Solid Surfacing countertops to cabinets, use dime-size dabs of a clear silicone sealant every 12-18" (304.8-457.2mm), then lower the unit into place.

When installing vertical panels for shower and bath surrounds, use a clear silicon adhesive. Apply a 3/16-1/4" bead around the perimeter and at 6-8" intervals in the middle.

When installing backsplash sections, use a clear silicone adhesive. If the backsplash is less than 8" (203.2mm) high, it may be bonded to the countertop using Formica® Solid Surfacing Seaming Adhesive.

Assembly
When countertops are placed between walls, allow 1/8" (3.2mm) space per 10' (3.05m) length for dimensional movement.

All inside corners of cutouts must be radiused as large as possible, to a minimum of 1/4" (6.4mm), and reinforced with Formica® Solid Surfacing corner blocks to avoid stress cracking. The edges and corners should be sanded smooth and free of chips or nicks. Two layers of heat-conductive aluminum tape must be used for drop-in stoves and around heat sources to protect from thermal stress. See the latest *Formica® Solid Surfacing Fabrication Guide* (Form No. 10-003) for details.

Polishing
Consult the *Formica® Solid Surfacing Technical Brief — Polishing* (Form No. 10-042) or *Formica® Solid Surfacing Fabrication Guide* (Form No. 10-003) for detailed information.

PRODUCT AVAILABILITY

Sheet Stock is generally available in two thicknesses, in the following nominal sizes*:

Thickness	Width	Length
1/4" (6.4mm)	30" (76.2cm)	98" (248.9cm)
1/2" (12.7mm)	30" (76.2cm)	145" (368.3cm)
	36" (91.4cm)	145" (368.3cm)

*Check with Formica® Solid Surfacing National Product Guide for current product availability.

All ***Kitchen Sinks*** are available in Arctic and Frost. Model K200, K420 and K175 are available in all solid colors.

- K200
  OD 33-1/2" x 18-5/8"
  ID 15-3/4" x 16-5/8" x 9" deep (each bowl)
  Double bowl, two equal sized bowls

- K175
  OD 33-1/2" x 20-1/2"
  ID 18-15/16" x 18-1/2" x 9" deep
  ID 12-9/16" x 15" x 7-3/16" deep
  Double bowl, one large and one small bowl

- K100
  OD 24" x 19"
  ID 21" x 16" x 9" deep
  Single bowl

- K075
  OD 19-3/8" x 16-3/8"
  ID 17-3/4" x 14-3/4" x 9" deep
  Single bowl

- K050
  OD 14-3/8" x 14-3/8"
  ID 12-3/4" x 12-3/4" x 6-5/8" deep
  Single bowl

- KB025
  OD 8" x 14-3/8"
  ID 6-3/8" x 12-3/4" x 5-3/8" deep
  Single bowl

- K420
  OD 32-1/4" x 21-3/8"
  ID 13-3/4" x 15-1/4" x 9" deep
  Double bowl

Vanity Bowls - Check for color availability.

- V100
  OD 19-7/8" x 16-1/8"
  ID 18-1/4" x 14-1/2" x 6-1/4" deep
  Rear overflow*
- V075
  OD 18-1/8" x 14-3/4"
  ID 16-1/2" x 13-1/4" x 5-5/8" deep
  Rear overflow*
- V065
  OD 18" x 14"
  ID 16" x 12" x 5" deep
  Front overflow
- V050
  OD 16-1/2" x 12"
  ID 15" x 10-3/8" x 5-1/2" deep
  Rear overflow*

**Bowls can be installed to meet American Disabilities Act (ADA) specifications. Please see www.access-board.gov for current ADA guidelines and information.*

HOW TO SPECIFY

Solid surfacing material shall be Formica® Solid Surfacing provided by Formica Corporation, Cincinnati, Ohio.

Sheet Stock			
Thickness	Width	Length	Color
Kitchen Sink			
Model No.	Color		
Vanity Bowl			
Model No.	Color		
Edge Strips/Windowsills			
Thickness	Width	Length	Color

Compositions which typically DO NOT stain Formica® Solid Surfacing sheets and sinks:

Ag Gentian Violet (1% solution)
Ammonia (10%)
Ammonium Hydroxide (28% solution)
Amyl Acetate
Amyl Alcohol
Beet Juice
Betadine®
Black Non-Permanent Felt Pen Ink
Black Paste Shoe Polish
Black Wax Crayon
Blood
Blue Ball Point Pen Ink
Calcium Hypochlorite
Chromic Acid (60% solution)
Citric Acid (10% solution)
Coffee
Cresol
Detergent (5% solution)
Dioxane
Ethyl Alcohol (50% solution)
Ethyl Acetate
Gasoline
Glacial Acetic Acid
Grape Juice
Hair Dye
Hydrogen Peroxide (3% solution)
Iodine (1% solution)
Isopropyl Alcohol (50% solution)
Lye Solution (2%)
Merthiolate (1% solution)
Methyl Ethyl Ketone
Milk
Mineral Oil
Mixture of Naphtha and Ethyl Alcohol (50:50)
Mustard
Perchloric Acid (60% solution)
Phenol (5%)
Red Food Dye
Red Lipstick
Soap (5% solution)
Sodium Hypochlorite
Tea
Tincture of Mercurochrome®
Toluene
Tomato Catsup
Trichlorethylene
Trisodium Phosphate (1% solution)
Urea (6.6% solution)
Urine
Vegetable Cooking Oil
Vinegar
Washable Blue Ink
Water

Following is the list of typical medical and dental stains used in testing:

Ammonia
BetadineTincture of
Dimethyl Methylene Blue
Eucalyptol
Eugenol
Gentian Violet
Iodine
Gentian Violet
Lysol® Brand Disinfectant
Rhodamine B Isothiocyanate
Safranine 0
Silver Nitrate
Tincture of Mercurochrome
Trypan Blue
Wright Stain
Zinc Oxide Ointment

Compositions which COULD stain Formica® Solid Surfacing sheets and sinks:

Dichromate Cleaning Solution
Formic Acid (90%)
Furfural
Hydrochloric Acid (37% solution)
Hydrofloric Acid (48%)
Nitric Acid (70% solution)
Phenolphthalein (1%)
Phosphoric Acid (85%)
Potassium Permanganate (2%)
Silver Nitrate (10%)
Sodium Hydroxide (40%)
Sodium Sulfide (15%)
Sulfuric Acid (77% solution)

**Stains can normally be removed by following the Formica Solid Surfacing Use and Care Instructions.*

USE AND CARE

Formica® Solid Surfacing is not only one of the most beautiful surfacing materials available today, but also one of the most durable. A product of sophisticated modern technology, Formica® Solid Surfacing is resistant to stains, bacteria, and impact. It is nonporous, with the same color and pattern running throughout its thickness. This combination of features provides a deep, rich appearance that's easy to care for, so its beauty can be preserved for years to come.

Do not use over-the-counter cleaners that contain strong acids (e.g. cleaners for tile, grout, ceramic stove tops, toilet bowls, etc.). We recommend using either Countertop Magic or Plexus as polishes you can put on your Solid Surface countertop to enhance the shine. We do not recommend using Hope's polish.

Normal Cleaning – Light Colors with a Matte or Satin Finish:

Formica® Solid Surfacing is nonporous and can be easily wiped clean with a damp cloth or sponge and mild detergents or general purpose cleaner such as Mr. Clean® or Lestoil.® If you have a Matte finish, abrasive cleansers like Ajax,® Bon Ami® or Comet® may also be used. Periodically, it may also be helpful to go over the entire surface with an abrasive cleanser or a wet 7447 Scotch-Brite® pad (if Matte finish) or a wet 7448 Scotch-Brite® pad (if Satin finish) to maintain a uniform appearance. Rinse with water and towel dry.

Normal Cleaning – Dark Colors with a Semi-Gloss or Gloss Finish:

Dark colors usually have a higher gloss than a Matte finish. Maintenance is generally limited to wiping with a mild detergent on a damp cloth and wiping dry.

Some Simple Precautions:

Do not place hot pans directly from the burner or oven on the countertop surface. Even though Formica® Solid Surfacing can withstand up to 175º F, prolonged or extreme heat could cause damage to the surface. A trivet should always be used under all heated appliances, such as crock pots, electric fry pans, coffee pots, etc. Extreme temperature swings should be avoided. When pouring hot water (from boiling pasta, potatoes, etc.) into sink, always run warm water to reduce temperature extremes.

Do not use your countertop as a cutting board. Although minor cuts and scratches on a matte finish can be repaired by the consumer, deep cuts and high gloss finished tops will require the service of a professional, which is an extra expense. (An extra piece of Formica® Solid Surfacing from your fabricator makes an excellent cutting board to protect your counter.)

Do not stand or sit on your countertop.

No dry ice. Do not allow dry ice to come in contact with Formica Solid Surfacing sheets or sinks.

Spills and Stains:

While most everyday spills can be removed with the cleaning techniques listed, some troublesome spills and stains such as food dye, tea and fruit drinks may require more aggressive cleaning. These items can be removed using full-strength bleach for two to five minutes, followed by a general cleaner and flushing with water. On Matte finish, if you prefer you can scrub with an abrasive cleanser.

Strong acids such as those found in drain, toilet bowl and oven cleaners should be used cautiously around Formica® Solid Surfacing. If these items are accidentally spilled, wipe them up at once and rinse with water. Some of these items, if left on the surface, may cause whitening, which can be difficult to remove.

Should a burning cigarette accidentally come in contact with the surface, it could leave a nicotine stain or a scorch mark. Either of these can be removed by cleaning with an abrasive cleanser or buffing with a Scotch-Brite® pad.

Removing Scratches:

Dark Colors: Specialized tooling is required to achieve a high-gloss finish. Please contact your professional fabricator. Maintenance is limited to cleaning with mild detergents or nonabrasive countertop cleaners and a soft cloth.
Should the above maintenance steps create a variation in the surface finish, proceed with the final blending step over the entire countertop surface.

Matte Finish: Sand with 220-grit sandpaper on sanding block. Use small circular motions until scratch is gone. Blend finish with an abrasive cleanser and a maroon 7447 Scotch-Brite® Pad.

Satin Finish: Sand with 320-grit sandpaper on sanding block. Use small circular motions until the scratch is gone. Blend finish with Soft Scrub® Cleanser (or equivalent) and a gray 7448 Scotch-Brite® pad.

Semi-Gloss Finish: Sand with 600-grit sandpaper on sanding block. Use small circular motions until the scratch is gone. Blend finish with a nonabrasive cleanser and a white 7445 Scotch-Brite® pad.

Polished Finish: Specialized tooling is required to achieve a high-gloss finish. Please contact your professional fabricator. Maintenance is limited to cleaning with mild detergents or nonabrasive countertop cleaners and a soft cloth.
Should the above maintenance steps create a variation in the surface finish, proceed with the final blending step over the entire countertop surface.

Mr. Clean, Lestoil, Ajax, Comet, Scotch-Brite, Bon Ami, Countertop Magic, Plexus and Soft Scrub are all trademarks of their respective owners.

DecoMetal®

Metal Laminate & Solid Metal

TECHNICAL DATA

RECOMMENDED APPLICATION

Formica DecoMetal® laminate is real metal foil laminated to a phenolic core to combine the practicality of a high pressure laminate with the beauty of real metal. Metal laminate is suitable for interior light duty horizontal or vertical applications such as furniture, exhibits, accents, etc., where the bold look and design of metal are required.

Formica DecoMetal® solid metals and solid metal strips are solid aluminum sheets with polished-anodized or brushed lacquer finished surfaces. They are intended for vertical and light-duty horizontal interior applications only.

SURFACE FINISHES

Aluminum surface laminate (brushed, cross-brushed, matte, satin, perforated, embossed and etched) has an epoxy coated aluminum surface and, depending on the design, is available in natural, goldtone, pewtertone, bronzetone and steeltone.

Polished aluminum surface laminate has an anodized aluminum surface available in natural and goldtone, in plain or embossed designs.

Copper surface laminate has a polyurethane, resin-coated true copper surface and, depending on the design, is available in plain, embossed, natural, patina and antique appearance.

Stainless steel surface laminate is real stainless steel surface available in a brushed design.

Brass surface laminate is real brass surface available in an embossed design.

GRADES

Grade 82 (.030" (0.8mm))
Formica DecoMetal® metal laminate:
Postformable aluminum sheets with a phenolic back. Engineered for vertical forming applications such as cabinet doors. **Not intended for countertop use in high-wear situations.** Formable to 3/8" (9.5mm) radius. (Full wrap doors can be made on 3/4" (19mm) cores.)

Grade 83 (.025" (0.7mm))
Formica DecoMetal® solid metals and solid metal strips:
Solid aluminum sheet with an anodized finish in various designs. Etched finishes in various scales are coated in enhanced polymers. Engineered for vertical and light-duty horizontal interior applications.

Grade 84 (.030" (0.8mm))
Formica DecoMetal® metal laminate:
Brushed stainless steel sheet or corrugated aluminum with a phenolic back. The phenolic back prevents creasing and allows for improved adhesion to substrates. Engineered for vertical and light-duty horizontal applications.

Grade 85 (.040" (1.0mm))
Formica DecoMetal® metal laminate:
Polished, anodized, matte, brushed or mirror aluminum or copper sheet with a phenolic back. The phenolic back prevents creasing and allows for improved adhesion to substrates. Engineered for vertical and light-duty horizontal interior applications.

Grade 86 (.050" (1.3mm))
Formica DecoMetal® metal laminate:
Matte, mirror, hammered or antiqued aluminum or copper sheet with a phenolic back. The phenolic back prevents creasing and allows for improved adhesion to substrates. Engineered for vertical and light-duty horizontal interior applications.

FABRICATION AND ASSEMBLY/HANDLING

Usage Limitations
Formica DecoMetal® products are intended for application to dry interior vertical or light-duty horizontal surfaces. They are not recommended for application directly to plaster, gypsum board, concrete, or softwood fir and pine plywoods. They should not be used in areas exposed to water, excessive moisture, constant high humidity, temperatures exceeding 140°F (60°C) for prolonged periods of time, or for exterior applications. Formica DecoMetal® products are manufactured using real aluminum, brass, stainless steel and copper foils. This surface is softer than the surface for Formica® Brand Laminate and will scratch easier. These products are not recommended for heavy- duty horizontal applications such as countertops or for use in high heat or moist areas such as backsplashes, behind cooktop or range hoods.

Postforming grade laminates are available in limited patterns. Consult the Formica DecoMetal® Catalog of Standard Items (Form No. 08-104). *Do not heat postform standard grade metal laminates (Grade 84, 85, & 86) or solid metals (Grade 83). Solid metals are cold postformable.*

The surface of the laminate is covered with a protective peelcoat which should not be removed before all work has been completed. Directional patterns have an arrow on the peelcoat indicating proper direction for application.

Damage, scratches or wear to the surface of the colored aluminum patterns will reveal silver natural aluminum. Mirror finishes may show some small dimples and, in certain lighting conditions, may display slight color changes. Mirror finish metal laminates should be viewed under lighting conditions specific to the application prior to fabrication, by peeling back a portion of the peelcoat for visual inspection.

Before routing, inspect the router base and bit guide bearings and check on a piece of scrap material to make sure that you will not scratch the surface.

Do not apply adhesive tape to the surface, as it can damage the finish. Masking tape may be applied over the peelcoat for additional protection for the router base and router bit bearing to guide on.

