GEORGIA TECH SOLAR DECATHLON 07

PROJECT SPECIFICATIONS

ICARUS REDUX

03.06.07

The Solar Decathlon is a project of the U.S. Department of Energy (DOE) in partnership with DOE's National Renewable Energy Laboratory.

Georgia Institute of Technology
Icarus Redux – Sustaining Life with Light
Solar Decathlon 2007

03.06.07 Deliverable

Specifications

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Georgia Tech Solar Decathlon Entry – Structural Narrative and Calculations
5 March 2007

Certification

The structural design of the Georgia Tech Structural Decathlon entry has been completed under my supervision. The overall structural design concept was developed by Jamie O'Kelley (a structural engineer and student in our graduate program of architecture). I completed the detailed structural analysis and review contained in this document. The structural drawings in this submittal were completed by Mr. O'Kelley under my supervision. These structural drawings represent the level of detail expected in a set of structural contract documents in a commercial project. Because of the level of detailing expected to be required as part of the fabrication process, it is likely that some of the connection details will be modified as shop drawings are produced. Any modifications to the details or member sizes will take place only after my review.

T. Russell Gentry, Ph.D., PE
Consulting Structural Engineer

Structural Narrative

The structural system of the Georgia Tech Solar Decathlon is described in the following document.

Description of Structural Frame

The gravity load system of the GTSD entry consists of two W12x26 longitudinal wide flange beams whose primary purpose is to support the building during transportation, and to provide

anchor points for the axles and hitch. A set of 10 transverse steel tubes, evenly spaced at 5'-4" intervals along the top of the wide flanges, provide support for the floor and the walls. Nine rows of wood 2x6 floor joists run parallel to the wide flange beams, and provide direct support for the plywood floor of the building.

Four portal frames, made up of wood/steel flitch assemblies, provide the main vertical load-carrying capability of the frame. These portal frames are connected to the transverse steel tubes. The portal frames fall at the 2nd, 5th, 6th, and 9th tubes. The portal frames support a level of roof framing at approximately 8 feet above the floor and a second layer of roof framing at approximately 10'-6" above the floor. The space between the two layers of roof framing creates a clerestory. The two layers of roof framing are also flitch structures. The framing at the 8' level is turned with its strong axis oriented horizontally, to act as wind girts at the top of the enclosure walls (SIP and Kalwall). The top level framing is oriented vertically and provides a strong, stiff platform for the loads imposed by the roof framing and the PV array.

The house is made stiff laterally through the integration of six shear walls, two longitudinally and four transverse. These walls are sheathed with Thermo-Ply "Blue", a structural shear panel 0.135 in. thick[1]. The shear walls fully lap the double 2x plate at the base of the walls and fully lap the horizontally oriented wind girts at the bottom of the clerestory. The shear walls do not continue to the roof level. The 12 columns are continuous to the roof and act to transfer the lateral loads from the clerestory level down to the tops of the shear walls.

Structural Loadings

Three key load cases and structural configurations were considered as part of the design of the GTSD frame.

Typical Gravity Load Case: The first is the typical gravity loaded configuration, with a dead load of 10 psf (floor), 20 psf (roof) and floor live loads of 50 psf, where the building is supported on 20 point foundations, one at the each end of the transverse steel floor beams. Eight additional point foundations will be used along the main frames of the building beneath the main structural frames of the building.

Transportation Loading Case: The second load case is of the building under transportation. In this case, the live loads are not present. The roof dead load is reduced to 10 psf as the building will be transported without the PV rack in place. The building is supported by 5 axles whose centroid is located approximately 2/3 back from the towing end of the vehicle.

In addition to the dead loads, lateral loads from accelerations during transportation must be considered. Analysis of typical towing situations have provided the following extremes: 1g of deceleration along the long axis of the vehicle, and 0.33 g of acceleration in the transverse direction. These loads are applied as equivalent static lateral forces at the roof level of the structure. Additional bracing will be applied at the interior of the frame to resist the inertial forces and to limit the in-plane and lateral deformation of the building under transportation. This bracing occurs in plan (in the plane of the roof) and in elevation (in the plane of the walls).

[1] See ICC Evaluations Services Report No. ESS-1122, Thermo-Ply Blue Structural Grade Sheathing.

Wind Loading Case: The final load case is the lateral load case for the case where the building is installed on the mall in Washington. The controlling lateral force in this case is the 90 MPH wind as required for the 2000 IBC. The primary concern here is not the overall structural strength of the building frame, but rather, the stability of the building under sliding forces and overturning moments. This is critical due to the minimal connection between the structural and the ground surface. To aid in the overturning and sliding aspects of this load, 8 of the building foundations will be pre-weighted with concrete. These 8 foundations will be tension-tied to the primary load carry frames so that the building will resist any potential uplift. The building is so small that there is little difference between the wind loading for the main wind force resisting system (overall frame) and the individual elements of the components and cladding. In general, the components and cladding are required to have higher wind load capacities due to gust effects. To be conservative, a 15 psf wind force (pressure or suction but not both simultaneously) is considered to be the key wind load for design of the main lateral load system and the building components.

A brief summary of the wind load calculation leading to the decision to use a design load of 15 psf is given below.

Wind Load Requirements

$V := 90$

$K_z := .85$ this is the Kz for the cladding which is much higher than for the entire structure

$K_d := 0.85$

$I := 1$

$K_{zt} := 1$

$q_z := 0.00256 \cdot K_z \cdot K_{zt} \cdot K_d \cdot V^2 \cdot I$ $q_z = 14.982$ psf (pounds per square foot)

$pressure := 0.68 \cdot q_z$ $pressure = 10.188$ psf

$suction := 0.18 \cdot q_z$ $suction = 2.697$ psf

It is conservative to use 15 psf as the entire loading (pressure + suction) and to design all enclosure components to resist 15 psf in pressure or suction.

Governing Codes for Structural Design

The following documents dictate the loading requirements and structural materials design limits for the GT SD entry:

2000 International Building Code w/ Georgia Amendments
2007 International Residential Code per Solar Decathlon Rules and Regulations

ASCE 7-05 Minimum Design Loads for Buildings and Other Structures[2]
ANSI/AF&PA NDS-2005, National Design Specification (NDS) for Wood Construction

Structural Analysis

A computer-based structural analysis of the frame was completed using Visual Analysis Version 4.0. Three separate analyses were performed, one for each of the load cases described previously. Extensive output from the structural analysis is provided in the calculations, Appendix A.

Allowable Stresses in Materials

The allowable stress methodology was used to design the GT solar decathlon frame. The 9th Edition of the AISC Allowable Stress Design (ASD) is used as the basis for the frame. The ASD methodology was considered appropriate due to the fact that the serviceability (deformation) of the frame is a much more serious concern than any stress limits in the steel. Furthermore, the structural frame is a combination of steel and wood (acting compositely) and it is much more simple to determine the interaction of the two structural materials under service load stresses.

The allowable stress in structural steel and timber were taken as follows:

Structural Steel Shapes	ASTM A992 Grade 50	Fb = 0.60 Fy = 30 ksi
Structural Steel Tube	ASTM A572 Grade 50	Fb = 0.60 Fy = 30 ksi
Structural Steel HSS	ASTM A500 Grade B	Fb = 0.60 Fy = 28.8 ksi
Wood Timber[3]	No. 2 SYP, 2 x 10	Fb = 1050 psi Fc = 1500 psi Fv = 90 psi E = 1,600,000 psi

Allowable Deformations

Much more important in the allowable stresses in the materials are the allowable deformations of the structural frame under the applied loadings. The air-tightness of the house depends on the rigidity of the frame. Therefore, the following deflection requirements have been followed:

Gravity Load Deflection:	L/480 based on DL + LL
Lateral Drift Under DL + LL:	0.5% story drift
Lateral Drift Under Wind Loads:	1% story drift
Lateral Drift Under Transport Loads:	1% story drift
Lateral Deflection of Wind Walls:	L/250[4]

[2] The "Simplified Method" for wind design described in ASCE 7-02 is considered to be the most appropriate for this low-rise structure that has no specific geographic exposure to high wind regions (the building is designed to reside in Washington, DC and Atlanta, GA).
[3] The same allowable stresses are used for smaller wood members, even though the code allows for a increase in stresses for members smaller than 2x10.

These deflection restrictions are significantly higher than called for in the building code.

Foundation Considerations

The foundations for the GTSD structure serve to distribute the gravity forces to the ground. The requirement for minimal site disturbance requires that a bearing pressure of 1500 psf be used. The structural analysis indicates that the maximum foundation load will be 8300 pounds (a combination of floor dead load, roof dead load, and the 50 psf live load). This foundation load occurs in four locations underneath the building. A bearing area of 6 square feet will be required in this location. At 4 other locations the bearing reaction is approximately 5500 pounds, requiring a bearing area of 4 square feet. At all other locations the 2500 pounds or less, requiring about 1.5 square feet of bearing.

Note that all of these foundation reactions assume the application of the full 50 psf live load in the house, with no live-load reduction. This is a fairly conservative assumption – to actually achieve the 50 psf live load, 150 people would have to be in the house at the same time.

Therefore, three foundation sizes are suggested, an F16 (16 inches square on a side), an F24, and an F30. The F30 foundations will be integrated with the dead weight hold-downs for wind load.

Global Wind Stability

The GTSD house is subject to a 90 mph (15 psf) wind load. This wind load applies a sliding, overturning and uplifting forces to the GT solar decathlon house. The calculations shown here demonstrate the overall stability of the structure (but not the efficacy of the lateral load resisting system). The checks are made to ensure that the house weighs enough to hold itself in place for each of these potential failure modes. The sliding mode is an issue in the design. The building does not weight enough to keep from sliding under full application of the design wind. Therefore, the 8 counterweights must be socketed into the soil 6 inches to provide additional sliding resistance. The over-turning and uplift calculations are acceptable.

[4] This corresponds to the “brittle finish requirement” in the International Residential Code.

Wind Sliding, Overturning, and Uplift

Sliding

$\rho := 15$ psf (wind pressure)

$l := 52$ feet

$h := 12$ feet (assume the PV array catches some wind)

$V := \rho \cdot l \cdot h$ $V = 9360$ sliding force of the wind, pounds

Assume a frictional coefficient of 0.4 between soil and concrete $\mu := 0.4$

The dead load of the house is the force resisting frictional sliding. ASCE 7 provide a load case of 0.6 DL + WL to define the sliding case (only 60% of dead load resists sliding)

$N := 12 \cdot 52 \cdot (10 + 20) \cdot 0.6$ 60% of the total dead load on floor+roof

$N = 11232$ pounds

$F := \mu \cdot N$ $F = 4493$ pounds

F < V so some sliding is possible -- need auger or dead weights to prevent sliding, OR, socket 8 dead loads 6 inches into the ground to engage them with the soil (suggested solution).

Overturning

$OTM := V \cdot 5.5$ $OTM = 51480$ overturning moment, foot-pounds

Overturning resisting moment comes from the dead weight of the structure (60%) plus the weights of the hold downs at the corners.

$ORM := N \cdot 6 + 4 \cdot 400 \cdot 6$ $ORM = 76992$ overturning resisting moment, foot-pounds

ORM > ORV so overturning is not an issue

Uplift

Gross uplift would require that the upward force of the wind overcome the dead load of the structure (factored) plus the dead weights. In this instance, the weight of the decks acts to hold the structure down as well.

$UP := \rho \cdot 12 \cdot 52$ $UP = 9360$ pounds of uplift

$DOWN := N$ $DOWN = 11232$

DOWN > UP so gross uplift is not a problem. The roof membrane to roof framing members will still have to be detailed to resist local uplift.

Appendix A
Excerpts from Computer-Based Structural Analysis

Shaded view of structural model. Large yellow plates represent longintudal and transverse shear walls.

Yellow member at perimeter of the frame is the wind girt, which has its strong axis horizontal to carry wind loads.

-133 lb/ft
-266 lb/ft
-266 lb/ft
-266

-53 lb/ft
-53 lb/ft
-53 lb/ft
-106 lb/ft
-106 lb/ft
-106

Deflected shape of structural members under full dead plus live loads. Controlling cases for deflection are: (1) midspan of steel tube floor beams and (2) cantilevered ends of roof framing. Both deflections are well below allowable of L/480.

Reactions under full floor + roof dead load and 50 psf floor live load. Highest reactions are along the structural lines that columns. Extra foundations are placed along these lines.

Bending stresses in steel wide flange beams, steel floor tubes, and in steel flitch plates due to full dead + live loads. Maximum flexural stresses in the steel plates are in the range of 7 ksi, well below the allowable stress.

Zoomed image of flexural stresses (from moment diagrams) in steel sections and plates. These moment diagrams are used to determine splice locations for the long-span roof beams.

View of frame equipped with supplemental tension cable bracing for transportation (a total of 20 tension cables depicted). Note that locations of supports have changed to reflect transportation on a drawbar at the front and a set of axles near the rear. Bracing is nominal 3/8” steel cable with turnbuckles. Additional temporary compression member (shown in RED) may be needed to brace structure.

Additional view of transportation bracing.

Roof dead loads under transportation are reduced to 10 psf as PV panels and supporting armatures are not in place during transportation of the unit to Washington.

Longitudinal braking loads. A deceleration of 1g is anticipated (this is an extreme situation where the brakes on the tow vehicle and the trailer are fully locked). The longitudinal lateral forces are equal to the weight of the roof. Total longitudinal lateral force is 6300 pounds.

Transverse braking loads. These loads results from cornering of the vehicle and sidesway when the travel vehicle hits bumps in the road. A transverse lateral acceleration of 0.33 g is considered. The total transverse load is 2100 pounds.

Deformation under longitudinal braking loads. Distortion of the roof occurs due to lack of rigid roof diaphragm. Additional temporary bracing will be necessary along the cantilevered column line.

Additional bracing in the plane of the roof links the exterior column line with the braced bay. The allowable drift is 1% of story height or 10.5 ft x 12 in/ft x 0.01 = 1.26 inches. **OK**

Transverse accelerations cause excessive racking of the roof at the cantilevered ends. More bracing in the plane of the roof will be required during transportation.

Additional transportation bracing in the plane of the roof.

Transverse racking now limited to
0.75 inches during transportation.
Meets limits of 1% story drift.

HIGHTEX

ETFE

Transparent or translucent ETFE membranes

ETFE - Ethyl Tetrafluorethylene

Fluorpolymer membranes such as the current ETFE foils are used in increasing numbers for transparent and highly translucent roofs and/or facades. The following technical data refers to ETFE foils only. The data of other, less common, transparent foils may be different.

Transparent membranes are becoming more and more important, particularly where transparency to the whole spectrum of natural light is required, and is to be combined with a lightweight structure to create an economical solution.

ETFE membrane is principally used in pneumatic, multi-layered systems. The maximum span width depends on the imposed loads and required geometry of the individual elements. For small span widths single layer ETFE can be used.

Multi-layered systems allow projects with varying physical requirements to be accommodated.

Owing to the outstanding physical characteristics of this material a long life expectancy is guaranteed, with no reduction in aesthetic appearance.

ETFE

Detailed characteristics:

Life span: As ETFE is one of the most stable organic combinations; resistance to all environmental influences is very high. Life expectancy is more than 20 years if the material is used according to the specifications.

Fire rating: ETFE membranes are flame retardant according to DIN 4102 B1. Tests have shown that, due to the low mass of the membrane (which is only between 0.08 and 0.2 mm thick); there is minimal danger of any material falling in the event of fire.

Cleaning: ETFE membrane is self-cleaning due to its chemical composition, and will therefore retain its high translucency throughout its life. Any accumulated dirt is washed off by normal rain if the form and connection details are designed correctly.
In climates where rainfall is minimal, or if special cleaning is required, cleaning is carried out using ecologically 'green' detergents.

Maintenance: The material is maintenance-free. However, inspections are still recommended in order to find defects (for example damage caused by mechanical impacts of sharp objects) and to identify and repair such damage as early as possible. It is also recommended that the clamping system and the primary structure be regularly inspected.

The inspections should normally be carried out annually. However, the specific intervals need to be assessed on a project-by-project basis. They can be carried out in conjunction with the cleaning, if the client requests this.

Translucency: Translucency of the ETFE membrane is about 95 % within the range of 400 - 600 Nm, with scattered light at a proportion of 12 % and direct light at a proportion of 88 %. For a three-layered module (upper layer 200µm, middle layer 100µm, inner layer 200µm), the degree of light transmission for vertical incidence is = 0.7. This value gives the translucency important for life (of humans, animals and plants).
Dangerous UV-B and UV-C radiation (which causes burning and is carcinogenic) is considerably reduced by filtration.

u-values are as follows:

- for one-layered membranes	≈ 5.1 W/m²K
- for two-layered membranes	≈ 3.5 W/m²K
- for three-layered membranes	≈ 2.0 W/m²K
- for four-layered membranes	≈ 1.5 W/m²K

Environmental compatibility: ETFE membranes can be 100% recycled. Additionally, the membrane has an extremely low mass due to the minimal thickness of up to only 200µm. 500 m² of a double-layered ETFE cushion, for example, has a material mass of approximately. 0.15 m³. The ETFE system can be fitted in foil, aluminium clamp-plates and steel bolts, nuts etc. The design of appropriate connection details helps to avoid non-separable glued connections.

Further details:
In a sufficient production quantity this material may also be supplied in colours such as blue or white.

In order to reduce solar gain while maintaining the transparency, two-dimensional patterns can be printed on the membrane.

HIGHTEX

ETFE - Foil

General Specification

Properties	Standard	Data	Data	Data	Data
Thickness	DIN 53370	100 µm	150 µm	200 µm	300 µm
Total weight	ISO 2286-2	175 g/m²	262,5 g/m²	350 g/m²	525 g/m²
Tensile strength	DIN EN ISO 527-1	60 N/mm²	58 N/mm²	55 N/mm²	50 N/mm²
Tensile stress at 10 % strain	DIN EN ISO 527-1	21 N/mm²	21 N/mm²	21 N/mm²	22 N/mm²
Tensile strain at break	DIN EN ISO 527-1	650%	750%	680%	650%
Tear resistance warp/weft	DIN 53 363	420 N/mm	500 N/mm	450 N/mm	500 N/mm
Light transmission	-	0,94	0,912	0,894	0,87
Flame Retardancy	DIN 4102	B1	B1	B1	B1

There is also material available outside the specified range. These values are intended to provide information and are not to be understood as a guarantee.

HIGHTEX

THERMAL PERFORMANCE SPECIFICATIONS OF THE ROOF SECTION

The following report analyzes the U-value of the ETFE roof with nanogel insulation based on material specifications provided by the Hightex (see attached email)

https://murmur.coa.ad.gatech.edu - AW: Solar Decathlon - Georgia Tech -- SolarNext/HIghtex - Microsoft Internet Explorer

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From: Jan Cremers [Jan.Cremers@SolarNext.de] Sent: Fri 2/9/2007 6:58 AM
To: Choudhary , Ruchi
Cc: Dave Capezzuto; Klaus Michael Koch; Kurt Koch; Klaus Wende
Subject: AW: Solar Decathlon - Georgia Tech -- SolarNext/HIghtex
Attachments: Roof%20Analysis-02052007.pdf(82KB)

Dear Ruchi,

thank you very much for mail. I try to answer your questions as best as possible:

ad1
Translucency of the ETFE membrane is about 95 % within the range of 400 - 600 Nm, with scattered light at a proportion of 12 % and direct light at a proportion of 88 %.
We have the following results from meassurements of 0,2mm ETFE films (transparent)which are pretty different from your estimations:
Solar transmittance: 0.90 ± 0.02 per film
Solar absorptance: 0.027 ± 0.02 per film
Solar reflectance: 0.07 ± 0.02 per film

ad2
The solar transmission of the ETFE-Nanogel-ETFE-Panel should be below 30%. I guess it is even below 20% as the Aerogel alone is somewhat like 25%.
Recently we had a test done in an external institute to meassure 2-layer ETFE applications (2x 0,2 mm, air gap of 300 mm) with the following results:
Visual (tVIS): 0.81 ± 0.02
solar (tSolar): 0.84 ± 0.02
ultraviolet (tUV): 0.66 ± 0.02
solar heat gain coefficient (g): 0.85 ± 0.02
shading coefficient (SC): 0.98 ± 0.02

The R-Value (German) is of course dominated by the Nanogel filling and should be around 3.5 m2K/W for 60mm filling. I guess that kind of equals your value for R (US).
And I know that the solar absorption of the panel will be very low but I can not provide you with any specific values here. See also ad1.

ad3
Personally I can not confirm the value because we did not meassure this up to now (as far as I know).

You should also consider that the values mentioned above are for transparent ETFE films only. Of course you have a great variety of options to control the values if you add printing patterns.

Did you have a chance to speak to Dave about how we should proceed? Please keep in mind that we will also need time to actually produce and ship the material. And concerning the Aerogel filled panels we definately will need extra time because we will have to co-operate with Cabot here which will include extra shipping for example...

Kind regards

Jan

Dr Jan Cremers
DipArch, PhD Eng., Architect
Head of Envelope Division

SolarNext AG
Nordstraße 10
D-83253 Rimsting

Unknown Zone (Mixed)

This roof sensitivity analysis has only been conducted in terms of load simulation. A complete analysis might have to be extended to light quality analysis and economic analysis.

HH(huafen.hu@gatech.edu)

Material Properties[1]:

1. Weather Protector made of ETFE

Conductivity: 0.24 w/m-K
Thickness: 0.000203 m (0.08 in)
Density: 1750 kg/m^3
Specific heat capacity: 250 J/kg-K
Solar transmittance[2]: 0.9 per film
Solar absorptance: 0.027 per film
Convective heat transfer coefficient over weather protector: 15 w/m^2-K

2. Ceiling made of ETFE filled with Nanogels

R-value (US): 20
Density: 90 kg/m^3
Specific heat capacity: 800 J/kg-K
Thickness: 6cm
Solar transmittance: 0.30;
Solar absorptance: 0.027;
Convective heat transfer coefficient over the surface facing interior room: 2 w/m^2-K

3. Cavity between roof surface and weather protector

Height[3]: 0.15m (150mm)
Length[4]: 1.63 m
Width: 4.49 m
Convective heat transfer coefficients over both surfaces facing air cavity: 4 w/m2-K

All the radiative heat transfer coefficients are set to be 5.5 w/m^2-K.

Simulations[5]:

1. Estimate classic U-value for the whole structure

Run the simulations with a variety of air cavity heights and air exchange rate (ACH). Results are shown in Table 1 and Figure 1.

[1] All the following data are of SI units
[2] Optical properties are cited from emails from SolarNext, assuming transparent ETFE films here
[3] Assume uniform height along its length
[4] Only one bay of ETFE roof is simulated here (9 in total).
[5] Assume that the retractable shading is always OFF in the following simulations in order to maximize the impacts of air cavity height.

Table 1: The classic U-value along with different air cavity heights and ACHs

height(mm)	ACH=1	ACH=10	ACH=20	ACH=40	ACH=80	ACH=160	ACH=320	ACH=500	ACH=800
10	0.260247	0.260275	0.260305	0.260363	0.260477	0.260688	0.261051	0.261389	0.261834
25	0.260174	0.260242	0.260316	0.260456	0.260711	0.261140	0.261770	0.262257	0.262786
50	0.260053	0.260190	0.260332	0.260591	0.261024	0.261663	0.262439	0.262936	0.263402
100	0.259811	0.260082	0.260348	0.260795	0.261450	0.262244	0.263014	0.263425	0.263761
150	0.259570	0.259972	0.260348	0.260932	0.261705	0.262527	0.263223	0.263560	0.263821
200	0.259329	0.259862	0.260333	0.261023	0.261857	0.262663	0.263288	0.263575	0.263788
250	0.259087	0.259750	0.260305	0.261074	0.261941	0.262718	0.263283	0.263532	0.263714
300	0.258845	0.259636	0.260267	0.261099	0.261980	0.262723	0.263239	0.263460	0.263619
350	0.258604	0.259522	0.260221	0.261100	0.261984	0.262695	0.263171	0.263369	0.263511
400	0.258362	0.259405	0.260167	0.261085	0.261965	0.262645	0.263086	0.263268	0.263397

Figure 1 Classic U-value of the roof structure along with different air cavity heights

2. Estimate the effective SHGC

Run the simulations with a variety of air cavity heights and air exchange rates (ACH). Results are shown in Table 2 and Figure 2.

Table 2: The effective SHGCs along with different air cavity heights

height(mm)	ACH=1	ACH=10	ACH=20	ACH=40	ACH=80	ACH=160	ACH=320	ACH=500	ACH=800
10	0.216279	0.216275	0.216270	0.216261	0.216244	0.216212	0.216157	0.216106	0.216039
25	0.216287	0.216276	0.216265	0.216244	0.216205	0.216141	0.216045	0.215972	0.215892
50	0.216299	0.216279	0.216257	0.216218	0.216153	0.216056	0.215939	0.215864	0.215794
100	0.216325	0.216284	0.216244	0.216177	0.216078	0.215959	0.215843	0.215781	0.215731
150	0.216350	0.216290	0.216234	0.216146	0.216030	0.215907	0.215803	0.215752	0.215713
200	0.216376	0.216296	0.216226	0.216122	0.215998	0.215877	0.215784	0.215741	0.215709
250	0.216401	0.216302	0.216219	0.216105	0.215976	0.215860	0.215776	0.215739	0.215712
300	0.216426	0.216309	0.216215	0.216092	0.215961	0.215851	0.215774	0.215741	0.215718
350	0.216452	0.216316	0.216212	0.216082	0.215951	0.215846	0.215776	0.215746	0.215725
400	0.216477	0.216323	0.216211	0.216076	0.215946	0.215845	0.215780	0.215753	0.215734

Figure 2 The effective SHGCs of the roof structure along with different heights of air cavity

Impacts to Space Heating/Cooling Loads

A serious of dynamic simulations has been conducted to illustrate the impacts of air cavity thickness to space heating/cooling loads. The simulation period is the exact competition week and the house is controlled basing on all the requirements defined by Department of Energy for Wednesday as it represents the worst condition (the house is required to be under strict control on Wednesday for 24 hours continuously without setbacks).

Table 3 shows the total heating/cooling loads for the competition week. As we can see the impact of air cavity thickness is almost ignorable in terms of energy. Probably its impact to light quality would be more essential. Table 4 shows the hourly heating load profile on Wednesday (Oct 17). The impact of air cavity thickness is small but at least observable. The thicker the air cavity is, the less the heating load is. The same trend happens to cooling load profile as shown in Table 5.

Table 3: Total Heating/Cooling Loads for the Competition Week (Oct 13 – Oct 19)

H(mm)	Qcooling(kWh)	Qheating(kWh)
25	137.490	28.511
50	137.148	28.318
100	136.890	28.002
150	136.809	27.699
200	136.692	27.739
300	136.549	27.501
400	136.482	27.317

Table 4: The Hourly Heating Load Profile on Wednesday (Oct 17)

Hour	H=25mm	H=50mm	H=100mm	H=150mm	H=200mm	H=300mm	H=400mm
1	242.06	239.36	235.38	232.52	230.34	227.17	224.83
2	342.34	341.68	340.65	339.85	339.20	338.15	337.31
3	403.90	403.58	403.04	402.58	402.17	401.47	400.86
4	409.04	408.85	408.51	408.22	407.96	407.50	407.11
5	370.99	369.57	367.53	366.12	365.07	363.59	362.57
6	406.93	405.65	403.84	402.60	401.67	400.34	399.39
7	358.28	357.91	357.34	356.89	356.51	355.90	355.40
8	148.10	147.90	147.56	147.26	147.00	146.53	146.12
9	0.37	0.37	0.36	0.35	0.34	0.33	0.32
10	0.00	0.00	0.00	0.00	0.00	0.00	0.00
11	0.00	0.00	0.00	0.00	0.00	0.00	0.00
12	0.00	0.00	0.00	0.00	0.00	0.00	0.00
13	0.00	0.00	0.00	0.00	0.00	0.00	0.00
14	0.00	0.00	0.00	0.00	0.00	0.00	0.00
15	0.00	0.00	0.00	0.00	0.00	0.00	0.00
16	0.00	0.00	0.00	0.00	0.00	0.00	0.00
17	0.00	0.00	0.00	0.00	0.00	0.00	0.00
18	0.00	0.00	0.00	0.00	0.00	0.00	0.00

19	0.00	0.00	0.00	0.00	0.00	0.00	0.00
20	0.00	0.00	0.00	0.00	0.00	0.00	0.00
21	41.97	148.22	114.08	81.95	65.67	49.28	33.59
22	247.49	240.61	231.05	224.61	219.99	213.65	209.43
23	361.30	356.92	350.88	346.88	344.01	340.11	337.54
24	545.29	540.12	533.05	528.41	525.11	520.67	517.77
sum(kWh)	**3.88**	**3.96**	**3.89**	**3.84**	**3.81**	**3.76**	**3.73**

Table 5: The Hourly Cooling Load Profile on Wednesday (Oct 17)

Time	H=25mm	H=50mm	H=100mm	H=150mm	H=200mm	H=300mm	H=400mm
1	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5	0.00	0.00	0.00	0.00	0.00	0.00	0.00
6	0.00	0.00	0.00	0.00	0.00	0.00	0.00
7	0.00	0.00	0.00	0.00	0.00	0.00	0.00
8	0.00	0.00	0.00	0.00	0.00	0.00	0.00
9	0.00	0.00	0.00	0.00	0.00	0.00	0.00
10	0.00	0.00	0.00	0.00	0.00	0.00	0.00
11	1267.64	1262.73	1257.16	1254.12	1252.24	1250.10	1248.97
12	1636.71	1629.32	1620.80	1616.08	1613.07	1609.52	1607.55
13	1455.79	1448.74	1440.84	1436.57	1433.90	1430.81	1429.11
14	1656.37	1650.55	1644.09	1640.60	1638.44	1635.96	1634.60
15	1403.69	1399.30	1394.58	1392.11	1390.61	1388.93	1388.05
16	1197.09	1195.17	1193.23	1192.26	1191.70	1191.12	1190.86
17	871.25	871.36	871.67	871.94	872.17	872.56	872.87
18	133.87	135.25	137.11	138.28	139.11	140.27	141.04
19	0.00	0.00	0.00	0.00	0.00	0.00	0.00
20	0.00	0.00	0.00	0.00	0.00	0.00	0.00
21	0.00	0.00	0.00	0.00	0.00	0.00	0.00
22	0.00	0.00	0.00	0.00	0.00	0.00	0.00
23	0.00	0.00	0.00	0.00	0.00	0.00	0.00
24	0.00	0.00	0.00	0.00	0.00	0.00	0.00
sum(kWh)	**9.62**	**9.59**	**9.56**	**9.54**	**9.53**	**9.52**	**9.51**

In general the thickness of air cavity does not play an important role to space heating/cooling load. We might need to run daylight simulation to evaluate its impact to daylight quality when determining its height.

Impact of coatings on ETFE film

Table 6: Optical Properties of different ETFE films

	Transparent film	Film with selective coatings
Solar Transmittance	0.9	0.57
Solar Absorptance	0.027	0.027

Table 7: Weekly Total Heating/Cooling Loads during Competition Week[6] (Oct 13-Oct 19)

Options	Qcooling(kWh)	Qheating(kWh)	%Qc	%Qh
Transparent film	136.809	27.699		
Film with selective coatings	122.154	28.115	-10.71%	1.50%
Transparent film with retractable shading ON	116.192	25.738	-15.07%	-7.08%

In conclusion two alternatives – (1) applying selective coatings to the transparent ETFE films and (2) Implementing retractable shading control over the roof – can almost do bring the same benefits to our house in terms of load reductions. You might notice the larger benefit in cooling load reduction brought by retractable shading in Table 7 but this reduction is under the assumption that our roof is completely shaded while in fact only 2/3 of the roof area can be completely shaded. In another word reducing solar transmittance from 0.9 to 0.57 is doing the same thing as what implementing controlled retractable shading does.

[6] Assume the retractable shading on the roof is OFF in order to exaggerate the impacts.

Cabot Nanogel® Aerogel

© 2005 Cabot Corporation

U-value of Nanogel in IGUs (DIN EN 673)

R-value of Nanogel

Optical Transmission of Nanogel

ThermaSteel Corporation

ARCHITECTURAL SPECIFICATIONS

ARCHITECTURAL SPECIFICATIONS
FOR
THERMASTEEL FRAME BUILDING PANEL SYSTEM
Manufactured by ThermaSteel Corp.

PART I - GENERAL

1.01 Summary: These specifications are to be used in preparing details and documentation for projects using the ThermaSteel Building System, manufactured by ThermaSteel Corp. For further product description and usage refer to:

A. ThermaSteel Assembly Manual

1.02 System Description:

A. The ThermaSteel Building System is customized to exact architectural drawings and specifications and can be used for below grade foundation wall systems as well as structural floor, wall and roof systems. (See attached drawing)

B. Individual panel size and configuration is dependent upon project design requirements. Maximum overall size shall be no greater than 4’ x 12’. Panel thickness shall be either 3 1/2”, 5 1/2” or 7 1/2”. Panel weight shall be no greater than 1.625 lb/sf.

C. Panels shall be composed of:

1. Integral steel framework of 24ga galvanized G-90 steel.

2. Exterior sheathing materials as specified by customer. (i.e. brick, lap siding, vinyl, etc.)

3. Polystyrene core insulation, Class 1 fire rated, is molded into a steel frame to produce a structural composite panel.

D. Joinery and peripheral components shall be:

1. Footer track shall be 18ga galvanized steel attached per code directly to concrete slab-on-grade or other appropriate foundation. Panel is positioned over track and secured using self-tapping sheet metal screws.

2. Shiplap joints on each panel will be joined using #8, 1/2” self-tapping screws.

3. A header is designed in various configurations to accommodate truss systems for various roof slopes or for parapet on flat roofs.

4. Corner components shall be manufactured using the same materials as the specified wall panels.

5. Other components shall be custom designed as necessary to meet project design as well as structural requirements.

E. Performance requirements: As a minimum the ThermaSteel 4’ x 8’ panels shall be tested by an independent laboratory to meet the following criteria:

1. Load Criteria:

WALL PANELS (STANDARD-ASSUMES SAFETY FACTOR OF 2.5)									
	DIMENSIONS				AXIAL LOAD LBS/LF kg/m	LATERAL LOAD LBS/SF (L/360) kg/m2	LATERAL LOAD LBS/SF (L/240) kg/m2	RACKING SHEAR LBS/LF kg/m 1/8” defl. Max.	
PANEL TYPE	W	H	T	RIB					
W 8-3/24	4’	8’	3 1/2”	24”	1033 lbs/lf	13.6 lbs/sf	20.5 lbs/sf	107 lbs/lf	249 lbs/lf
	1.2m	2.4m	8.9cm	60cm	1537 kg/m	66.4 kg/m^2	100.1 kg/ m^2	159.2 kg/m	370.5 kg/m
W 8-5/24	4’	8`	5 1/2’	24”	1067 lbs/lf	16.8 lbs/sf	21.8 lbs/sf	93 lbs/lf	243 lbs/lf
	1.2m	2.4m	13.9cm	60cm	1587.7 kg/m	82 kg/m^2	106.4 kg/ m^2	138.4 kg/m	361.6 kg/m
W 8-3/16	4`	8`	3 1/2’	16”	1300 lbs/lf	20.5 lbs/sf	27.9 lbs/sf	162 lbs/lf	355 lbs/lf
	1.2m	2.4m	8.9cm	40cm	1934 kg/m	100.1 kg/ m^2	136.2 kg/ m^2	241.1 kg/m	525.2 kg/m
W 8-5/16	4’	8’	5 1/2”	W	1869 lbs/lf	40.9 lbs/sf	42.3 lbs/sf	125 lbs/lf	312 lbs/lf/
	1.2m	2.4m	13.9cm	40cm	2781 kg/m	199.7 kg/ m^2	206.6 kg/ m^2	186 kg/m	464.3 kg/m
W 12-5/24	4’	12`	5 1/2"	24”	1104 lbs/lf	55.6 lbs/sf	>55.6 lbs/sf		
	1.2m	3.6m	13.9cm	60cm	1642.8 kg/m	271.5 kg/ m^2	>271.5 kg/ m^2		
W 12-5/16	4`	17’	5 1/2"	16”	1541 lbs/lf	53.7 lbs/sf	53.6 lbs/sf		
	1.2m	3.6m	13.9cm	40cm	2293 kg/m	262.2 kg/ m^2	310.6 kg/ m^2		

2. Fire Resistance: The panels have been tested for surface burning characteristics in accordance with UL 723 procedures (ASTM E84):

a. 3 1/2” (8.9cm) thick EPS, 1 1/2” PCF (24 kg/m^3):
Flame spread rating: 5-10
Smoke developed: 65-300

b. *5* 1/2” (13.9cm) thick EPS, 1.0 PCF (16kg/ m^3):
Flame spread rating: 5-20
Smoke developed: 125-175

In addition, fire wall assemblies have been tested in accordance with ASTM El19 for 1-hour and 2-hour ratings. Some are shown in the fire resistance table on the next page:

Wall Description	Rating
3 1/2” ThermaSteel w/steel channels - 1/2” regular gypsum boards - attached with 1” screws 12” o.c.	**Minimum**
3 1/2” ThermaSteel panel w/ recessed steel channels on exposed side - 5/8” Type X FIRECODE gypsum panels, recessed layer 5/8” gypsum over recessed channels - recessed gypsum board attached with 1” type S screws, 12” o.c., outer board attached with 1 5/8” type S screws, 12” o.c., on exposed side, no. 6 5/8” self-tapping screws 12” o.c., on protected side	**1 hour**
3 1/2” ThermaSteel panel w/steel channels - double layer 1/2” Type X FIRECODE gypsum boards - panels attached wIth 1” screws at 24” o.c. on exposed side, 1 5/8” screws at 12” o.c. on protected side	**2 hour**
5 1/2” ThermaSteel panel w/steel channels -- unfaced 2'' fiberglass insulation sandwiched between 5/8” Type X FIRECODE gypsum board (protected) and 1/2" regular gypsum board (exposed) - gypsum boards and fiberglass attached with 1 3/8” x 1 1/2” Hat studs at 24” o.c.	**1 hour Party Wall**

3. Sound Rating:

Wall Description	STC Rating
3 1/2” ThermaSteel partition panel with - 1/2” regular gypsum on either side 3 1/2” ThermaSteel partition panel with - 5/8” regular gypsum on either side	**36** **37**
2 -3 1/2" ThermaSteel panels with - 5/8” regular gypsum on either side 2 -3 1/2” ThermaSteel panels with - 5/8” air space between and 5/8” gypsum on either side 2 -3 1/2" ThermaSteel panels with - ceiling tile 2- 3 1/2” ThermaSteel panels 3 1/2” air space on one side, from metal furring channels and with-5/8” gypsum on either side ThermaSteel party wall panel: 5 1/2” panel with 5/8” gypsum on either side, 2” hat channel on either side of panel, infilled with 2" batt type FG insulation, covered with 1/2” gypsum. Total width = 8 5/8” with load capacity of 1250/LF	**40** **42** **48** **49** **51**
2 - 1 3/4” ThermaSteel panels (3 1/2” panel split down middle), 2” FG Batt insulation between panels, 5/8” gypsum on each side. Total width = 7” ThermaSteel Zublin partition wall: 2 -3 1/2” ThermaSteel panels with 2” air space between and 1/2” & 5/8” gypsum on either side. Total width = 11 1/4” o.c. on exposed side, 1 5/8” screws at 12” o.c. on protected side	**53** **57**
WOOD COMPARISON Wood studs with fiberglass insulation and 5/8” gypsum on each side. Notes: Wood studs are better at low frequency only. ThermaSteel is better than wood for approximately 90% of the frequency range. ThermaSteel is excellent in high frequency	**34**

* Improved sound rating values may be accomplished by the use of any of the following:

51/2” Panels
Fiberglass sound blankets between walls
Dynamat sound proofing films
The use of lead oil on one or both interior surfaces.
Changing the density of the EPS on either side.