Color Limitations
Due to deviations which are inherent to natural metal products, Formica DecoMetal® products may display a range of color shades, which **do not indicate a product defect.** Check that all sheets are of a consistent shading before fabrication. Lift a corner of the peelcoat to check shading; reposition peelcoat after color check to protect the surface during fabrication.

Formica DecoMetal® metal laminate and solid metals are directional and may show a color shift when viewed at different angles. It is absolutely necessary that the running direction is the same, and the general appearance checked, before assembly. Arrows are printed on the peelcoat of items which have a directional pattern, indicating alignment direction. Do not remove the peelcoat prior to fabrication.

Exposure of Formica DecoMetal® sheets to direct sunlight may produce color change in the tinted surface coating. Any slight change in color over time does not indicate a product defect. Do not expose solid metal sheets to temperatures that exceed 200°F (93°C) or to direct sunlight.

Occasionally, interference colors (Newton rings) can occur on polished, anodized aluminum surfaces. Check all polished aluminum laminates under the relevant lighting conditions before fabrication by lifting a corner of the peelcoat; reposition the peelcoat after checking to protect the surface during fabrication.

Storage
Formica DecoMetal® sheets should be stored horizontally, face side down, with a caul board placed on top to protect the material from possible damage and reduce the chance of warpage. The material should never be stored in a high moisture area, or in contact with the floor or an outside wall. Storage temperature should not exceed 86°F (30°C) or go below 50°F (10°C) for prolonged periods of time.

Optimum conditions for storage are approximately 70°F (21°C), and 50% to 60% relative humidity. Do not damage the protective peelcoat. The material should be protected from ultraviolet light and excessive heat to insure easy removal of peelcoat and prevent color shift due to exposure to light.

Preconditioning
Formica DecoMetal® metal laminate moves with changes in humidity, but less than standard high pressure laminate. Formica DecoMetal® laminate and substrates gain moisture and expand under high relative humidity conditions, and lose moisture and shrink under dry relative humidity conditions. Allow the sheet and the substrate to acclimate for at least 48 hours at the same ambient conditions prior to fabrication. Optimum conditions are approximately 70°F (21°C), and at a relative humidity of 50% to 60%. Provisions should be made for the circulation of air around the components.

Solid metals (Grade 83) do not move dimensionally with changes in humidity. However, wood-based substrates to which metals may be bonded will move. Recommended cores for solid metals are hardwood-faced plywoods.

Substrates
The recommended cores for Formica DecoMetal® metal laminates are 45# density, industrial grade particleboard (CS 236-66: Type 1, Grade B, Class 2) or Medium Density Fiberboard (MDF). MDF is recommended for mirror finishes to minimize telegraphing. Softwood fir and pine plywoods have rough surfaces and high shrinkage, and are unusable as substrates. All substrates should be sanded smooth, clean, free of oil or grease, and uniform in thickness. Do not use drywall (gypsum), plaster, concrete, solid lumber, bending plywood, or underlayment. Recommended cores for solid metals are hardwood-faced plywoods.

Postforming

Grade 82 is a special formula phenolic-backed metal laminate that can be heat postformed to radii as tight as 3/8" (9.5mm). The postforming process is similar to Formica® Brand Laminate except the temperature is lower. 250°F (120°C) is the ideal temperature. Lower temperatures than 250°F (120°C) could cause cracking of the phenolic core, where higher temperature can cause delamination and bubbling between aluminum foil surface and the phenolic core. Heater temperature, time of exposure to the heater, and the reflectance of the aluminum are some of the factors to consider. Since equipment can vary, it is recommended to test these conditions on a piece of scrap first using Tempilaq® temperature indicator.

Heat Postforming

Leave peelcoat on during postforming.

1. Radius core materials.
2. Bond Grade 82 Formica Decometal® to the core material with a neoprene contact cement which has been formulated for postforming.

3. Apply 250°F (120°C) temperature-sensitive paint (such as Tempilaq®) to the back of the Formica DecoMetal® sheet in an inconspicuous place in the area to be radiused. *Note: Always apply the temperature sensitive paint in the oversized or off fall area, as the paint will telegraph through the face.*
4. Leaving the peelcoat on the face, place the area to be formed over the heater, face down. Hold over heater until temperature-sensitive paint melts.
5. Remove from heat source. Quickly form into fixture using wiping action. When cool, remove from fixture and j-roll.

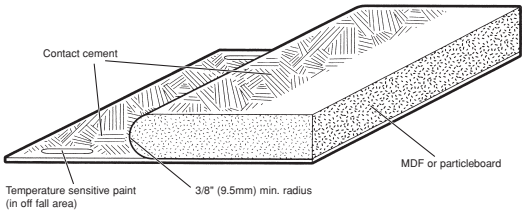


Figure 1

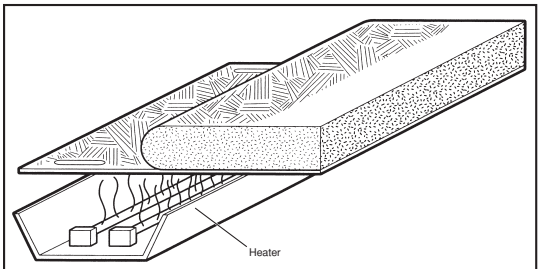


Figure 2

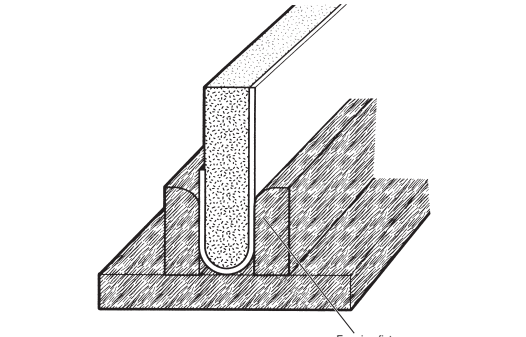


Figure 3

Grade 83 Cold Forming
Formica DecoMetal® solid metals can be cold formed and bent using sheet metal fabrication techniques. Sheet metal brakes and pipe rollers can be use to shape the metal prior to bonding to substrates.

For 3/8" (9.5mm) radius, the above technique for Grade 82 can be used, skipping steps three and four (no heat required). *Note: Very tight radii, less than 1/8" (3.1mm), can crack the anodized finish. Always test first.*

Adhesives
Conventional contact, PVAc, and rigid-set adhesives (resorcinol) can be used to bond Formica DecoMetal® laminate. Do not use urea adhesives. Do not hot press. Avoid contact adhesive contamination of the metal surface.

Formica® brand contact adhesives should be used to bond solid metal sheets to the substrate.

Do not allow contact adhesive solvent, lacquer thinner, or other strong solvents to come in contact with the urethane coated surface of Formica DecoMetal® copper or brass laminates, as it will damage the surface. Hexane, Heptane, Formica® Brand #203 Adhesive Remover or Citrus Cleaner can be used to remove contact adhesive overspray.

Assembly
Material, equipment, and workmanship should conform to the industry standard practices, conditions, procedures, and recommendations as specified by ANSI/NEMA LD3-2000, Section 4, Architectural Woodwork Quality Standards, DLPA (Decorative Laminate Products Association), and ANSI-161.2-1979 standards. Critical applications requiring a well-balanced panel assembly, such as cabinet doors, should use the same material on both sides to minimize warpage. Less critical assemblies may only require a cabinet liner or phenolic backer.

Formica DecoMetal® metal laminate *(except 2178 Brushed Stainless Steel)* can be sawed, drilled, routed and fabricated similarly to standard high pressure laminate. Carbide-tipped cutting tools are recommended. Always cut with the decorative surface face up. (See Special Trimming and Cutting Guidelines which follow for stainless steel metal laminate and solid metals.)

Do not postform standard grade Formica DecoMetal® laminate. Postforming grade is available as a factory order on select items.

Always align material in the same running direction. Arrows are printed on the peelcoat of several items to indicate alignment direction. Do not remove the peelcoat prior to fabrication.

All inside corners of cutouts must be radiused as large as possible (1/8" (3.18mm) minimum to avoid stress cracking). The edges and corners should be filed smooth and free of chips or nicks.

Cut or milled edges should be finished with a fine file or abrasive paper to remove any burrs.

CAUTION: Formica DecoMetal® metal laminate and solid metals conduct electricity. Contact with electrical current may cause shock hazards or short circuits. Sharp edges may cut electrical cords.

Special Cutting and Trimming Guidelines:
Formica DecoMetal® Brushed Stainless Steel (2178) and solid metal items require different machining techniques than plastic laminate. Use the following guidelines when cutting and trimming these products:

Cutting

- Cut stainless steel or solid metal to yield a minimum overhang (< 1/8" (3.18mm)).
- Use clean, sharp carbide saw blades.
- Eliminate pulling and bending by cutting solid metal with"zero clearance" at blade kerf or spot-gluing metal to scrap carrier board.

Trimming

- Use a small diameter cutter (3/8" (9.53mm)) and a variable speed router set at minimum setting, or use an electronic speed control accessory to reduce router RPM as slow as possible.
- Use a clean, sharp flush bit (rather than a bevel bit) which can be adjusted to yield up to 10 fresh cutting edges. Protect the self-edge face with masking tape at the bearing line.
- Feed the router as fast as possible. Rough cut at one height adjustment and re-trim at fresh cutting edge. Retract cutter from the work piece as soon as cut is complete. Dwelling in one spot during start or finish will greatly diminish cutter life. Plan your cutting strategy to reduce static starts and stops.
- Stainless steel will dull the cutting edge quickly. Overextending a dull edge will result in excessive heat which may cause delamination of the stainless steel surface form the phenolic core. Use Leitz #40776 for square trimming.
- Finish edges with a fine file, always cutting on the downward stroke.

CAUTION: Wear gloves. Metal burrs and edges are very sharp and can cut flesh and electrical cords.

Formica DecoMetal® metal laminate can be formed at room temperature only. Do not use heat to form or for adhesive reactivation. Forming radii limits will vary, depending on laminate thickness and width.

Do not heat postform Formica DecoMetal® solid metals. Solid metals are cold formable.

TECHNICAL DATA

Performance compliance of Formica DecoMetal® metal laminate and solid metal:

Formica DecoMetal® Cold Bending Radii

	2" (50.8mm) Wide Samples		48" (121.9cm) Wide Samples	
Grade/Thickness	**Outside Bend**	**Inside Bend**	**Outside Bend**	**Inside Bend**
83 / .025" (0.7mm)	3/32" (2.4mm)	3/32" (2.4mm)	3/32" (2.4mm)	3/32" (2.4mm)
84 / .030" (0.8mm)	2" (50.8mm)	2" (50.8mm)	4" (101.6mm)	6" (152.4mm)
85 / .040" (1.0mm)	2-1/2" (63.5mm)	2-1/2" (63.5mm)	6" (152.4mm)	10" (254mm)
86 / .050" (1.3mm)	3" (76.2mm)	3" (76.2mm)	8" (203.2mm)	10" (254mm)

To achieve a square outside corner, use a miter fold technique, such as the Betterley™ Mitre Fold System.

Formica DecoMetal® Heat Postforming Bending Radii

	2" (50.8mm) Wide Samples		48" (121.9cm) Wide Samples	
Grade/Thickness	**Outside Bend**	**Inside Bend**	**Outside Bend**	**Inside Bend**
82 / .030" (0.8mm)	3/8" (9.5mm)	3/8" (9.5mm)	3/8" (9.5mm)	3/8" (9.5mm)

Fire Test Data — ASTM E-1317 IMO Test

	8599 Alum. .040" (1.0mm)	8699 Copper .050" (1.3mm)
Heat of Ignition (kJ/m^2)	0.00	4,788.50
Heat of Sustained Burning (kJ/m^2)	0.00	1,745.51
Time of Extinguishment (min)	N/A	3.54
Distance Burnt (mm)	N/A	250.00
Critical Flux (kW/m^2)	N/A	34.93
Total Heat Release (kJ)	N/A	27.51
Peak Heat Release (kW)	N/A	0.29

Fire Test Data — ASTM E-84 Tunnel Test

Grade	Thickness	Adhesive	Substrate	Backer	Flame	Smoke	Class
84 Alum.	.030" (0.8mm)	Cascophen® Adhesive G-1149-A/G-1131-B	3/4" (19.1mm) FR Particleboard	91/BLS	25	0	I(A)
84 Alum.	.030" (0.8mm)	Cascophen® Adhesive G-1149-A/G-1131-B	3/8" (9.5mm) FR Particleboard	91/BLS	25	0	I(A)
84 Alum.	.030" (0.8mm)	Formica® #150 Contact	3/8" (9.5mm) FR Particleboard	91/BLS	40	5	II(B)
84 Alum.	.030" (0.8mm)	Cascophen® Adhesive G-1149-A/G-1131-B	3/4" (19.1mm) STD Particleboard	91/BLS	40	0	II(B)
84 Alum.	.030" (0.8mm)	Formica® #150 Contact	3/4" (19.1mm) FR Particleboard	91/BLS	45	5	II(B)
84 Alum.	.030" (0.8mm)	Cascophen® Adhesive G-1149-A/G-1131-B	3/8" (9.5mm) STD Particleboard	91/BLS	45	0	II(B)
84 Alum.	.030" (0.8mm)	Formica® #150 Contact	3/4" (19.1mm) STD Particleboard	91/BLS	60	5	II(B)
84 Alum.	.030" (0.8mm)	Formica® #150 Contact	3/8" (9.5mm) STD Particleboard	91/BLS	80	35	III(C)
86 Alum.	.050" (1.3mm)	Cascophen® Adhesive G-1149-A/G-1131-B	3/4" (19.1mm) FR Particleboard	91/BLS	20	0	I(A)
86 Alum.	.050" (1.3mm)	Cascophen® Adhesive G-1149-A/G-1131-B	3/8" (9.5mm) STD Particleboard	91/BLS	20	15	I(A)
86 Alum.	.050" (1.3mm)	Cascophen® Adhesive G-1149-A/G-1131-B	3/8" (9.5mm) FR Particleboard	91/BLS	25	5	I(A)
86 Alum.	.050" (1.3mm)	Formica® #150 Contact	3/8" (9.5mm) FR Particleboard	91/BLS	35	0	II(B)
86 Alum.	.050" (1.3mm)	Formica® #150 Contact	3/4" (19.1mm) FR Particleboard	91/BLS	45	5	II(B)
86 Alum.	.050" (1.3mm)	Cascophen® Adhesive G-1149-A/G-1131-B	3/4" (19.1mm) STD Particleboard	91/BLS	50	5	II(B)
86 Alum.	.050" (1.3mm)	Formica® #150 Contact	3/4" (19.1mm) STD Particleboard	91/BLS	60	5	II(B)
86 Alum.	.050" (1.3mm)	Formica® #150 Contact	3/8" (9.5mm) STD Particleboard	91/BLS	70	15	II(B)

USE AND CARE

Formica DecoMetal® metal laminate and solid metal may be cleaned with a damp cloth and mild detergent or citrus cleaner. To remove contact adhesive overspray, use hexane, heptane or Formica® Brand #203 Adhesive Remover. If in doubt about the suitability of a particular cleaner or detergent, check with its manufacturer. Use of abrasive cleaners, powders, scouring pads, steel wool, sandpaper, etc., will damage the finish. Acid or alkaline-based cleaners, compounds, solvents, etc., will mar, etch, corrode, and permanently discolor Formica DecoMetal® products. Never use these materials on Formica DecoMetal® items, nor allow bottles, rags, etc., contaminated with them to contact the surface. Accidental spills or splatters from these harsh materials should be wiped off immediately, and the area cleaned thoroughly with a damp cloth.