4. Thermal Efficiency:
   a. 3 1/2” ThermaSteel panel R-Value of 16
   b. 5 1/2” ThermaSteel panel R-Value of 25
   c. 7 1/2” ThermaSteel panel R-Value of 34

1.03 Quality Assurance

A. Qualifications:

1. Panel manufacturer shall be ThermaSteel Corp.

2. Contractor/Installer shall be knowledgeable in the proper installation of the ThermaSteel Building System.

3. All supplied fasteners and other third party supplied components shall be certified by ThermaSteel Corp. as to quality and suitability for use.

B. Regulatory Requirements:

1. The ThermaSteel Building System and panel shall meet or exceed all code requirements for structure and fire safety.

2. The use of the ThermaSteel panel shall be in accordance with all applicable building codes.

C. The ThermaSteel Building System and panel shall be recognized for the intended use by applicable building codes.

D. Third Party Inspection:

1. Manufacture of the building panel and components shall comply with quality assurance standards of a contracted independent third party quality assurance inspection agency.

1.04 Delivery, Storage, Handling

A. All ThermaSteel panels and components shall be delivered to the job site with labels intact. Questionable panels or parts shall not be used.

B. Store all panels in a clean and safe area.

C. Panels shall be handled so as not to damage corners, edges, or channels prior to installation.

1.05 Project Conditions

A. Application of sealants, primers, elasotmeric coatings, brick or stone facings or other forms of exterior sidings or finishes shall be done under the conditions set forth by the manufacturers of those products.

1.06 Sequencing and Scheduling

A. Installation of the ThermaSteel panels shall be coordinated with the other building trades.

B. Foundations or slab-on-grade must be complete and properly cured, ready to accept the footer track prior to installation of the building panels when they are used as structural wall systems.

C. Exterior finishing must be accomplished in a timely manner following the installation of the ThermaSteel building panels.

D. Other building trades may be scheduled as required.

1.07 Warranty

A. ThermaSteel Corp. shall provide a two year warranty against defective material upon written request. See warranty for complete details.

PART II - PRODUCT

2.01 Manufacturer: The ThermaSteel panel and components are all proprietary products of ThermaSteel Corp. and manufactured under strict quality controls as monitored by a third party independent quality assurance agency.

2.02 Materials

A. 24ga galvanized G-90 roll formed steel shall comprise the integral framework of the panel. Expandable polystyrene incorporated into the design shall provide a sufficient thermal break to ensure non-conductivity of temperature between surfaces.

B. The exterior skins of the panel shall be at the discretion of the customer. Specifications for the non-proprietary sheathings shall be available upon request from ThermaSteel Corp.

C. The panel core shall be Class 1 fire-retardant foam with a minimum density of 1.0 lbs/cf to 1.5 lbs/cf injected into the panel cavity to form a composite panel.

D. Footer tracks shall be 18ga galvanized G-90 roll-formed steel on all load bearing walls.

E. Header and other required components shall be custom designed to meet the structural requirements of the architectural design.

F. Mechanical fasteners and other third party components shall be available from authorized manufacturers and selected by the architect/owner.

G. Joint sealants, exterior finishes, facings or sidings shall be recommended by ThermaSteel Corp. and selected by the architect/owner.

PART III - EXECUTION

3.01 Examination

A. Prior to the installation of the ThermaSteel panels, it is the contractor's responsibility to ensure that:

1. The foundation/footer/slab-on-grade is appropriately level and smooth and ready to accept the footer track of the building system.

3.02 Preparation

A. Protection

1. In following good building site practices, it is recommended that the ThermaSteel building panels and components shall be protected from permanent or temporary damage prior to, during, and following installation until proper sealant and exterior finishing are applied.

B. Foundation Preparation

1. The foundation/footer/slab-on-grade shall be prepared so as to be level and square prior to delivery of the panels.

C. Wall System Preparation

1. When the ThermaSteel panels are used as a curtain wall, the structural steel wall system shall be prepared so as to provide a level plane for panel installation using construction devices to serve that purpose. All structural systems should be dry and free from extraneous materials which may prevent proper fastening of the panels.

3.03 Installation

A. Installation instructions shall be customized for each project. In general, panels are connected:

1. To the foundation using a footer track bolted to the slab upon which the panel is placed and attached with mechanical fasteners.

2. At the top using a metal track or wood plate over the top of the panels and attached using mechanical fasteners.

3. To the structural steel framing using mechanical fasteners of appropriate design and length in a pattern as specified by the ThermaSteel structural engineer.

3.04 Field Quality Control

A. The contractor shall be responsible for the proper installation of the ThermaSteel Building System and the necessary sealants and finishes.

B. Contractors shall be factory trained as to the installation of the system.

C. A representative of ThermaSteel Corp. shall act as an on-site resource for a period of one day or as negotiated to help ensure proper installation of the system.

3.05 Cleaning

A. All excess materials, if any, shall be removed from the job site by the contractor in accordance with contract provisions.

B. All surrounding areas where the panels have been installed and the finish applied shall be left free of debris and foreign substances resulting from the contractor's work.

THERMASTEEL™ Corporation

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DRAWING N-3

PANEL ELEVATION

NO LAP LEFT (NLL)

PANEL SECTIONS

NO LAP RIGHT (NLR)

609 West Rock Road, Radford,VA 24141
540-633-5000 / (fax) 540-731-3712

RECOMMENDED ATTACHMENTS & CONNECTION DETAILS

THERMASTEEL™
Corporation
www.thermasteelcorp.com

RECOMMENDED TYPICAL ThermaSteel PANEL TO METAL TRACK CONNECTION

(SAME ATTACHMENT FOR TOP OF PANEL)

DRAWING A-1

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RECOMMENDED ThermaSteel PANEL TO WOOD PLATE CONNECTION

DRAWING A-2

(SAME ATTACHMENT FOR TOP OF PANEL)

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Corporation
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RECOMMENDED ThermaSteel PANEL TO FLOOR SYSTEM CONNECTION

DRAWING B-6

(WITH WOOD PLATE NAILED DOWN)

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RECOMMENDED ThermaSteel PANEL TO FLOOR SYSTEM CONNECTION

DRAWING B-7

(WITH WOOD PLATE NAILED DOWN AND ATTACHMENT PLATES TO FLOOR SYSTEM)

SECTION G

G-1= CORNER CONNECTION DETAIL

G-2= PANEL SHIPLAP DETAIL

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PLAN VIEW OF ThermaSteel PANEL CORNER CONNECTION

DRAWING G-1

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PLAN VIEW OF ThermaSteel PANEL SHIPLAP JOINT CONNECTION

DRAWING G-2

SECTION M

M-1 = STANDARD WIRECHASE PLACEMENT IN A STAND ThermaSteel PANEL

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TYPICAL WIRECHASE LOCATIONS

PANEL AS VIEWED FROM INSIDE OF THE STRUCTURE

DRAWING M-1

SECTION N

N-1= STANDARD WALL PANEL 16” O.C.

N-2= STANDARD WALL PANEL 24” O.C.

N-3= STANDARD WINDOW PANEL

N-4= STANDARD DOOR PANEL

N-5= STANDARD HEADER PANEL

N-6= STANDARD CONCRETE “T-BEAM” PANEL

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DRAWING N-1

PANEL ELEVATION

NO LAP LEFT (NLL)

PANEL SECTIONS

NO LAP RIGHT (NLR)

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DRAWING N-4

PANEL ELEVATION

NO LAP LEFT (NLL)

PANEL SECTIONS

NO LAP RIGHT (NLR)

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DO NOT EXCEED PANEL DESIGN LIMITATIONS

PANEL ELEVATION

DRAWING N-5

PANEL SECTIONS

STRUCTURAL ANALYSIS
FOR ROOF PANEL ThermaSteel T – BEAM

TYPE OF ROOF PANELLING	SPAN (FT)	RESISTING MOMENT (FT-LBS)	REINFORCING BARS (BOTTOM)
RPB -1 (SEE FIG. 1)	**10**	**2750**	**2 - # 4**
	12	**3960**	**2 - # 4**
	14	**5400**	**2 - # 5**
RPB - 2 (SEE FIG. 2)	**16**	**7040**	**2 - # 5**
	18	**9850**	**2 - # 5**
	20	**12150**	**2 - # 6**
RPB - 3 (SEE FIG. 4)	**22**	**16100**	**2 - # 6**
	24	**19160**	**2 - # 6**
RPB - 4 (SEE FIG. 5)	**26**	**24420**	**2 - # 6**
	28	**28330**	**2 - # 7**
	30	**32520**	**2 - # 7**

STRUCTURAL ANALYSIS
FOR FLOOR PANEL ThermaSteel T – BEAM

TYPE OF FLOOR PANELLING	SPAN (FT)	RESISTING MOMENT (FT-LBS)	REINFORCING BARS (BOTTOM)
FPB -1 (SEE FIG. 1)	**10**	**3670**	**2 - # 4**
	12	**5290**	**2 - # 5**
FPB - 2 (SEE FIG. 2)	**14**	**7840**	**2 - # 5**
	16	**10240**	**2 - # 5**
	18	**12960**	**2 - # 6**
FPB - 3 (SEE FIG. 3)	**20**	**16250**	**2 - # 6**
FPB - 4 (SEE FIG. 4)	**22**	**20180**	**2 - # 6**
FPB - 5 (SEE FIG. 5)	**24**	**26650**	**2 - # 6**

Guide to Designing Energy-Saving, Translucent Wall Systems

- **ARCHITECTS**
- **CONTRACTORS**
- **OWNERS**

We're NOT trying to design your building… or even build it. That's not our business.

BUT, if you'd allow us, we'd like to point out how you can

- cut material costs
- cut labor costs

when designing with **Kalwall**®

See us @ www.kalwall.com

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What is Kalwall?

Kalwall is a lightweight, strong wall unit that combines the beauty and practicality of diffused, natural interior lighting with the functional qualities of high insulation, shatterproof construction and low maintenance. Available in sections up to 5' wide by 20' high (1.5 m x 6 m), its large size and light weight (only 1.5 pounds per square foot) allow rapid, economical installation.

Kalwall's 2¾" (70 mm) sandwich construction creates a wall unit capable of long spans without the need for intermediate supporting members. It's strong enough to withstand hurricane-force winds. That's what makes Kalwall a *structural* wall unit and not simply a glazing-type panel dependent upon supporting mullions and other framing members.

Bear in mind, however, that except in the case of small buildings, Kalwall wall systems are *not* designed to support roof or upper floor loads. Independent structural systems are required.

How to Cuts Costs When Designing Translucent Wall Systems

1. The Clamp-tite Installation System

This unique installation system maximizes the strength capabilities of Kalwall. There is no need for high-cost, conventional *structural* curtain wall framing: the extra strength isn't needed.

Kalwall's Clamp-tite closures are designed for the purpose of sealing translucent Kalwall to the building – and the continuous *clamp-action* does the job better than any other system. The rugged, two-piece aluminum extrusions, joined by stainless steel screws and combined with Kalwall Sealing Tape, provide a positive, weather-tight wall installation. Kalwall Clamp-tite systems have proved themselves in thousands of projects worldwide – in all types of climates and under all conditions – since 1955.

Clamp-tite closures are available to meet any installation requirement. Various shapes are made for head, sill, jamb and unit-to-unit closure. Also, special extrusions such as the 3¼" IS stiffener and the fin battens allow greater unsupported spans; others provide design emphasis at vertical joints. And our super thermal break design is 30% more efficient than others!

On the other hand, there is no need to over-engineer a project as this will increase your costs significantly. These special extrusions should be used only when necessary to fulfill specific design requirements. Your most economical choice is standard Kalwall with the standard-series installation system.

All members can be thermally broken.

2. Design with Kalwall in Front Of or Behind Columns

Vertical Installation

Horizontal Installation

When walls start and stop at each column, extra jamb Clamp-tite closures are needed, significantly increasing costs. The rough opening width is often an odd size, requiring more expensive, non-standard-width wall units as well as additional labor. Whether you're planning a wood post-and-beam building or one of structural steel or concrete, these items can unnecessarily strain the budget of your wall installation.

Instead, the Kalwall Translucent Wall can run continuously in front of or behind the columns – and save you money. Kalwall's long-span capability allows complete independence of the wall and the columns. With vertical installations, it's not necessary to tie wall units to the columns, so there's no need to worry about matching the placement of columns and unit-to-unit battens. This allows you to use economical, standard-width units for most of the wall.

3. Kalwall Standards and Options for Economy

For maximum economy, utilize the maximum number of standard-width modules – 4' and 5' (1.2 m and 1.5 m) nominal. There are options to "fill-in" the remaining areas not covered using standard modules:

a. Use a minimum number of non-standard "filler panels" (up to 5' wide).
b. Use optional wide battens (2½", 3¼" or 4") and/or deep jambs (2½" or 3") to take up the slack.

Note – changing from a 4' (1.2 m) standard module to a 4' 3" non-standard width module on a long wall can add more than 15% to the cost of the job!

Kalwall Non-Standard "Filler Panel"

Standard-Width Kalwall Units

4. Minimize Windows for Vision and Ventilation Only

Because translucent Kalwall provides all of the necessary diffused, glare-free, natural daylight, keep the use of windows to a minimum consistent with your design, vision and ventilation requirements.

Unneeded windows and other special wall components can significantly boost the per-square-foot, installed cost of your walls. Imagine, for example, a 10'- (3048 mm) high wall consisting of standard-width Kalwall units. Windows in every sixth unit (see Scheme A) will cost approximately $4.00 per square foot less than windows in every unit (see Scheme B).

5. Make the Most of Kalwall's Long-Span Capabilities

2¾"-thick Kalwall, using the standard Clamp-tite installation system, can span up to 14'9" (4500 mm) without the need for costly structural mullions, intermediate girts or other structural framing or support!

Remember that Kalwall's unit construction makes it as easy to install a 10'-high (3048 mm) unit (see Scheme C) as it is to install a 5'-high (1524 mm) unit (see Scheme D). If your design doesn't call for an entire translucent wall, consider the Kalwall Panel-Unit Wall system. This system combines translucent and opaque components and windows into single units as large as 5' wide by 34' high (10 m). Up to 170 square feet of wall area can be erected by two workmen in a fraction of the time other systems require.

Also, keep in mind that Clamp-tite closures must be used on all four sides of the units, regardless of their size. For a 10'-high Kalwall Translucent Wall (see Scheme C), standard closures add roughly $2.00 per square foot. However, for a combination wall with 5'-high Kalwall units set on masonry (see Scheme D), the added cost actually rises to $3.00 per square foot. Considering the higher per-square-foot erection cost for Scheme D, the pluses are all on the side of full-wall-height Kalwall units.

6. Call Your Kalwall Representative

Your Kalwall Representative will be pleased to further discuss the features and benefits of this unique Translucent Wall System technology. Detail sheets and samples of Kalwall's various systems demonstrate their full capability. In addition, Kalwall's Architectural Service Department is fully staffed with estimators, engineers and draftsmen ready to aid you through all stages of your design.

Since 1955 Kalwall®

1111 Candia Road, PO Box 237, Manchester, NH 03105
Phone 603-627-3861 • Fax: 603-627-7905 • www.kalwall.com

For immediate Assistance Call: 1-800-258-9777
or E-mail: info@kalwall.com

Printed in USA

Kalwall Translucent Panel U.S. Pat. No. 2,931,468.
Various systems and accessories patented and pats. pend.

New!
Revolutionary Product
KALWALL® INSULATED UNIT SKYLIGHTS with

THE ***GREATEST*** ADVANCEMENT
IN DAYLIGHTING ON THE GLOBE

nanogel™ TRANSLUCENT AEROGEL

R-20 insulation with 20% light transmission now available!

Panel "U" = .05 (NFRC 100)

Cabot Corporation and Kalwall Corporation, two innovative leaders have joined to launch a new revolutionary product, Kalwall® insulated skylight units with Nanogel® translucent aerogel. Nanogel, made by Cabot Corporation is the most insulating, diffuse light-transmitting product on the globe offering unsurpassed thermal and acoustic insulation with high light transmission.

- R-20 insulation with 20% light transmission now available!
- Doubles light transmission and thermal insulation over current technologies.
- Resistant to condensation, mold and mildew.

CABOT

- **Doubles your light transmission and thermal insulation over current technologies.**
- **Increases the ability to satisfy building code insulation "R"requirements.**
- **Provides designers a tool to increase the use of natural day lighting for enhanced aesthetic value.**
- **Yields constant insulating properties over time — no changes.**
- **Improved acoustical properties.**
- **Resistant to condensation,mold and mildew.**

Over Half a century of Experience

Since 1955 Kalwall®

Kalwall Corporation
1111 Candia Road
Manchester, NH 03105

Ph: (603) 627-3861, ext. 4433 or (800) 258-9777
Fx: (603) 627-7905 Email: info@kalwall.com

www.kalwall.com

Since 1955 Kalwall®

INSULATED UNIT SKYLIGHTS with NANOGEL® TRANSLUCENT AEROGEL

The **most thermally effective light transmitting skylights in the world.**™

Kalwall® Insulated Unit Skylights with nanogel™ TRANSLUCENT AEROGEL

Panel Specs

Thickness:	2¾''
Exterior face:	Crystal SW
Interior face:	Crystal S-171
U-Factor:	.05 = R20
Light transmission:	20%

Skylight

Minimum pitch:	⅜'' in 12''
Live load max:	60 psf

Perimeter corners are factory mitered and welded. Perimeter factory-assembled to panels.

Choose finish options for exposed aluminum

Mill Finish	
Black	
White	
Aluminum	

Size	1-5 Units	6-10	11-50	Order Qty.	Total Cost
4' x 6'	$ 960	-5%	-10%		
4' x 7'	$1,120	-5%	-10%		
4' x 8'	$1,280	-5%	-10%		
4' x 9'	$1,440	-5%	-10%		
4' x 10'	$1,600	-5%	-10%		
4' x 11'	$1,760	-5%	-10%		
4' x 12'	$1,920	-5%	-10%		
				Materials FOB, plus freight:	
				Plus tax:	

Since 1955 Kalwall®

Always... Light-years Ahead!™

Ph: (603) 627-3861, ext. 4433 or (800) 258-9777
Fx: (603) 627-7905 Email: info@kalwall.com

www.kalwall.com

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Light Transmission: 0 to 65%.

Impact: Standard exterior faces will withstand 70 ft.-lbs. impact. Optional hi-impact faces will withstand 230 ft.-lbs. (311J) impact, Hurricane-Resistant and Blast-Resistant Systems also available.

Chemical Resistance: Most anything allowed by EPA and OSHA.

Weathering: Kalwall's exterior face is made with innovative super-weathering and colorfast resins the full thickness... not a low-grade substrate overlaid with thin plastic film or gel to simulate weatherability. All standard exterior faces include a permanent glass veil erosion barrier to prevent "fiber bloom"! This is just one built-in quality bonus not offered by look-alikes!

Sound: Average transmitted by test, excellent performance.

Fire: Although some Kalwall panels contain combustible binder resins (ignition temperature greater than 800ºF), they will withstand a 1200ºF flame for one hour with no flame penetration. Kalwall panels pass the Class "A" Burning Brand Test (ASTM E-108). A special configuration of Kalwall is a UL Listed Class A Roof system. All interior faces are 1 in. or less Burn Extent, by ASTM D-635. Several categories of interior flame-spread/smoke developed by UL 723 tunnel tests, including Class 1, are available. Kalwall is listed by: ICC #PFC-1705; ICC #9446; several state and local areas and U.L. Canada. British Standard 476, Parts 3, 6, 7. FM Class I and NFPA 268 – Radiant Panel Test-Exterior Walls. Whenever reference is made to fire tests, the numerical rating is not intended to reflect hazards presented by this or any other material under actual fire conditions.

Bond Strength: Panels are a specially engineered composite designed for maximum architectural and structural life. Panels and adhesives are tested according to the stringent requirements of "Criteria for Sandwich Panels" issued by ICC (International Code Council) and must pass severe tensile and shear tests before and after numerous exposure conditions. Before specifying an alternate, insist on actual field proof of bond integrity over a 25-year period. Caution is urged in accepting "look-alikes" as equivalents.

Expansion: The coefficient of linear thermal expansion of Kalwall is 1.24 x 10^{-5} in/in/ºF. (2.23 x 10^{-5} mm/mm/ºC). An 8' panel will expand lengthwise approximately 1/8" when the temperature rises 100ºF or a 2 m long panel will expand approximately 2 mm when the temperature rises 40ºC.

NFRC Certified U-Factors as of 2004:

For identification purposes, we refer to the panel U-factors based on the 1994 NFRC test. Certified U-factors are based on a model of the system, 80" x 80" and consist of 2 panels, a center batten as well as head, sill and jamb members. All site-built window wall, curtainwall, sloped glazing and skylight systems are modeled at this size, allowing direct product comparisions.

WALLS							
.	Panel Only	2" Batten		Stiffener*		3-1/4" IS**	
	(1994)	U-Factor	Product #	U-Factor	Product #	U-Factor	Product #
Thermally Broken	0.23	0.27	002-009	0.29	002-001	0.32	002-005
	0.14	0.19	002-011	0.21	002-003	0.24	002-007
	0.10	0.15	002-012	0.17	002-004	0.20	002-008
	0.05	0.10	002-029	n/a	.	n/a	.
Non-Thermally Broken	0.29	0.38	003-009	0.39	003-001	0.42	003-005
	0.22	0.32	003-011	0.32	003-003	0.36	003-007
	0.18	0.28	003-012	0.29	003-004	0.32	003-008
ROOFS							
.	Panel Only	2" Batten		Stiffener*		3-1/4" IS**	
	(1994)	U-Factor	Product #	U-Factor	Product #	U-Factor	Product #
Thermally Broken	0.23	0.28	001-009	0.30	001-001	0.33	001-005

	0.14	0.20	001-011	0.22	001-003	0.25	001-007
	0.10	0.17	001-012	0.18	001-004	0.21	001-008
	0.05	0.11	001-029	n/a	.	n/a	.
Non-Thermally Broken	0.29	0.42	004-009	0.43	004-001	0.46	004-005
	0.22	0.35	004-011	0.36	004-003	0.39	004-007
	0.18	0.31	004-012	0.33	004-004	0.35	004-008

* Stiffener group includes: #2SSSE, #4SSSE, #12SSSE and Structural Tee Battens (walls only).

** 3-1/4" IS group includes the 4-1/2" fin batten (walls only).

Things to remember:

U-factors are for comparison of like products, not energy calculations as actual installed U-factor may vary from the certified value due to size difference.

Thermally broken systems use thermally broken perimeter. Non-thermally broken systems use standard aluminum perimeter. A thermally broken panel in non-thermally broken perimeter is not an NFRC certified product.

Certified products may be found listed in the NFRC Certified Products Directory or online at www.nfrc.org.

Kalwall Light Transmission, Solar Heat Gain Coefficients and U-Values For 2-3/4" (70mm) Panels

Contact us for info for 4" (100mm) and 1-9/16" (40mm) panels

Kalwall is a composite sandwich; various combinations are possible, and test data should be interpreted from this point of view. Consult Sales Service Department for further clarification. Since this table is of a very technical nature, please consult your heating and ventilation engineer for proper interpretation. Listed below are the light transmission, solar heat gain coefficients and U-values for some Kalwall Panel face sheet combinations. Others are available. Blue values indicate thermally broken panels.

FACE SHEET COMBINATIONS		% LIGHT TRANSMISSION note 1					SKYROOF SOLAR HEAT GAIN COEFFICIENT @ 0° INCIDENT ANGLE note 3					WALL SOLA
EXTERIOR COLOR	INTERIOR COLOR	.53 "U"	.29 /.23 "U" note 2	.22 /.14 "U" note 2	.18 /.10 "U" note 2	.05 "U" note 2	53 "U"	.29 /.23 "U" note 2	.22 /.14 "U" note 2	.18 /.10 "U" note 2	.05 "U" note 2	.53 "U"
Greenish Blue	White	25	14	5	3	10	0.37	0.18	0.10	0.07	0.11	0.36
Aqua	White	29	17	6	4	12	0.37	0.19	0.10	0.07	0.11	0.36
Rose	White	30	18	6	4	12	0.38	0.19	0.10	0.07	0.11	0.37
Ice Blue	White	35	20	8	6	15	0.44	0.22	0.11	0.07	0.12	0.44
Greenish Blue	Crystal	37	20	7	4	15	0.47	0.21	0.13	0.08	0.13	0.45
White	White	20	15	8	5	12	0.30	0.16	0.09	0.06	0.09	0.30
Crystal	White	35	20	12	8	15	0.42	0.23	0.11	0.07	0.11	0.39
Crystal	Crystal	50	30	15	10	20	0.55	0.27	0.14	0.09	0.12	0.51

U-value SI conversion: 1.0 w/m^{2}k = 0.176 BTU/(hr•ft^2•°F)

1. Approximate values by ASTM E-972. Light transmission values over 30% not recommended for most applications.
2. U-values determined by NFRC test method (ASTM C-236, E-1423 and C-1199 at certified lab). Expressed as BTU/(hr•ft^2•°F) for aluminum grid / thermally broken grid, nominal 12" x 24". Perimeter aluminum excluded. Test temperature at 15 mph wind (6.7 m/s): 0°F (-18°C) cold side and 70°F (21° C) warm side.
3. Shading Coefficient (SC) is equal to 1.15 times the Solar Heat Gain Coefficient (SHGC).

Click here to download this table as a Microsoft Word® document.

NEW! Tested assemblies by AAMA 1503.1-88 for air and water infiltration, structural integrity and overall thermal properties. Overall U-factor = .14 available!

Special Approvals and Listings:

• FM Explosion Venting Walls standard 4440

• FM Wall and Roof Systems standards 4411 and 4471
• S. Florida Hurricane-Resistant Systems
• NFRC Certified Products Listing
• UL Listings for Class A Roof System and Faces
• DoD/GSA Blast Resistant Construction

Computer-Modeled Daylight Analysis: Take the guesswork out of natural daylight level estimating and qualify your needs – contact us!

Technology and manufacturing from a single source. Translucent faces continuously manufactured for unparalleled longevity and fire performance enhance comfort while adding performance and structural integrity beyond comparison.

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Specification Summaries

SECTION 08 45 23 (formerly 08950) INSULATED TRANSLUCENT SANDWICH PANEL SKYLIGHT SYSTEM Click here to download this file	SECTION 08 45 23 (formerly 08950) INSULATED TRANSLUCENT SANDWICH PANEL SYSTEM Click here to download this file	SECTION 08 45 23 (formerly 08950) INSULATED TRANSLUCENT SANDWICH PANEL UNIT SYSTEM Click here to download this file
SECTION 08 45 23 (formerly 08950) INSULATED TRANSLUCENT SANDWICH PANEL PYRAMID/ GEODESIC SKYLIGHT SYSTEM Click here to download this file	SECTION 08952 (formerly 08950) INSULATED TRANSLUCENT FIBERGLASS SANDWICH PANEL WALL/ROOF SYSTEM Formatted compatible with MASTERSPEC®. A product of American Institute of Architects Click here to download this file	

A SUMMARY OF SPECIFICATIONS

Panel Width: 4' and 5' (1220mm and 1500mm) standard. Other widths up to 5' 0" (1500mm) are optional.

Panel Length: 3' to 20' (914mm to 6096mm) standard, 16' max. (5000mm) for skyroofs.

Panel Thickness: 4" (100mm), 2-3/4" (70mm), 1-9/16" (40mm). 1" (30mm) and 5/8" (16mm) thick glazing panels available.

Weight: Most panels and systems weigh under 3 PSF (14.65 kg/m^2).

Color: Crystal, White, Optional Kal-tint Panels, translucent insulation can be virtually any color to create dazzling results.

Surface Texture: flat, or pebble as option.

Grid Pattern: 12" x 24" (300mm x 600mm), reverse, 8" x 20" (200mm x 500mm), 10" x 10" (250mm x 250mm), 12" x 12" (300mm x 300mm) Tuckerman.

Materials: Translucent FRP faces. Other options include opaque faces, windows and louvers, aluminum grid, composite grid, fiberglass or aerogel insulation, aluminum and thermally broken installation systems.

High-Performance Aluminum Architectural Coatings: Corrosion-resistant finishes in standard and custom colors. View color samples.

U-Value Range: .53 to .05 (U-value SI conversion: 1.0 w/m^2k=0.176 BTU/(hr / ft^2 / °F)) for panels; NFRC system certification range .43 to .10.

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nanogel™ TRANSLUCENT AEROGEL

Product Features

Particle Size Range:	≈ 0.5 to 4.0 mm (0.02 to 0.16 in)
Pore Diameter:	≈ 20 nm
Porosity:	> 90%
Bulk Density:	90 to 100 kg/m^3 (5.6 – 6.2 lb/ft^3)
Surface Chemistry:	Fully Hydrophobic
Thermal Conductivity:	0.018 W/m·K at 25°C (0.125 Btu·in/hr·ft^2·°F)
Surface Area:	600 to 800 m^2/g
CAS RN:	102262-30-6

Nanogel® Aerogel Flammability Testing

Flammability of solids – burning rate (fire train test)
(Chilworth Technologies)

Result: not readily combustible substance of Division 4.1 (DOT); No smoke

Standard Test Method for Ignition Properties of Plastics – Test Method: ASTM D-1929 (Vtech)

Flash Ignition Temp	Self Ignition Temp
395°C (750°F)	395°C (750°F)

Minimum Ignition Energy of Dust:
US Bureau of Mines Report of Investigations 5624

Temperature	Minimum Ignition Energy
RT	>500 mJ

Caloric Content (ASTM E1354-02):

3.37 MJ/kg	1451 Btu/lb

Smoke Density (E662): Ds=0.3

Nanogel® Translucent Aerogel Properties

Aerogel Thickness		Light Transmission	Solar Heat Gain Coefficient /g factor	U (Btu/hr·ft^2·F)	K (W/m^2·K)
0.5"	1.3 cm	73%	0.73	0.25	1.4
1"	2.5 cm	53%	0.52	0.125	0.7
1.25"	3.1 cm	45%	0.43	0.1	0.57
1.5"	3.8 cm	39%	0.39	0.083	0.47
2"	5 cm	28%	0.26	0.063	0.35
2.5"	6.4 cm	21%	0.21	0.05	0.28

nanogel™

The Benefits of Utilizing Nanogel® Translucent Aerogel

- Introduces the best insulation, diffuse light-transmitting technology on the globe.
- Doubles light transmission and thermal insulation over current technologies.
- Ability to meet stringent building codes for thermal insulation and light transmission without trade-offs.
- Improved insulation performance, reduced energy consumption and HVAC costs.
- Better system performance, leads to better daylighting designs, leads to better lives.

State-of-the-Art

Nanogel® Aerogel Technology
Direct Silation of the Hydrogel

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Working Safely With Nanogel® Translucent Aerogel

nanogel™ TRANSLUCENT AEROGEL

Purpose

This guide provides users information on the safe handling of NANOGEL® Translucent Aerogel. Safety, health and environmental issues associated with the use of NANOGEL® Translucent Aerogel can be easily managed by the application of standard occupational safety, health and environmental practices, as provided in this guide.

Please note that this guide is not a substitute for the information provided in NANOGEL® Translucent Aerogel's material safety data sheet (MSDS) and users should refer to the MSDS prior to working with NANOGEL Translucent Aerogel.

General Information

NANOGEL® Translucent Aerogel [CAS No.: Not Assigned] is a surface-treated precipitated synthetic amorphous silica gel that is chemically very similar to other commercially available surface-treated precipitated synthetic amorphous silica products. It consists of greater than 97% treated precipitated silica amorphous silica gel and less than 3% water. **NANOGEL® Translucent Aerogel does not contain crystalline silica**. As shipped, its physical appearance is that of translucent granules between about 0.5 and 4 millimeters (mm). During transportation, a small amount of smaller particles, capable of entering the respiratory tract, may be generated due to abrasion and attrition.

Fire and Explosion

NANOGEL® Translucent Aerogel is not a readily combustible substance and presents a low risk of fire or explosion. Dust clouds of fine NANOGEL® Translucent Aerogel have been shown to be explosive. Refer to the MSDS for the minimum ignition energy and the maximum explosion concentration of fine NANOGEL® Translucent Aerogel.

If a fire involving NANOGEL® Translucent Aerogel does occur, direct water spray or stream may spread the fire due to the burning powder floating on the water or due to the generation of dust clouds. A fog spray is recommended when water is used as an extinguishing agent. Foam is also a suitable extinguishing agent. Areas where hot work, such as welding, occurs should be free from the dust of settled and airborne NANOGEL® Translucent Aerogel.

The product may build up static electrical charges when subjected to friction and may present an ignition source in the presence of flammable vapors or gases. All metal elements that come in contact with NANOGEL® Translucent Aerogel must be grounded.

Occupational Hygiene

Avoid exposure of skin and eyes to the dust of NANOGEL™ Translucent Aerogel. Use personal protective equipment, including protective gloves and clothing, safety goggles or safety glasses with eyeshields. Have an emergency eyewash and safety shower in close proximity. An occupational exposure limit (OEL) has not been established for this product or for any other surface treated precipitated synthetic amorphous silica. It is recommended that dust levels be maintained below the current OEL for precipitated synthetic amorphous silica and silica gel. Where this is not practical using engineering controls, use appropriate respiratory protection. Refer to NANOGEL™ Translucent Aerogel's MSDS for OEL and additional personnel protection equipment information.

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First Aid

Inhalation:
The dust of NANOGEL® Translucent Aerogel, like many dusts, may initiate a bronchial response among individuals with pre-existing lung conditions. Exposures above the current OEL for precipitated synthetic amorphous silica may produce temporary discomfort to the upper respiratory tract that may result in coughing. Removal from dust exposure normally is sufficient to cause symptoms to subside with no lasting effects.

Skin:
Repeated exposure to the dust of NANOGEL® Translucent Aerogel may cause drying of the skin. Wash dust from the skin with mild soap and water. Barrier cream application prior to skin exposure may assist in the removal of dust from the skin.

Ingestion:
No adverse effects are expected if NANOGEL® Translucent Aerogel is ingested.

Eyes:
The dust of NANOGEL® Translucent Aerogel may cause mechanical irritation. Flush gently with clean water to remove dust.

Environment

Avoid the release of NANOGEL® Translucent Aerogel to the environment. Spills should be collected immediately, preferably by dry vacuuming and then placed in sealed containers. Waste product should be disposed of in accordance with local regulations.

Storage

NANOGEL® Translucent Aerogel should be stored in a clean, dry uncontaminated area away from volatile chemicals.

Housekeeping

Avoid the production of any dust. Dry vacuuming is the preferred method for removing surface dust and cleaning up spills of NANOGEL® Translucent Aerogel. Dry sweeping should be avoided but may be performed when using dust suppression.

Health

Surface treated precipitated synthetic amorphous silica products are not carcinogenic or mutagenic. Chemically similar products have not been demonstrated to be skin sensitizors, skin or eye irritants, or toxic when ingested.