Examples of these materials are:

drain cleaners
ceramic cooktop cleaners
some countertop cleaners
metal cleaners
oven cleaners
coffeepot cleaners
chlorine bleach
rust removers
tub and tile cleaners
toilet bowl cleaners

SIZES

Stainless Steel (2178)	40" x 96" (1020 x 2440mm)
All others (pattern dependent)	48" x 96" (1220mm x 2440mm) 48" x 120" (1220mm x 3050mm)

Note: Metal strips are available in limited solid metals. Check with your Formica Representative for availability.

COLORS AND PATTERNS

Formica DecoMetal® metal laminate & solid metal is available in a broad selection of designs and colors. Samples are available from Formica Corporation by calling 1-800-FORMICA™.

HOW TO SPECIFY

Surface shall be Formica DecoMetal® metal laminate or Formica DecoMetal® solid metal from Formica Corporation, Cincinnati, Ohio.

COLOR NUMBER _____
COLOR NAME _____
GRADE _____
SIZE _____

3form® *eco*resin

Specifications

FLAMMABILITY & SMOKE TEST RESULTS – BUILDING CODE APPROVALS

*eco*resin panels (a polyester-based material), have been independently tested and meet the criteria for approved interior finishes and "light transmitting" resin materials as described in the 2003 International Building Code®.

TEST	3FORM *ECO*RESIN	RESULT
ASTM D 2843 Smoke Density	71.6%	PASS Less than 75
ASTM D 635 Flame Spread	Self extinguishing	PASS CC1
ASTM D 1929 Self-ignition Temperature	716°F	PASS Greater than 650°F
ASTM E84-03		
Flame Spread, 1/4" to 1" thickness	65	Class B: 26-75
Smoke generated	425	<450
ASTM E84-03		
Flame Spread, 1" thickness	20	Class A: 0-25
Smoke generated	250	<450
NFPA 286, 1/4" thickness	Pass	Class A

PANEL WEIGHT

THICKNESS (INCHES)	WEIGHT FLUX (LB/FT²)
1/16" (1.5 mm)	0.4 lb/ft² (2.0 kg/m²)
1/8" (3 mm)	0.8 lb/ft² (4.0 kg/m²)
3/16" (4.5 mm)	1.2 lb/ft² (6.1 kg/m²)
1/4" (6 mm)	1.7 lb/ft² (8.1 kg/m²)
3/8" (9.5 mm)	2.5 lb/ft² (12.2 kg/m²)
1/2" (12.5 mm)	3.3 lb/ft² (16.1 kg/m²)
3/4" (19 mm)	5.0 lb/ft² (24.4 kg/m²)
1.0" (25 mm)	6.6 lb/ft² (32.2 kg/m²)

EXPANSION/CONTRACTION ALLOWANCES

Like all resin products, 3form *eco*resin will expand and contract nominally with fluctuations in temperature. The following formula provides allowances that should be made in framed or fitted applications:

Longest length of panel (inches) x temperature change of the sheet (°F) x 0.00004 =
Amount of Linear Expansion/Contraction (inches)

Example:

A 48" x 96" panel that experiences a 50°F temperature change will expand/contract:
96 inches x 50 degrees x 0.00004 in/in °F = 0.192 inches (expansion)

Installers should take extra precautions if installation is occurring before the HVAC systems are operational. Allowances should also be made in the following situations:

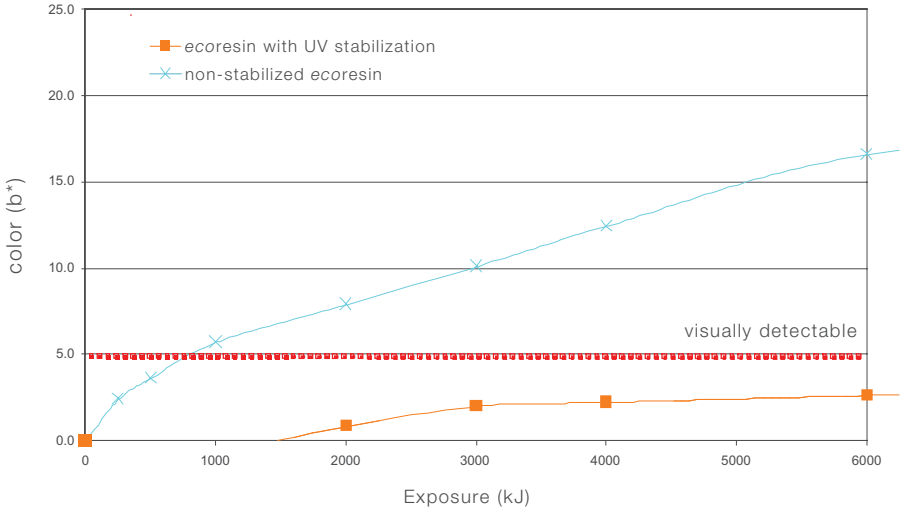
Fastening points
Holes for standoffs and other hardware
Meeting points for multiple sheets of 3form *eco*resin

ULTRAVIOLET EXPOSURE PERFORMANCE

UV stabilizers, when incorporated with 3form *eco*resin panels, have proven to be very effective in maintaining the integrity of the panels with extended exposure to UV radiation. The following charts provide an overview of the effectiveness of UV stabilizers that are incorporated with 3form *eco*resin panels. Following 6,000 kJ of exposure (representing approximately 10-years outdoor Florida exposure) it is shown that the 3form *eco*resin with UV stabilization exhibits excellent performance. The following chart demonstrates that the b* shift remains below the 5 b* visual threshold (and shows a leveling change over time).

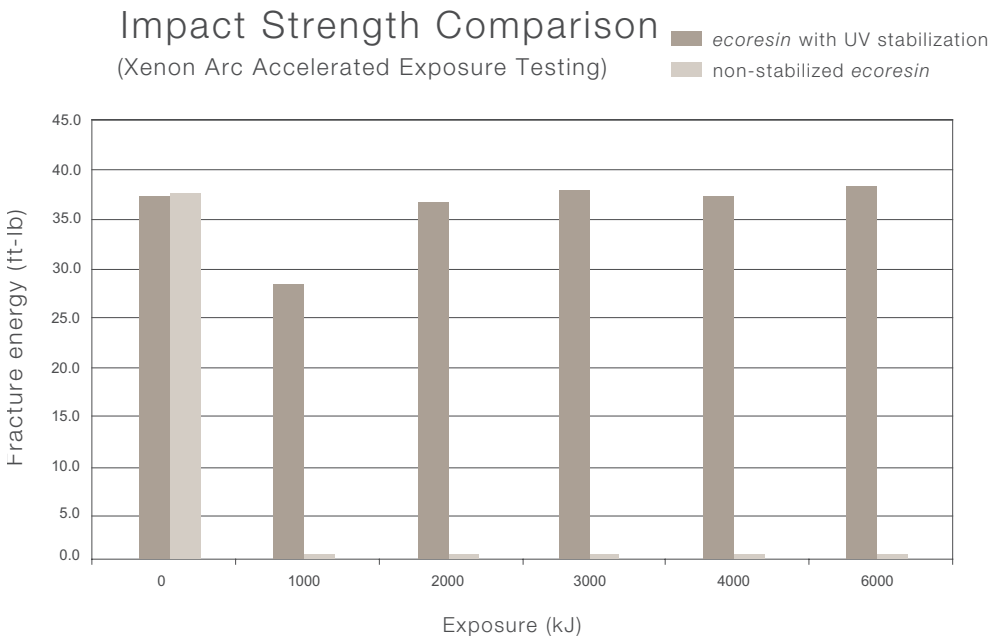
Color Stability

(Xenon Arc Accelerated Exposure Testing)



3form® *eco*resin

Additionally, as demonstrated in the following chart, *eco*resin panels maintain tremendous physical integrity when produced with UV stabilization technology.



DEFLECTION

3form *eco*resin will exhibit different amounts of deflection given a variety of factors: fastening techniques, loads, gauges and panel dimensions to list a few. Your 3form Representative can assist you with general deflection guidelines for your application. If your application has specific engineering requirements, please contact the 3form Product Technology team for additional direction.

HEAT FORMING/COLD BENDING

*eco*resin can be cold bent for simple bends and curved areas. As a rule, a minimum radius of 100 times thickness is acceptable for *eco*resin (will depend on innerlayer material).

*ECO*RESIN THICKNESS	MINIMUM COLD BEND RADII
1/16" (1.5 mm)	7" (178 mm)
1/8" (3 mm)	12" (305 mm)
3/16" (4.5 mm)	19" (483 mm)
1/4" (6 mm)	25" (635 mm)

3form® *eco*resin

3/8" (9.5 mm)	37" (940 mm)
1/2" (12.5 mm)	50" (1270 mm)
3/4" (19 mm)	75" (1905 mm)
1" (25 mm)	100" (2540 mm)

Because of its low thermoforming temperature, *eco*resin is easy to strip heat and line bend. Remove protective masking from area to be bent. Using a line heat device, regulate the heat to a temperature that allows *eco*resin to reach 250°F-300°F (138°C -160°C). Thicker gauge requires a longer period of time to allow heat penetration. Place sheet over heat source at bend area. Allow heat to soften material; time depends on gauge, 1/8" (3 mm) typically requires 2 minutes. Remove from heat and make desired bend, and place in wood or fabric-covered aluminum fixture to cool.

- Always strip heat a sample piece first
- Avoid drafty rooms which can cause uneven heating and cooling
- Be sure to cover forming fixtures with soft fabric to avoid scratching *eco*resin
- Bending *eco*resin when it is too cold results in a highly-stressed, weakened material
- Thicker gauges (over 1/8") may require heating on both sides by turning the sheet over periodically
- Always bend the sheet with the heated side forming the outside radius

EDGE FINISHING

Edges of 3form *eco*resin panels are able to be machined or routed into a variety of different forms. In addition to a straight edge, edges may accept beveling, rounding, etc. Additional finishing, such as sanding or polishing, can also be provided to some edges.

REFINISHING

*eco*resin finishes such as patent can have blemishes polished out; however, the majority of 3form products have a surface finish that would be ruined by buffing. “Stucco” is our most durable finish. This finish is recommended for any high-traffic areas.

Selected Mechanical and Physical Properties for 3form *eco*resin

					TYPICAL VALUE					
			UNITS		0.060" (2 MM)		0.118" (3 MM)		0.236" (6 MM)	
PROPERTY*	CONDITIONS	ASTM METHOD	SI	U.S. CUSTOMARY	SI	U.S. CUSTOMARY	SI	U.S. CUSTOMARY	SI	U.S. CUSTOMARY
GENERAL										
Density	23° C (73° F)	D 1505	kg/m^3	g/cm^3	1,270	1.27	1,270	1.27	1,270	1.27
Water Absorption	23° C (73° F), 24h immersion	D 570	%	%	0.3	0.3	0.2	0.2	0.1	0.1
Heat Deflection Temperature	@66psi	D648	°C	°F	—	—	73.3	164	—	—

Paneltech International, LLC
2999 John Stevens Way - Hoquiam, WA 98550
Office: 360.538.9815, Fax: 360.538.1510

"Saving the forest one tree at a time"

Material Specifications

Thermal Phenolic Fiber Composite

Water Absorption (by weight)		0.82%
Density (g/cm3)		0.7402%
Internal Bond (psi)		1,225 lbs.
Modulus of Rupture (flexibility)		
(face)	X direction	24,320 psi
	Y direction	24,080 psi
(edge)	X direction	21,834 psi
	Y direction	21,413 psi
Modulus of Elasticity		
	X direction	1724.25 ksi
	Y direction	1666.58 ksi
Compressive Strength		
	Z direction (face)	45,324 psi
	X direction	23,200 psi
	Y direction	22,560 psi
Coefficient of Thermal Expansion		
	X direction	3.64
	Y direction	3.48
	Z direction	2.62
Izod Impact Strength		
(face)	X direction (ft. lb. per inch of width)	3.29
	Y direction (ft. lb. per inch of width)	2.76
(edge)	X direction (ft. lb. per inch of width)	0.73
	Y direction (ft. lb. per inch of width)	0.75
Hardness Test		
	Barcole Meter (Barber Coleman)	47 avg.
UV exposure		slight darkening

For product inquiries or any other questions please contact us

All our products go through a rigorous testing and certification program to be of the highest quality, and most environmentally friendly.

Here are some of those results:

Formaldehyde Test Results
ASTM Fire Test Results

INTERTEK TESTING SERVICES NA, INC.

ASTM E84 DATASHEETS

Client:	KlipTech Composites	
Date:	7/11/2006	4:46 P.M.
Test Number:	4	
Project Number:	3099454SAT-001	
Operator:	EH/TA	

Specimen ID:
"KlipTech PaperStone™". The specimen was self-supporting.

TEST RESULTS:

FLAME SPREAD INDEX:	**20**
SMOKE DEVELOPED INDEX:	**110**

SPECIMEN DATA

Time to Ignition	=	218 (sec)
Time to Max FS	=	529 (sec)
Maximum FS	=	9.0 (feet)
Time to 980 °F	=	Never Reached (sec)
Max Temp	=	678 (°F)
Time to Max Temp	=	600 (sec)
Total Fuel Burned	=	50.81 (cubic feet)
FS*Time Area	=	40.5 (ft*min)
Smoke Area	=	69.2 (%A*min)
Fuel Area	=	5600.6 (°F*min)
Fuel Contributed Value	=	13
Unrounded F.S.I.	=	20.9

CALIBRATION DATA...

Time to Ignition of Last Red Oak	=	00:44 (min:sec)
Red Oak Smoke Area	=	62.50 (%A*min)
Red Oak Fuel Area	=	8972 (°F*min)
Glass Fiber Board Fuel Area	=	5065 (°F*min)

FACE MOUNT HANGERS – SOLID SAWN LUMBER (DF & SP)

SIMPSON Strong-Tie®

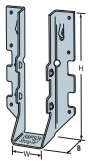
These products are available with additional corrosion protection. Additional products on this page may also be available with this option, check with Simpson for details.

CODES: See page 12 for Code Listing Key Chart.

Joist Size	Model No.	Ga	Dimensions W	H	B	Fasteners Header 10d	Header 16d	Joist	Doug Fir Larch/Southern Pine Allowable Loads Uplift (133)	Uplift (160)	Floor (100) 10d	Floor (100) 16d	Snow (115) 10d	Snow (115) 16d	Roof (125) 10d	Roof (125) 16d	Installed Cost Index (ICI)	Code Ref.
SAWN LUMBER SIZES																		
2x4	LU24	20	1⁹⁄₁₆	3⅛	1½	4-10d	4-16d	2-10dx1½	245	265	445	530	510	610	555	665	Lowest	2, 40, 121
	LUS24	18	1⁹⁄₁₆	3⅛	1¾	4-10d	—	2-10d	465	490	640	—	735	—	800	—	+3%	4, 37, 87, 133, 140
	U24	16	1⁹⁄₁₆	3⅛	1½	4-10d	4-16d	2-10dx1½	240	290	445	530	510	610	555	665	+67%	26, 83, 140, 144
	HU26	14	1⁹⁄₁₆	3¹⁄₁₆	2¼	—	4-16d	2-10dx1½	240	290	—	535	—	615	—	670	+295%	26, 83, 144
DBL 2x4	LUS24-2	18	3⅛	3⅛	2	—	4-16d	2-16d	440	440	—	765	—	880	—	960	Lowest	1, 84, 133
	U24-2	16	3⅛	3	2	4-10d	4-16d	2-10d	295	355	445	530	510	610	555	665	+33%	26, 83, 140, 144
	HU24-2	14	3⅛	3¹⁄₁₆	2½	—	4-16d	2-10d	300	360	—	535	—	615	—	670	+240%	26, 83, 144
2x6	LUS26	18	1⁹⁄₁₆	4¾	1¾	4-10d	—	4-10d	930	1115	830	—	955	—	1040	—	Lowest	4, 37, 87, 133, 140
	LU26	20	1⁹⁄₁₆	4¾	1½	6-10d	6-16d	4-10dx1½	490	565	665	800	765	920	830	1000	+6%	2, 40, 121
	U26	16	1⁹⁄₁₆	4¾	2	6-10d	6-16d	4-10dx1½	480	575	665	800	765	920	830	1000	+43%	26, 83, 121, 140, 144
NEW	LUC26Z	18	1⁹⁄₁₆	4¾	1¾	6-10d	6-16d	4-10dx1½	615	730	710	845	810	965	875	1040	+160%	160
	HU26	14	1⁹⁄₁₆	3¹⁄₁₆	2¼	—	4-16d	2-10dx1½	240	290	—	535	—	615	—	670	+179%	26, 83, 144
	HUS26	16	1⅝	5⅜	3	—	14-16d	6-16d	1550	1550	—	2565	—	2950	—	3205	+276%	4, 37, 87, 133
DBL 2x6	LUS26-2	18	3⅛	4⅞	2	—	4-16d	4-16d	1140	1165	—	1000	—	1150	—	1250	Lowest	1, 84, 121, 133
	U26-2	16	3⅛	5	2	8-10d	8-16d	4-10d	590	710	890	1065	1020	1225	1110	1330	+65%	26, 83, 121, 140, 144
	HUS26-2	14	3⅛	5³⁄₁₆	2	—	4-16d	4-16d	1080	1235	—	1005	—	1155	—	1255	+172%	1, 84, 133
	HU26-2 (Min)	14	3⅛	5⅜	2½	—	8-16d	4-10d	605	725	—	1070	—	1235	—	1340	+233%	26, 83, 144
	HU26-2 (Max)	14	3⅛	5⅜	2½	—	12-16d	6-10d	905	1085	—	1610	—	1850	—	2010	+254%	
TPL 2x6	LUS26-3	18	4⅝	4⅛	2	—	4-16d	4-16d	1140	1165	—	1000	—	1150	—	1250	*	9, 133
	U26-3	16	4⅝	4¼	2	8-10d	8-16d	4-10d	590	710	890	1065	1020	1225	1110	1330	*	26, 83, 121, 140, 144
	HU26-3 (Min)	14	4¹¹⁄₁₆	5½	2½	—	8-16d	4-10d	605	725	—	1070	—	1235	—	1340	*	26, 144
	HU26-3 (Max)	14	4¹¹⁄₁₆	5½	2½	—	12-16d	6-10d	905	1085	—	1610	—	1850	—	2010	*	
2x8	LUS26	18	1⁹⁄₁₆	4¾	1¾	4-10d	—	4-10d	930	1115	830	—	955	—	1040	—	Lowest	4, 37, 87, 133, 140
	LU26	20	1⁹⁄₁₆	4¾	1½	6-10d	6-16d	4-10dx1½	490	565	665	800	765	920	830	1000	+6%	2, 40, 121
	LUS28	18	1⁹⁄₁₆	6⅝	1¾	6-10d	—	4-10d	930	1115	1055	—	1210	—	1320	—	+23%	4, 37, 87, 133, 140
	LU28	20	1⁹⁄₁₆	6⅜	1½	8-10d	8-16d	6-10dx1½	735	850	890	1065	1020	1225	1110	1300	+39%	2, 40, 121
	U26	16	1⁹⁄₁₆	4¾	2	6-10d	6-16d	4-10dx1½	480	575	665	800	765	920	830	1000	+43%	26, 83, 121, 140, 144
NEW	LUC26Z	18	1⁹⁄₁₆	4¾	1¾	6-10d	6-16d	4-10dx1½	615	730	710	845	810	965	875	1040	+160%	160
	HU28	14	1⁹⁄₁₆	5¼	2¼	—	6-16d	4-10dx1½	480	575	—	805	—	925	—	1005	+251%	26, 83, 144
	HUS26	16	1⅝	5⅜	3	—	14-16d	6-16d	1550	1550	—	2565	—	2950	—	3205	+276%	4, 37, 87, 133
	HUS28	16	1⅝	7	3	—	22-16d	8-16d	2000	2000	—	3585	—	3700	—	3775	+409%	
DBL 2x8	LUS26-2	18	3⅛	4⅞	2	—	4-16d	4-16d	1140	1165	—	1000	—	1150	—	1250	Lowest	1, 84, 133
	LUS28-2	18	3⅛	7	2	—	6-16d	4-16d	1140	1165	—	1265	—	1455	—	1585	+8%	
	U26-2	16	3⅛	5	2	8-10d	8-16d	4-10d	590	710	890	1065	1020	1225	1110	1330	+65%	26, 83, 121, 140, 144
	HUS28-2	14	3⅛	7³⁄₁₆	2	—	6-16d	6-16d	1550	1550	—	1505	—	1730	—	1885	+188%	1, 84, 133
	HU28-2 (Min)	14	3⅛	7	2½	—	10-16d	4-10d	605	725	—	1340	—	1540	—	1675	+397%	26, 83, 144
	HU28-2 (Max)	14	3⅛	7	2½	—	14-16d	6-10d	905	1085	—	1875	—	2155	—	2345	+418%	
TPL 2x8	LUS28-3	18	4⅝	6¼	2	—	6-16d	4-16d	1140	1165	—	1265	—	1455	—	1585	*	9, 133
	U26-3	16	4⅝	4¼	2	8-10d	8-16d	4-10d	590	710	890	1065	1020	1225	1110	1330	*	26, 83, 121, 140, 144
2x10	LUS28	18	1⁹⁄₁₆	6⅝	1¾	6-10d	—	4-10d	930	1115	1055	—	1210	—	1320	—	Lowest	4, 37, 87, 133, 140
	LU28	20	1⁹⁄₁₆	6⅜	1½	8-10d	8-16d	6-10dx1½	735	850	890	1065	1020	1225	1110	1300	+13%	2, 40, 121
	LUS210	18	1⁹⁄₁₆	7¹³⁄₁₆	1¾	8-10d	—	4-10d	930	1115	1275	—	1470	—	1595	—	+15%	4, 37, 87, 121, 133, 140
	LU210	20	1⁹⁄₁₆	7¹³⁄₁₆	1½	10-10d	10-16d	6-10dx1½	735	850	1110	1330	1275	1530	1390	1660	+28%	2, 40, 121
	U210	16	1⁹⁄₁₆	7¹³⁄₁₆	2	10-10d	10-16d	6-10dx1½	720	865	1110	1330	1275	1530	1390	1660	+76%	26, 83, 121, 140, 144
NEW	LUC210Z	18	1⁹⁄₁₆	7¾	1¾	10-10d	10-16d	6-10dx1½	925	1100	1185	1410	1345	1605	1455	1735	+180%	160
	HU210	14	1⁹⁄₁₆	7⅛	2¼	—	8-16d	4-10dx1½	480	575	—	1070	—	1235	—	1340	+225%	26, 83, 144
	HUS210	16	1⅝	9	3	—	30-16d	10-16d	2845	3000	—	3775	—	3920	—	4020	+450%	4, 37, 87, 133
DBL 2x10	LUS28-2	18	3⅛	7	2	—	6-16d	4-16d	1140	1165	—	1265	—	1455	—	1585	Lowest	1, 84, 133
	LUS210-2	18	3⅛	9	2	—	8-16d	6-16d	1710	1745	—	1765	—	2030	—	2210	+34%	
	U210-2	16	3⅛	8½	2	14-10d	14-16d	6-10d	890	1065	1555	1860	1785	2140	1940	2330	+88%	26, 83, 140, 144
	HUS210-2	14	3⅛	9³⁄₁₆	2	—	8-16d	8-16d	2160	2590	—	2010	—	2310	—	2510	+217%	1, 84, 133, 140
	HU210-2 (Min)	14	3⅛	8¹³⁄₁₆	2½	—	14-16d	6-10d	905	1085	—	1875	—	2155	—	2345	+441%	26, 83, 144
	HU210-2 (Max)	14	3⅛	8¹³⁄₁₆	2½	—	18-16d	10-10d	1505	1810	—	2410	—	2775	—	3015	+467%	
	HHUS210-2	14	3⁵⁄₁₆	8⅞	3	—	30-16d	10-16d	2855	3430	—	5190	—	5900	—	5900	*	4, 37, 121, 133, 140
TPL 2x10	LUS28-3	18	4⅝	6¼	2	—	6-16d	4-16d	1140	1165	—	1265	—	1455	—	1585	*	9, 133
	LUS210-3	18	4⅝	8¹³⁄₁₆	2	—	8-16d	6-16d	1710	1745	—	1765	—	2030	—	2210	*	
	U210-3	16	4⅝	7¾	2	14-10d	14-16d	6-10d	890	1065	1555	1860	1785	2140	1940	2330	*	26, 83, 121, 140, 144
	HU210-3 (Min)	14	4¹¹⁄₁₆	8⁹⁄₁₆	2½	—	14-16d	6-10d	905	1085	—	1875	—	2155	—	2345	*	26, 83, 144
	HU210-3 (Max)	14	4¹¹⁄₁₆	8⁹⁄₁₆	2½	—	18-16d	10-10d	1505	1810	—	2410	—	2775	—	3015	*	
	HHUS210-3	14	4¹¹⁄₁₆	9	3	—	30-16d	10-16d	2855	3430	—	5190	—	5900	—	5900	*	133, 140
	HGUS210-3	12	4¹⁵⁄₁₆	9⅛	4	—	46-16d	16-16d	3630	3630	—	8780	—	8940	—	8940	*	133

1. 10d commons or 16d sinkers may be used instead of the specified 16d at 0.85 of the table load value.
2. 16d sinkers may be used instead of the specified 10d commons with no load reduction. *(16d sinkers are not acceptable for HDG applications.)*
3. Uplift loads have been increased 33% and 60% for earthquake or wind loading with no further increase allowed. Divide by 1.33 and 1.60 for normal loading such as in cantilever construction.
4. MIN nailing quantity and load values—fill all round holes; MAX nailing quantity and load values—fill all round and triangle holes.
5. DF/SP loads can be used for SCL that has fastener holding capacity of Doug Fir.
6. Truss chord cross-grain tension may limit allowable loads. Refer to Technical Bulletins T-ANSITPISPF, T-ANSITPISP and T-ANSITPIDF for allowable loads that consider ANSI/TPI 1-2002 wood member design criteria *(see page 199 for details)*.
7. **NAILS:** 16d = 0.162" dia. x 3½" long, 10d = 0.148" dia. x 3" long, 10dx1½ = 0.148" dia. x 1½" long. See page 16-17 for other nail sizes and information.

**Hangers do not have an Installed Cost Index.*



FTA/LFTA *Floor Tie Anchors*

SIMPSON Strong-Tie®

Designed for use as a floor-to-floor tension tie, one FTA replaces two comparably sized holdowns and the threaded rod.

The LFTA Light Floor Tie Anchor is for nailed installations.

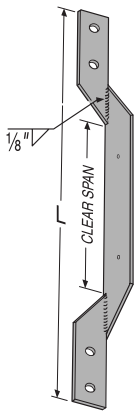
MATERIAL: See table

FINISH: LFTA–galvanized; FTA–Simpson gray paint

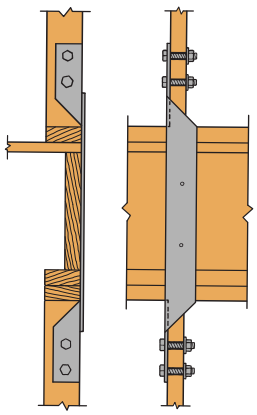
INSTALLATION: • Use all specified fasteners. See General Notes.
- Washers required on side opposite FTA for full loads.
- Nail holes between floors allow preattachment to the joist during installation; these nails are not required.

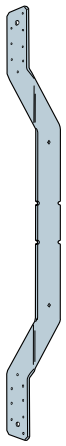
OPTIONS:
- The standard model's clear span of 17" will accommodate up to a 12" joist. The clear span of the FTA may be increased with a corresponding increase in overall length.

CODES: See page 12 for Code Listing Key Chart.



FTA


Typical FTA Installation


LFTA

Model No.	Ga	Dimensions			Fasteners (Total)		Allowable Uplift Loads[1] (133)						Allowable Uplift Loads[1] (160)						Code Ref.
		Max Width	Clear Span	L	Qty	Dia	Vertical Member Thickness					LFTA[2]	Vertical Member Thickness					LFTA[2]	
							1½	2	2½	3	3½		1½	2	2½	3	3½		
LFTA	16	2¼	17	38⅜	16-10d	—	—	—	—	—	—	1205	—	—	—	—	—	1400	5, 41, 85, 121
FTA2	10	3	17	37½	4	⅝	1575	2095	2600	2820	2820	—	1890	2510	3120	3385	3385	—	20, 80, 142
FTA5	10	3½	17	45½	4	¾	1865	2500	3125	3725	4050	—	2240	3000	3750	4400	4400	—	
FTA7	3	3½	17	56	6	⅞	3095	4185	5175	6360	7395	—	3715	5020	6210	7600	7600	—	

1. Allowable loads have been increased 33% and 60% for earthquake or wind loading with no further increase allowed; reduce where other loads govern.
2. Reduce the allowable load for the LFTA according to the code when nails penetrate wood less than 1¾".
3. **NAILS:** 10d = 0.148" dia. x 3" long. See page 16-17 for other nail sizes and information.

T and L *Strap Ties*

FINISH: Galvanized. See Corrosion Information, page 10-11.

CODES: See page 12 for Code Listing Key Chart.

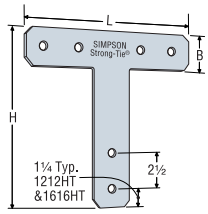
Model No.	Ga	Dimensions			Fasteners			Code Ref.
		L	H	B	Nails	Bolts		
						Qty	Dia	
55L	16	4¾	4¾	1¼	5-10d	—	—	180
66L	14	6	6	1½	10-16d	3	⅜	
88L	14	8	8	2	12-16d	3	½	
1212L	14	12	12	2	14-16d	3	½	
66T	14	6	5	1½	8-16d	3	⅜	
128T	14	12	8	2	12-16d	3	½	
1212T	14	12	12	2	12-16d	3	½	

1. Connectors are not load-rated.
2. The 55L is available in ZMAX®.
3. **NAILS:** 16d = 0.162" dia. x 3½" long, 10d = 0.148" dia. x 3" long. See page 16-17 for other nail sizes and information.

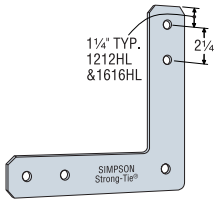
These products are available with additional corrosion protection. Additional products on this page may also be available with this option, check with Simpson for details.