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MATERIAL SAFETY DATA SHEET

Prepared in accordance with ISO 11014-1/ ANSI standard Z400.1-1998

Revision Date: 20/December/2006

1. PRODUCT AND COMPANY IDENTIFICATION

Product Name: **Nanogel® Translucent Aerogel (All Grades)**

Synonyms: Translucent Aerogel (All Grades)

Use of the Substance/Preparation: Insulating material, Industrial Products, Various

Supplier:

Cabot Corporation
157 Concord Road
Billerica, MA 01821
UNITED STATES
Tel: 1-978-670-6961
Fax: 1-978-670-6955

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SCHWEIZ
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Fax: (+41) 41-723 21 03

Emergency Telephone Number: US: CHEMTREC 1-800-424-9300 or 1-703-527-3887
US: Cabot 1-978-663-3455
Cabot (Germany): (+49) 69 305 48540

2. COMPOSITION/INFORMATION ON INGREDIENTS

Chemical Name	CAS Number	EINECS Number	Weight %	EU Classification
Silica, [(trimethylsilyl)oxy]-modified	102262-30-6	Not assigned	>97	None

3. HAZARDS IDENTIFICATION

EMERGENCY OVERVIEW - CAUTION: White, coarse, friable, granular solid with no distinct odor. Avoid temperatures above ~ 250°C (482°F). Dust irritating to respiratory tract. Irritating, but will not permanently injure eye tissue. Repeated exposure may cause skin dryness or cracking. Take precautionary measures against static discharges. All metal parts of the mixing and processing equipment must be earthed/grounded. Ensure all equipment is electrically earthed/grounded before beginning transfer operations.

Principle Routes of Exposure: Inhalation, Eyes, Skin contact

POTENTIAL HEALTH EFFECTS

Eye Contact: May cause mechanical irritation. Irritating, but will not permanently injure eye tissue.

Skin Contact: May cause skin irritation and/or dermatitis. Repeated exposure may cause skin dryness or cracking.

Inhalation: Dust may be irritating to respiratory tract. Provide appropriate exhaust ventilation at machinery and at places where dust can be generated. See also Section 8.

Ingestion: Health injuries are not known or expected under normal use. Low hazard for usual industrial or commercial handling.

Carcinogenic Effects: Does not contain any substances listed by IARC (International Agency for Research on Cancer), NTP (National Toxicology Program), OSHA (Occupational Safety and Health Administration), ACGIH (American Conference for Governmental Industrial Hygienists) or EU (European Union). See also Section 11.

Target Organ Effects: Lungs, Skin

Medical Conditions Aggravated by Exposure: Asthma, Respiratory disorder, Dermatitis

Potential Environmental Effects: Unknown. Avoid release into the environment. See also Section 12.

4. FIRST AID MEASURES

Skin Contact: Wash thoroughly with soap and water. Remove contaminated clothing and shoes. Seek medical attention if redness, swelling, itching, or burning occurs.

Eye Contact: Flush eyes immediately with large amounts of water for 15 minutes. Seek medical attention if redness, swelling, itching, burning or visual disturbances occur.

Inhalation: If cough, shortness of breath or other breathing problems occur, move to fresh air. Seek medical attention if symptoms persist. If necessary, restore normal breathing through standard first aid measures.

Ingestion: Do not induce vomiting. If conscious, give several glasses of water. Never give anything by mouth to an unconscious person.

Notes to Physician: Treat symptomatically.

5. FIRE AND IGNITION INFORMATION

Flash Point: Not determined
Explosion Limits in Air - Upper (%): Not determined
Explosion Limits in Air - Lower (%): Not determined
OSHA Flammability Classification: Not determined

Autoignition Temperature: 400°C
Burn Velocity: Does not ignite
Method: Standard method for solid particles

Extinguishing Media: Use extinguishing measures that are appropriate to local circumstances and the surrounding environment. DO NOT USE a solid water stream as it may scatter and spread fire. The product is insoluble and floats on water.

Special Protective Equipment for Firefighters: Wear suitable protective equipment. In the event of fire, wear self-contained breathing apparatus.

Specific Hazards: Heating can release vapors which can be ignited. Avoid temperatures above 250°C. The product is insoluble and floats on water. If possible, try to contain floating material.

Hazardous Decomposition and/or Combustion Products: Carbon monoxide, Carbon dioxide, Organic products of decomposition.

Risk of Dust Explosion: Dust may form explosive mixture in air. Take precautionary measures against static discharges.

6. ACCIDENTAL RELEASE MEASURES

Personal Precautions: Avoid dust formation. Ensure adequate ventilation. Remove all sources of ignition. Take necessary action to avoid static electricity discharge (which might cause ignition of organic vapors). Use personal protective equipment. See also Section 8.

Methods for Cleaning Up: Clean up promptly by vacuum. Use a suitable vacuum cleaner. Pick up and transfer to properly labelled containers. Avoid dust formation. See Section 13.

Environmental Precautions: The product is insoluble and floats on water. If possible, try to contain floating material. Prevent product from entering drains. Local authorities should be advised if significant spillages cannot be contained.

7. HANDLING AND STORAGE

Handling: Avoid dust formation. Do not breathe dust. Provide appropriate exhaust ventilation at machinery and at places where dust can be generated. Avoid contact with skin and eyes. Keep away from heat and sources of ignition. Take precautionary measures against static discharge. All metal parts of the mixing and processing equipment must be earthed/grounded. Ensure all equipment is electrically earthed/grounded before beginning transfer operations.

Storage: Keep containers tightly closed in a dry, cool and well-ventilated place. Keep in properly labeled containers. Do not store together with volatile chemicals as they may be adsorbed onto product.

8. EXPOSURE CONTROLS / PERSONAL PROTECTION

EXPOSURE LIMITS

There are no exposure limits identified for this product. In its facilities globally, Cabot Corporation manages to the Germany TRGS 900 occupational exposure limit of 4 mg/m³, TWA, Inhalable fraction.

Exposure limits for silica are stated below.

Amorphous Silica, The regulatory exposure limits are found under the general silica, CAS RN 7631-86-9:	Australia:	2 mg/m³, TWA, Respirable
	Austria MAK:	4 mg/m³, TWA, Inhalable fraction
	Finland:	5 mg/m³
	Germany TRGS 900:	4 mg/m³, TWA, Inhalable fraction
	India:	10 mg/m³, TWA
	Ireland:	2.4 mg/m³, TWA, Respirable dust
	Norway:	1.5 mg/m³, TWA, Respirable dust
	Switzerland:	4 mg/m³, TWA
	UK WEL:	6 mg/m³, TWA, Total inhalable fraction
		2.4 mg/m³, TWA, Respirable fraction
	US OSHA PEL:	6 mg/m³

Dust, or Particulates Not Otherwise Specified:	US ACGIH - TLV:	10 mg/m³, TWA, Inhalable 3 mg/m³, TWA, Respirable
	Belgium:	10 mg/m³, TWA, Inhalable 3 mg/m³, TWA, Respirable
	China:	8 mg/m³, TWA 10 mg/m³, STEL
	Italy:	10 mg/m³, TWA, Inhalable 3 mg/m³, TWA, Respirable
	Malaysia:	10 mg/m³, TWA, Inhalable 3 mg/m³, TWA, Respirable
	Spain:	10 mg/m³, VLA, Inhalable 3 mg/m³, VLA, Respirable

MAK: Maximale Arbeitsplatzkonzentration (Maximum Workplace Concentration)
OEL: Occupational Exposure Limit
PEL: Permissible Exposure Limit
STEL: Short Term Exposure Limit
TLV: Threshold Limit Value
TRGS: Technische Regeln für Gefahrstoffe (Technical Rule for Hazardous Materials)
TWA: Time Weighted Average
US ACGIH: United States American Conference of Governmental Industrial Hygienists
US OSHA: United States Occupational Safety and Health Administration
VLA: Valore Límite Ambientales (Environmental Limit Value)
WEL: Workplace Exposure Limit

ENGINEERING CONTROLS Provide appropriate exhaust ventilation at machinery and at places where dust can be generated. Ensure adequate ventilation to maintain exposures below occupational limits.

PERSONAL PROTECTIVE EQUIPMENT

Respiratory Protection: Approved respirator may be necessary if local exhaust ventilation is not adequate.

Hand Protection: Repeated exposure may cause skin dryness or cracking. Use protective skin cream before handling the product. Wear suitable gloves.

Eye Protection: Wear eye/face protection. Safety glasses with side-shields. Goggles.

Skin and Body Protection: Wear suitable protective clothing. Remove and wash contaminated clothing before re-use. No special protective equipment required.

Other: Handle in accordance with good industrial hygiene and safety practice. Emergency eyewash and safety shower should be located nearby.

9. PHYSICAL AND CHEMICAL PROPERTIES

Appearance:	White Coarse Friable Granules
Odor:	None
pH:	3.0 - 6.5
Vapor Pressure:	Not determined
Boiling Point/Range:	2230°C after partial decomposition
Melting Point/Range:	1700°C after partial decomposition
Water Solubility:	Insoluble

Density:	Not determined
Bulk Density:	60 - 150 kg/m^3 @ 20°C
Specific Gravity:	Not determined
Evaporation Rate:	Not determined
Viscosity:	Not determined
Partition Coefficient (n-octanol/water):	Floats on water; disperses in oil

10. STABILITY AND REACTIVITY

Stability:	Stable.
Hazardous Polymerization:	Hazardous polymerization does not occur.
Mechanical Sensitivity (shock):	Not sensitive to mechanical impact.
Conditions to Avoid:	Do not expose to temperatures above 250°C. Avoid conditions where oxygen may condense in or around this product, as this will increase the flammability.
Hazardous Decomposition and/or Combustion Products:	Carbon monoxide, Carbon dioxide, Organic products of decomposition.
Static Discharge Effects:	Dust may form explosive mixture in air. Avoid dust formation. Take precautionary measures against static discharges. All metal parts of the mixing and processing equipment must be earthed/grounded. Ensure all equipment is electrically earthed/grounded before beginning transfer operations.

11. TOXICOLOGICAL INFORMATION

Information given is based on data obtained from this substance or from similar substances.

ACUTE TOXICITY

Oral LD50: LD50/oral/rat = > 5000 mg/kg.

Inhalation LC50: Due to the product's physical characteristics, no suitable testing procedure is available.

Dermal LD50: Not determined.

Eye Irritation: Draize score 0.7/110 @ 24 hr. Non-irritating.

Skin Irritation: Non-irritating.

SUBCHRONIC TOXICITY

Not determined.

CHRONIC TOXICITY

Due to the product's physical characteristics, no suitable testing procedure is available.

Carcinogenic Effects: Does not contain any substances listed by IARC (International Agency for Research on Cancer), NTP (National Toxicology Program), OSHA (Occupational Safety and Health Administration), ACGIH (American Conference for Governmental Industrial Hygienists) or EU (European Union).

Mutagenic Effects: Not mutagenic in AMES Test, chromosomal aberration in Chinese hamster ovary (CHO) cells.

Reproductive Toxicity: Not determined.

Sensitizing Effects: A delayed contact hypersensitivity study in guinea pigs utilizing the Buehler technique was performed. Non-sensitizing.

Synergistic Materials: None reasonably foreseeable.

12. ECOLOGICAL INFORMATION

Information given is based on data obtained from this substance or from similar substances.

Aquatic Toxicity: Fish (Brachydanio rerio) LC50(96 hour) > 10,000 mg/l (Method: OECD 203)
Daphnia magna EC50 (24 hours) > 10,000 mg/l (Method: OECD 202)

Other Information: Aquatic toxicity is unlikely due to low solubility.

ENVIRONMENTAL FATE

Mobility: Insoluble. Not expected to migrate.

Bioaccumulation: According to experience not expected.

Persistence / Degradability: The methods for determining biodegradability are not applicable to inorganic substances.

Distribution to Environmental Compartments: Not determined.

13. DISPOSAL CONSIDERATIONS

Disclaimer: Information in this section pertains to the product as shipped in its intended composition as described in Section 2 of this MSDS. Contamination or processing may change waste characteristics and requirements. Regulations may also apply to empty containers, liners or rinsate. State/provincial and local regulations may be different from federal regulations.

Unused and Uncontaminated Product: Can be burned in suitable incineration plants or disposed of in a suitable landfill in accordance with the regulations issued by the appropriate federal, provincial, state and local authorities.

14. TRANSPORT INFORMATION

Not classified as dangerous in the meaning of transport regulations.

15. REGULATORY INFORMATION

Hazard Classification

United States - OSHA (29 CFR 1910.1200): Not hazardous.
Mexico - NOM-018-STPS-2000: Refer to HMIS Rating in Section 16.
Canada - WHMIS Classification (CPR, SOR/88-66): Not controlled.
This product has been classified in accordance with the hazard criteria of the Controlled Products Regulations and the MSDS contains all the information required by the Controlled Products Regulations.

International Inventories

All components of this product are listed on or exempt from the following inventories:

YES - Australian Inventory of Chemical Substances (AICS)
YES - Canadian Domestic Substances List (DSL)
YES - Chinese Inventory

Revision Date:	20/December/2006
Previous Revision Date:	23/June/2004
Reason for Revision:	Revisions throughout

Disclaimer:
The information set forth is based on information that Cabot Corporation believes to be accurate. No warranty, expressed or implied, is intended. The information is provided solely for your information and consideration and Cabot assumes no legal responsibility for use or reliance thereon. In the event of a discrepancy between the information on the non-English document and its English counterpart, the English version shall supersede.

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homebrella™

Advanced Moisture Management System

SHEATHING • HOUSEWRAP • FLASHING TAPE

Thermo ply®

PROTECTIVE SHEATHING

Tough and Durable

Isn't one of your biggest investments worth protecting?

Protecting your investment is easy when you use Thermo-ply® Protective Sheathing on your project. Thermo-ply is manufactured to withstand the most rigorous of job site conditions. Its core is constructed of 4 cross laminated plies that resist puncture, breakage and vandalism. Because wall sheathing gets shipped out with the framing package, it's dumped at the job site with lumber and must withstand a great deal of abuse and rough handling.

Thermo-ply Outperforms Foam and Fiberboard Sheathings in Damage Resistance

Foam and fiberboard sheathings can damage easily, reducing the performance of the wall envelope and increasing costs for replacement and repair. Thermo-ply's inherent strength stands up to on-site abuses, saving labor and material costs.

See for yourself and compare

Strong and Structural

Make your investment last a lifetime

Thermo-ply® is made to be strong. Thermo-ply's directionalized fiber and cross laminated 4 ply construction provides excellent dimensional stability and strength. Our red and blue structural grades provide racking resistance and may be used as an alternative corner bracing method. In addition, Thermo-ply can be used as a draft stop.* Thermo-ply can also be used as part of a 1 hour fire rated wall assembly.*

Choose the Grade to Fit Your Needs

Thermo-ply is available in 3 different grades

- Green - Lightweight non-structural grade, .078" thickness
- Red - Structural grade for 16" o.c. stud spacing, .113" thickness
- Blue - Structural grade for 16" o.c. stud spacing, .137" thickness

**Refer to Individual Evaluation reports (ICC-ES, BOCA, ICBO, SBCCI) for code compliance. Individual jurisdictions and municipalities may vary. Check with your local building officials for approval and acceptance.*

Moisture Management

Protection against Water Intrusion

As part of our Homebrella™ Advanced Moisture Management System, Thermo-ply® Exterior Wall Sheathing is a vital component as it protects the wall envelope and preserves the integrity of what's inside, i.e. ,cavity insulation, studs, drywall, etc.

Because of Thermo-ply's ⅛" thickness, a tight seal is formed to the framing members, producing excellent protection against water intrusion.

Foam and fiberboard sheathings tend to be spongy because of their composition. This makes it difficult to fasten the edges tightly to the wall frame, thus creating gaps and cracks for water to potentially enter.

Outperforming the Competition

Ludlow conducted an in-house study which showed that Thermo-ply significantly outperformed OSB sheathing in water resistance. A 24 hour soak test revealed OSB gained almost 30% in moisture and swelled in thickness by 30% while Thermo-ply consistently gained less than 12%.

OSB - Swelling

Water and Weather Resistant Plies

Thermo-ply's core is composed of high quality, long fibered, specially treated water and weather resistant plies. These plies are pressure laminated with a special water resistant adhesive. Thermo-ply's moisture content is measured and controlled constantly during the manufacturing process by a computerized system to ensure the highest qual-

The Importance of Controlling Air Infiltration

THERMAL PERFORMANCE

Air infiltration can account for over 50% of the heating and cooling energy loss through the walls of a home. Thermo-ply® provides superior protection against air infiltration because when fastened to the framing and studs, its inherent thickness provides the tightest seal of any sheathing material on the market. Cracks and gaps are minimized for air to infiltrate, resulting in improved energy efficiency and lower utility bills.

**Calculations show that just a 1/16" gap around the perimeter of an average home can waste 5 times more energy than can be saved by two inches of additional insulation to the walls of a normally insulated home.*

EFFECTIVE R-VALUE IS WHAT COUNTS

Insulative foam sheathings promote their initial high R-value. How much of that R-value is actually retained after it has been installed? Several factors can significantly impact its true performance.

- Foam sheathings age over time and can lose their original R-value. (Refer to aged R-value data in manufacturer's literature.)
- Foam sheathings are fragile and can easily be damaged at the job site by high winds and handling, creating holes and broken corners for air to penetrate if gone unrepaired.
- Foam sheathings are "spongy like" and are difficult to fasten tightly to the wall frame creating gaps for costly air infiltration to penetrate the wall cavity.
- Foam sheathings are non-structural which creates the need for structural bracings. Consequently, when plywood or OSB is used at the corners of the home, the exterior wall cannot "truly" claim the entire added R-value it gets from the foam sheathing when it is only used in the intermediate areas. Plywood and OSB have an R-value of less than 1.
- Fasteners (nails or staples) used to attach foam sheathing to the stud wall creates an effect called "thermal bridging" which can also reduce the sheathing's original R-value by up to 20%![1]

" Higher R-values and insulation belong in the wall cavity between the studs"

...PROTECT IT WITH THERMO-PLY WALL

[1] *("Energy Focus" article, September 1993 - Toledo Homebuilding Magazine)*

*Dow Styrofoam is a registered trademark of Dow Chemical Inc.

Sheathing Performance

Thermo-ply® outperforms other sheathing products which claim to deliver extra R-values.

"Performance in the Real World vs. A Controlled Laboratory"

One of the most important factors to consider is the sheathing's ability to do its basic job of controlling heat loss or gain caused by air moving or infiltrating through the walls into the insulation.

Thermo-ply retains a much larger percentage of the wall system's R-value than other sheathing products, which can lose over 50% of the R-value in only a 10 mph breeze.

R-Value Analysis [1, 2]

Sheathing	Calculated or Static "R" Without 10 mph Wind	Effective "R" When exposed to Simulated 10 mph Wind	Percentage of Retained Effective R-value
Thermo-ply	15.6	11.8	75.6%
1" Dow Foam (Styrofoam™)	20.0	11.3	56.5%
1" Foil -Faced Urethane Foam	23.4	10.5	44.9%
1" EPS Foam	18.67	10.8	57.8%
1/2" Fiberboard	15.99	8.15	51.0%

[1] "Affordable Manufactured Housing Through Energy Conservation," U.S. Depart. of Energy (DOE), July 1984.
[2] R-values of wall sections include aluminum siding, sheathing gypsum, airspace, air films, and an assumed R-13 kraft-faced batt insulation. *Note:* R-value means resistance to heat flow. The higher the R-value the greater the insulating power.

The percentages show the retained, effective R-value for wall sections built with all components being the same EXCEPT the sheathing. This summary on effective R-values is based on air infiltration tests run by an independent laboratory with industry accepted methods (ASTM E-283), and further supported by the 1984 Department of Energy report.*

The total static R-value for a Thermo-ply sheathing system is a combination of the R-value of Thermo-ply itself and that of the reflective airspace between the sheathing and the siding. The chart on page 7 shows the total R-value resulting from both of these factors for various airspace sizes, using typical siding components.

Environmentally Friendly

A "GREEN" Building Product

Not just the "in" thing to do

Environmental awareness is affecting the way everyone does business, including the construction industry. Homeowners, builders and architects are always looking for products that are environmentally friendly. Covalence has been using sound environmental policy in the manufacturing of Thermo-ply sheathing since the early 60's. That's long before it was considered the "in" thing to do. Our practices have saved tree after tree, forest after forest.

Based on standard measurements from the construction industry, the average 2,500 square foot house, using thermo-ply sheathing will save 6 trees. In a 50 home development thats 300 trees!

Since 1976, Covalence estimates we have saved over 9,400,000 trees through our use of recycled materials. Unlike other sheathing materials that use wood in some form or combination we use no wood chips, no old growth forests or no fast growing trees.

Recyclability

Thermo-ply is 99% recyclable. Any Thermo-ply job site waste or scrap can be collected and sent with other recyclable products, saving landfill space, which is a big concern for builders and communities.

Non-toxic bonding agents - Covalence uses 100% polyvinyl alcohol (PVA) as a bonding agent, PVA is one of the safest bonding agents available, used extensively in the food service industry. It is not a hazardous material (per the American Standard for Precautionary Labeling of Hazardous Industrial Chemicals), and has no known dermal effects. Unlike other sheathing materials, Thermo-ply does not contain asphalts, formaldehydes or phenols that can affect chemically sensitive people.

No CFC's - CFC's (chlorofluorocarbons) have been identified as a danger to the ozone layer surrounding the Earth.

Private Label Program

Create Name Recognition & Awareness with The Private Label Advantage...

Advertise Your Company Name & Logo on EVERY Sheet!

- *Available in virtually any color*
- *Display customized messages*
- *Very large imprint area (up to 18"H x 30"W)*
- *Small minimum order quantity requirement*
- *Minimal upcharge*
- *Quick turnaround*

User Friendly

Thermo-ply Cuts Easily

A knife, router or saw can be used to cut or trim Thermo-ply. And workers can kneel or walk on it without causing damage.

Thermo-ply is Lightweight

Thermo-ply can be handled easily by one worker. It only weighs 13lbs. per sheet. Its combined strength and light weight allow entire walls to be constructed and lifted into place.

Thermo-ply is Cost Effective

- Less work site damage means lower replacement costs.
- Size versatility means less scrap, less waste and less site clean up.
- Available up to 12' lengths.
- Easy installation saves time and labor.

Thermo-ply is Available with White Poly Facing

Excellent for use behind vinyl siding when a reflective surface is not required or desired.

Outstanding curb appeal gives your project a crisp, clean attractive appearance during framing of construc-

Multi-Family Use

- Can be used as a draft stop.*
- Can be used as part of a 1 hour fire rated wall assembly.*
- Red and blue structural grades are alternatives for exterior and interior shear load design. (See Shear Value tables for calculation values in Evaluation reports.)

*Refer to Individual Evaluation reports (ICC-ES, BOCA, ICBO, SBCCI) for code compliance. Individual jurisdictions and municipalities may vary. Check with your local building officials for approval and acceptance.

Thermo-ply and R-values

0.68	Inside Air Film
0.45	1/2" Gypsum
0.00	Kraft (Asphalt Coated) or Polyethylene Vapor Barrier
13.00	R-13 Fiberglass Insulation
0.20	Thermo-ply®
3.50	3/4" Reflective Airspace
0.41	Brick Veneer
0.17	Outside Air Film
18.41	TOTAL R-VALUE
0.0543	TOTAL U-VALUE

0.68	Inside Air Film
0.45	1/2" Gypsum
0.00	Kraft (Asphalt Coated) or Polyethylene Vapor Barrier
13.00	R-13 Fiberglass Insulation
0.20	Thermo-ply with Poly Facing
0.67	Vinyl Siding
0.17	Outside Air Film
15.17	TOTAL R-VALUE
0.0659	TOTAL U-VALUE

0.68	Inside Air Film
0.45	1/2" Gypsum
0.00	Kraft (Asphalt Coated) or Polyethylene Vapor Barrier
13.00	R-13 Fiberglass Insulation
0.20	Thermo-ply with Foil Facing
3.50	3/4" Furring Strip with Reflective Airspace
0.41	Hard Wood Siding
0.17	Outside Air Film
18.41	TOTAL R-VALUE
0.0543	TOTAL U-VALUE

Type of Siding Used (See Notes Below)	R-value of Thermo-ply alone or with Poly Facing	Average R-value of Thermo-ply with foil facing and Airspace	Average System R-value* for Thermo-ply plus one Reflective Foil Airspace Between Thermo-ply and Siding
Lapped Sidings - Aluminum, Vinyl, Hardboard, Wood, etc.**	0.2	1.33	1.53
Brick Veneer and Furred-Out Siding with 3/4" Airspace***	0.2	3.5	3.7

*Thermo-ply Reflective Foil System R-values are only for Thermo-ply and the reflective air space between Thermo-ply and siding. Insulation was in complete contact with inside of Thermo-ply for test. R-values for siding, cavity insulation, gypsum and air film corrections ARE NOT INCLUDED in Thermo-ply System R-values since many combinations are possible, but they can be added to Thermo-ply System R-value to obtain total Wall R-value. All tests were run according to ASTM C-236 at 75°F mean temperature, 30°F temperature differential.

**These lapped horizontal sidings form a variable reflective foil airspace with one foil surface on the Thermo-ply. This airspace varies between zero and the thickness or depth of the siding.

***Brick veneer is installed with 3/4" airspace. Siding must be spaced out 3/4" with furring strips. The airspace is a reflective foil airspace with one foil surface.

Thermo-ply® Installation Instructions

STEPS 1 & 2

1. Starting at the #1 indicated on the face of the panel, begin fastening from the top of the panel to the bottom. (Refer to installation instructions on the front side of the panel for proper fastener spacing.)

2. Moving across the panel, attach fasteners at the top and bottom of the panel until you reach #2 (the next stud). It is important when using staples to fasten them in a parallel direction to the stud.

STEP 3

3. Proceed to fasten panel in numerical order repeating the procedure described in steps 1 and 2.

STEP 4

4. Continue until the Thermo-ply panel is properly secured to the frame.

STEP 5

5. In order to prevent gaps or rippling, it is important to move across from one side of the panel to the other when installing. ***DO NOT fasten each of the four corners first.***

Thermo-ply® Sheathing Technical Specifications

PRODUCT NAME
Thermo-ply® Sheathing

PRODUCT DESCRIPTION

Grades: Standard Grade (green) .078"
Structural Grade (red) .113"
Structural Grade (blue) .137"

Basic Use: Thermo-ply Sheathing is used, where required by code, to provide support for interior and exterior wall surfaces for the lifetime of the structure. Installing sheathing on an entire home or structure is generally the most common industry practice. Several additional uses exist, including corner bracing.

Precautions and Limitations: Refer to individual code reports for the various findings and limitations applicable to the specific code areas of influence.

Composition and Materials: Thermo-ply Sheathing is composed of high-quality, long-fibered, specially treated water and weather-resistant plies. Plies are pressure laminated. A special water-resistant adhesive is used. Standard sizes are 48" x 96", 48.75" x 96", 48" x 108" and 48.75" x 108". Custom cut sizes up to 60" wide and 144" long are available upon request. Thermo-ply is available with a variety of approved outer facings, including poly and foil.

TECHNICAL DATA
Construction Specifications Institute Identification Codes:

Sheathings	06115
Structural Panels	06120
Building Insulation	07210
Firestopping (draft stop)	07270

Applicable Standards: Thermo-ply Sheathing meets and/or exceeds all major code requirements, including:

HUD/FHA material release No. 286 (Structural); 840 (Standard); 942 (Structural~Blue -- 24"o. c.)

For more information please see evaluation reports.

Thermo-ply can be used to meet the new FmHA and FHA insulation standards. Write Ludlow Coated Products for further information.

1-Hour Fire Resistive Construction: Thermo-ply Structural Grade~Red and Structural Grade~Blue may be used in a 1-hour fire-rated wall system, in accordance with the Standard Methods of Fire Tests of Building Construction and Materials using ASTM E-119 testing procedures. Refer to individual code reports for various approved wall assemblies and limitations.

Perm Rating: Perm ratings range from 0.53 - 0.63 depending on grade.

INSTALLATION

Standard Grade~Green, .078"

1. An approved corner bracing is required when installed on standard wood framing up to 24" o.c. Thermo-ply is attached to the framing with 1 1/4" galvanized roofing nails, 16 gauge 7/16" crown x 1 1/4" leg staples or 1" crown x 1 1/4" leg staples spaced 6" o.c. on all panel edges and 12" o.c. on intermediate supports.
2. All joints shall occur over studs, plates or solid blocking. Joints may be lapped or butted. Butt joints shall be gapped 1/16" minimum.
3. Cut or trim with saw, knife or router.
4. Thermo-ply shall not be used as a nail base.

Structural Grade~Red, .113"

1. When installed on maximum 16" o.c. framing with 1 1/4" galvanized roofing nails, 16 gauge 7/16" crown x 1 1/4" leg staples or 1" crown x 1 1/4" leg staples spaced 3" o.c. on all panel edges and 6" o.c. on intermediate supports, it is a shear panel and no corner bracing is required. (This fastening schedule is only required for sheets used as shear panels.)
2. When installed for use as a non-structural sheathing panel, the sheets shall be attached to the framing with 1 1/4" galvanized roofing nails, 16 gauge 7/16" crown x 1 1/4" leg staples or 1" crown x 1 1/4" leg staples spaced 6" o.c. on all panel edges and 12" o.c. on intermediate supports.
3. When installed on studs greater than 16" o.c., an approved corner brace is required. The fastening schedule for sheathing panels is to be followed in attaching the sheets to the framing.
4. All joints shall occur over studs, plates or solid blocking. Joints may be lapped or butted. When joints are lapped, one row of fasteners can be applied through both sheets and must penetrate a full 1" into the framing member. Butt joints shall be gapped 1/16" minimum.
5. Cut or trim with saw, knife or router.
6. Thermo-ply shall not be used as a nail base.

Structural Grade~Blue, .137"

1. When installed on maximum 16" o.c. framing with 1 1/4" galvanized roofing nails, 16 gauge 7/16" crown x 1 1/4" leg staples or 1" crown x 1 1/4" leg staples spaced 3" o.c. on all panel edges and 6" o.c. on intermediate supports, it is a shear panel and no corner bracing is required. (This fastening schedule is only required for sheets used as shear panels.)
2. When installed for use as a non-structural sheathing panel, the sheets shall be attached to the framing with 1 1/4" galvanized roofing nails, 16 gauge 7/16" crown x 1 1/4" leg staples or 1" crown x 1 1/4" leg staples spaced 6" o.c. on all panel edges and 12" o.c. on intermediate supports.
3. All joints shall occur over studs, plates or solid blocking. Joints may be lapped or butted. Butt joints shall be gapped 1/16" minimum.
4. Cut or trim with saw, knife or router.
5. Thermo-ply shall not be used as a nail base.

Fastening Procedure: It is important to work from one side of the panel to the other. Begin fastening from the top of the panel to the bottom. Moving across the panel, attach fasteners at the top and bottom of the panel until you reach the next stud. When using staples, fasten them in a parallel direction to the stud. Continue in the same manner until the Thermo-ply panel is properly secured to the frame. In order to prevent gaps or rippling, move across from one side of the panel to the other when installing. **DO NOT** fasten each of the four corners first.

Thermo-ply® Sheathing
Technical Specifications cont'd.

AVAILABILITY AND COST

Availability: Nationwide distribution facilities stock Thermo-ply and provide prompt delivery to most local building material / lumber dealers. In addition, Covalence field representatives are located in every part of the country to provide the best possible service.

Cost: Thermo-ply Sheathing is competitively priced. For specific information, contact a Covalence representative.

WARRANTY

Covalence Building Products guarantees the manufacturing of Thermo-ply Sheathing. All products shipped from the manufacturing facility will be free of defects at the time of shipping.

MAINTENANCE

When applied in accordance with manufacturer's recommendations, Thermo-ply Structural Sheathing will not require maintenance.

TECHNICAL SERVICES

Support is provided by full-time technically-trained field representatives and technical service personnel. In addition, Covalence Building Products is backed by a research, development and service staff.

For further information, literature or technical support, contact Covalence Building Products at 800.345.8881

Information contained herein conforms to the standard detail recommendations and specifications for the installation of Thermo-ply Sheathing and is presented in good faith. Covalence Building Products assumes no liability, expressed or implied as to the architecture, engineering, or workmanship of any project. This information may be concurrent with, or superseded by other applicable documents. Covalence Building Products must approve any deviations from published literature, in writing, prior to application. Contact Covalence Building Products for most current product information.

	Standard Grade (Green)	Structural Grade (Red)	Structural Grade (Blue)
Thickness	0.078 ± 0.004	0.113 ± 0.005	0.137 ± 0.006
Weight	275 ± 15 lbs./MSF	400 ± 20 lbs./MSF	470 ± 25 lbs./MSF
Sheets Per Skid	400	300	250
Corner Bracing Requirement	Non-Structural	Structural up to 16″ o.c.	Structural up to 24″ o.c.

Window Treatment

If windows and doors are made to accommodate traditional 1/2″ sheathing materials, use 3/8″ plywood shims around the openings for a tight, neat installation, or order windows with adjustable nailing fins from your supplier, for easy adaptability to 1/8″ Thermo-ply sheathing. Thermo-ply must be installed with appropriate flashing and counter flashing in conformance with accepted building standards and in compliance with local building codes.

Thermo-ply Architectural Specifications

Furnish and install Thermo-ply Insulative Sheathing as manufactured by Covalence Building Products, Constantine, Michigan. Sheets 48″ x 96″ are to be applied with a small gap between panels (1/16″ to 1/8″). Sheets 48 3/4″ x 96″ are to be overlapped 3/4″. Staple or nail through Thermo-ply and into studs using 1 1/4″ galvanized roofing nails or 16-gauge, 1″ minimum crown staples with 1 1/4″ staple leg length. Fasteners to be spaced in accordance with manufacturers instructions. Fastening schedule is printed on each sheet of Thermo-ply.

Fasten the bottom edge of Thermo-ply to the 2″ x 4″ floor plate where it meets the band joist area. It is not recommended to fasten Thermo-ply directly to the band joist area because of anticipated shrinkage. Contact Ludlow Coated Products for applications involving floor truss-joist systems.

Covalence homebrella™
Advanced Moisture Management System
SHEATHING • HOUSEWRAP • FLASHING TAPE

Covalence Coated Products
700 Centreville Road ▪ Constantine, MI ▪ 49042
269.435.2425 ▪ 800.345.8881 ▪ www.covcorp.com

Filing Category: WALL COVERING (288)

THERMO-PLY STRUCTURAL SHEATHING
LUDLOW COATED PRODUCTS
P.O. BOX 2002
10351 VERDON ROAD
DOSWELL, VA 23047

1.0 SUBJECT

Thermo-Ply Structural Sheathing.

2.0 DESCRIPTION

2.1 General:

Thermo-Ply Sheathing is laminated fibrous boards recognized as weather-resistive barriers complying with Section 1402.1 of the code. Structural and Super Strength grade products are used in wall-bracing applications.

2.2 Materials:

2.2.1 Thermo-Ply "Structural" Grade (Stormbrace) Sheathing: Thermo-Ply "Structural" grade (Stormbrace) sheathing consists of laminated fibrous boards with a 0.115-inch nominal thickness. Each surface is covered with aluminum foil, polyethylene, or a kraft/polyethylene/kraft laminate. The boards are produced in 48-inch-by-96-inch (1219 mm by 2438 mm) and $48^3/_4$-inch-by-96-inch (1238 mm by 2438 mm) standard sizes. Sizes up to 60 inches (1524 mm) wide and 192 inches (4877 mm) long are also available.

2.2.2 Thermo-Ply "Super Strength" (24 o.c.) Sheathing: The Thermo-Ply "Super Strength" (24 o.c.) sheathing is identical to the "Structural" grade sheathing described above, except the boards are nominal 0.137 inch thick.

2.2.3 Thermo-Ply "Standard" Grade (Weatherweight) Sheathing: Thermo-Ply "Standard" grade (Weatherweight) sheathing is identical to the structural grades in Sections 2.2.1 and 2.2.2, except the panels are nominal 0.078 inch thick. The "Standard" grade shall be used only in nonstructural applications.

2.3 Installation:

2.3.1 General: The boards are vertically installed on wood studs with all joints backed by studs, plates or blocks. The boards are a weather-resistive barrier complying with Section 1402.1 of the code, provided horizontal and vertical joints are weather-lapped at least $^3/_4$ inch (19.1 mm). For installations that do not require a weather-resistive barrier, such as interior locations or exceptions described in Section 1402.1 of the code, edges may be butted.

The local building official may require a vapor barrier at the warm side (interior) of the stud wall to prevent condensation within the stud cavity.

2.3.2 Wall Bracing: "Structural" grade and "Super Strength" grade sheathings are alternatives to wall bracing as set forth in Section 2320.11.3 or 2320.11.4 of the code. Installation details, fastener details and allowable shear values are set forth in Table 1.

2.3.3 Nonstructural Installation: Where wall bracing as set forth in Section 2320.11.3 or 2320.11.4 of the code is provided, boards may be installed in accordance with Table 2. No shear values are permitted with these installations.

2.4 One-hour Fire-resistive Construction:

2.4.1 Exterior Wood Stud Wall: Thermo-Ply "Structural" or "Super Strength" sheathings may be installed under exterior cement plaster described in Item 18-1.3 in Table 7-B of the code, provided the length of the fasteners attaching the metal lath is increased by an amount at least equal to the thickness of the sheathing.

2.4.2 Limited Load-bearing Exterior Wood Stud Wall: The wall construction consists of $^5/_8$-inch (15.9 mm), Type X gypsum wallboard complying with ASTM C 36, applied to the interior face of 2-inch-by-4-inch (51 mm by 102 mm) wood studs spaced at a maximum of 16 inches (406 mm) on center for the "Structural" (Stormbrace) sheathing, and a maximum of 24 inches on center (610 mm) for the "Super Strength" (24 o.c.) sheathing. The wallboard is applied in accordance with details in Item 17-1.3 in Table 7-B of the code. The exterior side is covered with $2^1/_4$-inch-high-by-$3^3/_4$-inch-wide (57 mm by 95 mm) face brick, with cored holes, applied to the studs as anchored veneer in accordance with Section 1403.6 and Item 18-1.5 in Table 7-B of the code. Unfaced friction-fit glass fiber batt insulation, $3^1/_2$- or $3^5/_8$-inch-thick-by-$15^1/_4$-inch-wide (89 or 92 mm by 387 mm), R-11 or R-13, 0.89 pcf (1403 kg/m^3) density, must be placed within the stud cavities. The Thermo-Ply sheathing may be used in lieu of the $^1/_2$-inch (12.7 mm) gypsum sheathing specified in Item 18-1.5. The maximum wall height is 8 feet (2438 mm). Allowable bearing loads cannot exceed the following, whichever is most restrictive:

1. 1,800 pounds (8 kN) per 2-inch-by-4-inch (51 mm by 102 mm) stud.
2. Design stress of 0.78 F'_c, as set forth in Section 2307.3 of the code.
3. Design stress up to 51 percent of the F'_c or $F_{c\perp}$ permitted for the stud species and grade.

2.5 Identification:

Each board is labeled with the Simplex Products Division name and address, the product name, the evaluation report number (ICBO ES ER-1439), and the name of the quality control agency (RADCO).

3.0 EVIDENCE SUBMITTED

Test reports on racking loads, tensile strength, water-resistance, water vapor transmission and fire resistance.

4.0 FINDINGS

That the Thermo-Ply "Structural," "Super Strength" and "Standard" grade sheathings described in this report comply with the 1997 *Uniform Building Code*™, subject to the following conditions:

ES REPORTS™ are not to be construed as representing aesthetics or any other attributes not specifically addressed, nor are they to be construed as an endorsement of the subject of the report or a recommendation for its use. There is no warranty by ICBO Evaluation Service, Inc., express or implied, as to any finding or other matter in this report, or as to any product covered by the report.

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4.1 An approved exterior wall covering capable of resisting loads perpendicular to the face of the walls is installed over the sheathing.

4.2 A 48- or 48$^3/_4$-inch-by-96-inch (1219 or 1238 mm by 2438 mm) sheet installed as described in Table 1 is equivalent to bracing required by Section 2320.11.3 of the code. It may be used where Construction Method 4 is permitted in Table 23-IV-C-1 of the code.

4.3 A minimum 32-inch-by-96-inch (813 mm by 2438 mm) structural grade sheathing board, installed on wood studs spaced 16 inches on center and attached in accordance with the minimum fastener details noted in Table 1, is equivalent to bracing described in Section 2320.11.3 of the code. It may be used where Construction Method 1 is permitted in Table 23-IV-C-1 of the code.

4.4 Solid blocking is installed behind all horizontal joints.

4.5 When installed as approved building paper, the vertical and horizontal joints shall be lapped a minimum of $^3/_4$ inch (19.1 mm), or flashing shall be provided.

4.6 The material is classified as combustible.

4.7 Allowable shear loads do not exceed values in Table 1.

4.8 The sheathing materials are manufactured in Constantine, Michigan, with quality control inspections by RADCO (AA-650).

This report is subject to re-examination in two years.

TABLE 1—ALLOWABLE SHEAR LOADS[1,2,6]

THICKNESS (inches)	FASTENER	FASTENER SPACING (inches on center)	ALLOWABLE SHEAR LOAD (in pounds per foot)
0.115 (Structural)	No. 16 gage galvanized staples $^7/_{16}$-inch crown, 1$^1/_4$-inch legs	3—panel edges 6—intermediate supports	175[3,7]
0.115 (Structural)	No. 16 gage galvanized staples 1-inch crown, 1$^1/_4$-inch legs or Large flat-head No. 11 gage galvanized roofing nails 1$^1/_4$ inches long	3—panel edges 6—intermediate supports	200[4,7]
0.137 (Super Strength)	No. 16 gage galvanized staples $^7/_{16}$-inch crown, 1$^1/_4$-inch legs or Large flat-head No. 11 gage galvanized roofing nails 1$^1/_4$ inches long	3—panel edges 3—intermediate supports	190[5,7]

For **SI:** 1 inch = 25.4 mm, 1 plf = 14.6 N/m.

[1]For wind or seismic forces in pounds per foot for panels installed vertically on studs with a minimum specific gravity of 0.42 and not less than 2 inches nominal thickness spaced 16 inches on center for the 0.115-inch material and 24 inches on center for the 0.137-inch material.

[2]The sheathing should preferably be applied in minimum 4-foot-by-8-foot sheets. Blocking not less than 2-inch nominal in thickness must be provided at horizontal joints. The maximum height-width ratio may be 2.1.

[3]The allowable shear load may be increased to 285 pounds per foot if $^1/_2$-inch gypsum wallboard is installed on the inside with No. 13 gage 1$^5/_8$-inch-long ring shank nails spaced 8 inches on center at all panel ends and edges and at all supports. All wallboard edges shall be blocked. In Seismic Zones 3 and 4, the allowable shear load shall be reduced to 230 plf, for earthquake-related forces.

[4]The allowable shear load may be increased to 300 pounds per foot if $^1/_2$-inch gypsum wallboard is installed on the inside with No. 13 gage 1$^5/_8$-inch-long ring shank nails spaced 8 inches on center at all panel ends and edges and at all supports. All wallboard edges shall be blocked. In Seismic Zones 3 and 4, the allowable shear load shall be reduced to 250 plf, for earthquake-related forces.

[5]The allowable shear load may be increased to 300 pounds per foot if $^1/_2$-inch gypsum wallboard is installed on the inside with No. 13 gage 1$^5/_8$-inch-long ring shank nails spaced 8 inches on center at all panel ends and edges, and at all supports. All wallboard edges shall be blocked. In Seismic Zones 3 and 4, the allowable shear load shall be reduced to 245 plf for earthquake-related forces.

[6]Sheathing may be applied horizontally with long dimension perpendicular to studs. Maximum stud spacing is 16 inches on center, and wall height cannot exceed four feet. Sheathing must be 48 inches wide and fastening is as indicated in table.

[7]Shear values may be doubled when Thermo-Ply structural sheathings are applied to both sides of the wall assembly, and the panel joints on each side are offset at least one stud space.

TABLE 2—NONSTRUCTURAL INSTALLATION SCHEDULE

NOMINAL THICKNESS (inches)	FASTENER SPACING (inches on center[1])		MAXIMUM STUD SPACING (inches)
	Edge	Intermediate	
0.078 (Standard)	6	12	24
0.115 (Structural)	6	12	24
0.137 (Super Strength)	6	12	24

For **SI:** 1 inch = 25.4 mm.

[1]Use minimum No. 11 gage, 1$^1/_4$-inch-long galvanized roofing nails or No. 16 gage galvanized staples having a $^7/_{16}$-inch crown and 1$^1/_4$-inch leg lengths.

FIBERTEC
Window & Door Mfg.

Fiberglass Gallery

FIBERTEC™ Window & Door Mfg.

300 Series Fixed — NFRC (USA) U-VALUE, SHGC, VT VALUE

ETC REPORT *# 05-871-16322.0*

	Total Product U-Value	Total Product SHGC	Total Product VT
Double glaze, 1 LowE, (LOF) Arg, W/E	0.30	0.56	0.64
Double glaze, 1 LowE, (LOF) Arg, W/E, with aluminum grids	0.30	0.50	0.58
Double glaze, 1 Low E (LOF), Arg, S/S	0.29	0.56	0.64
Double glaze, 1 Low E(RLE 7138) Arg W/E	0.26	0.33	0.61
Triple glaze, 1 Low E(LOF) 2 Arg, 2 W/E	0.22	0.51	0.59
Triple glaze, 2 Low E(LOF), 2 Arg, 2 W/E	0.18	0.48	0.54
Triple glaze, 1 Low E(RLE 7138), 2 Arg 2 W/E	0.20	0.31	0.55
Triple glaze 2 Low, E(RLE 7138) 2 Arg 2 W/E	0.15	0.29	0.48
Triple glaze 2 Low E(RLE 7138) 2 Krp 2S/S	0.13	0.29	0.48
Double glaze 2 SC75, 2Krp, 2W/E	0.10	0.20	0.36
Double glaze, SC75, Krp, W/E	0.21	0.31	0.54
Doube glaze TC88, Kry, W/E	0.18	0.44	0.56
Double glaze (.662 air gap) TC88, Krp, W/E	0.16	0.44	0.56
Triple glaze 2 Low E2 (cardinal), 2 Krp, 2S/S	0.13	0.30	0.49

300 Series Fixed - HC65 — ANSI/AAMA/NWWDA 101/I.S.2-97

Intertek Report No. 3043506-1A

Air infiltration (test pressure = 300pa(6.24 psf)		air leakage rate 0.05m3/h/m2 (0.003cfm/ft2)
Water Resistance (test pressure = 12.00 psf)	**HC80**	no leakage observed at 580pa (12.00 psf)
Uniform Load Structure (test pressure = +97.5 to -97.5 psf)	**HC65**	residual deflection .25mm & .03mm
Forced Entry Resistance (L1 = 150lbs. 3" from corner)		no entry observed

300 Series Fixed — CAN CSA-A440

Air Infiltration	A3
Water Penetration	B7
Wind Load	C3

Performance level requirements can vary from project to project specific project requirements must be outlines by project architect or engineer at the contractual stage

TYPICAL METHODS OF ANCHORAGE

CASEMENT
300 SERIES

DOUBLE HUNG TILT
400 & 500 SERIES

PATIO DOOR FRAME

1) THROUGH FRAME

Pre-drilled for # 10 x 3" pan-head screw, must shim door frame in screw area.

Patio Door Frame Jamb

ENTRANCE DOOR FRAMES

1) THROUGH FRAME:-

a) Lock Side:
Pre-drill frame for # 10 x 3" screws under weather strip to anchor door frame.

b) Hinged Side:
Remove 1 screw from each hinge & replace with # 10 x 3" screws to anchor door frame to wall.

c) Side lite / Transom
Pre-drill frame for # 10 x 3" screws & counter sink & plug hole.

Casement Frame Jamb

2) STRAP ANCHOR

F10 snap-on strap anchor gives flexibility to position the window projection from wall (required minimum eight per window).

Casement Frame Jamb

3) BRICKMOULD & JAMB EXT.

4) BRICKM'LD WITH NAILING FIN

5) JAMB EXTENSION

Can be applied together or individually, depending on required window frame depth. Various depth sizes of Jamb Extensions are available on request.

Casement Frame Jamb

Fixed Frame Jamb

1) THROUGH FRAME

Pre-drilled for # 10 x 3" pan-head screw, must shim window frame in screw area (common for retrofit applications).

INSTALLATION INSTRUCTIONS

To ensure proper operation and performance, and to maintain warranty, please follow all of the instructions detailed below.

1. Unit must be set plumb, level and square. Shim & anchor at corners and at 18" intervals between corners. (Cedar shims are recommended. Minimum space between frame and stud is 1/2" all around).

2. Check to ensure head, sills & jambs are not bowed. Screw through the shim using 3" long galvanized screws.

3. All holes through fiberglass must be pre-drilled to prevent cracking of the material.

4. Check operation of sash to ensure that there is equal space around sash and frame, and that sash operates smoothly.

400 DHT Frame Jamb

1) THROUGH FRAME

Pre-drilled for # 10 x 3" pan-head screw, must shim window frame in screw area (common for retrofit applications).

400 DHT Frame Jamb

6) NAILING FIN

Window is secured to wall using nailing fin application at jambs only.

FIBERTEC™
Window & Door Mfg.
FIBERGLASS WINDOW SYSTEMS

300 SERIES

FIXED WINDOW
TRIPLE GLAZED

FIXED WINDOW

Exterior View

SECTION A-A

NOTE: OPTIONAL FIBERGLASS GLASS STOP SHOWN ON FIXED WINDOW. STANDARD IS PVC.

SECTION B-B

FIBERTEC™
Window & Door Mfg.
FIBERGLASS WINDOW SYSTEMS

300 SERIES

FIXED WINDOW
Attachment - Nailing Fin

FIXED WINDOW

Exterior View

SECTION A-A

NOTE: OPTIONAL FIBERGLASS GLASS STOP SHOWN ON FIXED WINDOW. STANDARD IS PVC.

SECTION B-B

FIBERTEC™
Window & Door Mfg.
FIBERGLASS WINDOW SYSTEMS

300 SERIES

FIXED WINDOW

SECTION DETAILS

FIXED WINDOW

Exterior View

SECTION A-A

NOTE: OPTIONAL FIBERGLASS GLASS STOP SHOWN ON FIXED WINDOW. STANDARD IS PVC.

SECTION B-B

YES - European Inventory of Existing Commercial Chemical Substances (EINECS)
NO - Japanese Inventory of Existing and New Chemical Substances (ENCS)
NO - Korean Existing Chemicals List (KECL)
YES - New Zealand Hazardous Substances and New Organisms Act (HSNO)
NO - Philippines Inventory of Chemicals and Chemical Substances (PICCS)
YES - United States Toxic Substances Control Act (TSCA) Inventory

NOTE: The chemicals in this product may not be subject to notification in the following countries under an "article" exemption: Canada, Japan, New Zealand and Switzerland. Please contact your Cabot sales representative for more information.

U.S. Federal Regulations

TSCA 12(b) Export Notification: This product does not contain any components that are subject to TSCA 12(b) Export Notification.

Clean Air Act Amendments of 1990 (CAA, Section 112, 40 CFR 82): This product does not contain any components listed as a Hazardous Air Pollutant, Flammable Substance, Toxic Substance, or Class 1 or 2 Ozone Depletor.

Clean Water Act (CWA, 40 CFR 116) Priority Pollutants: This product does not contain any listed Priority Pollutants.

Comprehensive Environmental Response, Compensation and Liability Act (CERCLA, 40 CFR 302): This product does not contain any listed Hazardous Substances.

Superfund Amendments and Reauthorization Act, Title III (SARA):
SARA Section 302 (40 CFR 355) Extremely Hazardous Substances: No components are listed as extremely hazardous chemicals under SARA Section 302.

SARA Sections 311/312 (40 CFR 370) Hazard Category: This product does not meet any of the MSDS Requirement definitions for a hazardous material under SARA Sections 311/312.

SARA Section 313 (40 CFR 372) Toxics Release Inventory: Does not contain any of the substances identified under Section 313 as toxic chemicals in excess of the de minimis concentrations necessary to be subject to the supplier notification requirements.

Pharmaceutical Information: Not permitted for pharmaceutical uses.

U.S. State Regulations

California Proposition 65: This product does not contain any components listed on California Proposition 65.

US Coalition of NorthEastern Governors (CONEG) Metals List: This product meets the CONEG Source Reduction Council limits for the sum of the levels of lead, cadmium, mercury and hexavalent chromium of less than 100 parts per million by weight.

16. OTHER INFORMATION

HMIS Rating

HMIS Index: * - chronic, 0 - minimal, 1 - slight, 2 - moderate, 3 - serious, 4 - severe

Health:	1
Flammability:	1
Physical Hazard:	0

Additional Contacts:

Prepared by: Cabot Corporation - Safety, Health and Environmental Affairs

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FIBERGLASS WINDOW SYSTEMS

300 SERIES

ATTACHMENT OPTIONS:-
STRAP ANCHOR

HEAD DETAIL

SILL DETAIL

PLAN - STRAP ANCHOR

VERTICAL SECTION THRO' CASEMENT

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FIBERGLASS WINDOW SYSTEMS

300 SERIES

ATTACHMENT OPTIONS:-
STRAP ANCHOR

HEAD DETAIL

SILL DETAIL

PLAN - STRAP ANCHOR

VERTICAL SECTION THRO' CASEMENT

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300 SERIES

ATTACHMENT OPTIONS:-
NAILING FIN

VERTICAL SECTION THRO' CASEMENT WITH NAILING FIN

FIBERTEC™
Window & Door Mfg.
FIBERGLASS WINDOW SYSTEMS

300 SERIES

ATTACHMENT OPTIONS:-
NAILING FIN

HEAD DETAIL

SILL DETAIL

VERTICAL SECTION THRO' CASEMENT

NOTE:
USE LOW EXPANSION FOAM TO INSULATE GAP BETWEEN ROUGH OPENING AND FRAME.

1315 N. 13th Street
Rogers, AR 72756
Phone: (800) 803-5189
Fax: (479) 246-9524
Email: info@biobased.net
Website: www.biobased.net

Applicator Specification
BioBased 1701 Spray Foam

A. Product

BioBased 1701 is a nominal 1.7 lb/ft^3 density spray applied polyurethane foam insulation formulated with water as the sole blowing agent. **BioBased 1701** provides exceptional performance in reducing heat transfer, moisture gain, and improving racking loads.

B. Manufacturer

The resin is blended by BioBased Systems, LLC.

C. Product Description

BioBased 1701 spray foam insulation is a two-part, soy-based product installed using custom designed application equipment.

BioBased 1701 is applied by spraying liquid chemical components directly onto wall, ceiling and floor surfaces. When applied, the components quickly expand to create a foam layer covering surfaces, filling cracks, and sealing voids. The foam adheres to almost all clean surfaces and when cured can be trimmed as desired.

D. Foam Physical Properties (ICC Acceptance Criteria)

Typical Properties	Test Method	BioBased 1701 Results
"A" Component:		
Viscosity at 77ºF (25ºC), cps	ASTM D 4878	225
Specific Gravity at 77ºF (25ºC)	ASTM D 4669	1.24
"B" Component:		
Viscosity at 77ºF (25ºC), cps	ASTM D 4878	1800
Specific Gravity at 77ºF (25ºC)	ASTM D 4669	1.24
Sprayed Foam Density, pcf	ASTM D 1622	1.7 nominal
Open-Cell Content, %	ASTM D 2856	14.5%
R-Value per inch	ASTM C 518	
Initial		5.5
Aged		TBD*
Thermal Conductivity		>0.10 $m^2 \cdot K/W$
Maximum Service Temperature, ºF (ºC)	ASTM C 411	180ºF (82ºC)
Surface Burning Characteristics	ASTM E 84	
Class Rated		Class 1
Flame Spread Index		25
Smoke Developed		<250

TBD = To Be Determined

Caution: These physical property results are typical for this material as applied in our development facility under controlled conditions. The foam and resultant physical properties can vary with changes in the application parameters; e.g. temperature, thickness, processing equipment, mix head variations, throughput, etc. As a result, these published properties are for evaluation guidelines and physical property specifications should be determined from the actual production processed foam.

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E. Containers

A set of chemicals for **BioBased 1701** spray foam insulation consists of the following:

- one (1) 55 gallon drum of 'A' component
- one (1) 55 gallon drum of 'B' component

F. Storage

For both 'A' and 'B' components — store between 64°F and 86°F (18°C and 30°C).

G. Installation Specifications

- Pressure ..... 1000 psi ±100 psi (69 bar ± 7 bar)

  Drum temperatures ..... 95°F ±5°F (35°C ±3°C)

  Temperature of block

  A Side heaters and hose ..... 140°F ±10°F (60°C ±6°C)

  B Side heaters and hose ..... 150°F ±15°F (66°C ±6°C)

The shipping weight for each set is 1032 lbs (468 kg).

Complete and thorough mixing of the B-Side component prior to spraying is critical to obtain optimum foam characteristics. Contact BioBased Insulation for a list of approved mixing equipment.

H: Applicator Testing Procedure

The recommended application and handling procedures for the **BioBased 1701** should be known and followed by the foam applicator. BioBased Insulation recommends a small "test area" of spray foam should be applied and inspected prior to commencing the project. This simple, low-cost test area can indicate inadequate adhesion, improper surface preparation or need for primer, surface contamination, improper substrate, ambient temperature outside recommended application temperatures, equipment malfunctions, material contamination, or improper application technique. The visual inspection of a sample cut from a test spray and periodic job samples can reveal potential problems that may be due to one or more of the above conditions.

I. Cautions

Polyurethane foam insulation systems must be protected with a 15-minute thermal barrier or suitable ignition barrier solely dependent on the application. Some building codes allow for specific exceptions. BioBased Insulation recommends that the applicator check with your local building code official for final determination.

For the Surface Burning Characteristics, ASTM E84 Test Standard, the resultant numerical value for flame spread rating is not intended to reflect hazards presented by this or any other material under actual fire conditions.

BioBased 1701 should only be applied in ½ inch to 1 ½ inch passes. This application procedure is in compliance with the SPFA foam application guidelines. Thin passes (1/4 inch or less) should be avoided. They may result in reduced yield and loss of adhesion.

All rigid urethane foam products must not be applied with a thickness exceeding 4 inches in a 24 hour period. If this thickness is exceeded, the temperature buildup within the foam may cause internal charring of the applied foam, seriously affecting the quality and physical properties of the foam. Under certain conditions, applications exceeding this maximum recommended thickness may cause spontaneous combustion of the foam, often hours after the application time.

J: Disclaimer

The data presented herein is not intended for use by non-professional applicators, or those persons who do not purchase or utilize this product in the normal course of their business. The potential user must perform any pertinent tests in order to determine the product's performance and suitability in the intended application, since final determination of fitness of the product for any particular use is the responsibility of the buyer.

BioBased Insulation, LLC does not endorse open combustion appliances located in attic spaces.

K. Warranty

The information herein is to assist customers in determining whether our products are suitable for their applications. Our products are intended for sale to industrial and commercial customers. We request that customers inspect and test our products before use and satisfy themselves as to contents and suitability. We warrant good title and that our products will meet our written liquid component specifications. Nothing herein shall constitute any other warranty, express or implied, including any warranty of merchantability of fitness or that the products will be suitable for the purposes intended.

L. Technical Support

For technical support, please contact BioBased Insulation.

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BioBased Insulation & LEED Certification

The following are suggestions of how BioBased Insulation might be incorporated into a project in order to achieve LEED credits. This list is by no means exhaustive. Please consult with the LEED accreditation expert on your project to determine if BioBased Insulation can be used to gain additional LEED credits.

LEED Credit Category – Energy & Atmosphere

Prerequisite 2 – Minimum Energy Performance

Requires the building to comply with ASHRAE/IESNA Standard 90.1-1999 (without amendments) or the local energy code, whichever is more stringent.

When BioBased Insulation is installed into your structure, it is similar to turning it into an Igloo® cooler, keeping conditioned air inside and unconditioned air outside. In fact, it insulates your structure so well you will actually require a smaller HVAC (Heating, Ventilation, Air Conditioning) unit in your structure. Therefore, it will cost you less money every month to heat or cool your building. BioBased Insulation, when paired with other responsible building components, can help residential and commercial building owners save up to 50% on their monthly utility bills.

Credit 1 – Optimize Energy Performance

Requires a reduction in design energy cost compared to the energy cost budget.

BioBased Insulation can help achieve a reduction of up to 50% in energy consumption. We also allow you to downsize HVAC unit by around 30%

LEED Credit Category – Materials & Resources

Credit 2 – Construction Waste Management

Requires recycling and/or salvaging construction, demolition and land clearing waste.

Since BioBased Insulation is only sprayed by certified dealers, there is minimal waste. BioBased Insulation's composition contributes a significantly lower amount of waste materials by weight, which can help a project divert a minimum of 50% of waste from the landfill.

Credit 5 – Local/Regional Materials

Requires use of building materials and products that are manufactured regionally within a radius of 500 miles of the project site.

Our product is manufactured in Rogers, AR.

Credit 6 – Rapidly Renewable Materials

Requires use of rapidly renewable products and materials (made from plants harvested within a ten-year cycle or shorter) for 5% of the total value of all building materials and products used in the project.

Since BioBased Insulation is manufactured with annually renewable soybean oil, it is classified as a rapidly renewable product. Depending on the size, cost, and amount of the project insulated BioBased Insulation can be a significant portion, or all of the required 5% rapidly renewable products and materials.

LEED Credit Category – Indoor Environmental Quality

Credit 7 – Thermal Comfort

Requires a thermally comfortable environment that supports the productivity and well-being of building occupants.

BioBased Insulation can help a building comply with ASHRAE Standard 55-1992, Addenda 1995, for thermal comfort standards including humidity control within established ranges per climate zone because it eliminates random outside air infiltration and produces a tighter building envelope.

LEED Credit Category – Innovation & Design Process

Credit 1 – Innovation in Design

Provides design team and projects with an opportunity to be awarded points for exceptional performance above the requirements set by the LEED Green Building Rating System and/or innovative performance in Green Building categories not specifically addressed by the LEED Green Building Rating System.

BioBased Insulation's superior performance characteristics and installation flexibility contribute to this credit in three ways. First, BioBased Insulation allows easy installation in areas that do not allow simple installation of conventional insulation products. Second, it is extremely effective at controlling sound, making BioBased buildings quieter than other structures. Finally, BioBased Insulation is guaranteed to perform to the stated specifications for the life of the structure.

The above are suggestions only. It is recommended that a complete review of the LEED Green Building Rating System be made prior to applying for the listed prerequisites and credits. The LEED System can be reviewed at www.usgbc.org.

3form® ecoresin™

3-form.com/materials-ecoresin

3form® ecoresin™

imaginative. versatile. sustainable

features	benefits
chemical resistant	easy to clean and use in a variety of demanding environments
cost effective	wide range of price points to fit any budget
durable	40 times the impact strength of glass
exterior	available with UV stabilization for outstanding exterior performance
fire	self-extinguishing class-A and class-B performance
formable	easily formed to create complex curves and shapes
responsible	non-toxic, sustainable material made from *eco*resin™, which is GREENGUARD Indoor Air Quality Certified®
translucent	create more than a million custom options to provide both daylighting and privacy
versatile	offers unlimited aesthetic and design options

dimensions	standard panels 4' x 8' (1219mm x 2438mm) 4' x 10' (1219mm x 3048mm) 5' x 10' (1524mm x 3048mm) custom sizes available
colors	over 70 standard colors pantone color-matching system custom digital imagery
finishes	various options

For more information, please visit **3-form.com/materials-ecoresin** or call **800.726.0126**

JANUARY 2007 | MAT1P - 001

3form® ecoresin™

3form® ecoresin™ is a dynamic panel system. The choices of ecoresin panels are as diverse as your imagination. By allowing you to custom-select the color, pattern, texture, interlayer and finish of your material, ecoresin transforms into the perfect medium for your architectural application.

For more information, please visit **3-form.com** or call **800.726.0126**

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3form® *eco*resin

Product Description

*Eco*resin is a dynamic panel system. Options offered by *eco*resin panels are as diverse as your imagination. By allowing you to custom-select the color, pattern, texture, interlayer and finish of your material, *eco*resin transforms into the perfect medium for your architectural application.

An award-winning 3form product line, *eco*resin has the added benefits of being made from a specially-formulated co-polyester resin which is both environmentally responsible and high-performing. *eco*resin has been engineered to incorporate 40% post-industrial re-grind content, without compromising its overall physical properties. From a recycle stand-point, *eco*resin is also compatible with one of the largest post-consumer recycle streams, and is GREENGUARD Indoor Air Quality Certified®.

FEATURES AND BENEFITS

Produced on a individual order basis, allowing for creative design and product selection (minimum order quantity – ONE sheet!)
Post-formable into virtually any shape or size for eye-catching installations
Enables qualification for LEED credits for building sustainability
Very tough, allowing for easy fabrication and maximum installed durability
Extremely versatile which enables designers to achieve full design potential
Lightweight, half the density of glass, which makes for easier installation and reduces structural support requirements
Excellent chemical resistance which reduces potential harm incurred by cleaning agents
*eco*resin is GREENGUARD Indoor Air Quality Certified®

AVAILABLE COLORS

Available in a variety of standard colors
Custom colors also available

TEXTURES/PATTERNS/FINISHES

The *eco*resin collection includes a wide range of textures and patterns from our Organics, Moderna, Play, Texture, Color, and Graphic sub-collections.

Each item in the *eco*resin collection comes standard with both a front and back finish. Additionally, 3form provides the option of substituting between 8 standard finishes. In most cases, you can even pick different front and back finishes. Finishes include:

Liquid Silver - Smooth, silver, mirror-like finish on the backing of a panel
Markerboard Plus - Shiny, patent leather look which allows the *eco*resin surface to be used as a Dry Erase Board
Patent - Shiny, high gloss finish
Patina - Non-glare, slightly frosted, worn-look finish

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Pixel - Micro-grid look, creates moiré when applied to both sides, cannot be used in pieces > 1/2"
Sandstone - Grainy texture, slightly frosted look
Stucco - Pebble-like finish
Supermatte - MicroGrain texture, frosted look
Topo - Larger pebble-like finish
Opaque White Backer
Vision Plus

PANEL SIZES AND TOLERANCES

3form ecoresin panels are offered in 4' x 8' (1.2 m x 2.4 m) and 4' x 10' (1.2 m x 3 m). All dimensions and squareness (standard with custom) are subject to a 1/16" (1.5 mm) tolerance. 5' x 10' (1.5 m x 1.3 m) is also available though some restrictions apply.

Ecoresin is available in gauges from 1/16 inch to 1 inch.

All 'Solo' Sheets

NOMINAL GAUGE	MINIMUM ALLOWANCE GAUGE	MAXIMUM ALLOWANCE GAUGE
1/16" (0.0625")	0.050	0.070
1/8" (0.125")	0.104	0.132
3/16" (0.1875")	0.168	0.192
1/4" (0.250")	0.212	0.260
3/8" (0.375")	0.324	0.384
1/2" (0.500")	0.436	0.508
3/4" (0.750")	0.648	0.768
1" (1.000")	0.850	1.060

Non 'Solo' product sheets

NOMINAL THICKNESS	MINIMUM ALLOWANCE GAUGE	MAXIMUM ALLOWANCE GAUGE
1/8" (0.125")	0.098	0.138
3/16" (0.1875")	0.155	0.205
1/4" (0.250")	0.196	0.306
3/8" (0.375")	0.304	0.434
1/2" (0.500")	0.412	0.562
3/4" (0.750")	0.618	0.798
1" (1.000")	0.850	1.090

Sheet tolerance readings are based on an average of several on measurements along both long edges of each panel. These measurements are taken 2-3 inches (50-75 mm) from the edges of the panel.

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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)

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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 ecoresin

ULTRAVIOLET EXPOSURE PERFORMANCE

UV stabilizers, when incorporated with 3form ecoresin 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 ecoresin panels. Following 6,000 kJ of exposure (representing approximately 10-years outdoor Florida exposure) it is shown that the 3form ecoresin 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).

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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)

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

Because of its low thermoforming temperature, ecoresin 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 ecoresin 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 ecoresin
- Bending ecoresin 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 ecoresin 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

ecoresin 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 ecoresin

					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	—	—

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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
MECHANICAL										
Tensile Stress @ Yield	50 mm/min (2 in./min)	D 638	MPa	psi	53	7,700	53	7,700	53	7,700
Tensile Stress @ Break	50 mm/min (2 in./min)	D 638	MPa	psi	31	4,500	26	3,800	26	3,800
Elongation @ Yield	50 mm/min (2 in./min)	D 638	%	%	4.7	4.7	4.8	4.8	5.0	5.0
Elongation @ Break	50 mm/min (2 in./min)	D 638	%	%	210	210	50	50	40	40
Tensile Modulus	5.0 mm/min (0.2 in./min)	D 638	MPa	psi	—	—	2,200	320,000	—	—
Flexural Modulus	1.27 mm/min (0.05 in./min)	D 790	MPa	psi	2,200	320,000	2,100	310,000	2,000	290,000
Flexural Strength	1.27 mm/min (0.05 in./min)	D 790	MPa	psi	71	10,300	77	11,200	83	12,000
Rockwell Hardness	—	D 785	R Scale	R Scale	104	104	115	115	117	117
Safety Glazing	75°F 23.8°C	ANSI 97.1	does not break		—	—	PASS		—	—
Izod Impact Strength, Notched	23°C (73°F)	D 256	J/m	ft·lbf/in.	—	—	88	1.7	62	1.2
	0°C (32°F)	D 256	J/m	ft·lbf/in.	—	—	66	1.2	—	—
	–30°C (–22°F)	D 256	J/m	ft·lbf/in.	—	—	39	0.7	—	—
Impact Strength, Unnotched	23°C (73°F)	D 4812	J/m	ft·lbf/in.	—	—	NB**	NB**	NB**	NB**
	0°C (32°F)	D 4812	J/m	ft·lbf/in.	—	—	NBB	NBB	—	—
	–30°C (–22°F)	D 4812	J/m	ft·lbf/in.	—	—	NBB	NBB	—	—
Impact Resistance—Puncture, Energy @ Max. Load	23°C (73°F)	D 3763	J	ft·lbf	21	15	33	24	71	53
	0°C (32°F)	D 3763	J	ft·lbf	25	18	40	30	93	69
	–10°C (14°F)	D 3763	J	ft·lbf	26	19	42	31	96	71
	–20°C (–4°F)	D 3763	J	ft·lbf	28	21	43	32	>100	>74
	–30°C (–22°F)	D 3763	J	ft·lbf	25	18	47	34	>100	>74

* Unless noted otherwise, all tests are run @ 23°C (73°F) and 50% relative humidity, using specimens machined from extruded sheeting with a thickness as indicated.

**Nonbreak as defined in ASTM D 4812 using specimens having a thickness as indicated. Properties reported here are typical of average lots. 3form makes no representation that the material in any particular shipment will conform exactly to the values given.

SOUND TRANSMISSION CLASS (STC) VALUES FOR VARIOUS GAUGES OF *ECO*RESIN

Measurement protocol: ASTM E 90 - Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements

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ECORESIN THICKNESS	STC VALUES
1/8" (0.118")	25
3/16" (0.177")	29
1/4" (0.236")	31
3/8" (0.354")	34
1/2" (0.500")	34
1" (1.00")	39

CHEMICAL RESISTANCE OF 3FORM *ECO*RESIN TO SELECT COMPOUNDS

The following table provides indicative performance of the chemical resistance characteristics of *eco*resin tensile bars, the material from which *eco*resin panels are produced.

Polymer materials are affected by chemicals in different ways. Factors that initiate a change in performance or appearance when exposed to chemicals can be attributed to fabrication methods, exposure conditions, concentration of chemical substances or exposure duration of certain substances. Such factors can even influence the final affect on substances that 3form *eco*resin is considered "Resistant" to by this method. Further details are explained below:

Fabrication: Stresses generated from sanding, grinding, drilling, polishing, machining, sawing and/or forming (hot or cold).

Exposure: Exposure duration, stresses imparted during the application life-cycle due to loads, temperature changes, heat, environments, etc.

Application of chemicals: Application from contact, rubbing, wiping, spraying, soaking, etc. Also having an affect is the relative concentration of the chemical in question.

The following data is based on complete immersion of *eco*resin tensile bars in the chemical or reagent shown. Samples remained immersed and were stored at 23ºC (73ºF) for a period of one year. Following the test period the samples were removed from immersion, weighed and measured. This table represents the changes in weight, thickness and appearance of the immersed samples over the testing period.

REAGENT	% CHANGE		
	WEIGHT	THICKNESS	APPEARANCE AFTER EXPOSURE
Acetic Acid, 5%	<1	<1	Very slight yellowing
Acetic Acid, conc.	19	18	Discolored, swollen
Acetone	16	23	Discolored (brown), swollen, rubber-like
Ammonium Hydroxide, conc.	-29	-20	Turned white, outside crumbling off
Ammonium Hydroxide, 10%	4	4	Discolored (pink), surface has blisters

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REAGENT	% CHANGE		
	WEIGHT	THICKNESS	APPEARANCE AFTER EXPOSURE
Antifreeze, Automotive Ethylene Glycol Type	<1	<1	No change
Benzene	34	43	Discolored, rubber-like
Brake Fluid, DOT3	2	2	No change
Brake Fluid	6	6	Turned yellow, surface attacked, flaking off
Carbon Tetrachloride	27	18	Discolored, swollen
Chromic Acid, 40%	<1	<1	Slightly discolored
Citric Acid, 10%	<1	<1	Slight yellowing
Cottonseed Oil	<1	<1	Very slight yellowing
Deionized Water	<1	<1	Slight yellowing
Detergent, Alconox (0.25%)	<1	<1	Slight yellowing
Di (2-Ethylhexyl) Phthalate	<1	<1	Very slight yellowing
Dibutyl Sebacate	<1	1	Slight yellowing
Diesel Fuel	<1	2	Discolored
Dimethyl Formamide	22	39	Badly discolored and distorted
Ethanol, 50%	<1	<1	Slight yellowing
Ethanol, 100%	<1	<1	Very slight yellowing
Ethyl Acetate	20	24	Badly discolored and swollen, softened
Ethylene Dichloride	—	—	Completely deteriorated after 1 week
Gasohol, 10% Ethanol	9	8	Cloudy, slight yellowing
Gasohol, 10% Methanol	11	10	Cloudy, yellowed
Gasoline, Base for Gasohol	6	6	Slight yellowing
Gasoline, Premium Unleaded	2	3	Discolored
Gasoline, Regular	<1	<1	Slight yellowing
Gasoline, Regular Unleaded	2	2	Discolored
Grease, Automotive	<1	<1	No change
Hand Cleaner, Waterless Jergens SBS30	<1	2	No change
Hexane	<1	<1	Slight yellowing
Hydrochloric Acid, conc.	1	<1	Badly discolored, blisters under surface
Hydrochloric Acid, 10%	<1	<1	Slight yellowing
Hydrogen Peroxide, 3%	<1	<1	Slight yellowing
Hydrogen Peroxide, 28%	<1	<1	Slight yellowing
Isooctane	<1	<1	Very slight yellowing

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REAGENT	% CHANGE		
	WEIGHT	THICKNESS	APPEARANCE AFTER EXPOSURE
Kerosene	<1	<1	Very slight yellowing
Lacquer Thinner	7	6	Cloudy, white
Methyl Alcohol	<1	<1	Very slight yellowing, crazing
Mineral Oil	<1	<1	Very slight yellowing
Motor Oil	<1	<1	No change
Nitric Acid, conc.	—	—	Completely deteriorated after 1 wk.
Nitric Acid, 10%	<1	<1	Slight yellowing
Nitric Acid, 40%	1	<1	Turned white
Oleic Acid, 83%	<1	<1	Very slight yellowing
Olive Oil	<1	<1	Very slight yellowing
Penetrating Oil, Liquid Wrench #1	10	11	Discolored
Phenol, 5%	13	14	Turned black
Silicone Spray Lubricant	67	34	White, swollen
Soap Solution, 1%	<1	<1	Slight yellowing
Sodium Carbonate, 2%	<1	<1	Slight yellowing
Sodium Carbonate, 20%	<1	<1	Slight yellowing
Sodium Chloride, 10%	<1	<1	Slight yellowing
Sodium Hydroxide, 1%	<1	<1	Slight yellowing
Sodium Hydroxide, 10%	8	6	Slight yellowing
Sodium Hypochlorite, 3.5%	<1	<1	Slight yellowing
Sulfuric Acid, conc.	—	—	Completely deteriorated after 1 wk.
Sulfuric Acid, 3%	<1	<1	Slight yellowing
Sulfuric Acid, 30%	<1	<1	Slight yellowing
Tapping Oil	<1	1	No change
Toluene	26	31	Turned white, softened
Transformer Oil	<1	<1	Very slight yellowing
Transmission Fluid, Auto	<1	<1	No change
Turpentine	<1	<1	Slight yellowing

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Cleaning Instructions

3form *eco*resin, like all thermoplastic resin materials, should be cleaned periodically. A regular, seasonal cleaning program will dramatically help prevent noticeable weathering and dirt build-up.