Model No.	Ga	Dimensions			Minimum Bolt End & Edge Distances		Bolts		Allowable Loads[1,2]		Code Ref.
		W	H	L	d_1	d_2	Qty	Dia	Tension/Uplift (100/133/160)	F_1 (100/133/160)	
1212HL	7	2½	12	12	2½	4⅜	5	⅝	1535	565	170
1616HL	7	2½	16	16	2½	4⅜	5	⅝	1535	565	
1212HT	7	2½	12	12	2½	4⅜	6	⅝	2585	795	
1616HT	7	2½	16	16	2½	4⅜	6	⅝	2585	795	

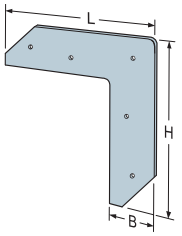
1. 1212HL, 1616HL, 1212HT and 1616HT are to be installed in pairs with machine bolts in double shear. A single part with machine bolts in single shear is not load-rated.
2. Allowable loads are based on a minimum member thickness of 3½".
3. 1212HT, 1616HT loads assume a continuous beam.



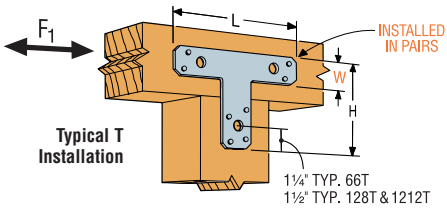
1212HT



1212HL

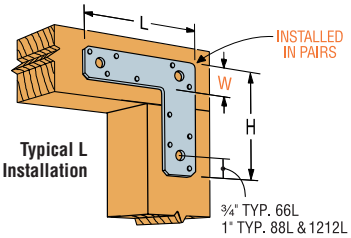


55L



Typical T Installation

1¼" TYP. 66T
1½" TYP. 128T & 1212T



Typical L Installation

¾" TYP. 66L
1" TYP. 88L & 1212L

RBC *Roof Boundary Clip*

The RBC Roof Boundary Clip is designed to aid installation and transfer shear loads between the roof diaphragm and wall top plates. The locator tabs make proper location of the clip easy. The RBC can be used on wood or masonry walls and will handle roof pitches from 0:12 to 12:12.

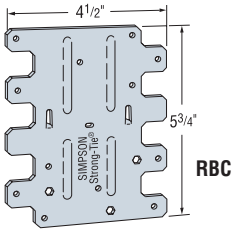
MATERIAL: 20 gauge **FINISH**: Galvanized

INSTALLATION: • Use all specified fasteners. See General Notes.
- Field bend to desired angle – one time only.
- See flier F-RBC04 for more information on installation and code requirements *(see page 199 for details)*.

CODES: See page 12 for Code Listing Key Chart.

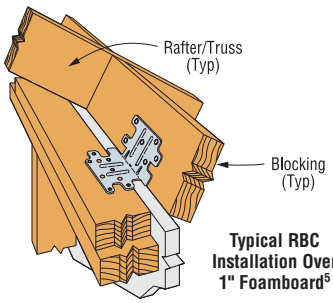
The RBC installed to blocking resists rotation and lateral displacement of rafter or truss.
Code references:
- IRC 2000/2003/**2006, R802.8** Lateral Support
- IBC 2000/2003/**2006,**, 2308.10.6 Blocking
- UBC 1997, 2320.12.8 Blocking

Blocking allows proper edge nailing of sheathing.
Code references:
- IRC 2000/2003/**2006,**, Table R602.3(1), footnote i
- IBC 2000/2003/**2006,**, 2305.1.4 Shear Panel Connections
- UBC 1997, 2315.1 General

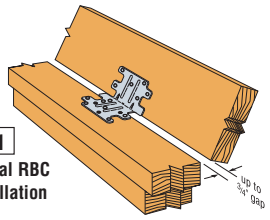


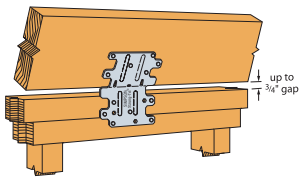
RBC

U.S. Patent Pending



Typical RBC Installation Over 1" Foamboard[5]

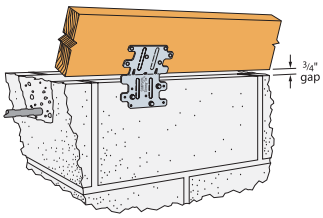

1 **Typical RBC Installation**



2 **Typical RBC Installation**

Model No.	Type of Connection	Bending Angle	Fasteners		Doug Fir Larch/ So. Pine Allowable Loads	Spruce-Pine-Fir Allowable Loads	Code Ref.
			To Plate	To Blocking	Lateral (133/160)	Lateral (133/160)	
RBC	1	45° to 90°	6-10dx1½	6-10dx1½	440	380	160
	2	0° to 45°	6-10dx1½	6-10dx1½	485	420	
	3	0° to 45°	3-¼x2¼ Titen[4]	6-10dx1½	350	350	

1. Allowable loads are for one anchor attached to blocking minimum 1½" thick.
2. RBC can be installed with up to ¾" gap and achieve 100% of the listed load.
3. Allowable loads have been increased 33% and 60% for earthquake or wind loading with no further increase allowed; reduce where other loads govern.
4. When attaching to concrete use 3-¼x1¾" Titens.
5. RBC installed over 1" foamboard has a load of 395 lb. (133/160%) in a parallel to wall (F_1) load direction for Douglas Fir. For SPF, the load is 340 lb.
6. **NAILS:** 10dx1½ = 0.148" dia. x 1½" long. See page 16-17 for other nail sizes and information.



3 **Typical RBC Installation to CMU Block**

A *Angles and* Z *Clips*

Z2 clips secure 2x4 flat blocking between joists or trusses to support sheathing.

MATERIAL: Z clips—see table. A21 and A23—18 ga.; all other A angles—12 ga.

FINISH: Galvanized. Some products available in stainless steel or ZMAX®; see Corrosion Information, page 10-11.

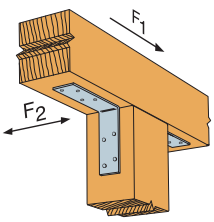
INSTALLATION: • Use all specified fasteners. See General Notes.
- Z clips do not provide lateral stability. Do not walk on stiffeners or apply load until diaphragm is installed and nailed to stiffeners.

CODES: See page 12 for Code Listing Key Chart.

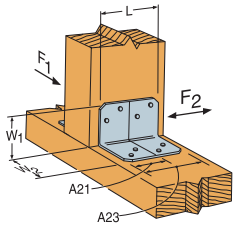
These products are available with additional corrosion protection. Additional products on this page may also be available with this option, check with Simpson for details.

Model No.	Dimensions			Fasteners				Allowable Loads[2] DF/SP				Code Ref.
	W_1	W_2	L	Base		Post		(133)		(160)		
				Bolts	Nails	Bolts	Nails	F_1	F_2	F_1	F_2	
A21	2	1½	1⅜	—	2-10dx1½	—	2-10dx1½	180	175	245	175	4, 28, 37, 87, 121
A23	2	1½	2¾	—	4-10dx1½	—	4-10dx1½	485	485	585	565	4, 37, 87, 121
A33	3	3	1½	—	4-10d	—	4-10d	625	330	750	330	170
A44	4⅜	4⅜	1½	—	4-10d	—	4-10d	625	295	750	295	
A66	5⅞	5⅞	1½	2-⅜	—	2-⅜	—	—	—	—	—	
A88	8	8	2	3-⅜	—	3-⅜	—	—	—	—	—	
A24	3⅞	2	2½	1-½	—	1-½	2-10d	—	—	—	—	
A311	11	3⅝	2	1-½	—	1-½	4-10d	—	—	—	—	

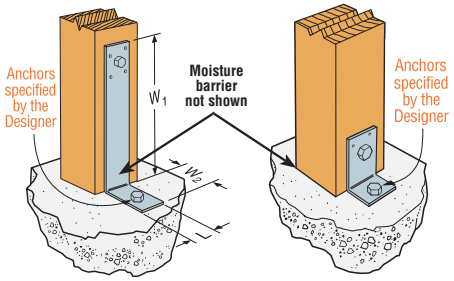
See footnotes on page 176.



A44 Installation ***(A33 similar)***



A21/A23 Installation



A311 Installation **A24 Installation**

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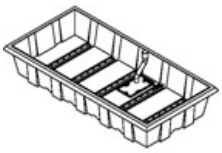
Products > Green Roof Components > **Tournesol Modular Green Roof Products**



Tournesol Modular Green Roof Products

The developments in putting green roofs on buildings is helping to give legs to the whole green building movement. While the concept is at heart an environmental one, there is far more practical to the technology than casual observers realize.

View Larger | Printable Version | CAD Details

OVERVIEW > | HOW IT WORKS > | SPECIFICATIONS > | ACCESSORIES >

Model	Description
GRT-242404	Extensive Green Roof Tray, 24"l x 24"w x 4"d,
GRT-482404	Extensive Green Roof Tray, 48"l x 24"w x 4"d
GRT-404004	Extensive Green Roof Tray, 40"sq. x 4"d
GRT-242408	Intensive Green Roof Tray, 24"l x 24"w x 8"d
GRT-482408	Intensive Green Roof Tray, 48"l x 24"w x 8"d
GRT-404008	Intensive Green Roof Tray, 40"sq. x 8"d
AFT-242408	Intensive AutoFill Irrigated Green Roof Tray, 24"l x 24"w x 8"d
AFT-482408	Intensive AutoFill Irrigated Green Roof Tray, 48"l x 24"w x 8"d
AFT-404008	Intensive AutoFill Irrigated Green Roof Tray, 40"sq. x 8"d

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Guide Specifications

Simplify specification writing with standard 3-part guide specs.
Show Specification >

Field Manuals

Instructions and maintenance manuals for print or download.
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Support Information

Parts, accessories, FAQs & more make your job easier.
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MATERIAL SAFETY DATA SHEET

Product Name: Sealed Lead Acid Batteries
Manufacturer: Uni-Vision, Discover-Energy & its Dealers and Representatives
Date: January , 2005

1. HAZARDOUS COMPONENTS

Components	% Weight	TLV	LD50 Oral	LC50 Inhalation	LC50 Contact
Lead (Pb,Pbo_PbSO_)	about 70%	N/A	(500)mg/kg	N/A	N/A
Sulfuric Acid	about 20%	1mg/m²	(2.140)mg/kg	N/A	N/A
Fiber Glass Separato	about 2%	N/A	N/A	N/A	N/A
ABS (Case & Cover	about 8%	N/A	N/A	N/A	N/A

2. PHYSICAL DATA

Components	Density	Melting Point	Solubility (H_0)	Odor	Appearance
Lead	11.34	327.4°C (Boiling)	None	None	Siler-Grey Metal
Lead Sulfate	6.2	1070°C (Boiling)	40mg/l (15°C)	None	White Powder
Lead Dioxide	9.4	290°C (Boiling)	None	None	Brown Powder
Sulfuric Acid	about 1.3	about 114°C (Boiling)	100%	Acidic	Clear Colorless Liquid
Fiber Glass Separator	N/A	N/A	Slight	Toxic	White Fibrous Glass
ABS (Case & Cover)	N/A	N/A	None	None	Solid

3. FLAMMABILITY DATA

Components	Flash Point	Explosive Limits	Comments
Lead	None	None	
Sulfuric Acid	None	None	
Hydrogen	-	4%-74.2%	Sealed batteries can emit hydrogen only if overcharged (float voltage>2.3vpc 25°C)
Fiber Glass Separator	N/A	N/A	Toxic vapor may be released. In case of fire; wear self-contained breathing apparatus
ABS	None	N/A	Temperature over 200°C may release gases

4. FIRST AID: Sulfuric Acid Precautions

Inhalation	Move to ventilated area. Obtain medical attention
Eyes	Wash the eyes with copious quantities of running water for 15 minutes. Obtain medical attention
Skin	Flush area with large amounts of running water. Remove contaminated clothing and obtain medical attention
Ingestion	Wash out mouth with running water. Do not induce vomiting. Call Physician.

5. REACTIVITY DATA

Component	Sulfuric Acid
Stability	Stable at all temperatures
Polymerization	Will not polymerize
Incompatibility	Reactive metals, strong bases, most organic compounds
Decomposition products	Sulfuric dioxide, trioxide, hydrogen sulfide, hydrogen
Conditions to avoid	Keep away from flames during and immediately after charging. Combustion or overcharging may create or liberate toxic and hazardous gases and liquid including hydrogen, sulfuric acid mist, sulfur dioxide, sulfur trioxide and sulfuric acid Avoid mixing acid with other chemicals

6. SPILL OR LEAK PROCEDURES

Step to take in case of leak or spill	Wear protective clothing, Ventilate enclosed areas. Dike to contain contaminated material and liquids. Limit site access to emergency responses. Neutralize with sodium bicarbonate, soda ash, lime, and other neutralizing agents.
Waste disposal method	Return whole scrap batteries to distributor, manufacturer or lead smelter for recycling. For neutralized spills, place residue into containers with absorbent material, sand or earth for disposal. Contact local and/or state environmental officials for proper disposal requirements.

7. PROTECTION

Exposure site	Protection	Comments
Skin	Rubber Gloves, Apron	Protective equipment must be worn if the battery is cracked or damaged. A respirator should be worm during certain operations if the TLV is exceeded.
Respiratory	Respirator	
Eyes	Safety Goggles, Face shield	

8. ELECTRICAL SAFETY

Due to battery's low internal resistance and high power density, high level of short circuit current could be developed across the battery terminals. Do not rest tools or cables on the battery. Use the insulated tools only. Follow all installation instructions and diagram when installing or maintaining battery systems.

9. HEALTH HAZARD DATA

Lead	The toxic effects of lead are accumulated and slow to appear. It affects the kidneys, reproductive and central nerves system. The Symptoms of Lead overexposure are vomiting, headaches, stomach pain. Exposure to lead from a battery most often occurs during lead reclaim operations through the breathing or ingestion of lead dust or fumes. THIS DATA MUST BE PASSED TO ANY SCRAP DEALER OR SMELTER WHEN A BATTERY IS RESOLD.
Sulfuric Acid	Sulfuric Acid is a strong corrosive; contact with acid can cause severe burns on the skin and eyes. Acid can be released if the battery case is damaged.

Anachemia

255 Norman.
Lachine (Montreal), Que
H8R 1A3

Material Safety Data Sheet

EMERGENCY NUMBERS:

(USA) CHEMTREC : 1(800) 424-9300 (24hrs)
(CAN) CANUTEC : 1(613) 996-6666 (24hrs)
(USA) Anachemia : 1(518) 297-4444
(CAN) Anachemia : 1(514) 489-5711

WHMIS	Protective Clothing	TDG Road/Rail
WHMIS CLASS: D-2B		Not controlled under TDG (Canada). PIN: Not applicable. PG: Not applicable.
		

Section I. Product Identification and Uses

Product name	**LITHIUM BROMIDE**
Chemical formula	LiBr
Synonyms	Lithium bromide anhydrous, AC-5459, 52256
Supplier	Anachemia Canada. 255 Norman. Lachine (Montreal), Que H8R 1A3
Material uses	For laboratory use only.