Rinse the sheets with lukewarm water. Remove dust and dirt from *eco*resin with a soft cloth or sponge and a solution of mild soap and/or liquid detergent in water. A 50:50 solution of isopropyl alcohol and water also works well. Rinse thoroughly with lukewarm water.

Always use a soft, damp cloth to blot dry. Rubbing with a dry cloth can scratch the material and create a static charge. Never use scrapers or squeegees on *eco*resin. Also avoid scouring compounds, gasoline, benzene, acetone, carbon tetrachloride, certain deicing fluids, gasoline, lacquer thinner or other strong solvents.

Do not:

- Use a squeegee
- Strong solvents, highly alkaline or abrasive cleaning agents
- Clean in hot sun or elevated temperatures
- Rub with a dry cloth

PRESSURE WASHING

Pressure washing can also be an effective way to remove miscellaneous debris from surfaces of 3form *eco*resin installations that are in exterior or hard-to-reach places.

Pre-soak panels with a light water spray to loosen and remove incidental surface debris.

It is recommended that the water pressure for cleaning *eco*resin panels be 1,500 psi or less. 3form *eco*resin is a tough material but can be damaged if high pressure is concentrated in a single position too long. Use a gradual sweeping motion over the application. Never concentrate water spray in a single position. Pressure nozzle should never be positioned closer than 8" (203 mm) from the panel surface.

Test a portion of the sheet first before spraying. If test piece shows any sign of material fatigue, abrasion or delamination – discontinue pressure washing and proceed with manual cleaning instructions as described above.

Coated or painted parts are not suitable for pressure washing as finish may be stripped off. Pressure washing is not suitable for *eco*resin panels that have been edge sealed. If using detergent, use mild detergents only. Rinse sheet with light water spray after washing.

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Do not:

- Concentrate spray in single position
- Use more than 1,500 psi pressure
- Position pressure nozzle closer than 8" (203 mm) from panel
- Proceed with pressure washing if test piece shows detrimental effects to panel
- Pressure wash *eco*resin panels that have been painted or coated to maintain coating integrity
- Pressure wash *eco*resin panels with sealed edges to ensure edge seals remain in tact

If debris or dirt is not removed by pressure washing attempt to clean with manual procedures described in preceding section.

Important: If a cleaning material is found to be incompatible in a short-term test, it will usually be found to be incompatible in the field. The converse, however, is not always true. Favorable performance is no guarantee that actual end-use conditions have been duplicated. Therefore, these results should be used as a guide only and it is recommended that the user test the products under actual end-use conditions.

For additional information about 3form *eco*resin please contact 3form @ 801.649.2500

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varia™ flammability + smoke test results

3form Varia™ meets the performance requirements established by the 2003 *International Building Code* (IBC) for light transmitting plastics. The provisions of these codes provide adequate regulation for most applications of light transmitting plastics.

For use as an interior finish, ASTM E84 testing has been performed and ¼" varia produced from ecoresin™ achieves a class B rating, with a flame spread index less than 75 and a smoke density less than 450. Varia produced from ecoresin at 1" thickness meets the criteria for a Class A rating, with a flame spread index less than 25 and a smoke density less than 450.

Note: A class B material can be used in place of a class A material when installed with an approved automatic fire suppression system. (Section 803.5 of the 2003 IBC)

NFPA 101-00 (Section 10.2.4.4) refers to the use of light transmitting plastic for interior applications to authorities and organizations having local jurisdiction. Such authorities typically adopt the IBC, which is supported by the International Code Council.

Varia is further recognized by the New York Department of Buildings (MEA#65-05 III) and the Los Angeles Department of Building Safety (LARR 25591).

There are three specific ASTM tests, evaluations which form the basis for a plastic material become recognized by BOCA, ICBO and SBCCI. These three ASTM tests are required in the 2003 IBC, upon which officials rely for material compliance.

TEST	VARIA	RESULT
ASTMD 2843-99 Smoke Density Rating	PASS	71.6% density vs. 75% max allowable
ASTMD 635-98 Flame Spread	PASS	CC1 rating (self-extinguishing)
ASTMD 1929-96 Self Ignition Temperature	PASS	716°F vs. 650°F minimum

VARIA UL 723/ASTM E84 TEST RESULTS

UL723 / ASTM E84 Tunnel Test	Surface Burning Characteristics
Class A	Flame Spread 20
	Smoke Density 250
Class B	Flame Spread 65
	Smoke Density 425

NFPA 286 TEST RESULT

Class A (1/4")	PASS (walls only)

The NFPA 286 corner burn test is also accepted by the 2003 IBC for interior finishes. Passing the NFPA 286 test qualifies the material as a Class A material.

All test reports are available upon request.

December 2006

stc values for *eco*resin panels

SOUND TRANSMISSION CLASS (STC) VALUES FOR VARIOUS GAUGES OF ECORESIN PANELS

Measurement protocol ASTM E 90 - Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements

ECORESIN THICKNESS	STC VALUES
1/8" (0.118")	25
3/16" (0.177")	29
1/4" (0.236")	31
3/8" (0.354")	34
1/2" (0.500")	34
1" (1.00")	39

Note: The typical finished composition of 3form Varia™ is greater than 95% ecoresin. Hence, the STC ratings for 3form Varia™ are assumed to be equivalent to the above STC approximations for pure ecoresin.

As a matter of comparison, the following tables demonstrate various STC values for typical communication cases and other common construction materials.

STC	PRIVACY
25	NORMAL SPEECH -EASILY UNDERSTOOD
30	NORMAL SPEECH - AUDIBLE, BUT UNINTELLIGIBLE
35	LOUD SPEECH - UNDERSTOOD
40	LOUD SPEECH - AUDIBLE, BUT UNINTELLIGIBLE
45	LOUD SPEECH - BARELY AUDIBLE
50	SHOUTING - BARELY AUDIBLE
55	SHOUTING - NOT AUDIBLE

STC	CONSTRUCTION MATERIAL
18	HOLLOW-METAL DOOR WITHOUT SEALS
22	SOLID WOOD DOOR WITHOUT SEALS
26	1/4" PLATE GLASS
32	1/2" PLATE GLASS
38	1/2" DRYWALL ON WOOD STUDS, BOTH SIDES
41	4" PAINTED CONCRETE BLOCK WALL
42	5/8" DRYWALL ON STEEL STUDS, BOTH SIDES
46	8" HOLLOW CONCRETE BLOCK
48	12" PAINTED CONCRETE BLOCK WALL
50	DOUBLE 5/8" DRYWALL ON STEEL STUDS, INSULATED
53	12" POURED SOLID CONCRETE WALL

Lumicor®

Technical: TECH GUIDE

Lumiform™ / Lumiclear™ / Lumiguard™ Comparison vs. Differences

Technical Specs

Technical Specs

- Product
- Size
- Textures
- Resin(s)
- Protective Finish Option
- Fabrication
- Frame Depth
- Expansion / Contraction
- Weight

Product [top]

Select from over 100 standard Lumicor products from our seven product families: Botanicals, Metallics, Elements, Embosses, Neutrals, Patterns, and Colorways; or create your own custom Lumicor by combining decors.

Size [top]

Lumicor is available in gauges from 1/16" to 1" with a thickness tolerance of +/- 10%.

1/16th	.60"	.60"
1/8"	.118"	3.0mm
5/32"	.160"	4.0mm
3/16"	.196"	5.0mm
1/4"	.236"	6.0mm
3/8"	.354"	9.0mm
1/2"	.472"	12.0mm
17/32"	.531"	13.5mm
3/4"	.708"	.18.0mm
1"	.944"	24.0mm

Sheet Dimensions:
Many Lumicor products are available in the following sheet sizes:

4' X 8'	Standard
4' X 10'	Oversized
5' X 10'	Oversized

* Some decors are not available in oversize sheets. Minimums may apply.

Textures [top]

Lumicor is available in a variety of surface textures to provide different aesthetics. You can specify different textures on each side of the sheet. The most common surface textures are matte and glass.

H - Matte	A - Gloss	C - Mesh
K - Frost	L - Satin	U - Moire
T - Diffusion	E - Adobe	

Resins [top]

Lumicor is manufactured using several high performance engineering resins, including **Lumi**clear™ (Acrylic), chemical resistant acrylic **Lumi**guard™ (Acrylic), and **Lumi**form™ (PETG). The resin used will depend on the performance requirements of your project.

LUMICLEAR™: Outstanding clarity, UV resistance, and renewable surface.
LUMIGUARD™: All the benefits of **Lumi**clear™ (acrylic) plus enhance chemical and stain resistance. Ideal for horizontal applications such as counter tops and tables.
LUMIFORM™ (PETG): Superior impact resistance, lower flammability, and greater flexibility.

Protective Finish Option [top]

Lumicor is available with a Tedlar finish on *one or both* sides of the sheet.

TEDLAR Â® FINISH
Tedlar is a high performance clear film developed by DuPont. Tedlar can be applied to one or both sides of Lumicor acrylic products. With the Tedlar protective film applied, Lumicor can be used in environments requiring superior stain and chemical resistance. Tedlar is available only on **Lumi**clear™ and **Lumi**guard™ but cannot be renewed if damaged.

Fabrication [top]

Lumicor is easily fabricated using standard woodworking tools equipped with blades designed for cutting plastic. Many Lumicor products can be thermoformed into unique shapes for dramatic design possibilities. If your Lumicor application will be exposed to moisture, it is important to seal the edges after fabrication to prevent wicking.

Frame Depth [top]

Lumiclear™ (Acrylic) AND Lumiform™ (PETG)
When installing Lumicor into framed systems, it is important to use adequate frame depth to maintain the panel within the system. The recommended frame depth is based on sheet length.

SHEET LENGTH	FRAME DEPTH
24"	7/16"
36"	5/8"
48"	3/4"
60"	7/8"
72"	7/8"
84"	1"
96"	1 1/8"
108"	1 1/18"
120"	1 1/14"

Expansion / Contraction [top]

Lumicor will expand and contract nominally with changes in temperature. Please allow for expansion / contraction when installing fasteners, hardware, frame systems, or when edge butting sheets. The formula below can be used to calculate the appropriate allowance for expansion and contraction:

$$\left(\begin{matrix}\text{Length}\\ \text{in Inches}\end{matrix}\right) \times \left(\begin{matrix}\text{Anticipated Change}\\ \text{in F Temperature}\end{matrix}\right) \times \left(.00004\right) = \begin{matrix}\text{Expansion}\\ \text{Allowance}\end{matrix}$$

Example: $\left(48''\right) \times \left(31^{\circ}F\right) \times \left(.00004\right) = 1/16''$

Weight [top]

Lumiclear Weight*	1/8" .120" 3mm	5/32" .160" 4mm	3/16" .196" 5mm	1/4" .236" 6mm	3/8" .354" 10mm	1/2" .472" 12mm	17/32" .531" 13.5mm	3/4" .708" 18mm	1" .944" 24mm
Lbs. per Sq. Foot	.73	.97	1.21	1.46	2.19	2.92	3.22	4.38	5.84
4'x8' Sheets									
Lbs. per Sheet	23	31	39	47	70	93	103	140	187
4'x10' Sheets									
Lbs. per Sheet	29	39	48	58	88	117	129	175	234
5'x10' Sheets									
Lbs. per Sheet	37	49	61	73	110	146	161	219	292

Lumiform Weight*	1/8" .118" 3mm	5/32" .160" 4mm	3/16" .196" 5mm	1/4" .236" 6mm	3/8" .354" 9mm	1/2" .472" 12mm	17/32" .531" 13.5mm	3/4" .708" 18mm	1" .944" 24mm
Lbs. per Sq. Foot	.8	1.2	1.3	1.57	2.35	3.13	3.47	4.7	6.23
4'x8' Sheets									
Lbs. per Sheet	26	38	42	50	75	100	110	150	200
4'x10' Sheets									
Lbs. per Sheet	32	48	52	63	94	125	138	188	250
5'x10' Sheets									
Lbs. per Sheet	40	60	65	79	118	157	173	235	312

* Estimated weights; actual weights will vary depending on decor.

Download The Tech Specs

- Care & Handling
- MSDS (Material Safety Data Sheet)
- Limited Warranty
- Flammability
- CSI Specification
- Lumiclear™ Properties
- Lumiguard™ Properties
- Lumiform™ (PETG) Properties
- Deflection Matrix
- Lumiclear™ (Acrylic) Bend Radius
- Lumiform™ (PETG) Bend Radius
- Chemical Resistance
- Refinishing
- Tedlar Cleaning
- Lumiclear™ Emission/GreenGuard Statement
- Recycler List
- Stand-off Placement Guide
- Edge Profiles for Countertops

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1400 MONSTER ROAD SOUTHWEST
RENTON, WA 98057
425-255-4000

Lumicor®

Lumiform™

MATERIAL SAFETY DATA SHEET

1. CHEMICAL PRODUCT AND COMPANY IDENTIFICATION

Product Name	Lumiform™ translucent panels
Product Identification	PETG Sheet
Manufacturer/Supplier	Lumicor®, Inc.
MSDS Prepared by	Lumicor® Engineering
Chemical Name	PETG
Synonym(s)	not applicable
Molecular Formula	not applicable
Molecular Weight	not applicable
Product Use	plastic
OSHA Status	nonhazardous

For emergency health, safety & environmental information, call 888-LUMICOR.

For emergency transportation information, call LUMICOR at 888-LUMICOR

2. COMPOSITION INFORMATION ON INGREDIENTS

Typical composition is given, and it may vary. A certificate of analysis can be provided.

Weight %	Component	CAS Registry No.
100%	copolyester	25640-14-6

One or more of the following co-components may be present in trace amounts: Polyester, Rayon, Aluminum, Raime, Cotton, Linen, Natural straw or foliage, Paper.

3. HAZARDS IDENTIFICATION

Skin Contact:	Caution! Molten material will produce thermal burns
Eye Contact:	“Inert” or “Nuisance” dust may cause abrasion irritation to the eye.
Inhalation:	Caution! Inhalation of vapors from heated product can cause nausea, headache, dizziness, as well as irritation of the lungs, nose and throat.
Chronic (Cancer):	No evidence of adverse effects; adverse effects unlikely.
Teratology (Birth Defects):	No information, but adverse effects unlikely.
Reproductive Information:	No information, but adverse effects unlikely.
HMIS® Hazard Ratings:	Health - 1, Flammability -1, Chemical Reactivity - 0

In the United States of America, refer to NFPA® Pamphlet No. 654, "Prevention of Fire and Dust Explosions in the Chemical, Dye, Pharmaceutical, and Plastics Industries."

HMIS® rating involves data interpretations that may vary from company to company. They are intended only for rapid, general identification of the magnitude of the specific hazard. To deal adequately with the safe handling of this material, all the information contained in this MSDS must be considered.

4. FIRST-AID MEASURES

Inhalation:	If symptomatic, move to fresh air. Get medical attention if symptoms persist.
Eyes:	If molten material or dust contacts the eye, immediately flush with water for at least 15 minutes. If easy to do, remove contact lenses. Get medical attention immediately.
Skin:	If burned by contact with molten material, cool as quickly as possible. Do not peel material from skin. Get medical attention. For contact with the material in solid state form, wash skin with soap and water.
Ingestion:	Material is not expected to be absorbed from the gastrointestinal tract so that induction of vomiting should not be necessary.
Note to Physicians:	Burns should be treated as thermal burns. The material will come off as healing occurs; therefore, immediate removal from the skin is not necessary.

5. PHYSICAL AND CHEMICAL PROPERTIES

Physical Form:	Solid (panel)
Appearance:	Clear to opaque
Odor:	Slight
Specific Gravity:	>1
Softening Point:	>100 °C / >212 ˚F
Solubility in Water:	Insoluble
Flash Point:	Not applicable, combustible solid
Auto-ignition Temperature:	454 °C / 850 °F (ASTM E659)

6. STABILITY AND REACTIVITY

Stability:	Not fully evaluated. Materials containing similar structural groups are normally stable.
Incompatibility:	Material reacts with strong oxidizing agents.
Hazardous Polymerization:	Will not occur.
Thermal Decomposition:	Thermal stability not tested. Low stability hazard expected at normal operating temperatures

7. FIRE FIGHTING MEASURES

Extinguishing Media:	Water spray dry chemical foam or carbon dioxide
Fire-Fighting Procedures:	Wear self-contained air purifying respirator (pressure-demand, MSHA/NIOSH approved or equivalent) and full protective gear
Hazardous Combustion Products:	Carbon dioxide, carbon monoxide
Unusual Fire and Explosion Hazards:	Heated material can cause flammable vapors with air.

8. WASTE DISPOSAL/ACCIDENTAL RELEASE MEASURES

Disposal: Product can be disposed by incineration at a facility that complies with local, state and federal regulations

Accidental Release: Incase of spill, sweep, scoop or pick up and remove to a suitable container.

9. HANDLING AND STORAGE

Maximum Storage Temperature: 160 °C / 320 ˚F. Extensive storage at higher temperatures will emit MMA vapors, carbon dioxide or carbon monoxide.

Storage Measures:
Store at ambient temperature when possible.
Keep from contact with oxidizing materials.
Minimize dust generation and accumulation.
At temperatures >60 °C / >140 ˚F store panels at a 15˚ angle to the vertical plane to minimize cold-forming effects.
At temperatures <60 °C / <140 ˚F store panels in flat stacks.

Handling Measures:
Avoid temperatures <300 °C / <570 ˚F
Sawing, cutting or routing of Lumiform™ product generates “inert” or “nuisance” dust.
Blower collection systems or exhaust ventilation systems should be installed to prevent airborne contaminant dispersion due to cutting, sawing or thermal forming operations.

10. EXPOSURE CONTROLS/PERSONAL PROTECTION

Country specific exposure limits have not been established or are not applicable unless listed below.

Ventilation: Good general ventilation (typically 10 air changes per hour) should be used. Ventilation rates should be matched to conditions. Supplementary local exhaust ventilation, closed systems, or respiratory protection may be needed in special circumstances such as poorly ventilated spaces, mechanical generation of dusts, heating, drying, etc.

Respiratory Protection: None required under normal circumstances. However, if engineering controls do not maintain airborne concentrations to an acceptable level, an approved respirator must be worn. In the United States of America, if respirators are used, a program should be instituted to assure compliance with OSHA Standard 63 FR 1152, January 8, 1998. Respirator type: dust, organic vapor

Eye Protection: Wear a face shield or safety glasses with side shields when working with molten material, or when sawing, cutting or routing the material.

Skin Protection: Wear cotton or canvas gloves to protect against thermal burns, cuts and abrasions to hands.

Recommended Decontamination Facilities: Eye bath, washing facilities.

11. TOXICOLOGICAL INFORMATION

Toxicity data are not available unless listed below.

Oral LD-50: (male rat)	>3,200 mg/kg(highest dose tested)
Oral LD-50: (male mouse)	>3,200 mg/kg(highest dose tested)
Dermal LD-50: (guinea pig)	> 1,000 mg/kg
Skin Irritation: (guinea pig)	slight irritation
Eye Irritation: (rabbit, unwashed eyes)	slight
Eye Irritation: (rabbit, washed eyes)	slight

Acute Aquatic Effects Data:

96 h LC-50 (fathead minnow):	> 100 mg/l (highest concentration tested)
96 h LC-50 (daphnid):	> 100 mg/l (highest concentration tested)
96 h LC-50 (ramshorn snail):	> 100 mg/l (highest concentration tested)
96 h LC-50 (flatworm):	> 100 mg/l (highest concentration tested)

12. REGULATORY INFORMATION

WHMIS (Canada) Status: noncontrolled
SARA 313: none, unless listed below

Carcinogenicity Classification (components present at 0.1% or more): none, unless listed below

TSCA (US Toxic Substances Control Act): This product is listed on the TSCA inventory. Any impurities present in this product are exempt from listing.

DSL (Canadian Domestic Substances List) and CEPA (Canadian Environmental Protection Act): This product is listed on the DSL. Any impurities present in this product are exempt from listing.

EINECS (European Inventory of Existing Commercial Chemical Substances): All components of this product are listed on EINECS. Any polymer intentionally present in this product has regulatory clearance under Directives of the European Union.

AICS / NICNAS (Australian Inventory of Chemical Substances and National Industrial Chemicals Notification and Assessment Scheme): This product is listed on AICS or otherwise complies with NICNAS.

MITI (Japanese Handbook of Existing and New Chemical Substances): This product is listed in the Handbook or has been approved in Japan by new substance notification.

ECL (Korean Toxic Substances Control Act): This product is listed on the Korean inventory or otherwise complies with the Korean Toxic Substances Control Act.

13. TRANSPORT INFORMATION

Marine Pollutant Components:	None unless listed below
DOT (USA):	Class not regulated
ICAO Status:	Class not regulated
IMDG Status:	Class not regulated

14. OTHER INFORMATION

Lumicor®, Inc. believes that the information and recommendations contained herein (including data and statements) are accurate as of the date hereof. Users should perform their own tests to determine the suitability of these products for their own particular purposes. NO WARRANTY OF FITNESS FOR ANY PARTICULAR PURPOSE, WARRANTY OF MERCHANTABILITY, EXPRESSED OR IMPLIED, IS MADE CONCERNING THE INFORMATION CONTAINED HEREIN. The information provided herein relates only to the specific product designated and may not be valid where such product is used in combination with any other materials or in any other process. Further, the conditions and methods of use are beyond the control of Lumicor®, Inc. Lumicor®, Inc. expressly disclaims any and all liability as to any results obtained or arising from any use of the product or reliance on such information.

HÄFELE

AL FRESCO DOOR HARDWARE

Sliding/Folding for Exterior/Patio Doors

Al Fresco

- For wood door leaves
- For 2 to 8 leaf folding doors
- Floating suites possible
- Full corrosion resistant construction
- 316 marine grade cast stainless steel parts for improved strength and maximum corrosion resistance
- Concealed channel to enhance appearance
- Mortice or Non-Mortice hinges and hangers
- Choice of 3 finishes: satin stainless steel, polished stainless steel and titanium gold (tarnish free for years)
- Precision bearings top and bottom to reduce rolling resistance
- Durable polypropylene channel provides quiet operation
- Ideal for coastal applications

- Max. door weight: **45kg. (99 lbs.) or 75kg. (165 lbs.)** per door leaf
- Max. door height: **3000mm or 3300mm (9' 10 1/8" or 10' 9 15/16")**
- Max. door leaf width: **900mm (36")**
- Max. panels per folding suite: **8**
- For door thickness: **35-50mm (1 3/8" - 2")**
- Min. track radius: **5.0 m (16' 4 7/8")** for curved openings

Material/Color

- Running track: aluminum, clear anodized
- Lower guide channel: aluminum, brass or black polypropylene
- Running gear: nylon rollers with precision stainless steel bearings
- Hinges: stainless steel
- Pivot block: stainless steel (316 marine grade)
- Hanger bodies: stainless steel (316 marine grade)
- Bottom guides: stainless steel (316 marine grade) with sealed precision stainless steel bearings
- Guides, running gears, hinges and pivot assemblies available in satin or polished stainless steel or titanium gold finishes

45 kg. (165 lbs.) Track

75 kg. (165 lbs.) Track

Note: Mortice hardware sets shown.

Dimensions in mm
Inches are approximate

Dimensional data not binding. We reserve the right to alter specifications without notice.

Sliding/Folding for Exterior/Patio Doors

Al Fresco

Installation configuration

Many Al Fresco installation configurations are possible, with the option of either an odd or even number of panels. Some examples are shown below. A maximum of 8 panels can be folded to the left, to the right or floating

Note: Curved tracks possible, please contact our product specialist at **1-888-437-7477**.

Dimensional data not binding. We reserve the right to alter specifications without notice.

Dimensions in mm
Inches are approximate

Sliding Door Accessories

Angle Profile – Hawa

- Elegant design with almost invisible mounting
- Continuous profile for simple leveling
- Easy and fast to install with the attachment screws
- Drilling of upper track and angle profile is not required
- Finished product is anodized aluminum
- Additional support structure is not required
- Use for wood or glass sliding doors
- Supports door weights of **40 kg (88 lbs.), 80 kg (176 lbs.), and 120 kg (264 lbs.)**

For Hawa Junior 40, Hawa Junior 80 and Hawa Junior 120 upper tracks

Hawa angle bracket for wood sliding door applications:

Hawa Junior 40 - type

Hawa Junior 80 - type

Hawa Junior 120 - type

Hawa angle bracket for glass sliding door applications:

Hawa Junior 40 - type

Hawa Junior 80 - type

Hawa Junior 120 - type

Dimensions in mm
Inches are approximate

Dimensional data not binding. We reserve the right to alter specifications without notice.

Brackets

Load capacities are approximate figures and can change depending on application. These figures were determined by static testing – distributing the weight evenly over the surface, but not extending the length of the bracket.

Bracket

Material: steel, lacquered

Dimensions A	C	B	Screw hole	Load capacity kg/pair	brown	white
150	200	36	5.0	50 (110 lbs)	287.30.243	287.30.145
250	300	44	5.2	60 (132 lbs)		287.30.172
300	350	47	5.2	70 (154 lbs)	287.30.289	

Packing: 20 pcs.

Bracket

Material: aluminum, lacquered

Dimensions A	C	B	Screw hole	Load capacity kg/pair	brown	white
100	150	20	3.5	80 (175 lbs)	287.35.122	
150	200	20	5.0	120 (265 lbs)	287.35.131	287.35.739
200	250	24	5.0	130 (285 lbs)	287.35.140	287.35.748
200	300	26	6.0	150 (330 lbs)	287.35.159	287.35.757

Packing: 10 pcs.

Hebgo bracket

Mounting holes for table top

Mounting holes for wall mounting

Load capacity to 150 kg (330 lbs) per pair

Material: steel

Dimensions A	C	B	gray primed
200	80	46	287.44.416
240	80	46	287.44.425
280	100	53	287.44.434
330	100	53	287.44.443
380	130	65	287.44.452
480	130	65	287.44.461
580	170	82	287.44.470
680	170	82	287.44.489

Packing: 1 pc.

Hebgo bracket

Mounting holes for table top

Mounting holes for wall mounting

Load capacity to 500 kg (1100 lbs) per pair

Material: steel

Dimensions A	C	B	gray primed
380	180	80	287.45.459
480	180	80	287.45.468
580	220	100	287.45.477
680	220	100	287.45.486
780	220	100	287.45.495

Packing: 1 pc.

Dimensions in mm
Inches are approximate

Dimensional data not binding. We reserve the right to alter specifications without notice.

Mirror Fittings

Mirror Holder,
for frameless mirrors

Includes:
- 2 brackets, fixed
- 2 brackets with spring
- 4 wood screws ø 3.5 mm
- 4 plastic dowels for ø 6 mm holes

Material: brass

Color	Item No.
chrome polished	293.50.025

Packing: 25 sets

Mirror Holder, cranked

Pan Head #5

Material: steel

Color	Item No.
nickel-plated	291.21.015

Packing: 500 pcs.

Mirror Holder, oval shaped

Pan Head #5

Material: plastic

	Item No.
transparent	291.09.402

Packing: 500 pcs.

Glass Retainer Clip

Pan Head #5

Material: steel

Color	Item No.
bronzed	291.02.109

Packing: 500 pcs.

Glass Retainer Clip

- Complete assembly for easy installation
- Wood screw is held in place by a small washer
- Pressure screw has a soft vinyl tip

Material: plastic, with soft plastic tip

Offset	clear
4.8 mm (3/16")	291.03.420
3.2 mm (1/8")	291.03.440
7.85 mm (5/16")	291.03.430

Packing: 5000 pcs.

Flat head screws	pages 450-452
Pan head screws	page 453

Dimensions in mm
Inches are approximate

Dimensional data not binding. We reserve the right to alter specifications without notice.

Magnetic Catches

Magnetic catch, screw-mounted

- The poles are fixed in the case, while the magnet core is adjustable
- Holding power (approximately) **3-4** kg

Pan Head #5

Catch: fixed
Strike: floating
Material: Catch: plastic; Strike: steel

Color	Item No.
white	246.09.701
brown	246.09.103
black	246.09.309

Packing: 50 pcs.

Magnetic catch, press-fit with dowel

- Holding power (approximately) **3-4** kg

Catch: fixed
Strike: floating
Material: Catch: plastic; Strike: steel

Color	Item No.
white	246.08.704
brown	246.08.106
black	246.08.300

Packing: 50 pcs.

Magnetic catch, screw-mounted

- Holding power (approximately) **5** kg
- Flat (only 6 mm high)
- Adjustable
- Floating poles

Catch: fixed
Strike: floating
Material: Catch: plastic; Strike: steel

Color	Item No.
white	246.50.708
brown	246.50.100

Packing: 20 pcs.

Magnetic catch, screw-mounted

Metal case provides heat-resistance to 300° C.
Note: Holding power is diminished by **1%** per **5°** C (+). increase in temperature. Cooling restores the magnet's holding power to its original level. No strike is necessary with steel doors or lids.

- Holding power (approximately) **5** kg

Catch: fixed
Strike: floating
Material: Catch: aluminum; Strike: steel

	Item No.
	246.92.000

Packing: 12 pcs.

Flat head screws	pages 450–452
Pan head screws	pages 453

Dimensions in mm
Inches are approximate

Dimensional data not binding. We reserve the right to alter specifications without notice.

Cabinet Suspension Fittings

Covering strip

Note: We recommend attaching the wall rail to studs with dry wall screws only. Do not attach to sheetrock. For additional attachment to dry wall, see page **459** for dry wall anchors.

- Screw-hole increments of 25 mm

Material: steel

Color	Item No.
zinc-plated	290.11.900

Packing: 1 pc. (2.5 m long)

- Gives clean appearance to the part(s) of the rail not covered by cabinets or other closet components
- Only suitable for rail number 290.11.900

Material: plastic

Color	Item No.
white	290.12.780
beige	290.12.480

Packing: 1 pc. (2.5 m long)

Screw Mounted Cabinet Hanger, for rail suspension

- Vertical adjustment: 11 mm
- Depth adjustment: 12 mm
- Lateral adjustment: 10 mm
- Load carrying capacity per pair: 200 kg

Flat Head #8

Material: steel

	zinc-plated
left	290.07.711
right	290.07.710

Clip-on cover cap (optional), for above

Material: plastic

	white
left	290.07.713
right	290.07.712

Packing: 100 pcs.

Screw-mounted Cabinet Hanger, wall rail suspension

- Vertical adjustment: 16 mm
- Depth adjustment: 15 mm
- Lateral adjustment: 10 mm
- Load carrying capacity per pair: 200 kg

Flat Head #8

Material: steel

	nickel-plated
left	290.02.701
right	290.02.700

Packing: 100 pcs.

Screw-mounted Cabinet Hanger, wall rail suspension

- Vertical adjustment: 16 mm
- Depth adjustment: 15 mm
- Lateral adjustment: 10 mm
- Load carrying capacity per pair: 200 kg

Flat Head #8

Material: steel, epoxy-coated

	beige
left	290.07.401
right	290.07.400

Material: steel, epoxy-coated

	white
left	290.07.701
right	290.07.700

Packing: 100 pcs.

Flat head screws pages 450-452

Dimensions in mm
Inches are approximate

Dimensional data not binding. We reserve the right to alter specifications without notice.

Concealed Hinges

Duomatic – Rapido

Hinge with **Quick-mount feature**
- Door thickness 16 to 26 mm (5/8" - 1")
- Side panel thickness from 16 mm (5/8")
- Tab: 3 - 6 mm
- Corresponding mounting plates can be found on pages **537 - 545**

Opening angle: 110°

Quick-mount, 45/9.5 hole pattern, self-closing
Material: Cup: steel
Hinge arm: steel

Mounting	Hinge arm	Hinge type	nickel-plated
Full overlay	straight	**17**	329.17.580
Half overlay	9 mm crank	**8**	329.17.581
Inset mounting	17 mm crank	**0**	329.17.582

Packing: 300 pcs.

Installation

Dismantling

Quick-mount, 45/9.5 hole pattern, free-swinging
Material: Cup: steel
Hinge arm: steel

Mounting	Hinge arm	Hinge type	nickel-plated
Full overlay	straight	**17**	329.16.580
Half overlay	9 mm crank	**8**	329.16.581
Inset mounting	17 mm crank	**0**	329.16.582

Packing: 300 pcs.

Dimensions in mm
Inches are approximate

Dimensional data not binding. We reserve the right to alter specifications without notice.

Institutional Hinges

Aximat SM With Exposed Axle, 4 mm Gap

- Speeds mounts with a press of the thumb - **no tools required**
- For side panel thicknesses 16-19 mm
- For door thicknesses up to 21 mm
- **4 mm** gap
- 3 screws required for mounting to side panel
- Meets ANSI/BHMA 156.9 - 1994 grade I requirements
- Only meets grade I requirements if third screw and adjustment tabs are in place
- Lateral cam adjustment
- **Accessories** can be found on page **559**

Opening angle: 270°

SYSTEM VARIANTA 32

VARIANTA 3 VARIANTA 5

Flat Head #6

Screw-mounted Drilling diagram 45/9.5

Press-fit Drilling diagram 45/9.5

Corner Hinge with spring, for side panel mounting
Material: zinc alloy

Color	Door overlay	Side panel thickness	Screw-mounted Drilling diagram 45/9.5	Press-fit Drilling diagram 45/9.5
nickel-plated	**12 mm**	16 mm	344.52.000	344.52.100
nickel-plated	**15 mm**	19 mm	344.52.001	344.52.101
black	**15 mm**	19 mm	344.52.051	344.52.151

Packing: 50 pcs. (includes black plastic trim cap)

Side panel mounting for **front-hung doors:** door overlay **12 mm**, side panel thickness **16 mm**

Minimum gap between two doors with two side panels Opening angle 180°

Side panel mounting for **front-hung doors:** door overlay **15 mm**, side panel thickness **19 mm**

Minimum gap between two doors with two side panels Opening angle 180°

Dimensions in mm
Inches are approximate

Dimensional data not binding. We reserve the right to alter specifications without notice.

Swing Up Fitting

Duo

- Two applications; lid or flap stay
- Can be mounted left or right
- Adjustable braking effect
- Lid/Flap stay clip mounts to brackets without tools
- Use of a magnet is recommended when used as a flap stay application, see page **388**
- Aluminum doors are on page **608**

Wood Door Lid Stay

Aluminum Door Lid Stay

Flap Stay Doors

Function:
Set the function to stopping or braking by adjusting the screw with a 4 mm Hex Key. (sold seperately - see next page)

Cabinet mounting bracket

Wood or aluminum frame mounting bracket

Aluminum frame mounting bracket

Duo Lid/Flap Stay Arm

Material: zinc alloy

Version	Color	Item No.
A (6 kg/13 lbs.)	nickel-plated	373.66.660
B (8 kg/18 lbs.)	nickel-plated	373.66.661
A (6 kg/13 lbs.)	silver	373.66.960
B (8 kg/18 lbs.)	silver	373.66.961
A (6 kg/13 lbs.)	black	373.66.360
B (8 kg/18 lbs.)	black	373.66.361

Packing: 20 pcs.

Please order mounting brackets separately (choose from available options below)

Cabinet mounting bracket

- For attachment to side panel of cabinet

Material: steel

Mounting distance from front edge	Color	Item No.
28 mm (1 1/8")	nickel-plated	373.66.693
37 mm (1 7/16")	nickel-plated	373.66.694
28 mm (1 1/8")	silver	373.66.993
37 mm (1 7/16")	silver	373.66.994
28 mm (1 1/8")	black	373.66.393
37 mm (1 7/16")	black	373.66.394

Packing: 20 pcs.

Door mounting bracket

- For wood or aluminum frames over 35 mm (1 3/8") profile wide

Material: steel

Color	Item No.
nickel-plated	373.66.681
silver	373.66.981
black	373.66.381

Packing: 20 pcs.

Door mounting bracket

- For aluminum frames up to 35 mm (1 3/8") profile wide

Material: steel

Color	Item No.
nickel-plated	373.66.682
silver	373.66.982
black	373.66.382

Packing: 20 pcs.

Dimensions in mm
Inches are approximate

Dimensional data not binding. We reserve the right to alter specifications without notice.

Ball Bearing – Self-closing

Full Extension, Telescopic, Self-closing - Accuride 3832HDSC

cam DRAWER ADJUST

This innovative mechanism enables installers to adjust the vertical position of drawers by up to 1/8".