CI#	Not available.
CAS#	7550-35-8
Code	AC-5459
Formula weight	86.85
Supersedes	

Section II. Ingredients

Name	CAS #	%	TLV
1) LITHIUM BROMIDE	7550-35-8	99+	Not established by ACGIH

Toxicity values of the hazardous ingredients

LITHIUM BROMIDE:
ORAL (LD50): Acute: 1800 mg/kg (Rat). 1840 mg/kg (Mouse).
INTRAPERITONEAL (LD50): Acute: 1160 mg/kg (Mouse).

Section III. Physical Data

Physical state and appearance / Odor	Solid. (White powder. Odorless.)
pH (1% soln/water)	9
Odor threshold	Not available.
Percent volatile	0% at 21°C
Freezing point	550°C
Boiling point	1265°C
Specific gravity	3.464 (Water = 1)
Vapor density	Not available.
Vapor pressure	1 mm Hg @ 748°C
Water/oil dist. coeff.	Not available.
Evaporation rate	Not applicable.
Solubility	Easily soluble in cold water.

Section IV. Fire and Explosion Data

Flash point	Not applicable.
Flammable limits	Not available.
Auto-ignition temperature	Not available.
Fire degradation products	Hydrogen bromide. Oxides of lithium.
Fire extinguishing procedures	Use extinguishing media suitable for surrounding materials. Wear adequate personal protection to prevent contact with material or its combustion products. Self contained breathing apparatus with a full facepiece operated in a pressure demand or other positive pressure mode.
Fire and Explosion Hazards	The sensitivity to static discharge is not available. The sensitivity to impact is not available. Emits toxic fumes under fire conditions.

Section V. Toxicological Properties

Routes of entry	Inhalation and ingestion. Eye contact. Skin contact.
Effects of Acute Exposure	Harmful by inhalation, in contact with skin and if swallowed. Anhydrous lithium bromide is extremely hygroscopic and contact with tissue can produce a dehydrating action resulting in localized burns. Animal: studies conducted with rats and mice have shown lithium ion in high amounts to be teratogenic. Human data are ambiguous. The safety of lithium ion exposure during pregnancy has not been established.
Eye	May cause irritation or burns.
Skin	May cause irritation or burns.
Inhalation	Harmful if inhaled. Material is irritating to mucous membranes and upper respiratory tract. See ingestion.
Ingestion	Lithium compounds may cause central nervous system depression (headache, nausea, vomiting, abdominal pain, muscular weakness, dizziness, tremors, etc...), diarrhea, prostration, hypothyroidism, leukocytosis, edema, micturition, polyuria, skin eruptions, blurred vision, hypotension, vertigo, thirst, apathy, anorexia, emaciation, fatigue, lethargy, dysarthria, memory troubles, psychosis, kidney damage, paralysis, coma, and possibly death. See chronic effects.

Section V. Toxicological Properties

Effects of Chronic Overexposure	See ingestion. May cause allergic skin reactions (bromide rashes - acne, bromoderma and furunculosis). Neuromuscular effects such as tremor, ataxia, weakness, clonus and hyperactive reflexes may occur as a result of repeated exposure to lithium ion. Lithium ion can cause kidney damage, brain and heart effects, central nervous system disturbances, gastrointestinal disturbances, fatigue, dehydration, weight loss, dermatological effects and thyroid disturbances. May cause anorexia, nausea, vomiting, diarrhea, muscle weakness, elocution and vision troubles, dizziness, loss of sensation, convulsions, stupor, polyuria, oliguria, coma, liver damage. Human: passes through the placenta, excreted in maternal milk. May cause reproductive effects based on studies in laboratory animals. May cause congenital malformations in the foetus. To the best of our knowledge, the chemical, physical, and toxicity of this substance has not been fully investigated.

Section VI. First Aid Measures

Eye contact	Immediately flush eyes with copious quantities of water for at least 15 minutes holding lids apart to ensure flushing of the entire surface. Call a physician.
Skin contact	Immediately flush skin with plenty of water and soap for at least 15 minutes while removing contaminated clothing and shoes. Call a physician. Wash contaminated clothing before reusing.
Inhalation	Remove patient to fresh air. Administer approved oxygen supply if breathing is difficult. Administer artificial respiration or CPR if breathing has ceased. Call a physician.
Ingestion	If conscious, wash out mouth with water. Never give anything by mouth to an unconscious or convulsing person. Seek immediate medical attention.

Section VII. Reactivity Data

Stability	Unstable. Hygroscopic; keep container tightly closed. Conditions to avoid: High temperatures, sparks, open flames and all other sources of ignition, contamination.
Hazardous decomp. products	Not available.
Incompatibility	Oxidizing agents, acids, interhalogens (bromine trifluoride, bromine trichloride, etc...).
Reaction Products	Not available. Hazardous polymerization will not occur.

Section VIII. Preventive Measures

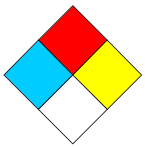
Protective Clothing in case of spill and leak	Wear respirator, chemical safety goggles, rubber boots and heavy rubber gloves.
Spill and leak	Evacuate the area. Sweep up and place in container for disposal. Avoid raising dust. Ventilate area and wash spill site after material pick up is complete. DO NOT empty into drains. DO NOT touch damaged container or spilled material.
Waste disposal	Dissolve or mix the material with a combustible solvent and burn in a chemical incinerator equipped with an after burner and scrubber. According to all applicable regulations. May be harmful to aquatic life. Can be dangerous if allowed to enter drinking water intakes. Do not contaminate domestic or irrigation water supplies, lakes, streams, ponds, or rivers.
Storage and Handling	Store in a cool place away from heated areas, sparks, and flame. Store in a well ventilated area. Store away from incompatible materials. Do not add any other material to the container. Do not wash down the drain. Do not breathe dust. Keep container tightly closed and dry. Manipulate under an adequate fume hood. Avoid raising dust. Empty containers may contain a hazardous residue. Handle and open container with care. Minimize dust generation and exposure - use dust mask or appropriate protection. This product must be manipulated by qualified personnel. Do not get in eyes, on skin, or on clothing. Wash well after use. In accordance with good storage and handling practices. Do not allow smoking and food consumption while handling. Protect from moisture. Product is highly hygroscopic. In case of accident or if you feel unwell, seek medical advice immediately (show the label when possible.).

Section IX. Protective Measures

Protective clothing	Splash goggles. Impervious gloves, apron, coveralls, and/or other resistant protective clothing. Sufficient to protect skin. In case of insufficient ventilation, wear suitable respiratory equipment. For emergency situations, a self-contained respirator is recommended (NIOSH-approved). Do not wear contact lenses. Make eye bath and emergency shower available. Ensure that eyewash station and safety shower is proximal to the work-station location.
Engineering controls	Use only in a chemical fume hood. Use adequate ventilation. Do not use in unventilated spaces.

Section X. Other Information

Special Precautions or comments Harmful solid! May cause irritation or burns. Possible teratogen! May cause harm to breastfed babies. Possible risks of irreversible effects. Do not breathe dust. Avoid all contact with the product. Avoid prolonged or repeated exposure. Use only in a chemical fume hood. To the best of our knowledge, the chemical, physical and toxicity of this substance has not been fully investigated. Handle and open container with care. Container should be opened only by a technically qualified person.
RTECS NO: OJ5755000 (Lithium bromide).



NFPA

Prepared by MSDS Department/Département de F.S..

Validated 11-Aug-2004

Telephone# (514) 489-5711

While the company believes the data set forth herein are accurate as of the date hereof, the company makes no warranty with respect thereto and expressly disclaims all liability for reliance thereon. Such data are offered solely for your consideration, investigation and verification.

APPENDIX B

STRUCTURAL CALCULATIONS

THP Limited Inc. 100 East Eighth Street Cincinnati, OH 45202 (513) 241-3222 *ph* (513) 241-2981 *fx*	PROJECT UC Solar Decathlon	THP #	Sheet
	TITLE Design Control	BY SOM	DC-1
	ISSUE	DATE 3/4/07	

Design Control

Ohio Building Code
ASCE 7-02
Solar Decathlon Building Code
} Most Restrictive Provisions

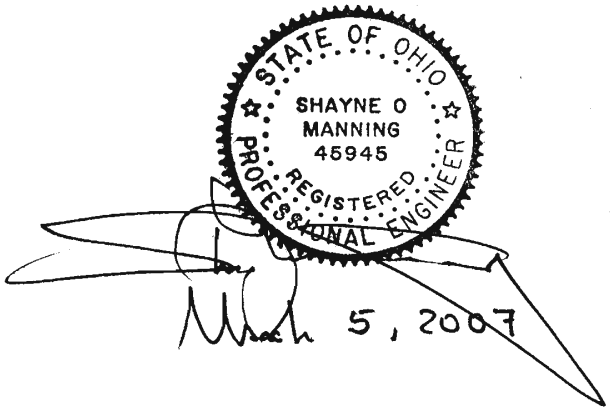
Floor Live Load = 100 psf

Roof Snow Load = 20 psf (min.) (Southern Ohio)

Wind Load = 90 mph (3 sec gust)
Exposure Category C

Foundations- 1500 psf bearing capacity
(Summer installation - non-frost concern;
final post-event foundation to be
designed later)

Handrails (min.) 200# load @ top of rail
in any direction



THP Limited Inc. 100 East Eighth Street Cincinnati, OH 45202 (513) 241-3222 *ph* (513) 241-2981 *fx*	PROJECT	THP #	Sheet
	TITLE	BY	DC-2
	ISSUE	DATE	

DESIGN CONTROL (CONT)

CATEGORY II ORDINARY STRUCTURES

$I_w = 1.0$

$\Pi_w = 1.21$

WIND RESISTIVE SYSTEM

$p_s = \Pi(I)(p_{s30}) = 1.21 \times 1.0 \times 12\ psf$ ← ADJ PER FIG 6-2 NOTE 7

$= 14.5\ psf$

COMPONENTS & CLADDING EDGE = 3'

$p_{net} = \Pi(I)(p_{net\ 30})$

$= 1.21 \times$ "

		(AREA = 20 ☐')	(AREA = 100 ☐')
WALLS			
INT.	-15.1 × 1.21 =	18 PSF	= 16.5 PSF
EDGE	-18.2 × 1.21 =	22 PSF	= 18 PSF
ROOF	(AREA = 20 ☐')		(AREA = 100 ☐')
INT.	-14.2 × 1.21 =	17 PSF	-16 PSF
EDGE	-21.9 × 1.21 =	26 PSF	-19 PSF
CORNER	-30.5 × 1.21 =	37 PSF	-19 PSF

SNOW

P_g = 20 psf

C_e = 0.9

C_t = 1.2 (WORST CASE ASSUMES UNHEATED CONDITION DURING LIFE OF STRUCTURE)

I_s = 1.0

P_f = 0.7 × 0.9 × 1.2 × 1.0 × 20 psf = 15 psf

5 psf RAIN ON SNOW (POTENTIAL)

20 psf

Seismic

Seismic Use Group = I

I_{EQ} = 1.0

Lateral System = Shear Wall

Site Class D

$A_{cc\ 0.2\ s}$ = 20% g

$A_{cc\ 1.0\ s}$ = 9.5% g

S_{MS} = 1.6 × 0.20 = 0.32

S_{M1} = 2.4 × 0.095 = 0.23

S_{DS} = 0.21

Use Group B

S_{D1} = 0.15

Use Group C ← CONTROLS

R = 2½

Ω = 2½

C_D = 2½

NOTE: R = 6½ IF SEISMIC RATED PLYWOOD IS USED

Analysis 9.5.4 (ASCE 7)

$V = (1.2\ S_{DS}/R)\ W = 0.10W$

$F_x = \frac{1.2\ S_{DS}}{R}\ W_x$ = 0.10W i.e. 10% OF ROOF @ ROOF ETC

THP Limited Inc. 100 East Eighth Street Cincinnati, OH 45202 (513) 241-3222 *ph* (513) 241-2981 *fx*	PROJECT UC S-D	THP #	Sheet
	TITLE	BY SOM	FL-1
	ISSUE	DATE 3/5/07	

FLOOR CONSTRUCTION

ALL LOADS WSD

1/2" FINISH FLOOR
1 1/4" WARMBOARD
3/4" PLYWOOD
} 8 psf

2x8 JOISTS @16" o/c ~ 2 psf

DL = 10 psf

LL = 100 psf (including contents, partitions etc.)

$M_{JST} = (1.33 \times 0.11) \times 7.9'^2/8 = 1.14^{k-ft}$/JST

$F_b = 1.14 \times 12 \times 6 / (1.5 \times 7.25^2) = 1.04$ ksi

F_b allow. = 1200 psi x 1.15 repetitive member = 1.38 ksi OK

(CHECK MIN. SPEC ON WOOD FRAMING)

REACTION = $1.33 \times 0.11 \times 7.9'/2 = 0.58^k$ FOR CONNECTION DESIGN

(CHECK HEAVY LOADING AREAS)

WORST CASE FOR JOISTS IS ENTRANCE RAMP

L = 10.25' ← CUT W HALF w/ ADDITIONAL SUPPORT (NOT CRITICAL ANY MORE)

WOOD = SPRUCE / PWO / FIR SPF

USE LUS26 Simpson conn FOR 2x8 JOISTS
LU24 " " " 2x4 JOISTS

FLOOR LOADING (CONT.)

BAY W/ WATER TANKS

→ 300 GALLONS @ 8.34#/GAL = 2500#
CONTINUED.

+ 150# TANK (ASSUME)

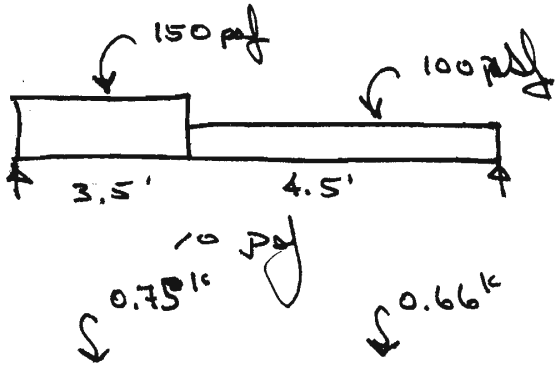
2650#

120 GALLONS @ "

1000#

+ 75# TANK (ASSUME)

1075#



LL 2650#/3' x 7' = 126 plf

DL USE 150 plf (CONSV.)

TL/16"

↑ 0.77k (0.58k @ 12" o/c) ↑ 0.64k @ 16" o/c (0.48k @ 12" o/c)

M_{TL} = 0.64 x 4.5' - 0.66 x 2.25 = 1.41k @ 16" o/c

$f_{b\ 2x8} = \frac{1.4 \times 12 \times 6}{1.5\ (7.25^2)} = 1.28$ KSI

@ 12" o/c $F_b = \frac{12}{16} \times 1.28 = 0.96$ KSI

COULD JUSTIFY 2x8's @ 16" o/c BUT WATER IS SUSTAINED LOAD - LEAVE JOISTS @ 12" o/c IN THIS BAY.