- Weight capacity, max. **45 kg.** (100 lbs)/pair
- Self-closing with a **pull force x 2** of standard 3832SC slide
- Bounce back is eliminated
- Keeps drawer front aligned
- Affordable option adds value to cabinetry
- Features low profile for shallow drawers
- Heavy duty hold-in detent
- Lever disconnect
- 32 mm system compatible

VARIANTA 5

Material: steel, zinc-plated or epoxy-coated

Installed Length		Extension Length				
inch	mm	inch	mm	zinc	black	white
12"	300	12"	300	422.97.930	422.97.330	422.97.730
14"	350	14"	350	422.97.935	422.97.335	422.97.735
16"	400	16"	400	422.97.940	422.97.340	422.97.740
18"	450	18"	450	422.97.945	422.97.345	422.97.745
20"	500	20"	500	422.97.950	422.97.350	422.97.750
22"	550	22"	550	422.97.955	422.97.355	422.97.755
24"	600	24"	600	422.97.960	422.97.360	422.97.760
26"	650	26"	650	422.97.965	422.97.365	422.97.765

Packing: 10 pairs (bulk packed, order screws separately)

Dimensions in mm
Inches are approximate

Face Frame brackets

Material: steel

Color	Item No.
zinc-plated	422.04.000

Packing: 50 sets
(1 set = 2 front and 2 rear brackets)

Ball bearing slide screws page 454
Varianta screws page 458

Dimensional data not binding. We reserve the right to alter specifications without notice.

ʼanization

ıared into the bottom of the tray
.ood, fully assembled
.ım beech ply base

Cutlery Tray
Material: beech, unsteamed

Dimensions					
Length	x	Width	x	Height	Item No.
495 (19½")		291 (11½")		50 (2")	556.91.301
495 (19½")		367 (14½")		50 (2")	556.91.302
495 (19½")		443 (17½")		50 (2")	556.91.303
495 (19½")		519 (20½")		50 (2")	556.91.304

Packing: 1 pc.

- Unique groove for knife handles prevents shifting
- Stores 6 knives
- Mix and match to create customized organization

Cutlery Tray with Knife Block
Material: beech, unsteamed

Dimensions					
Length	x	Width	x	Height	Item No.
495 (19½")		367 (14½")		50 (2")	556.91.311
495 (19½")		519 (20½")		50 (2")	556.91.312

Packing: 1 pc.

- Free standing
- Easily trimmable up to 13 mm (1/2") on each side
- Stores 6 knives

Knife Block
Material: beech, unsteamed

Dimensions					
Length	x	Width	x	Height	Item No.
495 (19½")		195 (7¾")		50 (2")	556.91.310

Packing: 1 pc.

- Optional spacer strips are available for a custom fit
- Easy to cut down for minor depth or width adjustments

Spacer Strips
Material: beech, unsteamed

Dimensions					
Length	x	Width	x	Height	Item No.
600 (24")		6 (¼")		52 (2 1/16")	556.92.340
1200 (48")		6 (¼")		52 (2 1/16")	556.92.341

Packing: 1 pc.

Dimensions in mm
Inches are approximate

Dimensional data not binding. We reserve the right to alter specifications without notice.

Minifix™ Connecting Bolts

- Connecting bolts for through-installation
- For single or double-sided installation in **8 mm diameter holes**

ixconnect

Capped bolt

Panel thickness 16 mm
Material: steel

Drilling distance	nickel-plated	bronzed
24 mm	262.27.752	262.27.154
34 mm	262.28.759	

Double-ended bolt, with snap ring

Panel thickness 16 mm
Material: steel

Drilling distance	galvanized	Packing
24 mm	262.27.805	250 pcs.
34 mm	262.28.802	1000 pcs.

Panel thickness 19 mm
Material: steel

Drilling distance	galvanized
24 mm	262.27.814
34 mm	262.28.811

Packing: 250 pcs.

Double-ended bolt, with center ridge

- For butt joints using **7 mm diameter holes**
- To eliminate up and down movements, 7 mm pilot holes are recommended

Material: steel

Drilling distance	galvanized
34 mm	262.28.786

Packing: 500 pcs.

Dimensions in mm
Inches are approximate

Dimensional data not binding. We reserve the right to alter specifications without notice.

Product and Cut-out Dimensions
Combination Microwave Oven
H4080BM

Location Codes
E - 5 foot electrical main with plug connects upper rear right side O - 208 - 240 Volt - 20 Amp 4 wire connection with NEMA 14-30R. Location must be accessible
Notes
• Width with optional EBA Trim Kits: EBA4470 26" - 26 1/4" EBA4476 28 3/8" - 28 1/2" • All installations must be done in accordance with local codes.

NOTE: Drawing is not to scale.
SPECIFICATION SHEETS 150306

Life's Good

WASHER/DRYER COMBO

WM3431HW
WM3431HS

All-In-One Washer and Dryer

Performance

- NeveRust Stainless Steel Drum
- 2.44 Cu.Ft. Capacity (IEC)
- Direct Drive Motor is Highly Reliable, Durable and Quiet
- 1400 RPM Maximum Spin Speed
- Ventless Condensing Drying System
- 115V Power Source

Intelligent Fabric Care

- SenseClean System Automatically Adjusts Water and Wash Time for Optimal Care
- Sensor Dry System Measures Moisture in the Drum and Automatically Adjusts Drying Time and Temperature for Optimal Care
- Flexibility of Wash to Dry, Wash Only or Dry Only
- 9 Wash Programs
- 5 Rinse Temperatures
- Sanitary Cycle
- Delay Wash up to 19 hours

Style and Design

- 24" Installation Under Counter
- Premium Finishes in Titanium and White
- Upfront Electronic Controls with Dial-A-Cycle
- Chrome Trimmed Door with Clear Glass

Environmentally Friendly

- Energy Star Rated
- LoDecibel Quiet Operation

White

Titanium

ENERGY STAR

LG front load washers exceed Energy Star® classifications by a minimum of 39%.

WASHER/DRYER COMBO

All-in-One Washer and Dryer

This laundry dream washes and dries all in one machine.

Who Is It for?

People who want to be able to do laundry at home but don't have an external venting source which conventional dryers require. It's great for busy people who want to start a load and return to clean clothes. The Delay Start feature allows convenient completion of laundry to fit your schedule. Homes, apartments, businesses and vacation homes where there may be space constraints.

What Are The Advantages?

No outside venting is required because it is ventless condensing. It runs on a standard 115V electricity and not gas. No need to wait to transfer from the washer to the dryer.

What Else Should I Know?

Ventless condensing dries from within the drum so the water that is extracted from the clothes drains through the drum and out the water pump. This drying process takes longer than conventional drying.

It requires installation where a water hook-up is available.

	WM3431HW WM3431HS
TYPE	
Front Loader	●
Design Look	Front Panel
Intelligent Electronic Controls with Dial-A-Cycle	●
Drying System	Ventless Condensing
CAPACITY	
Total Capacity	2.44 cu.ft. (IEC)
Maximum Dry Capacity	8.8 lbs.
ENERGY	
Energy Star Compliant	●
PROGRAMS	
9 Wash Programs	Sanitary, Cotton/Towels, Normal, Permanent Press, Delicates, Wool/Silk, Hand Wash, Speed Wash, Drain & Spin
5 Wash/Rinse Temperature Levels	Extra Hot/Cold, Hot/Cold, Warm/Warm, Warm/Cold, Cold/Cold
Spin Speeds	1400 RPM, Extra High, High, Medium, Low, No Spin
5 Dry Times	150 min, 120 min, 90 min, 60 min, 30 min
Temperature Options	Normal, Low Temperature
Water Level	Automatic
No. of Soil Levels	5
Options	Extra Rinse, Rinse & Spin, Soak, Extra Wash, Spin Only, Dry Only, Delay Wash up to 19 Hours
FABRIC CARE FEATURES	
SenseClean	●
Sensor Dry	●
CONVENIENCE FEATURES	
3 Tray Dispenser (Main Wash, Bleach, Softener)	●
End of Cycle Beeper	●
Child Lock	●
Self Diagnosis	●
Auto-Balancing	●
Auto Suds Removal	●
Forced Drain System	●
Remaining Time Display/Status Indicator	●
Water Heater	●
Leveling Legs	4 Adjustable
LoDecibel Quiet Operation	●
MOTOR AND AGITATOR	
Motor Type / Motor Speed	Direct Drive / Variable
Agitator Type	Horizontal Axis
MATERIALS AND FINISHES	
NeveRust Stainless Steel Drum	●
Transparent Glass Window Door	●
Door Rim	Chrome
Cabinet	Painted Steel
Cabinet Top	Premium Plastic
Control Panel	Plastic
Colors	White, Titanium
POWER SOURCE	
Ratings/Requirements	UL Listed/120V, 60Hz, 10 Amps
Type	Electric
DIMENSIONS	
Product (WxHxD)	23 5/8" x 33 1/4" x 23 13/16" (25"D including door)
Weight (lbs): Net / Gross	147 / 163
WARRANTY	
	1 year parts and labor 2 years on the control board 7 years on the motor Lifetime on the drum
UPC CODE	
White	048231 008594
Titanium	048231 008600

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Design and specifications are subject to change without notice.

LG ELECTRONICS INC.
1000 Sylvan Ave., Englewood Cliffs, NJ 07632
800.243.0000 | LGappliances.com

Printed in March 2005 SS-WM3431HW/WM3431HS

Specification

■ Name:	Front-loading Washing Machine
■ Power supply :	120V~, 60Hz
■ Size:	$23^{3}/_{8}$ X $25^{3}/_{8}$ X $33^{1}/_{4}$ (inches)
	595 X 645 X 845 (mm)
■ Weight:	147 lbs. (66.7 kg)
■ Wash capacity:	2.11 cu.ft.
■ Dry capacity:	2.11 cu.ft. – Max. $8^{13}/_{16}$lbs. (4 kg)
■ Spin speed:	1400 rpm max. (WM3431H*)
	1200 rpm max. (WM3434H*)
■ Permissible water pressure:	4.5 ~ 145 PSI (30 ~ 1000 kPa)

✻ Specifications subject to change by manufacturer.

■ Accessories

Hose
Hot/Cold (1 each)

Wrench

Tie strap
to secure drain hose to standpipe, inlet hose, or laundry tub

Installation

Install or store unit where it will not be exposed to temperatures below freezing or exposed to outside weather conditions.
Properly ground washer to conform with all governing codes and ordinances.
To reduce the risk of electric shock, do not install the washer in humid spaces.
The base opening must not be obstructed by carpeting when the washing machine is installed on a carpeted floor.
In countries where there are areas which may be subject to infestation by cockroaches or other vermin, pay particular attention to keeping the appliance and its surroundings in clean condition at all times.
Damage caused by cockroaches or other vermin will not be covered by the appliance warranty.

■ Shipping bolts

The appliance is fitted with shipping bolts to prevent internal damage during transport.

- Packing and all shipping bolts must be removed before using the washer.

☞ When unpacking the base, be sure to remove the additional packing support in the middle of the base packing.

■ Removing shipping bolts

1. To prevent internal damage during transport, 4 locking bolts are installed. Before operating the washer, remove the bolts.

- If they are not removed, it may cause severe vibration, noise, and malfunction.

2. Unscrew the 4 bolts with the wrench supplied.

3. Take out the 4 bolts by twisting the braces slightly. Keep the 4 bolts and the wrench for future use.

- Whenever the appliance is transported, the shipping bolts must be replaced.

4. Close the holes with the caps supplied.

Installation

■ Installation place requirement

Level floor

Allowable slope under entire washer is 1˚.

Power outlet

Must be within 60 inches (1.5 m) of either side of the washer. Do not overload the outlet with more than one appliance.

Time-delay fuse or circuit breaker is recommended.

NOTE **It is the personal responsibility and obligation of the customer to have a proper outlet installed by a qualified electrician.**

Minimum installation spacing

- Additional spacing of 1 in. (2.5 cm) on all sides of the washer is recommended to reduce noise transfer.
- Most installations require a minimum 4 in. (10 cm) clearance behind the washer.
- Companion appliance spacing should also be considered.

■ Positioning

- **To minimize noise and vibration, the washer MUST be installed on a solidly constructed floor.**
- Carpeting and soft tile surfaces are not recommended.
- Never install the washer on a platform or weakly supported structure.

NOTE A firm, solid floor is even more critical to a front-loading washer than to a top-loader. If your floor is wood and/or frame construction, you may need to reinforce it. Front-loaders use substantially faster spin speeds than top-loaders, causing greater vibration. If the floor is not solid, your washer will vibrate. You will hear and feel the vibration throughout your house.

Installation

■ Electrical connection

- Do not use an extension cord or double adapter.
- If the supply cord is damaged, it must be replaced by a qualified person in order to avoid a hazard.
- If the machine will not be used for an extended time, unplug it and shut off the water supply.
- Connect the machine to a grounded outlet in accordance with current wiring regulations.
- The appliance must be positioned so that the plug is easily accessible.
- Repairs to the washing machine must only be carried out by qualified personnel. Repairs carried out by inexperienced persons may cause injury or serious malfunctioning. Contact your local service center.
- Do not install your washing machine in rooms where temperatures below freezing may occur. Frozen hoses may burst under pressure. The reliability of the electronic control unit may be impaired at temperatures below freezing point.
- If the appliance is delivered in the winter months and temperatures are below freezing : Store the washing machine at room temperature for a few hours before putting it into operation.

■ Washing Machine is to be connected to the water mains using new hoses Old hoses should not be used.

■ Connecting water supply hose

- Water supply pressure must be between 4.5 and 145 PSI (30~1000 kPa)
- Do not crossthread when connecting inlet hose to the valve.
- If the water supply pressure is more than 145 PSI, a pressure reducing device should be installed.
- Two Sealing washers are supplied with the water inlet hoses to prevent water leaks.
- Check for leakage of washing machine connections by turning the tap completely on.
- Periodically check the condition of the hose and replace the hose if necessary.
- Make sure that there is no kink in the hose and that it is not crushed.
- Be sure that the two water input ports are connected to the correct water faucets. The connector for hot water is colored red.

Installation

■ Installation of drain hose

- When installing the drain hose at a sink, secure it so it cannot break away and cause flooding and damage.
- Properly securing the drain hose will protect the floor from damage due to water leakage.

- The drain hose should not be placed higher than 40″ above the floor.
- Properly securing the drain hose will protect the floor from damage due to water leakage.

This equipment is not designed for maritime use or for mobile installations such as in RV's, aircraft, etc.
Turn off the faucet if the machine is to be left for an extended period of time (e.g. holiday).

When disposing of the appliance, cut off the power cable, and destroy the plug.
Disable the door lock to prevent young children being trapped inside.

Packaging material (e.g. Films, Styrofoam) can be dangerous for children. There is a risk of suffocation! Keep all packaging from children.

Installation

■ Level adjustment

1. Adjusting the washing machine level properly prevents excessive noise and vibration.
   Install the appliance on a solid and level floor surface, preferably in a corner of the room.
   NOTE Timber or suspended type flooring may contribute to excessive vibration and unbalance errors.
2. If the floor is uneven, adjust the adjustable feet as required. (do not insert pieces of wood etc. under the feet)
   Make sure that all four feet are stable and resting on the floor and then check that the appliance is perfectly level. (use a spirit level)

※ ***After the washer is level, tighten the lock nuts up towards of the base of the washer. All lock nuts must be tightened.***

※ ***Diagonal Check***
When pushing down the edges of the washing machine top plate diagonally, the machine should not move up and down at all. (Please, check both of two directions)
If machine rocks when pushing the machine top plate diagonally, adjust the feet again.

■ Concrete floors

- The installation surface must be clean, dry and level.
- Install washer on a flat hard floor.

■ Tile floors (Slippery floors)

- Position each foot on the Tread Mat and level the machine to suit (Cut the Tread Mat into 2 $^{3}/_{4}$ inch squares and stick the pieces to the dry tile where machine is to be placed).

※ ***Tread Mat is a self adhesive material used on ladders & steps to prevent slipping.***

■ Wooden floors

- Wooden floors are particularly susceptible to vibration.
- To prevent vibration we recommend you place rubber cups under each foot, at least 15mm thick under the washer, secured to at least 2 floor beams with screws.
- If possible install the washer in one of the corners of the room, where the floor is more stable.

※ ***Insert the rubber cups to reduce vibration.***
※ ***You can obtain the rubber cups (p/no.4620ER4002B) from the LG parts dept.***

Important!

- Proper placement and levelling of the washer ensure long,regular and reliable operation.
- The washer must be absolutely horizontal and stand firmly in position.
- It must not "Seesaw" across corners under load.
- The installation surface must be clean, free from floor wax and other lubricant coatings.
- Do not let the feet of the washer get wet. If the washer feet get wet, slipping may occur.

Product and Cut-out Dimensions
Knob Control Electric Cooktop
KM421

Location Codes
E - 208 / 240 Volt - 30 Amp 3-wire power supply connects rear center bottom.
Notes
• Please specify 208 Volt or 240 Volt unit when ordering. • All installations must be done in accordance with local codes.

NOTE: Drawing is not to scale.
SPECIFICATION SHEETS 010402

DDP 02/06

NEW FOR 2006

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

Quick Installation Guide - DDP3

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

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

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

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

DDP-3 electrical characteristics are:

Operating voltage ... 220 V~ 60 Hz
Total power ... 7600 W
Connect to ... 220 V, 60 Hz, 2 Pole+G, 40 A supply (3 wire #8 AWG)

Cooktop and Cut-out Sizes	Width	Depth	Thickness
Cut-out Size	565 mm [22 1/4"]	500 mm [19 11/16"]	100 mm* [4"]*
Cooktop Box Size	558 mm [22"]	492 mm [19 3/8"]	50 mm [2"]
Cooktop Rim Size	598 mm [23 9/16""]	532 mm [20 15/16"]	6 mm [1/4"]

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

Clearance

You should keep:

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

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

INDUCTION
DIVA
THE ART OF TECHNOLOGY

Power

Make no mistake. The Diva Induction Cooktops are the most powerful cooktops on the market. With an output of 3600 Watts, Prometheus would be jealous. Boil water in half the time of the most powerful gas or electric burner. Cook a Holiday meal in half the time it took last year. In fact, you would need a 25,000 BTU gas burner just to match their power.

Also, the cooking zones can provide full power to each burner or can share the power when two or more burners are engaged. Such unprecedented technology in a cooktop creates a dual benefit: speed and power. Adjust from maximum to just a mere 50 Watts simmer, or bring a simmer back to a roaring boil in seconds, instead of waiting minutes.

Remarkably, all this power creates less energy waste. With an efficiency of over 90%, compared to 50% for gas or even 60% for other electric technologies, induction heats fast using less, therefore, wasting less. The result is inductive, a substantial energy savings of 17-30% over energy consumed by standard cooking technologies. Even when compared to a microwave, nothing can match the speed, power and safety of the Diva Induction Cooktop.

DDP-3 (Available Spring 2006)
24” Induction Cooktop with 3 cooking zones.

Total Cooktop Power:	7.6 kW
Maximum power per zone:	
Left Rear (5 1/2”):	1.2 kW
Left Front (9”):	3.0 kW
Right (9 1/2”):	4.0 kW

One integrated touch control with 9 power levels and 3 presets (medium, high & maximum) and built-in safety features

Installation:

Power:	Electric/7.6 kW
Voltage/Amps:	220V/40A
Phase:	2 Pole

Dimensions:

Overall:	23 9/16” x 20 15/16” x 2 1/4”
Cut-out:	22 1/4” x 19 11/16” x 4”
Weight:	31 Lbs/ 34 Lbs (net/gross)

To ensure maximum power from each coil, the DDP-3 induction cooktop measures the amount of voltage available and compensates for lower voltage by increasing the amperage used (from 208V to 240V).

DDP-5 (Available in black & white glass)
36” Induction Cooktop with 5 cooking zones including 1 Large Central Zone.

Total Cooktop Power:	9.6 kW
Maximum power per zone:	
Front Left (9”):	2.8 kW
Front Right (6”):	2.2 kW
Center Expandable (6”-11”):	3.6 kW
Back Left (6”):	2.2 kW
Back Right (9”):	2.8 kW

5 integrated front touch controls with 12 power levels and 3 presets (medium, high & maximum) with built-in safety features for overflow & overheating

Installation:

Power:	Electric/9.6 kW
Voltage/Amps:	240V/50A
Phase:	2 Pole

Dimensions:

Overall:	36 15/16” x 20 3/8” x 3 5/8”
Cut-out:	35 7/16” x 19 1/2” x 6”
Weight:	60 Lbs/ 65 Lbs (net/gross)

DIVA

DS603I
Single DishDrawer®

Single
Integrated

Consumption Data	
Energy Efficiency Star Rating	**3**
Energy Consumption	**132 kWh per year**
Water Efficiency Star Rating	**2.5**
Water Consumption	**8.8 litres**
Performance Features	
Choice of wash programmes	**9**
Economical eco option	**Yes**
Flow through detergent dispenser	**Yes**
Quiet fan dry	**Yes**
Usability Features	
Accomodates long stemmed wine glasses	**Yes**
Control key lock and child lock option	**Yes**
Easy to use, primary and secondary (concealed) control panels with single touch programming	**Yes**
Energy saving, delay start option - up to 12 hours	**Yes**
Flexible racking system - design it yourself	**Yes**
Holds 6 place settings	**Yes**
Intelligent load sensing for optimum performance	**Yes**
Large, 290mm dinner plate capacity	**12**
Option to fully integrate DishDrawer® to complement your kitchen	**Yes**
Permanent memory of the last cycle used	**Yes**
Rinse aid indicator light	**Yes**
Smart Drive intelligent technology	**Yes**
Three stage flood protection	**Yes**
Warranty	
2 Year Parts and Labour Warranty	**Yes**
Wash Programmes	
Delicate	**Yes**
Delicate Eco	**Yes**
Fast	**Yes**
Fast Eco	**Yes**
Heavy	**Yes**
Heavy Eco	**Yes**
Normal	**Yes**

Normal Eco	**Yes**
Rinse	**Yes**

The product images shown are for presentation purposes only. For exact values, sizes, dimensions and capacities please check product details.

Product Dimension

Overall depth of product (mm)	**570**
Overall height of product (mm)	**409**
Overall width of product (mm)	**595**

Check with your local retailer for pricing, availability and stock of this model. The product dimensions and specifications in this page apply to the specific product and model as of November 2006. Under our policy of continuous improvement, these dimensions and specifications may change at any time. You should therefore check with your retailer or Fisher & Paykel's Customer Care Centre to ensure this page correctly describes the model currently available.

Concept

The art of ventilation

LUXURY

LUXURY STYLING

- integrated stainless steel ventilation panel
- optional stunning glass & stainless light fixture
- artistic design, impeccable fit & finish
- hidden dishwasher-safe grease filters
- Easy Dismounting™ System

HIGH PERFORMANCE TECHNOLOGY

- Comfort-Panel™ perimetric suction system
- 600 cfm internal PRO™ blower model
- 900 cfm remote blower model
- pre-installed Silent Kit™ sound-proofing
- whisper-quiet sone range

STATE OF THE ART CONTROLS

- operated by remote control (included)
- or by push-button electronic controls on panel
- 4 pre-set speeds plus Intensive Power Boost
- 24-hour kitchen anti-pollution mode
- 30 minute delayed shut-down mode
- grease filter saturation indicator

DUCTING OPTIONS

- top or bottom venting (3 1/4 x 10" rectangular)
- direct rear venting (6" round Internal Blower model, 10" round Remote blower model)

Faber has redefined the rangehood with the new CONCEPT, a patented stainless steel ventilation panel that integrates into the wall behind the cooking surface. An optional highly-styled, halogen light fixture of stainless and glass adds to the dramatic look.

Size/Color/Model #	
36 Internal Blower Vent Panel Stainless	630003946
36 Remote Blower Vent Panel Stainless	630003843
Light Fixture Glass & Stainless	620000353
900 cfm Remote Blower	630001732

p.o. box 435 • Wayland, MA 01778 • tel: (508) 358-5353 • fax: (508) 358-5730 • e-mail: info@faberonline.com • www.faberonline.com

Dimensional Diagrams

IMPORTANT NOTE: Internal Blower models and Remote Blower models differ. Please consult the installation instructions for more detailed dimensional diagrams.

Ventilation Panel

Light Fixture (side view)

WARNING! Product specifications are subject to change without notification. Consult the installation instructions before you begin installing this rangehood.

FABER

Concept

Remote Blower

Instruction Manual

READ AND SAVE THESE INSTRUCTIONS

The Installer must leave these instructions with the homeowner. The homeowner must keep these instructions for future reference and for local electrical inspectors' use.

CONTENTS

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USE	13
MAINTENANCE	14

READ THESE INSTRUCTIONS BEFORE YOU START INSTALLING THIS RANGEHOOD

READ AND SAVE THESE INSTRUCTIONS

WARNING: - TO REDUCE THE RISK OF A RANGE TOP GREASE FIRE: Never leave surface units unattended at high settings. Boilovers cause smoking and greasy spillovers that may ignite. Heat oils slowly on low or medium setting. Always turn hood ON when cooking at high heat or when flambeing food (i.e. Crepes Suzette, Cherries Jubilee, Peppercorn Beef Flambè). Clean ventilating fans frequently. Grease should not be allowed to accumulate on fan or filter. Use proper pan size. Always use cookware appropriate for the size of the surface element.

WARNING: - TO REDUCE THE RISK OF INJURY TO PERSONS IN THE EVENT OF A RANGE TOP GREASE FIRE, OBSERVE THE FOLLOWING: SMOTHER FLAMES with a close-fitting lid, cookie sheet, or metal tray, then turn off the burner. BE CAREFUL TO PREVENT BURNS. If the flames do not go out immediately EVACUATE AND CALL THE FIRE DEPARTMENT. NEVER PICK UP A FLAMING PAN - You may be burned. DO NOT USE WATER, including wet dishcloths or towels - a violent steam explosion will result. Use an extinguisher ONLY if: 1. You know you have a Class ABC extinguisher, and you already know how to operate it. 2. The fire is small and contained in the area where it started. 3. The fire department is being called. 4. You can fight the fire with your back to an exit.

CAUTION: To Reduce The Risk Of Fire And Electric Shock, Install This RangeHood Only With Remote Blower Models Rated Maximum. 4,2 A suitable for use with solid stade speed controls.

WARRANTY & SERVICE

This rangehood carries a limited warranty against manufacturer's defects. To obtain warranty service, contact the dealer from whom you purchased the rangehood, or the local Faber distributor. If you cannot identify a local Faber distributor, contact Faber USA at (508) 358-5353 for the name of a distributor in your area.

USE AND CARE INFORMATION

This rangehood system is designed to remove smoke, cooking vapors and odors from the cooktop area. This unit also has several features to insure operator safety.

VENTING REQUIREMENTS

Determine which venting method is best for your application. Ductwork can extend either through the wall or the roof.

The length of the ductwork and the number of elbows should be kept to a minimum to provide efficient performance. The size of the ductwork should be uniform. Do not install two elbows together. Use duct tape to seal all joints in the ductwork system. Use caulking to seal exterior wall or floor opening around the cap. Flexible ductwork is not recommended. If it is used, each foot of flexible ductwork used is equivalent to two feet of straight metal ductwork when calculating the ductrun length. Thus, a flexible elbow equals two standard elbows.

Make sure there is proper clearance within the wall or floor for exhaust duct before making cutouts. Do not cut a joist or stud unless absolutely necessary. If a joist or stud must be cut, then a supporting frame must be constructed. For best results, remote blowers should transition to 10" round duct as soon as possible. If small ducting is used, it should be transitioned to 9 or 10" round as soon as possible.

WARNING - To Reduce The Risk Of Fire, Use Only Metal Ductwork.

⚠ WARNING

- Venting system MUST terminate outside the home.
- DO NOT terminate the ductwork in an attic or other enclosed space.
- DO NOT use 4" laundry-type wall caps.
- Flexible-type ductwork is not recommended.
- DO NOT obstruct the flow of combustion and ventilation air.
- Failure to follow venting requirements may result in a fire.

ELECTRICAL REQUIREMENTS

A 120 volt, 60 Hz AC-only electrical supply is required on a separate 15 amp circuit, fused on both sides of the line. A time-delay fuse or circuit breaker is recommended. The fuse must be sized per local codes in accordance with the electrical rating of this unit as specified on the serial/ rating plate located inside the unit near the field wiring compartment. THIS UNIT MUST BE CONNECTED WITH COPPER

WIRE ONLY. Wire sizes must conform to the requirements of the National Electrical Code, ANSI/NFPA 70 - latest edition, and all local codes and ordinances. Wire size and connections must conform with the rating of the appliance. Copies of the standard listed above may be obtained from:

National Fire Protection Association
Batterymarch Park
Quincy, Massachusetts 02269

This appliance should be connected directly to the fused disconnect (or circuit breaker) through flexible, armored or nonmetallic sheathed copper cable. Allow some slack in the cable so the appliance can be moved if servicing is ever necessary. A UL Listed, 1/2" conduit connector must be provided at each end of the power supply cable (at the appliance and at the junction box).

When making the electrical connection, cut a 1 1/4" hole in the wall. A hole cut through wood must be sanded until smooth. A hole through metal must have a grommet.

SUITABLE FOR USE WITH SOLID STATE SPEED CONTROLS. WARNING - TO REDUCE THE RISK OF FIRE, ELECTRICAL SHOCK, OR INJURY TO PERSONS, OBSERVE THE FOLLOWING: Use this unit only in the manner intended by the manufacturer. If you have any questions, contact the manufacturer.

Before servicing or cleaning unit, switch power off at service panel and lock the service disconnecting means to prevent power from being switched on accidentally. When the service disconnecting means cannot be locked, securely fasten a prominent warning device, such as a tag, to the service panel.

CAUTION: For General Ventilating Use Only. Do Not Use To Exhaust Hazardous or Explosive Materials and Vapors.

WARNING - TO REDUCE THE RISK OF FIRE, ELECTRICAL SHOCK, OR INJURY TO PERSONS, OBSERVE THE FOLLOWING: Installation Work And Electrical Wiring Must Be Done By Qualified Person(s) In Accordance With All Applicable Codes And Standards, Including Fire-Rated Construction.

Sufficient air is needed for proper combustion and exhausting of gases through the flue (chimney) of fuel burning equipment to prevent backdrafting. Follow the heating equipment manufacturer's guideline and safety standards such as those published by the National Fire Protection Association (NFPA), and the American Society for Heating, Refrigeration and Air Conditioning Engineers (ASHRAE), and the local code authorities.

When cutting or drilling into wall or ceiling, do not damage electrical wiring and other hidden utilities.

Ducted fans must always be vented to the outdoors.

⚠ WARNING

- Electrical ground is required on this rangehood.
- If cold water pipe is interrupted by plastic, nonmetallic gaskets or other materials, DO NOT use for grounding.
- DO NOT ground to a gas pipe.
- DO NOT have a fuse in the neutral or grounding circuit. A fuse in the neutral or grounding circuit could result in electrical shock.
- Check with a qualified electrician if you are in doubt as to whether the rangehood is properly grounded.
- Failure to follow electrical requirements may result in a fire.

CHARACTERISTICS

Components

	Q.ty	
1	1	Hood Body, complete with: Blower, Filters, Controls
2	1	Built-in hood body case
3	1	Rear remote motor connection panel
4	1	Top air outlet flange with valve
5	1	Top air outlet plug
10	1	Light
11	4	Support arms
12	2	Bush masking plug
13	2	Arm support bush
A	10	Screws 3,5 x 16
C	4	Screws 5 x 70
D	4	Wall Plugs ø 10
E	2	Screwsfor wall plugs ø 5
F	2	Wall Plugs ø 5
G	4	Grub screws

Dimensions

22-3/4
35-11/32
1-15/32
13/16
1-31/32
21/32
7-11/16
10
20
1-15/32
3-5/32
8-7/32
8-7/32
3-5/32
9-3/32
15-21/32
9-3/32
1-15/32
32-13/32
1-15/32
3-3/16
2-9/16
4.6
9-29/32
13/32
A
33-15/32
ϕ10.2
1-3/8
1-3/8
20-21/32
12-13/32
10-1/4
7.2
Distance from
the Hob
10
7-3/32
A
3-11/32
7/8
5-1/32
SECTION
A-A

Dimensional chart - LIGHT

INSTALLATION

The hood can be installed in the following ways: top air outlet, bottom air outlet, rear air outlet. Once the desired configuration has been chosen (see the diagrams below) it will be necessary to provide an opening in the wall where to house the built-in hood body case. Besides the air ducting pipes, basing on the chosen configuration, the hood has to be electrically connected, and an additional connection raceway between the hood installation area and the lighting area has to be provided.

HOOD INSTALLATION SCHEME

RECESSED HOUSING LOWER BORDER SHALL BE INSTALLED AT THE MINIMUM DISTANCE OF 7-3/32 IN. ABOVE THE COOKING SURFACE.

- Basing on the following scheme prepare the opening H for housing the built-in hood body case. In case of the bottom air outlet configuration consider that the holes for electrical connection have to be made up on the left side (position U).
- Concerning the ductrun consider the figures in the following scheme bearing in mind that the rear hole P serves only for the rear air outlet-configuration.

CALCULATE THE DUCTRUN LENGTH

The ductwork length should not exceed 35 equivalent feet for 3 1/4" X 10" duct, or 55 equivalent feet for 9" or 10" round duct. Calculate the length of the ductwork by adding the equivalent feet listed in FIGURE 1 for each piece of duct in the complete system. An example is given in FIGURE 2. For best results, use no more than three 90° elbows. Make sure that there is a minimum of 24" of straight duct between elbows if more than one is used. Do not install two elbows together. Round duct is recommended instead of rectangular duct especially if elbows are needed. For internal blower models, rectangular duct should be transitioned to 9" round as soon as possible.

45° Elbow	5.0 feet
90° Elbow	7.0 feet
90° Flat Elbow	12.0 feet
Wall Cap	0.0 feet

FIGURE 1

9 Feet Straight Duct	9.0 feet
2 - 90° Elbows	14.0 feet
Wall Cap	0.0 feet
Total System	23.0 feet

FIGURE 2

LIGHTING UNIT INSTALLATION SCHEME

LIGHTING UNIT LOWER BORDER SHALL BE INSTALLED AT THE MINIMUM DISTANCE OF 34 9/16 IN. ABOVE THE COOKING SURFACE.

With the aid of the drilling template provided mark the necessary holes and drill them.

TOP OR BOTTOM AIR OUTLET CONFIGURATION

The hood is manufactured with the air outlet at the top.

- Fit the flange with non-return valve onto the air outlet position of the built-in hood body case.
- In case of the bottom air outlet configuration turn the built-in hood body case 180° before fixing it to the wall.

REAR AIR OUTLET CONFIGURATION

- Remove the suction panel by unfastening the 8 screws around the frame.
- Remove the metal grease filters.

- Remove the metal profile fixed to the flange by unfastening the 5 screws.
- Fit the air outlet plug into the top air outlet.

- Remove the rear air outlet plug .

- Fit the rear air outlet flange in place of the plug

Built-in hood body case installation

FIXING INTO THE BRICK WALL

- With the aid of pliers bend the lateral metal tongues of the built-in case.
- It is necessary to wall the built-in hood body case inside the hollow in the wall paying attention that the external edge of the built-in case adheres perfectly to the wall. It is necessary that the built-in case is precisely levelled both horizontally and vertically, and that the air outlet flange is correctly placed inside the ductrun.

  BEFORE INSTALLING THE HOOD IT WILL BE NECESSARY TO WAIT UNTILL THE BUILT-IN HOOD BODY CASE WALLING PROCESS IS COMPLETELY TERMINATED.

FIXING INTO THE WOODEN WALL

- Insert the built-in hood body case inside the wall paying attention that the built-in case is precisely levelled both horizontally and vertically.
- Fix the built-in case to the wall using the 10 screws **A** (3,5x16) provided.

Hood body installation

- In case of the bottom air outlet configuration the hood body has to be turned 180°.

- Remove the top cover of the terminal box by unfastening the two screws fixing it to the hood casing.
- With the aid of pliers brake through a hole inside the terminal box providing thus for a passage of the electrical connection for the lighting unit.

- Place the hood body inside the built-in case paying attention that the screws of the built-in case fall to the gaps of the hood body.
- Once the screws have reached the gaps it is necessary to fasten them in order to definitively fix the hood body inside the built-in case.

- It is necessary to make sure that the hood body air outlet is correctly in its' position inside the air outlet of the built-in case.

- Provide for passage of the electrical connection wires with the hood body.
- Slide the top cover downwards, unfastening the two side screws and taking care not to scratch the tubular support members.

- Insert the 4 plugs D into the earlier drilled holes.
- Decide the height of the light; loosen the grub screws on the outer columns to allow the light to slide up and down. Take care not to scratch the columns when sliding.
- Fasten the light to the ceiling using 4 screws **C**.

- Fix the two support arm connection bushes to the wall..

- Make electrical connection:
- Connect the red wire in the Light-unit with the red lead in the hood using a twist-on connector; connect the purple wire in the Light-unit with the purple lead in the hood using a twist-on connector.
- Connect the green ground wire to the unused, green ground screw.
- Replace the top cover, fixing it in place with the two side screws.

- Screw the support arms into their housings.
- Hook them to the connection bushes and lock them in position with the grub screws provided.
- Close the bush using the masking plug provided

⚠ WARNING

ELECTRICAL SHOCK HAZARD

- Disconnect power before making electrical connctions.
- Connect ground wire to green ground screw in terminal box.

- Connect the red wire of the Light cable with the red lead in the hood using a twist-on connector; connect the purple wire of the Light cable with the purple lead in the hood using a twist-on connector.
- Connect the blue blower wire with the blue lead in the hood using a twist-on connector; connect the brown blower wire with the brown lead in the hood using a twist-on connector.
- Connect the ligth unit to the ground using one of the following two alternative ways:
  - a- Connect the domestic green ground wire under the unused green ground screw belonging to the light unit wiring box using a listed conduit connector.
  - b- Connect one end of the green ground wire (max lenght 10 yards using 14 awg wire) under the unused green ground screw belonging to the light unit wiring box and the other end under the unused green ground screw belonging to the range hood wiring box.
- Connect the green ground wire (from exterior blower and from power supply cable) under the unused green ground screw.
- Tighten strain relief screws.
- Connect the white wire of the power supply conduit with the white lead in the hood using a twist-on connector; connect the black wire of the power supply conduit with the black lead in the hood using a twist-on connector.

- Place the suction panel so that the connection flat wiring for the hood controls passes through the specific opening in the hood body.
- Fix the suction panel to the hood body fastening the screws removed earlier.
- Open the suction cover using the lever provided.
- Connect the flat connection wiring coming from the hood controls with the connector piece placed close to the terminal box. Only in case of the bottom air outlet configuration remove the protection cover from the connector piece on the opposite side of the terminal box.
- Fix the terminal box cover again and fasten the 2 screws removed earlier.
- Replace the metal grease filters in their housings.
- Close the suction panel.

USE

Control Panel

The hood can be switched on pushing directly onto the requested speed without firstly having to select 0/1 button.

		LED	FUNCTIONS
L	0/1 Light		Turns lighting on and off.
T1	0/1 Motor	Fixed	First speed. When pressed for about 2 seconds the motor is switched off.
T2	Speed	Fixed	Second speed.
T3	Speed	on	Third speed.
T4	Speed	Fixed	Max. speed
		Flashing	Intensive speed. Suitable for the strongest cooking vapours and odours. The function becomes active when the button is pushed for about 2 seconds. After 10 minutes of functioning it turns off automatically. This function can be interrupted by means of pressing any of the buttons.
S1	Led	Fixed	Indicates that the Metal grease filters saturation alarm has been triggered, and the filters need to be washed. The alarm is triggered after 100 working hours. *(Reset; check the Maintenance-paragraph)*
		Flashing	indicates that the activated charcoal odour filter saturation alarm has been triggered, and the filter has to be replaced; the metal grease filters must also be washed. The activated charcoal odour filter is triggered after 200 working hours. *(Activation and Reset; check the Maintenance-paragraph)*

MAINTENANCE

Grease filters

CLEANING METAL GREASE FILTERS

•Alarm signal reset
- Switch off the lights and extractor motor.
- Press button **T3** for at least 3 seconds, until the leds start to flash.

Cleaning the filters
- Open the suction cover using the lever provided.
- The filters are washable and must be cleaned when the Led **S1** lights up or at least every 2 months of operation, or more frequently for particularly heavy usage.
- Remove the filters one at a time by pushing them towards the back of the group and pulling down at the same time.
- Wash the filters, taking care not to bend them. Allow them to dry before refitting.
- When refitting the filters, make sure that the handle is visible on the outside.
- Close the suction panel.

Lighting

LIGHT REPLACEMENT

20 W halogen light.

- Extract the lamp from the Support.
- Replace with another of the same type, making sure that the two pins are properly inserted in the lamp holder socket holes.

Electric Diagram

30" BUILT-IN BOTTOM MOUNT REFRIGERATOR / FREEZER | C 1650 / C 1651 / C 1601

Premium NoFrost

The Liebherr 30” built-in refrigerator- freezer with stainless steel door and transferable door hinges can be easily integrated into any kitchen layout. With the satin finish Glass - Line shelves and door racks, opening a combined refrigerator freezer is an experience in itself. High quality stainless steel trims enhance the harmonious interior of the refrigerator. The extra deep transparent drawers are an especially attractive design feature. They are removable so they give you a clear view of the contents and offer extra convenient storage.

LIEBHERR

A delight in freshness

Unit Dimensions

Cabinet Opening Dimensions

Electrical Requirements

A 115 Volt, 60HZ, 15 Amp (20 Amp for side-by-side) fused electrical supply is required. We recommend using a dedicated circuit to prevent electrical overload.

Unit Venting

1. The following ventilation dimensions must be observed:

There must be a ventilation space at least 31 in.² (200 cm²) at the airflow inlet (1) and at the airflow outlet (2). The 30" and 60" models are equipped with a rolling base, which is already providing you with the bottom airflow inlet requirements.

The top ventilation space can be directed in one of the following ways:

A) Directly over the appliance (2) with either an optional factory air vent or custom made one using the template supplied with the unit.

B) Above the cabinet and below the ceiling (3).

C) Through a vent installed in a soffit (4).

The refrigerator is designed to allow proper air flow when the appliance is installed up against the wall.
A minimum space of 1 1/2" is required when a cabinet is built above.

Apple Product Environmental Specification

Product: Apple Cinema Display, 30" Flat Panel **Date: 10/14/04**

Model Number: M9179 (Agency Number A1083)

This list of environmental attributes can be used as a guide to determine product compliance with various regional, country, and industry sector product environmental criteria. The environmental criteria listed is based on programs such as ECMA, IT ECO (formerly SITO), Blue Angel, ENERGY STAR®, and TCO.

Each criteria listed includes a reference to the section of the Eco-label specification where it is described.
Note: Not all environmental criteria apply to all products.

This environmental specification is provided for informational purposes only. Nothing contained within shall be construed as a warranty, expressed or implied, with respect to the product.

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1.0 Environmental policy & environmental management **2**

An environmental policy and environmental management system (EMS) demonstrates the commitment, purpose, objective and mission of a company. Apple has established an internal EMS, and has certified its facilities in Sacramento, CA, Ireland, and Singapore to ISO 14001.

2.0 Environmentally conscious design **2**

Environmentally conscious design is the systematic approach of identifying and incorporating product features and functions with respect to environmental, health and safety objectives throughout all stages of a product's life. Apple has established a process where we address these issues in the design, development, manufacture, use, and end-of-life of our products.

3.0 Banned/restricted materials **3**

Some materials that have traditionally been used in electronic products have been determined to be environmental or health hazards. The use of these materials has been banned or restricted by legislation or ecolabels.

4.0 Batteries **4**

Apple uses rechargeable batteries to provide power for notebooks, develops power management software and energy saving features to obtain maximum efficiency, and avoids batteries that contain lead, cadmium and/or mercury.

5.0 Energy consumption **4**

The use of energy-efficient products results in savings in energy costs and the reduction of pollution resulting from the generation of electricity. Apple promotes energy conservation in its product design and performance including our participation in the ENERGY STAR® program and no-load power consumption programs such as the EU Code of Conduct for external power supplies, and the U.S. Federal Energy Management Program. The energy data listed reflects standard configurations only. Other configurations may yield different energy values.

6.0 Emissions **4**

Apple products are tested and certified to international standards to assure the safe use of our products.

7.0 Electrical Safety, EMC, and connection to telephone network **5**

The safe use of Apple products is of foremost concern. Therefore, Apple tests and certifies our products to international standards to assure their safe use.

8.0 Ergonomics **5**

Visual ergonomics is an important concern to computer users. It affects user comfort and performance. Apple designs, tests and certifies our displays to meet stringent visual ergonomics (front of screen) criteria. In addition, our displays have the capability of tilting and swiveling to adjust to user needs.

9.0 Packaging and documentation **5**

Apple evaluates the environmental attributes of our packaging for hazardous materials as well as the minimization of the quantity and weight of the packaging materials. These considerations enable and promote recycling of packaging materials for our customers.

10.0 Recycling **5**

Apple designs its products with specific features and functions that promote the ease of recyclables. In addition, in specific countries, Apple has established takeback/recycling programs to assist customers.

11.0 Additional Attributes **5**

12.0 Additional Information/Notes **6**

	APES (Apple's Product Environmental Specifications)	Requirement met			IT ECO	Blue Angel	TCO '03	ECMA
		Yes	No	Not rel.	('02)	Desktop CPUs	Desktop Display	(6/99)
1	**Environmental policy & environmental management**							
1.1	The manufacturer has a documented environmental policy approved by the management	X			C3.1			5.1
1.2	The manufacturer has an environmental management system according to: ISO 14001 ___, EMAS ___ or internal system _X_	X			C3.2			5.1
1.3	The manufacturer regularly publishes an environmental report	X			C3.3		A.6.1	
1.4	The ISO/EMAS certification authority shall be accredited in accordance with ISO/IEC Guide 66, and shall meet the provisions of ISO/IEC Guide 61	X					A.6.1	
1.5	TCO-prepared Document to accompany product	X					A.1.1	
1.6	A document specifying how the TCO Document shall accompany the product, signed by the responsible person on behalf of the applicant company shall be submitted	X					A.1.1	
2.0	**Environmentally conscious design**							
2.1	Large mechanical plastic parts consist of one material or of materials that are easy to separate	X			P6.3			5.9
2.2	All plastic components that weigh >100g shall be made from no more than 2 types of plastic materials, regardless of their location in the product.	X			P6.3		A.6.3.3	
2.3	The variety of materials forming components of comparable functions are limited to one material	X				B.1		
2.4	The proportional use of recyclate is permitted		X			B.5		
2.5	All mechanical plastic parts, heavier than _X_25 g / __50 g have material codes according to ISO 11469 (version 1996)) or All mechanical plastic parts, heavier than _X_25 g / __50 g have material codes according to ISO 11469 (version 2000; addition of ISO 1043, parts 1-4 Plastics-Symbols and abbreviated terms)	X			P6.4, 6.5, 6.15	3.1.3	A.6.3.1	5.9
2.6	The coating of plastic components is limited to a minimum	X				B.3		
2.7	No internal or external metallization or molded-in or glued metal parts in the plastic housing shall be used	X					A.6.3.4	
2.8	Plastic parts are free from metal inlays that cannot be removed by one person alone with a standard tool	X			P6.6			
2.9	Labels should be inherent and separable for recycling	X			P6.7			
2.10	Components made of incompatible materials can be removed separately or via separation aids	X				A.1		
2.11	Connections to be separated during disassembly are easily traceable	X				A.3		
2.12	Connections to be separated during the disassembly of Flat Panel Display must be easy to take apart in order to not damage the mercury lamps. This means that gluing and welding must not be used to bond parts and make removal of the lamps complicated.	X					A.6.3.2	
2.13	The product is designed for easy dismantling during recycling. Gluing/welding of different materials has been avoided	X			P6.1	3.1.1		
2.14	Disassembly can be done exclusively with all-purpose tools	X				A.4		
2.15	Disassembly can be done by a single person	X				A.9		
2.16	All screwed connections between modules can be separated with no more than three tools	X				A.7		
2.17	Large-size plastic case parts are so designed as to ensure the reutilization of the plastics on the basis of existing technologies for the production of high-quality and long-lived plastic products	X				3.1		
2.18	Materials and material compounds can be recycled on an industrial scale (technologically and economically useful)	X				B.4		
2.19	Future recycling and material utilization processes are taken into account	X				3.1		
2.20	Electronic modules containing harmful substances are easily traceable and removable for recycling	X				A.2		
2.21	The case parts are free from electronic modules	X				A.11		
2.22	The product has a modular design and no special tools are needed to upgrade the product	X			P6.8	4.4, C.1		
2.23	Processor, memory and cards of various types can be changed/upgraded	X			P6.9	4.4, C.2		5.2

APES (Apple's Product Environmental Specifications)		Requirement met			IT ECO	Blue Angel	TCO '03	ECMA
		Yes	No	Not rel.	('02)	Desktop CPUs	Desktop Display	(6/99)
2.24	Information on the ability to change/upgrade components is included in the product documentation	X				4.5		5.2
2.25	Design allows for installation, expansion exchange, upgrade, or attachment of a mass storage unit				P6.10	4.4, C.3		5.2
3.0	**Banned/restricted materials**							
3.1	CFCs and HCFCs are not present in the product	X			P1.1			
3.2	No substances included in annex A, B or C of the Montreal Protocol on Substances that Deplete the Ozone Layer are used in the manufacture of the printed wiring boards, assembly of the Printed Wiring Boards and final assembly of the product	X						5.8
3.3	Asbestos, PCB and PCT are not present in the product.	X						5.8
3.4	Mercury is not present in the product (with the exception of mercury in flat panel backlighting)	X			P1.2			5.8
3.5	Connections to be separated during disassembly of FPD must be easy to take apart in order to not damage the mercury lamps. This means that gluing and welding must not be used to bond parts and make removal of the lamps complicated.	X					A.6.3.2	
3.6	Mercury (Hg) in flat panel display backlight bulb(s): __1.8_ mg (minimum) __3.0_ mg (average) __3.5_ mg (maximum) __16_ number of backlight bulbs	« Values			P6.17		A.6.3.2	
3.7	Brominated and chlorinated flame retardants, PBB and PBDEs are not present in mechanical plastic parts heavier than X 25 g / ___ 50 g	X			P6.12			5.8
3.8	No PCB (polychlorinated biphenyls) or PCT (polychlorinated terphenyls) are present in product	X						5.8
3.9	The base material of Printed Wiring Board must not contain any PBB (polybrominated biphenyls), PBDE (polybrominated diphenyl ethers) or chlorinated paraffins	X				3.1.2.2		
3.10	Plastic components weighing more than 25 grams shall not contain flame retardants that contain organically bound chlorine or bromine. The flame retardant threshold value is 0.5 weight percent.	X					A.6.2.3	
3.11	A list of all plastic components in the product that weigh >25 grams shall be given. The list shall include information regarding use of flame retardants. CAS# and FR type must be provided for flame retardant concentrations over 0.5 weight percent. Part of the information can, for secrecy reasons, be sent directly from the plastic manufacturer to TCO certified lab.	X					A.6.2.4	
3.12	Plastic parts that weight more than 25 grams in the VDU shall not contain chlorine or bromine as a part of the polymer; i.e. polyvinyl chloride (PVC)	X					A.6.2.5	
3.13	No antimony trioxide (Sb_2O_3) flame retardants are used in plastic enclosure resins	X						
3.14	No cadmium (Cd) or cadmium compounds & lead (Pb) or lead compounds are intentionally added to cable enclosures	X						5.8
3.15	Cadmium (Cd) and lead (Pb) are not present in mechanical plastic parts heavier than __X_25 g / __50g	X						5.8
3.16	Cadmium is not present in the CRT (Cathode Ray Tube)			X				5.8
3.17	No mercury (Hg) or cadmium (Cd) in electronic components	X					A.6.2.1	5.8
3.18	Paint, lacquer, plastic parts, connectors, batteries, and solder in the VDU shall not contain cadmium (Cd) or mercury (Hg). The threshold value per listed part is 2 ppm for mercury and 5 ppm for cadmium.	X					A.6.2.1	
3.19	Batteries, paint, lacquer, external cables, plastic materials and external adaptors belonging to the VDU shall not contain lead (Pb). The threshold value is 50 ppm per weight per listed part	X					A.6.2.2	
3.20	Paints and inks used in the product are free from cadmium (Cd) and lead (Pb)	X			P1.4			5.8
3.21	Chloroparaffins with chain length 10-13 C atoms, chlorinated greater than 50% are not present in mechanical plastic parts heavier than X_25g / __50g	X						5.8

	APES (Apple's Product Environmental Specifications)	Requirement met			IT ECO	Blue Angel	TCO '03	ECMA
		Yes	No	Not rel.	('02)	Desktop CPUs	Desktop Display	(6/99)
4	**Batteries**							
4.1	Batteries, defined as hazardous in the EU Directive 91/157/EEC and amendments 98/101/EC, are not used in the product	X				3.1.4		5.10
4.2	Battery handling information is given in the product documentation			X		3.1.4		5.10
4.3	Batteries may not contain mercury (Hg) or cadmium (Cd)			X	P2.2	3.1.4	A.6.2.1	5.8
4.4	The battery chemical composition: Logic board/memory/clock battery _____ Power battery _____	N/A		X				5.10
5	**Energy consumption**							
5.1	Power supply maximum continuous power rating 150 W at 115V/60Hz, and 175 CD/m^2 Standby: 84.4 W Sleep mode: 0.8 W Off: 0.7 W at 230V/50Hz, and 175 Cd/m^2 Standby: 79.3 W Sleep mode: 0.9 W Off: 0.7 W at 100V/50Hz & 60HZ Sleep mode: ____W	« Values « Values « Values N/A		X	P8.1	4.1.1.6	A.7.1	5.3
5.2	External power supply (AC adaptor) no-load power consumption at 115v/60Hz 0.4 watts at 230v/50Hz 0.5 watts	« Values						
5.3	Product meets the requirements of ENERGY STAR®	X			P8.4	4.1.1.1		5.3
5.4	External power supply/AC Adaptor meets EU CoC (Code of Conduct) criteria	X						
5.5	Product meets US FEMP (Federal Energy Management Program) criteria	X						
5.6	Information about the energy save function is given in the user manual	X			P8.3			5.3
5.7	There shall be a description, from the user's point of view, how the VDU is brought into energy mode(s) and how this is indicated on the VDU.	X					A.7.1	
5.8	The sleep mode is activated automatically	X			P8.1	4.1.1.2		
5.9	The appliance may be separated from the mains for at least 4 weeks without damage to the appliance	X				4.1.1.4		
5.10	The computer must be so equipped as to support an operating system allowing the implementation of power-saving functions. Unit must offer at least one power-saving rest mode as a special operating mode. This mode must activate itself automatically after a factory pre-set activation time	X				4.1.1.2		
5.11	First step sleep must be ≤15W, readable screen within 3 sec (5 sec for AIO). If Sleep ≤5W in second step or in first step then no wakeup time requirement applies.	X					A.7.1	
6	**Emissions**							
6.1	Alternating Electric Field: Band I: 5 Hz - 2 kHz, ≤ 10 V/m, measured 30 cm & 50 cm in front of VDU; Band II: 2 - 400 kHz, ≤ 1 V/m, measured 50 cm around VDU and 30 cm in front of VDU	X					A.4.2	
6.2	Alternating Magnetic Fields: Band I: 5 Hz - 2 kHz, ≤ 200 nT, measured 30 cm in front of VDU and at 50 cm around VDU; Band II: 2 - 400 kHz, ≤ 25 nT measured 50 cm around VDU	X					A.4.3	

APES (Apple's Product Environmental Specifications)		Requirement met			IT ECO	Blue Angel	TCO '03	ECMA
		Yes	No	Not rel.	('02)	Desktop CPUs	Desktop Display	(6/99)
7	**Electrical safety, EMC and connection to the telephone network**							
7.1	The product is CE-marked. A CE certificate of conformity is available	X			P3.4			5.4
7.2	The product meets applicable EMC Directive (electromagnetic compatibility)	X			P3.2			
7.3	The product is to be connected to the PTT network and meets the EU telecommunications Directive	X			P3.3			
7.4	Product meets the Low Voltage Directive (LVD) regarding electrical safety (73/23/EEC &93/68/EEC	X			P3.1			
7.5	The VDU shall be certified according to EN 60950 / IEC 60950 for electrical safety of information technology equipment including business equipment	X					A.5.1	
8	**Ergonomics**							
8.1	The LCD meets the ergonomic requirements of ISO 13406-2 for flat panel displays	X			12.1			
8.2	The LCD panel meets the ergonomic requirements of TCO'03	X					A.2,A.3	
9	**Packaging and documentation**							
9.1	The product package material does not contain heavy metals	X			P5.1			
9.2	The product package material does not contain CFC/HCFC.	X			P13.1			5.8
9.3	Product packaging:				P13.2			5.11
	Material type: corrugated cardboard Weight: 2.9 kg	« Value						
	Material type: EPS foam Weight: 1.8 kg	« Value						
	Material type: Urethane foam Weight: 0.02 kg	« Value						
	Material type: HDPE/LDPE laminated bag Weight: 0.027 kg	« Value						
9.4	Plastic packaging material is marked according to: DIN 6120 _____ ISO 11469 / ISO 1043 _____ SPI _X_	X			13.3	3.1.8		5.11
9.5	The company participates in/ has its own system for collection and recycling of packaging material. (Refer to section 13)	X			C1.1			5.11
9.6	Product plastic packaging is free from polyvinyl chloride (PVC)	X			P13.5			
9.7	Packaging is in conformance with national guidelines, regulations and/or standards such as those implementing the EU Directive 94/62/EEC and/or the Ordinance on Packaging, as amended	X						5.11
10	**Recycling**							
10.1	The company has a system for reuse/ recycling of the product and/or consumables. (see item 13)	X			C2.1	3.1.7		5.12
10.2	The TCO'03 certificate holder (or his representative, associated company or affiliate) shall inform its customers of the possibility to dispose of the VDU by environmentally acceptable recycling. The information shall be made available to customers in the geographical markets in the following way: (1) For VDUs sold within EU: Customers in at least three countries where the VDU is sold. (2) For VDUs sold in Asia: For customers in at least one Asian country. (3) For VDUs sold in America (North and South): For customers in at least one country or one state in the USA.	X					A.6.3.5	
10.3	Information about the system for reuse/recycling can be found in the user manual or specified elsewhere. (see item 13)	X			C4.1	3.1.7		5.12
11	**Additional Attributes**							
11.1	The supply of spare parts for a repair of the product is guaranteed for at least 5 years from the termination of the production	X			P6.11	3.1.6		5.2
11.2	Information on modularity of design, expansion capacity and guarantee are included in product documentation	X				3.1.7		5.2

APES (Apple's Product Environmental Specifications)		Requirement met			IT ECO	Blue Angel	TCO '03	ECMA
		Yes	No	Not rel.	('02)	Desktop CPUs	Desktop Display	(6/99)
12	**Additional Information/Notes**							
12.1	Product recycling/takeback systems are local and regionalized. They may not exist, in the same manner, in all municipalities/countries. See: www.apple.com/environment/summary.html							
12.2	Apple has established regional systems for packaging takeback/recycling in those countries with packaging legislation.							

CAS	Chemical Abstract Service
CFC	chlorofluorocarbon
CRT	cathode ray tube
EMAS	EU Eco Management and Audit Scheme
EMC	electromagnetic compatibility
EPS	expanded polystyrene
FPD	flat panel display
HCFC	hydro chlorofluorocarbon
ISO	International Organization of Standardization
IT ECO	Association of the Swedish IT and Telecom Industry (formerly SITO)
LCD	liquid crystal display
LDPE	low density polyethylene
MSDS	material safety data sheet
PBB	polybrominated biphenyl
PBDE	polybrominated diphenyl ether
PCB	polychlorinated biphenyl
PCT	polychlorinated terphenyl
PVC	polyvinyl chloride
PWB	printed wiring board
SPI	Society of Plastics Industry
TBBA	tetrabrominated bisphenol A
VDU	visual display unit

Apple Product Environmental Specification

Product: 15.4-inch MacBook Pro **Date:** 2/14/07
Model Numbers: MA609, MA610

This list of environmental attributes can be used as a guide to determine product compliance with various regional, country, and industry sector product environmental criteria. The environmental criteria listed is based on programs such as ECMA, IT ECO (formerly SITO), Blue Angel, ENERGY STAR®, and TCO.

Each criteria listed includes a reference to the section of the Eco-label specification where it is described.
Note: Not all environmental criteria apply to all products.

This environmental specification is provided for informational purposes only. Nothing contained within shall be construed as a warranty, expressed or implied, with respect to the product.

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		Page
1.0	***Environmental policy & environmental management***	2
	An environmental policy and environmental management system (EMS) demonstrates the commitment, purpose, objective and mission of a company. Apple has established an internal EMS, and has certified its facilities in Sacramento, CA, Ireland, and Singapore to ISO 14001.	
2.0	***Environmentally conscious design***	2
	Environmentally conscious design is the systematic approach of identifying and incorporating product features and functions with respect to environmental, health and safety objectives throughout all stages of a product's life. Apple has established a process where we address these issues in the design, development, manufacture, use, and end-of-life of our products.	
3.0	***Banned/restricted materials***	3
	Some materials that have traditionally been used in electronic products have been determined to be environmental or health hazards. The use of these materials has been banned or restricted by legislation or eco-labels.	
4.0	***Batteries***	3
	Apple uses rechargeable batteries to provide power for notebooks, develops power management software and energy saving features to obtain maximum efficiency, and avoids batteries that contain lead, cadmium and/or mercury.	
5.0	***Energy consumption***	4
	The use of energy-efficient products results in savings in energy costs and the reduction of pollution resulting from the generation of electricity. Apple promotes energy conservation in its product design and performance including our participation in the ENERGY STAR® program and no-load power consumption programs such as the EU Code of Conduct for external power supplies, and the U.S. Federal Energy Management Program. The energy data listed reflects standard configurations only. Other configurations may yield different energy values.	
6.0	***Emissions***	4
	Apple products are tested and certified to international standards to assure the safe use of our products.	
7.0	***Electrical Safety, EMC, and connection to telephone network***	4
	The safe use of Apple products is of foremost concern. Therefore, Apple tests and certifies our products to international standards to assure their safe use.	
8.0	***Noise characteristics***	4
	Acoustical noise is becoming an increasingly important concern to computer users. It affects user comfort and performance, and it may become disruptive and annoying to the user or others in the work environment. For these reasons, Apple is concerned and designs our products to generate acoustical noise levels as low as possible.	
9.0	***Ergonomics***	5
	Visual ergonomics is an important concern to computer users. It affects user comfort and performance. Apple designs, tests and certifies our displays to meet stringent visual ergonomics (front of screen) criteria. In addition, our displays have the capability of tilting and swiveling to adjust to user needs.	
10.0	***Packaging and documentation***	5
	Apple evaluates the environmental attributes of our packaging for hazardous materials as well as the minimization of the quantity and weight of the packaging materials. These considerations enable and promote recycling of packaging materials for our customers.	
11.0	***Recycling***	5
	Apple designs its products with specific features and functions that promote the ease of recyclables. In addition, in specific countries, Apple has established takeback/recycling programs to assist customers.	
12.0	***Additional Attributes***	5
13.0	***Additional Information/Notes***	5

Apple Product Environmental Specification		Requirement met			IT ECO	Blue Angel	TCO '99	ECMA
		Yes	No	N/A	('02)	Desktop CPUs	Desktop Display	(6/99)
1	**Environmental policy & environmental management**							
1.1	The manufacturer has a documented environmental policy approved by the management	X			C3.1		1.1.1	5.1
1.2	The manufacturer has an environmental management system according to: ISO 14001 _X_, EMAS ___ or internal system ___	X			C3.2		1.1.3	5.1
1.3	The manufacturer regularly publishes an environmental report		X		C3.3			
1.4	The manufacturer and the manufacturer's representative market its products in accordance with environmental rules in applicable marketing legislation	X					1.1.4	
2	**Environmentally conscious design**							
2.1	Large mechanical plastic parts consist of one material or of materials that are easy to separate	X			P6.3			5.9
2.2	All plastic components that weigh >100g shall be made from no more than 2 types of plastics	X			P6.3		1.4.2	
2.3	The variety of materials forming components of comparable functions are limited to one material	X				B.1		
2.4	The proportional use of recyclate is permitted		X			B.5		
2.5	Mechanical plastic parts, heavier than 25 g are marked with plastic identification code according to ISO 11469 and ISO 1043, parts 1-4 Plastics - Symbols and abbreviated terms	X			P6.4, 6.5, P6.15	3.1.3	1.4.1	5.9
2.6	The coating of plastic components is limited to a minimum	X				B.3		
2.7	Paints, lacquers or varnishes do not increase the weight of any plastic component weighing >25 g by more than 1%. In-mold decoration is not allowed in any plastic components weighing >25 g. Metallic paint (particles > 10 microns) is not allowed	X					1.4.3	
2.8	No internal or external metallization or molded in metal parts or glued parts in plastic housing for CRT or LCD			X			1.4.4(a)	
2.9	Plastic parts are free from metal inlays that cannot be removed by one person alone with a standard tool	X			P6.6			
2.10	Labels should be inherent and separable for recycling	X			P6.7			
2.11	Components made of incompatible materials can be removed separately or via separation aids	X				A.1		
2.12	Connections to be separated during disassembly are easily traceable	X				A.3		
2.13	The product is designed for easy dismantling during recycling; gluing/welding of different materials has been avoided	X			P6.1	3.1.1		
2.14	Disassembly can be done exclusively with all-purpose tools	X				A.4		
2.15	Disassembly can be done by a single person	X				A.9		
2.16	All screwed connections between modules can be separated with no more than three tools	X				A.7		
2.17	Large-size plastic case parts are so designed as to ensure the reutilization of the plastics on the basis of existing technologies for the production of high-quality and long-lived plastic products	X				3.1		
2.18	Materials and material compounds can be recycled on an industrial scale (technologically and economically useful)	X				B.4		
2.19	Future recycling and material utilization processes are taken into account	X				3.1		
2.20	Electronic modules containing harmful substances are easily traceable and removable for recycling	X				A.2		
2.21	The case parts are free from electronic modules	X				A.11		
2.22	The product has a modular design and no special tools are needed to upgrade the product	X			P6.8	4.4, C.1		
2.23	Processor, memory and cards of various types can be changed/upgraded	X			P6.9	4.4, C.2		5.2
2.24	Information on the ability to change/upgrade components is included in the product documentation	X				4.5		5.2
2.25	Design allows for installation, expansion exchange, upgrade, or attachment of a mass storage unit	X			P6.10	4.4, C.3		5.2

Apple Product Environmental Specification		Requirement met			IT ECO	Blue Angel	TCO '99	ECMA
		Yes	No	N/A	('02)	Desktop CPUs	Desktop Display	(6/99)
3	**Banned/restricted materials**							
3.1	Compliant with EU Directive 2002/95/EC on the restriction of the use of certain hazardous substances in electrical and electronic equipment (RoHS) Exempted applications to Directive 2002/95/EC in use: • Lead in electronic ceramic parts • Lead in glass of cathode ray tubes, electronic components and fluorescent tubes • Lead as an alloying element in steel containing up to 0.35% lead by weight, aluminum containing up to 0.4% lead by weight, and copper containing up to 4% lead by weight • Mercury in backlight display fluorescent lamps	X						
3.2	No CFCs or HCFCs present in the product	X			P1.1			
3.3	No substances included in annex A, B or C of the Montreal Protocol on Substances that Deplete the Ozone Layer are used in the manufacture of the printed wiring boards, assembly of the PWBs and final assembly of the product	X					1.2.1	5.8
3.4	No asbestos, PCB (polychlorinated biphenyls) or PCT (polychlorinated terphenyls) present in the product	X						5.8
3.5	No mercury present in the product (exception: mercury in flat panel display lamps for backlighting)	X			P1.2			5.8
3.6	Mercury (Hg) content in flat panel display backlight lamp(s): Number of backlight bulbs in display: 1 Average mercury per lamp: 3.0 mg Maximum mercury per lamp: 3.5 mg Maximum total mercury in flat panel display: 3.5 mg	← See Values			P6.17		1.3.2	
3.7	No brominated or chlorinated flame retardants, PBB or PBDEs present in mechanical plastic parts heavier than 25 g	X			P6.12		1.3.5(a)	5.8
3.8	The base material of PWB must not contain any PBB (polybrominated biphenyls), PBDE (polybrominated diphenyl ethers) or chlorinated paraffins	X				3.1.2.2		
3.9	Plastic components that weigh >25 g shall not contain flame retardants that contain organically bound chlorine or bromine. PVC is inherently flame retardant with organically bound chlorine and, therefore, not allowed (exception: PVC cables)	X					1.3.5	
3.10	No Antimony Trioxide (Sb_2O_3) flame retardants in plastic enclosures	X						
3.11	No polyvinyl chloride (PVC) is used in plastic resins (exception: cable enclosures)	X					1.4.2	
3.12	No cadmium (Cd), cadmium compounds, lead (Pb), or lead compounds are intentionally added to cable enclosures	X						5.8
3.13	No cadmium (Cd) or lead (Pb) present in mechanical plastic parts heavier than 25 g	X						5.8
3.14	No cadmium (Cd) in the CRT (Cathode Ray Tube)			X			1.3.1	5.8
3.15	No mercury (Hg) or cadmium (Cd) in electronic components	X					1.3.4	5.8
3.16	No cadmium (Cd) or lead (Pb) in paints and inks used in the product	X			P1.4			5.8
3.17	No chloroparaffins with chain length 10-13 carbon atoms and chlorinated greater than 50% are present in mechanical plastic parts heavier than 25 g	X						5.8
4	**Batteries**							
4.1	Batteries defined as hazardous in the EU Directive 91/157/EEC and amendments 98/101/EC are not used in the product	X				3.1.4		5.10
4.2	Battery handling information is provided in the product documentation	X				3.1.4		5.10
4.3	No mercury (Hg) or cadmium (Cd) in batteries	X			P2.2	3.1.4	1.3.3(a)	5.8
4.4	Remote battery chemical composition: Lithium manganese dioxide	← See Values						
	Backup battery chemical composition: Lithium manganese dioxide							
	Power battery chemical composition: Lithium-ion polymer							

Apple Product Environmental Specification		Requirement met			IT ECO	Blue Angel	TCO '99	ECMA
		Yes	No	N/A	('02)	Desktop CPUs	Desktop Display	(6/99)
5	**Energy consumption**							
5.1	Power supply maximum continuous power rating 85 W Maximum Power Use Input Power Source / On (idle) / Sleep / Off 100V, 50 and 60 Hz / <22 W / <2.9 W / <1.4 W 115V, 60 Hz / <22 W / <2.9 W / <1.4 W 230V, 50 Hz / <22 W / <2.6 W / <1.4 W	← See Values			P8.1	4.1.1.6	4.5	5.3
5.2	External power supply (AC adaptor) no-load power consumption Input Power Source / Maximum No-Load Power / Average Power Efficiency 115V, 60 Hz / <0.4 W / 85% 230V, 50 Hz / <0.5 W / 85%	← See Values						
5.3	Product meets ENERGY STAR® criteria	X			P8.4	4.1.1.1	4.5	5.3
5.4	External power supply meets ENERGY STAR® criteria	X						
5.5	External power supply/AC Adaptor meets European Code of Conduct (2003) criteria	X						
5.6	Product meets US FEMP (Federal Energy Management Program) criteria	X						
5.7	Information about the energy save function is given in the user manual	X			P8.3			5.3
5.8	Sleep mode is activated automatically	X			P8.1	4.1.1.2		
5.9	Product shall not be damaged if separated from power source for at least 4 weeks	X				4.1.1.4		
5.10	The computer supports an operating system allowing the implementation of power-saving functions. Unit must offer at least one power-saving rest mode which activates automatically after a factory pre-set interval	X				4.1.1.2		
6	**Emissions**							
6.1	External alternating magnetic fields: ≤ 0.10 mm at a field of 200 nT RMS with a frequency of 80 Hz (Products with CRTs Only)			X			3.1	
6.2	X-Ray Radiation: ≤ 5000 nGy/h (Products with CRTs Only)			X			4.1	
6.3	Electrostatic Potential: surface potential within ±0.5 kV (Products with CRTs Only)			X			4.2	
6.4	Alternating Electric Field: Band I: 5 Hz to 2 kHz, < 10 V/m, measured 30 cm & 50 cm in front of display; Band II: 2 kHz to 400 kHz, < 1 V/m, measured at 50 cm around display & at 30 cm in front (Products with CRTs and Flat Panels)			X			4.3	
6.5	Alternating Magnetic Fields: Band I: 5 Hz to 2 kHz, ≤ 200 nT, measured at 50 cm around & at 30 cm in front; Band II: 2 kHz to 400 kHz, ≤ 25 nT measured at 50 cm around display (Products with CRTs and Flat Panels)			X			4.4	
7	**Electrical safety, EMC and connection to the telephone network**							
7.1	The product is CE-marked and a CE certificate of conformity is available	X			P3.4			5.4
7.2	The product meets applicable EMC Directives	X			P3.2			
7.3	The product is to be connected to the PTT network and meets the EU telecommunications Directive	X			P3.3			
7.4	Product meets the Low Voltage Directive (LVD) regarding electrical safety (73/23/EEC and 93/68/EEC)	X			P3.1			
7.5	The product meets the requirements of EN 60950 for electrical safety	X					5.1	
8	**Noise Characteristics**							

8.1 Declared Noise Emissions in accordance with ISO 9296

Product	Condition	Sound Power Level L_{Wad} (B) 1B = 10dB	Sound Pressure Level, Operator Position, Unit on Table L_{pAm} (dB)
2.16GHz Intel Core 2 Duo MA609	Idle	3.0	19
	Hard drive accessing	3.1	20
2.33GHz Intel Core 2 Duo MA610	Idle	3.0	20
	Hard drive accessing	3.0	21