THP Limited Inc. 100 East Eighth Street Cincinnati, OH 45202 (513) 241-3222 *ph* (513) 241-2981 *fx*	PROJECT	THP #	Sheet
	TITLE	BY	FL-3
	ISSUE	DATE	

FLOOR GIRDER

M10 x 9 CONTINUOUS FULL LENGTH

$I_x = 38.8$ $S = 7.76$ FULLY BRACED

w/ TL = 0.12 K/SF

$$L_{MAX} = \sqrt{\frac{7.76\ w^3 \times 21.6\ k\cdot in \times 8}{0.12 \times 8' \times 12''/FT}} = 10.8'$$

MAX SPAN

IGNORES CONTINUITY

SUPPORT 28'-9" TRAILER @ 1/3 POINTS

≈ 9'-6" o/c

P_{MAX} = 9.5' x 8' x 0.12

+ (" " - 18 ϕ) x 0.04

+ (5 + 4) x 12.5 x 0.01 = 12.6 K WT. FTG

OR = 7' x 8' x 0.13

+ 14' x 8' x 0.04 = 12 K

$A_{FTG} \geq 12.6^K / 1.5\ KSF = 8.4\ SF.$

@ EXT.

P_{MAX} = (5' x 8' x 0.12

+ 9' x 8' x 0.04

+ 8' x 12.75' x 0.010 = 9.1 K

$A_{FTG} \geq 9.1 / 1.5\ KSF = 6.0\ SF.$

THP Limited Inc. 100 East Eighth Street Cincinnati, OH 45202 (513) 241-3222 *ph* (513) 241-2981 *fx*	PROJECT UC S-D	THP #	Sheet
	TITLE	BY SDM	RF-1
	ISSUE	DATE 3/5/07	

Roof Panel Design

SIPS PANELS w/ TJI JOISTS @ 2:0 o/c
(x 11 7/8" deep)

Smallest TJI ~ "110" x 11 7/8"

Mw cap = 3'-1k

$w_{cap} = \frac{3 \times 8}{7.5' \times} \times 2'\text{-}0" \text{ o/c} = 213 \text{ psf} > \text{Req.}$

Roof Loading

Snow Load	20 psf	SL
SIPS PANELS w PW + TJI	7 psf	
Roofing	2.5 psf	
P.V. Panels + framework	3.5 psf	
~~13~~ psf		DL

Use 15 psf min. DL

$W_{SL} = 2' \times 0.02 = 0.04$

$W_{DL} = 2 \times 0.015 = 0.03$

0.07 K/Ft

$M = 0.56'^{-k}$ $R = 0.28^{k}$

Simpson Connector for "110" TJI

RF-2

ABOUT THIS GUIDE

The residential products in this guide are intended for use in single-family dwellings and are readily available through our nationwide network of distributors and dealers.
For information on using these products in multi-family dwellings, contact your iLevel representative.

For commercial applications such as retail stores, office buildings, schools, restaurants, hotels, and nursing homes, please refer to the *iLevel Trus Joist® Commercial TJI® L65, L90, H90 Joists Specifier's Guide* (Reorder #COM-2000). Commercial products are typically designed, manufactured, and sold for each specific job.

For more information on any iLevel™ product, please call **1-888-453-8358**.

Design Properties (100% Load Duration)

Depth	TJI®	Basic Properties				Reaction Properties		
		Joist Weight (lbs/ft)	Maximum Resistive Moment(1) (ft-lbs)	Joist Only EI x 10^6 (in.^{2}-lbs)	Maximum Vertical Shear (lbs)	1¾" End Reaction (lbs)	3½" Intermediate Reaction (lbs)	
							No Web Stiffeners	With Web Stiffeners
9½"	110	2.3	2,380	140	1,220	885	1,935	N.A.
	210	2.6	2,860	167	1,330	980	2,145	N.A.
	230	2.7	3,175	183	1,330	1,035	2,410	N.A.
11⅞"	110	2.5	3,015	238	1,560	885	1,935	2,295
	210	2.8	3,620	283	1,655	980	2,145	2,505
	230	3.0	4,015	310	1,655	1,035	2,410	2,765
	360	3.0	6,180	419	1,705	1,080	2,460	2,815
	560	4.0	9,500	636	2,050	1,265	3,000	3,475
14"	110	2.8	3,565	351	1,860	885	1,935	2,295
	210	3.1	4,280	415	1,945	980	2,145	2,505
	230	3.3	4,755	454	1,945	1,035	2,410	2,765
	360	3.3	7,335	612	1,955	1,080	2,460	2,815
	560	4.2	11,275	926	2,390	1,265	3,000	3,475
16"	210	3.3	4,895	566	2,190	980	2,145	2,505
	230	3.5	5,440	618	2,190	1,035	2,410	2,765
	360	3.5	8,405	830	2,190	1,080	2,460	2,815
	560	4.5	12,925	1,252	2,710	1,265	3,000	3,475

(1) **Caution: Do not** increase joist moment design properties by a repetitive member use factor.

TJI® joists are intended for dry-use applications

General Notes

- Design reaction includes all loads on the joist. Design shear is computed at the inside face of supports and includes all loads on the span(s). Allowable shear may sometimes be increased at interior supports in accordance with ICC ES ESR-1153, and these increases are reflected in span tables.
- The following formulas approximate the uniform load deflection of Δ (inches):

For TJI® 110, 210, 230, and 360 Joists

$$\Delta = \frac{22.5\ wL^4}{EI} + \frac{2.67\ wL^2}{d \times 10^5}$$

For TJI® 560 Joists

$$\Delta = \frac{22.5\ wL^4}{EI} + \frac{2.29\ wL^2}{d \times 10^5}$$

w = uniform load in pounds per linear foot
L = span in feet
d = out-to-out depth of the joist in inches
EI = value from table above

Material Weights

(Include TJI® weights in dead load calculations—see **Design Properties** table at left for joist weights)

Floor Panels

Southern Pine

½" plywood 1.7
⅝" plywood ..... 2.0 psf
¾" plywood ..... 2.5 psf
1⅛" plywood ..... 3.8 psf
½" OSB ..... 1.8 psf
⅝" OSB ..... 2.2 psf
¾" OSB ..... 2.7 psf
⅞" OSB ..... 3.1 psf
1⅛" OSB ..... 4.1 psf

Based on: Southern pine – 40 pcf for plywood, 44 pcf for OSB

Roofing

Asphalt shingles ..... 2.5 psf
Wood shingles ..... 2.0 psf
Clay tile ..... 9.0 to 14.0 psf
Slate (⅜" thick) ..... 15.0 psf

Roll or Batt Insulation (1" thick):

Rock wool ..... 0.2 psf
Glass wool ..... 0.1 psf

Floor Finishes

Hardwood (nominal 1") ..... 4.0 psf
Sheet vinyl ..... 0.5 psf
Carpet and pad ..... 1.0 psf
¾" ceramic or quarry tile ..... 10.0 psf

Concrete:

Regular (1") ..... 12.0 psf
Lightweight (1") ..... 8.0 to 10.0 psf
Gypsum concrete (¾") ..... 6.5 psf

Ceilings

Acoustical fiber tile ..... 1.0 psf
½" gypsum board ..... 2.2 psf
⅝" gypsum board ..... 2.8 psf
Plaster (1" thick) ..... 8.0 psf

Code Evaluations: See ICC ES ESR-1153 and ICC ES ESR-1387

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ROOF (CONT)

EDGE BM SUPPORTING SIPS PANEL

TRIBUTARY B = 4'-0"

$w_{TL} = (0.035 \times 4') + \underset{\text{SELF WT}}{0.02} = 0.16^{K}/_{FT}$

$M_{TL} = 0.16 \times 16^2/8 = 5.12^{'-K} < 7.975^{'-K}$

WORST CASE

TIMBER STRAND LSL

W1 PARALLAM 1.55E x 1 3/4" x 11 7/8"

(ALTERNATIVE 2.0E x 2"/16" x 11 7/8")

$R_{TL} = 1.28^{K} < 4.3^{K}$

R SEAT TO CARRY LOAD W END BEARING

1/2" THICK - WELD T & B MIN 3/16" fillet weld to angle vertical.

Allowable Design Properties[1] (100% Load Duration)

Grade	Width	Design Property	Depth												
			4⅜"	5½"	5½" Plank Orientation	7¼"	8⅝"	9¼"	9½"	11¼"	11⅞"	14"	16"	18"	20"
TimberStrand® LSL															
1.3E	3½"	Moment (ft-lbs)	1,735	2,685	1,780	4,550	6,335	7,240		10,520					
		Shear (lbs)	4,085	5,135	1,925	6,765	8,050	8,635		10,500					
		Moment of Inertia (in.⁴)	24	49	20	111	187	231		415					
		Weight (plf)	4.5	5.6	5.6	7.4	8.8	9.4		11.5					
1.55E	1¾"	Moment (ft-lbs)						4,950	5,210	7,195	7,975	10,920	14,090		
		Shear (lbs)						3,345	3,435	4,070	4,295	5,065	5,785		
		Moment of Inertia (in.⁴)						115	125	208	244	400	597		
		Weight (plf)						5.1	5.2	6.2	6.5	7.7	8.8		
	3½"	Moment (ft-lbs)						9,905	10,420	14,390	15,955	21,840	28,180		
		Shear (lbs)						6,690	6,870	8,140	8,590	10,125	11,575		
		Moment of Inertia (in.⁴)						231	250	415	488	800	1,195		
		Weight (plf)						10.1	10.4	12.3	13	15.3	17.5		
Microllam® LVL															
1.9E	1¾"	Moment (ft-lbs)		2,125		3,555		5,600	5,885	8,070	8,925	12,130	15,555	19,375	23,580
		Shear (lbs)		1,830		2,410		3,075	3,160	3,740	3,950	4,655	5,320	5,985	6,650
		Moment of Inertia (in.⁴)		24		56		115	125	208	244	400	597	851	1,167
		Weight (plf)		2.8		3.7		4.7	4.8	5.7	6.1	7.1	8.2	9.2	10.2
Parallam® PSL															
2.0E	2¹¹⁄₁₆"	Moment (ft-lbs)						9,535	10,025	13,800	15,280	20,855	26,840	33,530	
		Shear (lbs)						4,805	4,935	5,845	6,170	7,275	8,315	9,350	
		Moment of Inertia (in.⁴)						175	192	319	375	615	917	1,305	
		Weight (plf)						7.8	8.0	9.5	10.0	11.8	13.4	15.1	
	3½"	Moment (ft-lbs)						12,415	13,055	17,970	19,900	27,160	34,955	43,665	
		Shear (lbs)						6,260	6,430	7,615	8,035	9,475	10,825	12,180	
		Moment of Inertia (in.⁴)						231	250	415	488	800	1,195	1,701	
		Weight (plf)						10.1	10.4	12.3	13.0	15.3	17.5	19.7	
	5¼"	Moment (ft-lbs)						18,625	19,585	26,955	29,855	40,740	52,430	65,495	
		Shear (lbs)						9,390	9,645	11,420	12,055	14,210	16,240	18,270	
		Moment of Inertia (in.⁴)						346	375	623	733	1,201	1,792	2,552	
		Weight (plf)						15.2	15.6	18.5	19.5	23.0	26.3	29.5	
	7"	Moment (ft-lbs)						24,830	26,115	35,940	39,805	54,325	69,905	87,325	
		Shear (lbs)						12,520	12,855	15,225	16,070	18,945	21,655	24,360	
		Moment of Inertia (in.⁴)						462	500	831	977	1,601	2,389	3,402	
		Weight (plf)						20.2	20.8	24.6	26.0	30.6	35.0	39.4	

(1) For product in beam orientation, unless otherwise noted.

TimberStrand® LSL Grade Verification

TimberStrand® LSL is available in more than one grade. The product will be stamped with its grade information, as shown in the examples below. With the 1.55E TimberStrand® LSL Beam, larger holes can be drilled through the beam. See **Allowable Holes** on page 36.

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COLUMN DESIGN

$\perp$L 3 x 3 x 3/16 WORST CASE

(STITCH WELDED WITH CONNECTOR RE @ NO MORE THAN 4'-0" o/c

P_{MAX}: 9' x 8' x 0.04 = 2.9 k

f_A = 2.9 / 1.09 x 2 = 1.33 ksi

r_3 does not control

r_x & r_y = 0.939 $\quad l/r = 9.33' \times 12 / 0.939$
$= 120$

F_A = 9.4 ksi > 1.33 ksi OK

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WALL DESIGN (NON-LOAD BRG)

WIND LOAD (MAX @ CORNERS) = -22 psf

W1 2 - 2x3, @ 24" o/c

l_d = 6.85' (MAX)

$M = 0.022 \times 6.85^2 / 8 = 0.13$ FT-K

$f_b = 0.13 \times 12 \times 6 / 1.5 \times 2.5^2 = 1$ KSI OK

T&B R: 2x8

WHICH @ TOP ACTS AS A GIRT

$\frac{wL^2}{8} = M = \frac{(4' \times 0.02)(8^2)}{8}$ $\quad$ $\frac{wL^2}{8} = M = \frac{4 \times 0.02 (16^2)}{8}$

$= 0.64^{1-k}$ $\quad$ $= 2.56^{1-k}$

$R = 0.32^k$ $\quad$ $R = 0.64^k$

w/ 2x8 $M_{cap} = 1.4^{1-k}$

8'-0 SPAN PANEL ~ 1-2x8 TOP

16'-0 " " 2-2x8 TOP

8'-0 PANEL SIMPSON A23 CONN.

16'-0 " " 2@ A23 "

ADD 88 SL CONNECTOR TO TIE TOP OF PANELS TOGETHER

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WALL (CONT.)

Angle Framing

$M_z = \frac{(16' + 2')}{2} \times 0.0165 \times 8^2/8 \cdot 1.2^{1-k}$

w/ L 3x3x3/16 vert.

$f_b = 1.2 \times 12 / 0.441 = 32.65$ ksi NG.

w/ 2x8

$f_{bw} = 1.2 \times 12 \times 6 / 1.5 \times 7.5^2 = 1.0$ ksi OK

∴ CONTINUE 2x8 PANEL EDGE MEMBER TO CONNECT TO GUTTER

R = 0.6 k

OTHER WALL PANELS

N = 9.5'

W/ PANEL CONNECTING TO CRUCIFORM COLUMN

$w = (8' \times 0.0165) = 0.132$

$M = 1.5^{1-k}$

$f_b = 1.5 \times 12 / 4 \times 0.441 = 10$ ksi OK

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V_{WIND} @ Foundation

W BLDG = 14.5 psf

$F_{LOOR+ROOF}$ = 33' x 12.75' x 0.0145 = 6.1^k

TRANS

LONG = 29 x 2 x $\frac{12.5}{2}$ x 0.0145 = 5.3^k

$V_{BC} = \{ 770^{\#} \times [0.012 + 0.01] + 190^{\#} \times 0.01$

$+ 2 [33 + 28'] \times 12.5' \times 0.010 \} \times 0.1 = 3.4^k$

AVG

Seismic Does Not control

Diaphragm w/ connections - drive flexible

+ dist. by tributary area

See plan

V_{TRANS} = 2.6 @ roof ÷ 2 = 1.3 ea. side

+ 3.5 @ flr ÷ 2 = 1.75 " "

V_{LONG} = 2.2 @ roof ÷ 2 = 1.1 ea side

+ 3.1 @ floor ÷ 2 = 1.65 " "

EACH SIDE $M_{BASE\ TRANS}$ = 1.3 x 12.5' + 1.75' x 2' = 20'-k

LONG = 1.1 x 12.5' + 1.65 x 2' = 17'-k

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SHEAR WALL DESIGN

$W_{BLDG} = 14.5$ psf

ROOF $V_{TRANS} = 33' \times \frac{10.75'}{2} \times 0.0145 = 2.6^{k}$

$V_{LONG.} = 29' \times \frac{10.5'}{2} \times 0.0145 = 2.2^{k}$

WORST CASE SHEAR LOADING

$2.6^{k}/2 \times (16' + 2') = 0.072^{k}/FT$

TRY TO TRANSFER W/ CRUCIFORM COLUMN
(AGAIN WORST CASE IS ONE ANGLE)

$M_{\frac{LL}{TP}} = \frac{2.6^{k}}{2} \times (2.5' + 0.5') = 3.9^{1-k}$

$I = 0.962 \times 4 + 2 \times 2 \times 1.09 \times [0.82 + 0.25]^2$

$= 5.34$

$f_b = 3.9 \times 12 \times 3.25 / 5.34 = 17.2$ ksi OK

TIE FORCE = 1.3^{k} ← STRAP TOP & TO CRUCIFORM &

CHECK SEISMIC ← WORST CASE WALL WTS →

$V_{EQ} = \{770\,\phi \times 0.015 + 2 \times [33 + 29'] \times 5' \times 0.015\} \times 0.1$

$= 2.1^{k}$ = FACTORED LOAD & REGARDLESS LESS THAN V_{WIND}

WIND CONTROLS

W-5

spacing; or the table in the Appendix may be used directly for APA panels (the table is recognized by ICBO). Other steps, as shown in the following examples, are identical for any load level.

Obviously, lateral loads may be applied to a building in any direction. Usually, however, the building is analyzed with respect to its two primary axes. In its simplest form, a horizontal diaphragm is a regular rectangle, and is a simple span between end walls or side walls, depending on the direction of load.

Wind loads and seismic loads applied in each of the building's two primary directions should be computed and tabulated (see Figure 1). The "worst case" in each direction will govern design of the diaphragm.

Use ASCE 7-88, Minimum Design Loads for Buildings and Other Structures, or local building code requirements, for design criteria.

TABLE 2

Recommended Shear (pounds per foot) for APA Panel Shear Walls with Framing of Douglas-Fir, Larch, or Southern Pine[a] for Wind or Seismic Loading[b]

Panel Grade	Minimum Nominal Panel Thickness (in.)	Minimum Nail Penetration in Framing (in.)	Panels Applied Direct to Framing: Nail Size (common or galvanized box)	Nail Spacing at Panel Edges (in.): 6	4	3	2[e]	Panels Applied Over 1-1/2" Gypsum Sheathing: Nail Size (common or galvanized box)	Nail Spacing at Panel Edges (in.): 6	4	3	2[e]
APA STRUCTURAL I grades	5/16	1-1/4	6d	200	300	390	510	8d	200	300	390	510
	3/8	1-1/2	8d	230[d]	360[d]	460[d]	610[d]	10d[f]	280	430	550	730
	7/16			255[d]	395[d]	505[d]	670[d]					
	15/32			280	430	550	730					
	15/32	1-5/8	10d[f]	340	510	665	870	–	–	–	–	–
APA RATED SHEATHING, APA RATED SIDING 303[g] and other APA grades except species Group 5.	5/16 or 1/4[c]	1-1/4	6d	180	270	350	450	8d	180	270	350	450
	3/8			200	300	390	510		200	300	390	510
	3/8	1-1/2	8d	220[d]	320[d]	410[d]	530[d]	10d[f]	260	380	490	640
	7/16			240[d]	350[d]	450[d]	585[d]					
	15/32			260	380	490	640					
	15/32	1-5/8	10d[f]	310	460	600	770	–	–	–	–	–
	19/32			340	510	665	870	–	–	–	–	–
APA RATED SIDING 303[g] and other APA grades except species Group 5.	5/16[c]	1-1/4	Nail Size (galvanized casing)	140	210	275	360	Nail Size (galvanized casing)	140	210	275	360
			6d					8d				
	3/8	1-1/2	8d	160	240	310	410	10d[f]	160	240	310	410

(a) For framing of other species: (1) Find species group of lumber in the NFPA 1986 National Design Spec. (2)(a) For common or galvanized box nails, find shear value from table for nail size, and for STRUCTURAL I panels (regardless of actual grade). (b) For galvanized casing nails, take shear value directly from table. (3) Multiply this value by 0.82 for Lumber Group III or 0.65 for Lumber Group IV.

(b) All panel edges backed with 2-inch nominal or wider framing. Install panels either horizontally or vertically. Space nails 6 inches o.c. along intermediate framing members for 3/8-inch and 7/16-inch panels installed on studs spaced 24 inches o.c. For other conditions and panel thicknesses, space nails 12 inches o.c. on intermediate supports.

(c) 3/8-inch or 303-16 oc is minimum recommended when applied direct to framing as exterior siding.

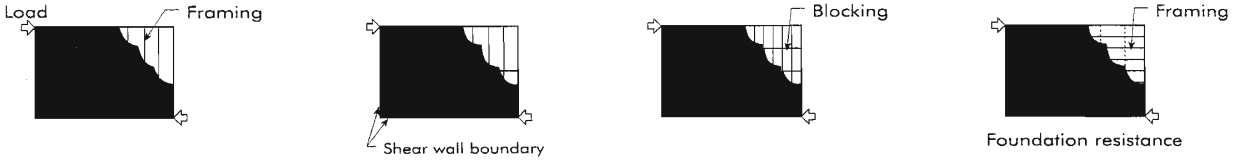
(d) Shears may be increased to values shown for 15/32-inch sheathing with same nailing provided (1) studs are spaced a maximum of 16 inches o.c., or (2) if panels are applied with long dimension across studs.

(e) Framing at adjoining panel edges shall be 3-inch nominal or wider, and nails shall be staggered where nails are spaced 2 inches o.c.

(f) Framing at adjoining panel edges shall be 3-inch nominal or wider, and nails shall be staggered where 10d nails having penetration into framing of more than 1-5/8 inches are spaced 3 inches o.c.

(g) Values apply to all-veneer plywood APA RATED SIDING 303 panels only. 303-16 oc plywood may be 11/32-inch, 3/8-inch or thicker. Thickness at point of nailing on panel edges governs shear values.

Typical Layout for Shear Walls



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P_{TJ} 1 + 3 $\qquad P_{DL}$

$P_{UP+DN} = \frac{17}{2} \div 8' = 1.1^K \qquad 0.9^K$ (MW)

P_{TJ} 6 + 10 $\qquad 2.1^K$

$P_{UP+DN} = \frac{17}{4} \div 8' = 0.53^K$

P_{TJ} 3 + 4

$P_{UP+DN} = 20 \times 0.38 / 10' = 0.76^K \qquad 0.9^K$ @ 3, 1.6 @ 4

P_{TJ} 5 + 6

$P_{UP+DN} = 20 \times 0.62 / 16 = 0.78^K \qquad 1.6^K$ (MW)

P_{TJ} 10 + 11

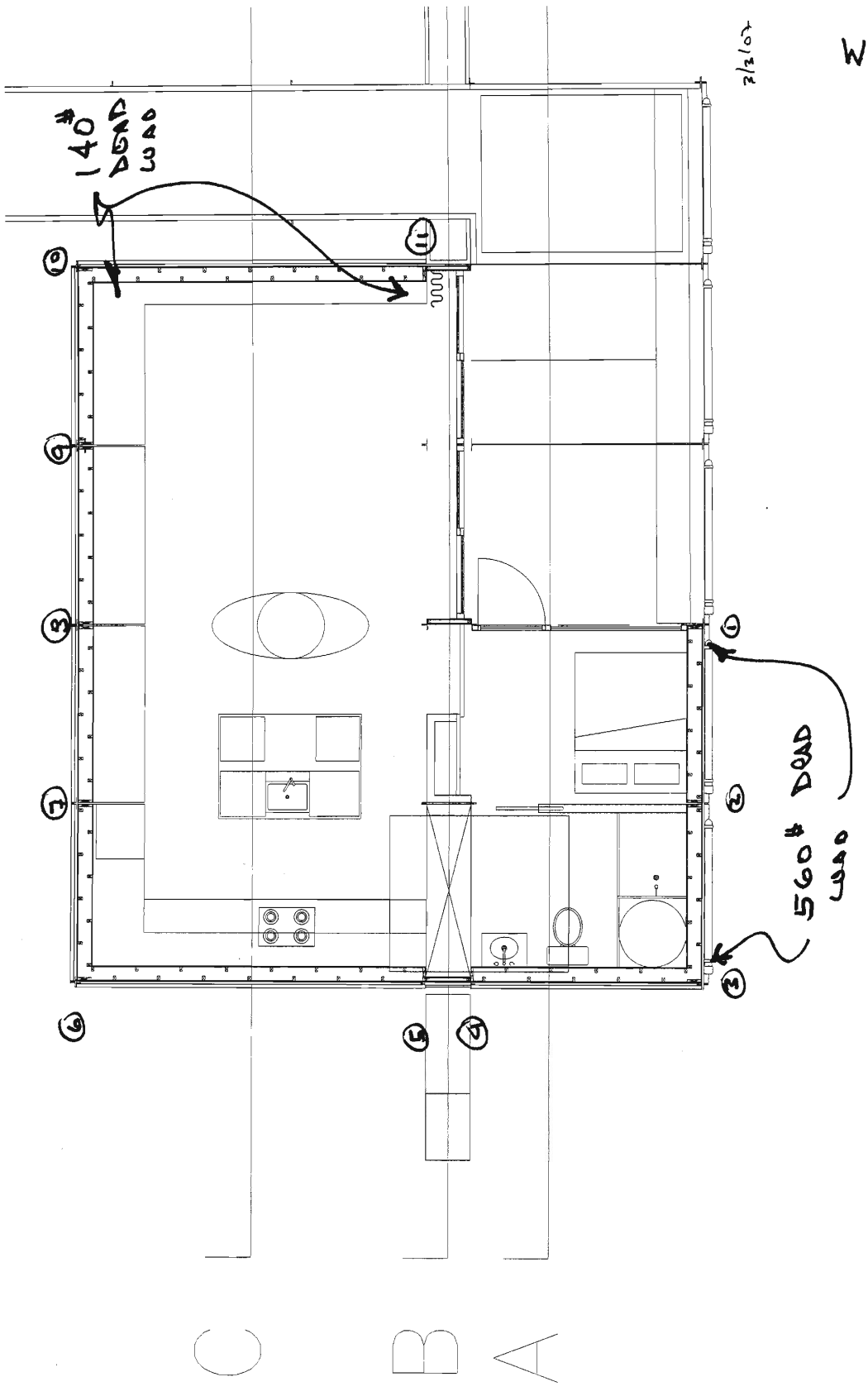
$P_{UP+DN} = 20 / (6' + 2') = 1.1^K \qquad 1.6^K$ (MW)

w/ P_{DL} + W @ $\quad 0.6 P_{DL} + W$ (ACI 7)

$T = 1.1 - 0.6 \times 0.9 = 0.56^K \uparrow$ @ 1 & 3

$= 0.76 - 0.6 \times 0.9 = 0.22^K \uparrow$ @ 4 ← NOT REQ'D

$= 1.1 - 0.6 \times 1.6 = 0.14^K \uparrow$ @ 10 & 11


W-7
2/2/07
#140 ROAD 3A0
#560 ROAD 3A0
11
10
6
3
1
7
2
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8
5
4
C
B
A

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WOOD - DOWN @ POWTS

3 + 1 SHORT SHEAR WALLS T = 560#

10 + 11 SWOOD SHEAR WALL T = 140#

PERMANENT CONDITION ANCHOR TO FOUNDATION STRUCTURE

TEMPORARY CONDITION

P_T 1 ADD MASS OF 0.56K

P_T 3 79 gallon tank P_{DL} = 660# OK

P_{Ts} 10 + 11 ADD MASS OF 0.14K

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Handrails

P = 200# w any direction

M = 0.2K x 5.25'/4 = 0.26 1-K

IGNORE CONTINUITY

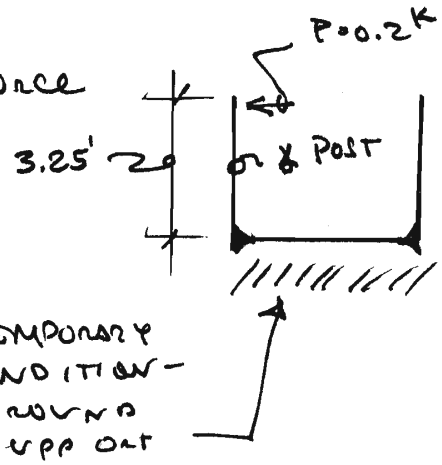
S ≥ 0.26 1-K x 12 / 33 KSI x 0.66 = 0.145 W³

1 1/4" ϕ (1.66" OD) SCH 40 PIPE OK

S = 0.235

@ Base End

Frame to Brace Force



M = 0.2K x 3.25'

= 0.65 1-K

fb 2 ∠ 3x3x3/16

< 0.65 x 12 / 0.941

= 17.7 KSI OK

w/ Horz. & w/ LEG CUT OFF

MW t = 3/8"

$f_b = \frac{0.65 \times 12 \times 6}{0.375 \times 4^2} = 7.8^K$ OK

$Weld = \frac{0.65 \times 12 \times 6}{2 \times 4^2} = 1.5$ K/INCH / weld

3/16" Fillet Cap = 3 x 0.928 = 2.8 > 1.5

3/16" FILLET EACH SIDE

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Floor Girders For Ramp

SPA = 5'-3" w = 0.11

L = 7'-0"

R = 2.0 k M = 3.54 ft-k

V = 2.0 k

w/ steel Angles S ≥ 3.54 x 12 / 20 ksi = 2.1

⊥ 4 x 4 x 1/4

Also anchor handrail moment.

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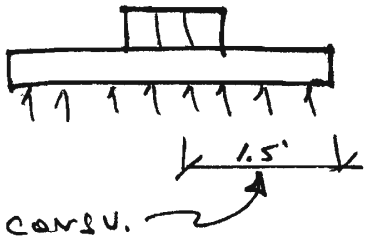
FOUNDATIONS

DNT. FOOTING $A \geq 12.6^{k} / 1.5^{KSF} = 8.4\ SF$

$= 3' \times 3' \pm$



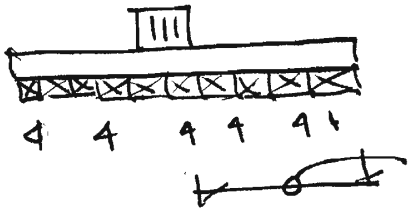
$M = 1.5\ KSF \times 1.5'^{2}/2$

$= 1.69\ K/FT$

$S \geq \frac{1.69 \times 12}{1\ KSI} = 20.3\ IN^{3}/FT$

W1 4 X 4 s $\quad S \geq 12" EFF \times 3.5^{2}/6 = 24.5$

$36"/3.5" = 10$ - 4 X 4 s x 3'-0"



MIN

$M = (3 \times 0.5\ KIP) \times 1.25^{2}/2$

$= 3.5\ K-F$

$S \geq 42$

2 @ 6 x 6) $(5.5" \times 2) \times 5.5^{2}/6 = 55 > 42$

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EXTERIOR FOOTING

$A \geq 9.1^{k} / 1.5\ ksf = 6.1\ \phi$

$= 2'-6" \times 2'-6"$

or 0.76' CONT.

FOOTING.

LOADS CONSV.

2x8 CONT. BEARING WALL