Apple Product Environmental Specification		Requirement met			IT ECO	Blue Angel	TCO '99	ECMA
		Yes	No	N/A	('02)	Desktop CPUs	Desktop Display	(6/99)
9	**Ergonomics**							
9.1	The personal computer system meets the ergonomic requirements of ISO 9241-3, -7, -8 for CRT and ISO 13406-2 for flat panel displays			X	12.1			
9.2	The product keyboard meets the requirements of ISO 9995 and EN ISO 9241-4			X	12.2			
9.3	The computer input device meets the requirements of ISO 9241-9			X	12.3			
9.4	The LCD panel meets the ergonomic requirements of TCO'99			X			B.1,B.2	
10	**Packaging and documentation**							
10.1	The product package material does not contain heavy metals	X			P5.1			
10.2	The product package material does not contain CFC/HCFC	X			P13.1			5.8
10.3	Product packaging materials and weights: Material type: — Retail Box Weight — Retail and Outer Box Weight Corrugated cardboard and paperboard — 610g — 1210g EPS (expanded polystyrene) — 180g — 220g HDPE/LDPE — 35g — 65g	← See Values			P13.2			5.11
10.4	Plastic packaging material is marked according to: DIN 6120_____ ISO 11469 / ISO 1043 _____ SPI _X_	X			13.3	3.1.8		5.11
10.5	The company participates in or has its own system for collection and recycling of packaging material (refer to item 13)	X			C1.1			5.11
10.6	No polyvinyl chloride (PVC) used in packaging	X			P13.5			
10.7	Packaging is in conformance with national guidelines, regulations and/or standards such as those implementing the EU Directive 94/62/EEC and/or the Ordinance on Packaging, as amended	X						5.11
11	**Recycling**							
11.1	The company has a system for reuse/recycling of the product and/or consumables (refer to item 13)	X			C2.1	3.1.7	1.4.5	5.12
11.2	Information about the system for reuse/recycling can be found in the user manual or specified elsewhere (refer to item 13)	X			C4.1	3.1.7		5.12
12	**Additional Attributes**							
12.1	The supply of spare parts for repair of the product is guaranteed for at least 5 years from termination of production	X			P6.11	3.1.6		5.2
12.2	Information on modularity of design, expansion capacity and guarantee is included in product documentation	X				3.1.7		5.2
13	**Additional Information/Notes**							
13.1	Product recycling/take-back systems are local and regionalized. They may not exist, in the same manner, in all municipalities/countries.							
13.2	Apple has established regional systems for packaging take-back/recycling in those countries with packaging legislation.							
13.3	Definitions: CAS — Chemical Abstract Service CFC — chlorofluorocarbon CRT — cathode ray tube EMAS — Eco Management and Audit Scheme EMC — electromagnetic compatibility EPS — expanded polystyrene HCFC — hydro chlorofluorocarbon ISO — International Organization of Standardization IT ECO — Association of the Swedish IT and Telecom Industry LCD — liquid crystal display LDPE — low density polyethylene MSDS — material safety data sheet PBB — polybrominated biphenyls PBDE — polybrominated diphenyl ethers PCB — polychlorinated biphenyls PCT — polychlorinated terphenyl PVC — polyvinyl chloride PWB — printed wiring board SPI — Society of Plastics Industry TBBA — tetrabrominated bisphenol A VDT — visual display terminal							

Minta 32 319

Dual Spray Pull-Out

Description

GROHE SilkMove® Ceramic Cartridge
SpeedClean® Anti-Lime System
Locking Push Button Control - to switch from regular flow to spray
Stainless Steel Braided Flexible Supplies
Quick Installation System
Single Lever Handle
Variable Handle Positioning
8 9/16" Spout Reach

Flow Rate

2.2 gpm at 45 psi, 2.5 gpm at 80 psi
(9.5 lpm)

Code Compliance

* ASME/ANSI A112.18.M
* ASSE Standard 1016
* ANSI/NSF Standard 61
* ADA Compliant

Finish Options

32 319 OOO Chrome

GROHE AMERICA, INC 241 COVINGTON DRIVE, BLOOMINGDALE, IL 60108 . 630-582-7711.FAX:630-582-7722

Atrio 32 006

Single Lever Lavatory Centerset

Description

6" swivel spout
Single lever handle
GROHE SilkMove® ceramic cartridge
Solid brass body
Stainless steel braided supply hoses
Includes pop-up drain
Single-hole installation

Flow Rate

2.2 gpm at 60 psi, 2.5 gpm at 80 psi

Code Compliance

* ASME/ANSI A112.18.M
* ANSI/NSF Standard 61
* ADA Compliant

Finish Options

32 006 OOO Chrome
32 006 AVO Infinity Satin Nickel
32 006 BEO Sterling Infinity Finish
32 006 ENO Infinity Brushed Nickel

GROHE AMERICA, INC 241 COVINGTON DRIVE, BLOOMINGDALE, IL 60108 . 630-582-7711.FAX:630-582-7722

Rainshower 28 373

Shower Head

Description

8" diameter
120 spray nozzles
GROHE DreamSpray® Technology
Speedclean anti-lime system
1/2" NPT female threads

Spray: Non-adjustable wide spray

Flow Rate

2.5 gpm at 80 psi

Code Compliance

* ASME/ANSI A112.18.M

Finish Options

28 373 OOO Chrome
28 373 ROO Infinity Polished Brass
28 373 AVO Infinity Satin Nickel
28 373 RRO Velour Chrome
28 373 BEO Sterling Infinity Finish
28 373 ENO Infinity Brushed Nickel

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Sena 28 341

Hand Shower

Description

GROHE DreamSpray® Technology
Speedclean anti-lime system

Spray: Non-adjustable wide spray

Flow Rate

2.5 gpm at 80 psi

Code Compliance

* ASME/ANSI A112.18.M

Finish Options

28 341 OOO Chrome
28 341 AVO Infinity Satin Nickel
28 341 BEO Sterling Infinity Finish

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Rainshower 27 031

Shower system

Description

Allows use of Rainshower shower head and a hand shower with existing exposed thermostat valve, shower arm, hand shower union, or tub spout with 1/2" hose connection
50" Riser
Pivoting shower arm - 16" reach from wall
Adjustable hand shower holder
Grohclick quick connection system hand shower hose (1/2" threads)

Flow Rate

N/A

Code Compliance

* ASME/ANSI A112.18.M

Finish Options

27 031 OOO Chrome
27 031 AVO Infinity Satin Nickel

Atrio 19 167

Integrated thermostat trim

Description

Integrated volume and temperature control
Trio spoke handle volume control
Trio spoke handle temperature control

For use with Grohtherm 34 909 or 34 126
Integrated thermostatic rough-in valves

Note: Recommended for shower installations

Flow Rate

NA

Code Compliance

* ASME/ANSI A112.18.M

Finish Options

19 167 OOO Chrome
19 167 AVO Infinity Satin Nickel
19 167 BEO Sterling Infinity Finish
19 167 ENO Infinity Brushed Nickel

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iW PROFILE g2

An INTELLIWHITE™ Product

The iW Profile g2 fixture is a low-profile, linear 12" (30.2 cm) system that features higher light output and enhanced light quality with new optics and advanced LEDs (as compared to the previous generation). The linear design and fixture-to-fixture color consistency of this high-quality white light is well suited for display, museum, exhibit, retail, hospitality and architectural applications.
iW Profile g2 provides flexible color temperature and brightness control through Chromacore® technology, the proven approach that underlies Color Kinetics' existing intelligent solid-state lighting systems. When applied to IntelliWhite™ products, Chromacore controls channels of warm white and cool white LEDs to produce color temperatures within the range of 3000–6500 Kelvin from within a single fixture. iW Profile g2 allows the adjustment of light intensity while providing the option to either maintain or vary the color temperature.

iW Profile g2 is available with three different beam angles to meet diverse application demands: narrow, medium, and forward-throw asymmetric. iW Profile g2 is rated for indoor and damp location installations. The end-to-end locking connectors, capable of making 180° turns, make iW Profile g2 extremely versatile and easily adaptable to even the most challenging mounting environments.

iW Profile g2 is track mounted using the provided eight inch long 0°/60° track or 45° track for forward-throw asymmetric fixtures. This track allows for a light aim perpendicular to the mounting surface, angled at 60° from center, or angled at 45° from center. Optional 5 1/2 foot tracks are available for long, linear runs of 0°/45°/60° mounting angles.

iW PROFILE g2 SPECIFICATIONS

COLOR TEMP RANGE	3000K to 6500K
SOURCE	High intensity LEDs
BEAM ANGLE	Narrow, Medium, Forward-Throw Asymmetric
HOUSING	Aluminum with enamel finish
LENS	Clear tempered UV resistant lens
CONNECTORS	Unified power and data cable
LISTINGS	UL/cUL, CE

COMMUNICATIONS SPECIFICATIONS

DATA INTERFACE	Color Kinetics iW PDS-150 or iW PDS-60
CONTROL	Color Kinetics Line of Controllers, including iW Scene Controller, or LSM*

ELECTRICAL SPECIFICATIONS

POWER REQUIREMENT	24VDC
POWER CONSUMPTION	15W

ENVIRONMENTAL SPECIFICATIONS

TEMPERATURE RANGE	-4°F to 122°F (-20°C to 50°C) based on testing of specific product
PROTECTION RATING	IP60 (top of housing); IP50 (bottom of housing)

* For large or complex installations, consider controlling iW Profile g2 with Light System Manager (LSM). Refer to the LSM data sheets or contact support@colorkinetics.com for more information.

CHROMACORE® BY COLOR KINETICS

OPTIBIN® BY COLOR KINETICS

DRY

DAMP

c UL us LISTED 78GF

ITEM# 501-000010-00 (Medium)
501-000010-01 (Narrow)
501-000010-02 (Forward-Throw Asymmetric)

This product is protected by one or more of the following patents: U.S. Patent Nos. 6,016,038, 6,150,774 and other patents listed at http://colorkinetics.com/patents/. Other patents pending.

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BRO185 Rev 03

Specifications subject to change without notice. Refer to www.colorkinetics.com for the most recent data sheet versions.

LED SOURCE LIFE

In traditional lamp sources, lifetime is defined as the point at which 50% of the lamps fail. This is also termed Mean Time Between Failure [MTBF]. LEDs are semiconductor devices and have a much longer MTBF than conventional sources. However, MTBF is not the only consideration in determining useful life. Color Kinetics uses the concept of useful light output for rating source lifetimes. Like traditional sources, LED output degrades over time (lumen depreciation) and this is the metric for SSL lifetime.

LED lumen depreciation is affected by numerous environmental conditions such as ambient temperature, humidity, and ventilation. Lumen depreciation is also affected by means of control, thermal management, current levels, and a host of other electrical design considerations. Color Kinetics systems are expertly engineered to optimize LED life when used under normal operating conditions. Lumen depreciation information is based on LED manufacturers' source life data as well as other third party testing. Low temperatures and controlled effects have a beneficial effect on lumen depreciation. Overall system lifetime could vary substantially based on usage and the environment in which the system is installed.

Temperature and effects will affect lifetime. Color Kinetics rates product lifetime using lumen depreciation to 70% of original light output. When the fixture is running on warm or cool, at room temperature, the LED lifetime is in the range of 50,000 – 70,000 hours. This is based on LED manufacturers' test data. High output is defined as any LED device that is 1/2 watt or above. For more detailed information on source life, please see www.colorkinetics.com/lifetime.

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iW Profile g2 - Narrow

PHOTOMETRIC PERFORMANCE

SOURCE SPECIFICATIONS

Lens:	UV-resistant soft-focus polycarbonate lens
Source:	9 LEDs (6 warm white, 3 cool white)
Beam Angle:	10° X 110° (at 50% of peak illuminance)
Distribution:	Symmetric direct illumination
CRI:	79 All, 73 Warm, 83 Cool

ILLUMINANCE DISTRIBUTION

0.2 / 2.2	0.2 / 2.2	0.2 / 2.2	0.2 / 2.2	0.2 / 2.2	0.2 / 2.2	1.0′/0.3m
0.5 / 5.4	3.9 / 42.0	6.9 / 74.3	3.9 / 42.0	0.6 / 6.5	0.2 / 2.2	2.0′/0.6m
0.9 / 9.7	7.7 / 82.9	17.1 / 184.1	14.0 / 150.7	4.5 / 48.4	0.6 / 6.5	3.0′/1.0m
0.6 / 6.5	4.5 / 48.4	14.0 / 150.7	17.1 / 184.1	7.7 / 82.9	0.9 / 9.7	4.0′/1.2m
0.2 / 2.2	0.6 / 6.5	3.9 / 42.0	6.9 / 74.3	3.9 / 42.0	0.5 / 5.4	5.0′/1.5m
0.2 / 2.2	0.2 / 2.2	0.2 / 2.2	0.2 / 2.2	0.2 / 2.2	0.2 / 2.2	6.0′/2.0m
3.0′/1.0m		0′/0m			3.0′/1.0m	

Units: Footcandles (top)/Lux (bottom)
10.8 lux = 1 fc

Location: Centered 1′/0.3m from, and perpendicular to, surface
Measured on: All, Reflectance 50%

CANDLE POWER DISTRIBUTION

Measured on: All
Beam peak: 163 cd
Thin dashed line: Indicates 50% of peak

ILLUMINANCE

	3′ / 1m	6′ / 2m	9′ / 3m	15′ / 5m
ALL	19.7 / 212.1	4.3 / 46.3	1.8 / 19.4	0.6 / 6.5

Measured in Footcandles (top)/Lux (bottom).
Measured on all, reflectance 0.

LIGHT OUTPUT

	TOTAL OUTPUT (lumems)	POWER (Watts)	EFFICACY (lm/W)
ALL	118	12.0	9.8
WARM	107	11.8	9.1
COOL	118	11.8	10.0

Note: Efficacy figures are for a complete tested fixture not simply a lamp source.

CRI

It is common practice in the lighting industry to use color rendering index (CRI) to compare the properties of various light sources. There are known deficiencies and limitations associated with CRI and as a result, it is not always an accurate indicator of good object color appearance. This is especially true for LED-based sources. Until a better method for measuring color rendering in LEDs is accepted, Color Kinetics measures CRI in accordance with the current CIE 13.3-1995 standard using the Ra calculation. The reference illuminants employed are the Planckian locus below 5000K and CIE Daylight reference above 5000K. All measurements for Color Kinetics products are performed by third party laboratories using NIST-traceable instruments.

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iW PROFILE g2 - MEDIUM

PHOTOMETRIC PERFORMANCE

SOURCE SPECIFICATIONS

Lens:	UV-resistant soft-focus polycarbonate lens
Source:	9 LEDs (6 warm white, 3 cool white)
Beam Angle:	50° X 50°
Distribution:	Symmetric direct illumination
CRI:	79 All, 73 Warm, 83 Cool

ILLUMINANCE DISTRIBUTION

0.2 / 2.2	0.3 / 3.2	0.3 / 3.2	0.3 / 3.2	0.3 / 3.2	0.2 / 2.2	1.0′/0.3m
0.3 / 3.2	3.9 / 42.0	7.4 / 79.7	4.0 / 43.1	0.4 / 4.3	0.2 / 2.2	2.0′/0.6m
0.3 / 3.2	7.4 / 79.7	17.9 / 192.7	14.5 / 156.1	4.0 / 43.1	0.3 / 3.2	3.0′/1.0m
0.3 / 3.2	4.0 / 43.1	14.5 / 156.1	17.9 / 192.7	7.4 / 79.7	0.3 / 3.2	4.0′/1.2m
0.2 / 2.2	0.4 / 4.3	4.0 / 43.1	7.4 / 79.7	3.9 / 42.0	0.3 / 3.2	5.0′/1.5m
0.2 / 2.2	0.2 / 2.2	0.3 / 3.2	0.3 / 3.2	0.3 / 3.2	0.2 / 2.2	6.0′/2.0m
3.0′/1.0m		0′/0m			3.0′/1.0m	

Units: Footcandles (top)/Lux (bottom)
10.8 lux = 1 fc

Location: Centered 1′/0.3m from, and perpendicular to, surface
Measured on: All, Reflectance 50%

CANDLE POWER DISTRIBUTION

Measured on: All
Beam peak: 126 cd
Thin dashed line: Indicates 50% of peak

ILLUMINANCE

	3′ / 1m	6′ / 2m	9′ / 3m	15′ / 5m
ALL	18.3 / 197.0	4.0 / 43.1	1.7 / 18.3	0.6 / 6.5

Measured in Footcandles (top)/Lux (bottom).
Measured on all, reflectance 0.

LIGHT OUTPUT

	TOTAL OUTPUT (lumems)	POWER (Watts)	EFFICACY (lm/w)
ALL	120	12.0	10.0
WARM	102	11.8	8.6
COOL	127	11.8	10.8

Note: Efficacy figures are for a complete tested fixture not simply a lamp source.

CRI

It is common practice in the lighting industry to use color rendering index (CRI) to compare the properties of various light sources. There are known deficiencies and limitations associated with CRI and as a result, it is not always an accurate indicator of good object color appearance. This is especially true for LED-based sources. Until a better method for measuring color rendering in LEDs is accepted, Color Kinetics measures CRI in accordance with the current CIE 13.3-1995 standard using the Ra calculation. The reference illuminants employed are the Planckian locus below 5000K and CIE Daylight reference above 5000K. All measurements for Color Kinetics products are performed by third party laboratories using NIST-traceable instruments.

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iW Profile g2 - Asymmetric

PHOTOMETRIC PERFORMANCE

SOURCE SPECIFICATIONS

Lens:	UV-resistant soft-focus polycarbonate lens
Source:	9 LEDs (6 warm white, 3 cool white)
Beam Angle:	20° X 40° X 100°
Distribution:	Asymmetric direct illumination
CRI:	79 All, 73 Warm, 84 Cool

ILLUMINANCE DISTRIBUTION

0.2 / 2.2	0.3 / 3.2	0.4 / 4.3	0.3 / 3.2	0.2 / 2.2	0.2 / 2.2	1.0′/0.3m
0.3 / 3.2	2.4 / 25.8	4.4 / 47.4	2.6 / 28.0	0.5 / 5.4	0.2 / 2.2	2.0′/0.6m
0.5 / 5.4	6.2 / 66.7	13.4 / 144.2	10.1 / 108.7	2.7 / 29.1	0.4 / 4.3	3.0′/1.0m
0.4 / 4.3	4.3 / 46.3	13.2 / 142.1	15.0 / 161.5	6.2 / 66.7	0.5 / 5.4	4.0′/1.2m
0.2 / 2.2	0.5 / 5.4	4.0 / 43.1	7.4 / 79.7	4.0 / 43.1	0.4 / 4.3	5.0′/1.5m
0.2 / 2.2	0.2 / 2.2	0.2 / 2.2	0.2 / 2.2	0.2 / 2.2	0.2 / 2.2	6.0′/2.0m
3.0′/1.0m		0′/0m			3.0′/1.0m	

Units: Footcandles (top)/Lux (bottom)
10.8 lux = 1 fc

Location: Centered 1′/0.3m from, and perpendicular to, surface

Measured on: All, reflectance model 50/%

CANDLE POWER DISTRIBUTION

Measured on: All
Beam center: 79 cd
Thin dashed line: Indicates 50% of peak

ILLUMINANCE

	3′ / 1m	6′ / 2m	9′ / 3m	15′ / 5m
ALL	7.1 / 76.4	1.5 / 16.1	0.7 / 7.5	0.2 / 2.2

Measured in Footcandles (top)/Lux (bottom).
Measured on all, reflectance 0.

LIGHT OUTPUT

	TOTAL OUTPUT (lumens)	POWER (Watts)	EFFICACY (Lm/W)
ALL	100	12.0	8.3
WARM	90	11.8	7.6
COOL	101	11.8	8.6

Note: Efficacy figures are for a complete tested fixture not simply a lamp source.

CRI

It is common practice in the lighting industry to use color rendering index (CRI) to compare the properties of various light sources. There are known deficiencies and limitations associated with CRI and as a result, it is not always an accurate indicator of good object color appearance. This is especially true for LED-based sources. Until a better method for measuring color rendering in LEDs is accepted, Color Kinetics measures CRI in accordance with the current CIE 13.3-1995 standard using the Ra calculation. The reference illuminants employed are the Planckian locus below 5000K and CIE Daylight reference above 5000K. All measurements for Color Kinetics products are performed by third party laboratories using NIST-traceable instruments.

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iW Profile g2

PHYSICAL DIMENSIONS

TOP

SIDE

BOTTOM

0°/60° Track - 8″ (20 cm) and 5.5′ (1.7m)

45° Track - 5.5′ (1.7m)

iW Profile g2 ITEM# 501-000010-00/01/02	
POWER CONNECTOR	Unified power and data cable
POWER REQUIREMENT	24VDC (15W)
WEIGHT	11 oz (0.3 kg)

iW Profile g2

FUNCTIONAL FLOW DIAGRAM (iW PDS-150)

For complete installation instructions and safety precautions, refer to the iW Profile g2 User Guide and wiring diagrams located at www.colorkinetics.com/support.

Additional Items	
Power/Data Supply	iW PDS-150 (ITEM# 509-000001-00)
Controller	Any Color Kinetics iW Controller

iW Profile g2

FUNCTIONAL FLOW DIAGRAM (iW PDS-60)

For complete installation instructions and safety precautions, refer to the iW Profile g2 User Guide and wiring diagrams located at www.colorkinetics.com/support.

Additional Items	
Power/Data Supply	iW PDS-60 (ITEM# 509-000002-00)
Controller	Any Color Kinetics iW Controller

OPTIBIN®

There are inherent variations in the fabrication processes of all semiconductor materials. For LEDs, this variance results in differences in the color and intensity of light output as well as electrical characteristics. Due to these differences, LED manufacturers sort production into "bins," but insuring the availability of a single bin is very difficult. To minimize this issue and achieve optimal color consistency in its products, Color Kinetics has developed and uses a proprietary technology called Optibin. Optibin is an advanced production binning optimization process that minimizes the effects of LED variance for the best possible output uniformity in the final product. Color Kinetics Optibin technology gives you the most consistent control of color and intensity from product to product.

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iW PROFILE g2

USER GUIDE

An INTELLIWHITE™ Product

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CHROMACORE® BY COLOR KINETICS

OPTIBIN® BY COLOR KINETICS

DRY

DAMP

ITEM# 501-000010-00 (Medium)
501-000010-01 (Narrow)
501-000010-02 (Forward Throw Asymmetric)

This product is protected by one or more of the following patents: U.S. Patent Nos. 6,016,038, 6,150,774 and other patents listed at http://colorkinetics.com/patents/. Other patents pending.

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All other brands or product names are trademarks or registered trademarks of their respective owners.

PUB-000150-00 Rev. 02

Specifications subject to change without notice.

GETTING STARTED

iW™ Profile g2 is a sleek, low profile, linear white light fixture suitable for many applications, such as museum, display, exhibit, retail, hospitality, and architectural. This guide contains important information about installing and operating your new iW Profile g2 safely and accurately.

Included In This Box

- iW Profile g2 fixture
- 8" (20.3 cm) 0°/60° mounting track
- 8" (20.3 cm) 45° mounting track (for Asymmetric fixtures only)
- User Guide

Additional Items Needed

- Color Kinetics iW PDS-150 (Item# 509-000001-00) or iW PDS-60 (Item # 509-000002-00)
- iW Profile leader cable (Item# 108-000023-00)
- Controller - Color Kinetics iW Scene Controller (508-000001-00/02)
- #6 (M3.5) flat-head mounting hardware and screw driver

Optional Items

- 5-1/2 foot (1.7 m) 45° Mounting track (Item# 501-000006-00)
- 5-1/2 foot (1.7 m) 0°/60° Mounting track (Item# 501-000006-01)
- 1' (0.3 m), 4' (1.2 m), and 8' (2.4 m) iW Profile jumper cables (Item# 108-000024-00/01/02)

Scope of This User Guide

The goal of this user guide is to explain the steps necessary to install iW Profile g2 and assure peak performance. Its intended use is for reference only, by persons who are fully qualified. This document should never be considered a substitute for any provisions of a regulation or state and/or local code.

Identification and Warnings of Safety Hazards

In accordance with ANSI Z535.4-2002 the following system of identifying the severity of the hazards associated with the products is used:

"**DANGER**" Imminently hazardous situation which, if not avoided, will result in death or serious injury.

"**WARNING**" Potentially hazardous situation which, if not avoided, could result in death or serious injury.

"**CAUTION**" Potentially hazardous situation which, if not avoided, may result in minor or moderate injury or property damage. Also used to alert against unsafe practices.

IGNORING A HAZARD WILL VOID ANY WARRANTY.

WARNING: Risk of electric shock! Ensure that the main power supply is off before installing or wiring iW Profile g2.

WARNING: iW Profile g2 must be installed by a qualified electrician in accordance with NEC and relevant state/local codes.

WARNING: Do not install or use iW Profile g2 until you read and understand the installation instructions and safety labels.

WARNING: Do not use iW Profile g2 if the power cables are damaged.

CAUTION: Use appropriate materials and mounting methods to support the fixture adequately.

CAUTION: iW Profile g2 has no user serviceable parts. Do not attempt to open the fixture.

CAUTION: Do not exceed the specified voltage and current input.

CAUTION: Do not exceed the maximum number of specified fixtures in a light run.

CAUTION: Do not use sharp tools near or on the fixture lens.

CAUTION: Do not hot swap. Ensure that power to the fixture is off before connecting or disconnecting fixtures.

CAUTION: iW Profile g2 is a Class 1 LED product with LED radiation. Do not stare into beam or view directly with optical instruments.

NOTE: The instructions and precautions set forth in this user guide are not necessarily all-inclusive, or relevant to all applications as Color Kinetics cannot anticipate all conceivable or unique situations.

Owner/User Responsibilities

It is the responsibility of the contractor, installer, purchaser, owner and user to install, maintain, and operate iW Profile g2 in such a manner as to comply with all state and local laws, ordinances, regulations, and the American National Standards Institute Safety Code.

PLANNING THE INSTALLATION

iW Profile g2 installation requires planning to ensure a timely, successful installation with minimal complications and down time.

Planning Suggestions

When planning an iW Profile g2 installation, Color Kinetics suggests doing the following:

- Consult an Electrical Inspector to review all wiring plans.
- Refer to local and state codes for installation compliance.
- Create a Layout Plan drawing, per a Lighting Designer's or Architect's recommendation.
- Consult Color Kinetics Application Engineering Services, as needed, at support@colorkinetics.com.

Installation Considerations

When creating your installation plan, consider the following:

- **Zones.** iW Profile g2 fixtures are dimmable, color-temperature adjustable fixtures that are controlled in zones. Using iW Scene Controller, you can set the brightness level and color temperature from cool to warm, for all fixtures within a specified zone.

  Create zones by designating each iW PDS as a specific alphanumeric zone, 1-9 or A-F. All fixtures attached to that power/data supply reside within the designated zone. For example, in an installation with two iW PDSs where the first power/data supply is set to Zone 1 and the second is set to Zone 2, the fixtures attached to the first power/data supply are in Zone 1 and the fixtures attached to the second power/data supply are in Zone 2.

  For installations where all fixtures are controlled in unison, set each iW PDS in the installation to the same zone designator. For installations where groups of fixtures are controlled individually, set unique zone designators for each power/data supply.
- **Location of iW PDS in relationship to iW Profile g2 fixtures.** The iW Profile leader cable between iW PDS and the first iW Profile g2 fixture is 50 feet (15 m). Thus, iW PDS must be located within 50 (15 m) feet of the first fixture. The leader cable can be shortened, but not lengthened.
- **Location of the fixture and method of attaching.** Mounting hardware is dictated by the mounting surface. Ensure that the hardware used is appropriate for the mounting surface.
- **Install and wire iW PDS before installing iW Profile g2 fixtures.** Refer to the iW PDS-150 or iW PDS-60 Installation Guides.

STEPS TO A SUCCESSFUL INSTALLATION

1. Set the zone(s) for iW PDS according to the instructions provided in iW PDS-150 or iW PDS-60 Installation Guides.
2. Install iW PDS.
3. Install the iW Profile g2 fixtures.
4. Connect the power/data leader cable from iW PDS to the fixtures.
5. Install iW Scene Controller.

Installing the iW PDS

Determine the location for iW PDS. Each iW Profile g2 fixture draws a maximum of 15 watts. One iW PDS-150 can support up to ten iW Profile g2 fixtures and one iW PDS-60 can support up to four iW Profile g2 fixtures. Multiple iW PDS-150 power/data supplies are needed for installations with more than ten iW Profile g2 fixtures or which require multiple zones. Multiple iW PDS-60 power/data supplies are needed for installations with more than four iW Profile g2 fixtures or which require multiple zones.

Refer to the iW PDS-150 or iW PDS-60 Installation Guides for complete installation, wiring, and zone setting instructions. After running power and data to iW PDS and setting the zone, you are ready to attach the iW Profile g2 fixtures.

WARNING: Ensure that the power supply is off before wiring or connecting fixtures to iW PDS. Failure to do so could result in death or serious injury and will void the warranty.

CAUTION: Never lengthen the iW Profile leader cable. Doing so may result in minor or moderate injury or property damage and will void the warranty.

Installing iW Profile g2 Fixtures

iW Profile g2 fixtures are installed in series. The in-line connectors support end-to-end fixture installation for the best visual effects. Jumper cables are available to add space between the fixtures when needed.

Installing Tracks

iW Profile g2 mounts to surfaces using the provided 8" (20.3 cm) track or one of the optional 5-1/2' (1.7 m) mounting tracks. The optional mounting tracks are ideal for long linear runs, or for direct view installations where the gaps between 8" (20.3 cm) tracks will be visible. The tracks provide 0°, 60°, and 45° mounting.

An 8" (20.3 cm), 0°/60° track is provided with the fixture. Additionally, an 8" (20.3 cm), 45° track is provided with the Asymmetric fixture.

An optional 5 1/2' (1.7 m), 0°/60° or 45° track is also available. These tracks allow you to position the fixture perpendicular to the mounting surface, or angled at 60° or 45° to the surface.

NOTE: The track is field cuttable. When trimming the track, trim evenly from each end of the track. For example, to remove 6" (15 cm) from the track length, cut 3" (7 cm) from each end. This ensures that the fixture mounting clips are always securely planted in the track. See Fig. 1.

Fig. 1

CAUTION: When installing the track, use hardware suitable for the mounting surface. Failure to do so may result in minor or moderate injury or property damage and will void the warranty.

RECOMMENDED: Consult a structural engineer and state/local codes to confirm size, type, and amount of hardware that will support the full weight of the track and fixture securely to specified mounting surface.

Installing the Fixture Perpendicular to Surface

Use the 0°/60° track to install fixtures perpendicular to the mounting surface. Position the base of the track against surface and attach using #6 flat-head mounting screws suitable for the mounting surface. Press firmly to snap the fixture into the track. See Fig. 2.

Fig. 2

Installing the Fixture 60° to Surface

Use the 0°/60° track to install fixtures angled 60° to the mounting surface. Position the mounting hole side of the track against the surface and attach using #6 (M3.5) flat-head mounting screws suitable for the mounting surface. Press firmly to snap the fixture into the track. See Fig. 3.

Fig. 3

Installing the Fixture 45° to Surface

Use the 45° track to install fixtures angled 45° to the mounting surface. Position the mounting hole side of the track against the surface and attach using #6 flat-head mounting screws suitable for the mounting surface. Press firmly to snap the fixture into the track. See Fig. 4.

Fig. 4

Aiming Fixtures

For the Narrow and the Medium fixtures, the position of the track determines how fixtures are aimed.

For the Asymmetric fixtures, refer to the label on the female connector end of the end caps of each fixture to determine where the majority of the light will be directed. Position the fixture in the track accordingly. The light direction arrow should point in the direction where the majority of the light will be projected.

For example, if you want to aim most of the light into a display case, position the fixture in the track so the arrow on the end cap of the fixture points into the case. See Fig. 5.

Fig. 5

Side View of Display Case

Installing the Fixtures

WARNING: Power must be off before installing iW Profile g2. Failure to do so could result in death or serious injury and will void the warranty.

1. Connect the first fixture in a run to the leader cable, then press to snap into the track. Connect the next fixture in the series and snap it into the track. See Fig. 6. Consult the iW PDS-150 or iW PDS-60 Installation Guides for the maximum number of fixtures that can be run in a single series.

   The flexible connector cables allow for up to 180° turning radius.

Fig. 6

2. Continue mounting the fixtures, making in-line power/data connections as you go, until all fixtures in the series are mounted.
3. Repeat Steps 1 and 2 for each iW PDS output.

Making Electrical Connections

iW Profile g2 is compatible with Color Kinetics iW PDS series.

Connecting Power

iW Profile g2 requires 24VDC. After installing the light fixtures, connect the iW Profile g2 leader cables to iW PDS using the provided terminal connectors. See Fig. 7.

The iW Profile leader cable contains three color-coded wires:

- Black = Common
- White = Data
- Red = +24 VDC

Fig. 7

CAUTION: Do not overload iW PDS. Doing so may result in minor or moderate injury or property damage and will void the warranty.

CAUTION: You must use the cable provided with the unit. Failure to do so may result in minor or moderate injury or property damage and will void the warranty.

Installing the Scene Controller

All lights connected to an iW PDS reside in the zone designated on iW PDS. iW Scene Controller allows you to adjust the color temperature of the lights from warm to cool and set the brightness level for all lights within a zone.

After installing iW PDS and attaching lights, install iW Scene Controller. Simply plug one end of the 4-pin, 50-foot (15 m) cable into the connector located on the back of iW Scene Controller, and the other end into the controller connector within iW PDS. iW Scene Controller fits into a standard single-gang wall box. iW Scene Controller must be located within 50 feet (15 meters) of iW PDS.

Refer to the iW PDS-150, iW PDS-60, and iW Scene Controller Installation Guides for complete installation, wiring, and operation instructions.

ROUTINE MAINTENANCE

Cleaning: Using a soft cloth, clean the surface of iW Profile g2 with mild soap and water. Do not use abrasives or glass cleaners. Doing so may scratch or cloud the lens and housing.

IMPORTANT INFORMATION

Strobe Warning

There is some anecdotal evidence that strobe lighting may induce epileptic symptoms in certain susceptible individuals, although no associated product warnings have been issued by the United States government according to the Food and Drug Administration.

If strobe lights are used, some international regulatory agencies[1] recommend keeping flicker rates at or below four flashes per second (as less of the flicker-sensitive population will then be at risk of an attack). This flicker rate applies only to the overall output of any group of lights in direct view. However, when more than one strobe light is used, the flashes should be synchronized. End users should also consider issuing a warning, alerting audience or viewers to the presence of strobe lighting.

Temperature Monitoring

For protection from extreme temperatures, iW Profile g2 has been designed with a temperature monitoring feature. If operating temperatures rise to an unsafe level, a compensation circuit is triggered and iW Profile g2 operation is interrupted, causing the lights to turn dim warm (3000K). After 30 minutes, the lights will return to normal operation. The lights can also be reset by cycling the power.

To prevent additional power shut-downs, determine the cause of the overheating and correct the problem. If any problems occur during usage, unplug the product immediately and call or email: Color Kinetics Technical Support Group:
1-888-FULL RGB or 617-423-9999 or support@colorkinetics.com.

iW PROFILE g2 SPECIFICATIONS

COLOR TEMP RANGE	3000K to 6500K
SOURCE	High intensity LEDs
BEAM ANGLE	Narrow, Medium, Asymmetric Forward Throw
HOUSING	Aluminum with enamel finish
LENS	Clear tempered UV resistant lens
CONNECTORS	Unified power and data cable
LISTINGS	UL/cUL, CE
PROTECTION RATING	IP60
DATA INTERFACE	Color Kinetics iW PDS-150 or iW PDS-60
CONTROL	Color Kinetics line of controllers including iW Scene Controller, or LSM*
POWER REQUIREMENT	24VDC
POWER CONSUMPTION	15W Max. at full power
TEMPERATURE RANGE	-4°F to 122°F (-20°C to 50°C) based on testing of specific product

*For large or complex installations, consider controlling iW Profile g2 with Light System Manager (LSM). Refer to the LSM data sheets or contact support@colorkinetics.com for further information.

LED Source Life

In traditional lamp sources, lifetime is defined as the point at which 50% of the lamps fail. This is also termed Mean Time Between Failure [MTBF]. LEDs are semiconductor devices and have a much longer MTBF than conventional sources. However, MTBF is not the only consideration in determining useful life. Color Kinetics uses the concept of useful light output for rating source lifetimes. Like traditional sources, LED output degrades over time (lumen depreciation) and this is the metric for SSL lifetime.

LED lumen depreciation is affected by numerous environmental conditions such as ambient temperature, humidity, and ventilation. Lumen depreciation is also affected by means of control, thermal management, current levels, and a host of other electrical design considerations. Color Kinetics systems are expertly engineered to optimize LED life when used under normal operating conditions. Lumen depreciation information is based on LED manufacturers' source life data as well as other third party testing. Low temperatures and controlled effects have a beneficial effect on lumen depreciation. Overall system lifetime could vary substantially based on usage and the environment in which the system is installed.

Temperature and effects will affect lifetime. Color Kinetics rates product lifetime using lumen depreciation to 70% of original light output. When the fixture is running on warm or cool, at room temperature, the LED lifetime is in the range 50,000 – 70,000 hours. This is LED manufacturers' test data. High output is defined as any LED device that is 1/2 watt or above. For more detailed information on source life, please see www.colorkinetics.com/lifetime.

Warranty

This product is sold pursuant to CK's Standard Terms and Conditions (the "T&Cs") which may be found at http://colorkinetics.com/howtobuy/buy/terms and which contain important provisions, including, among others, Limited Warranty, exclusions and limitations on CK's liability for damages, and restrictions on the remedies that are available to you.

[1] Guide to Health, Safety and Welfare at Pop Concerts and Similar Events, HMSO Publications (UK)

iW MR

IntelliWhite™ iW MR is a compact lamp designed to retrofit into standard MR16 fixtures and sockets. It is well suited for use with tracks, rails, cables and pendants in interior architectural, retail, exhibit, display, and residential applications. The lamp features standard MR16 bi-pin connectors and a sleek housing with painted silver finish. iW MR is available in three distinct kelvin temperatures: 3000K, 3500K, and 6500K.

iW MR leverages Color Kinetics' new DIMand™ technology developed specifically for solid-state lighting devices. It uniquely allows the adjustment of light intensity using standard low-voltage dimmers, making the product suitable for retrofitting into existing low voltage MR16 systems. Unlike conventional light sources, which decrease in color temperature as they are dimmed, the iW MR will maintain a constant color temperature at any intensity.

iW MR fits most standard, low voltage MR16 lighting fixtures, including: track, cable, and rail styles. iW MR is equipped with a factory installed clear lens and includes a tempered sand blasted lens. An accessory/adapter ring (Item# 101-000050-00) is available for attaching lighting accessories and to ensure a proper fixture fit in some fixtures.

iW MR SPECIFICATIONS

TEMPERATURE RANGE	3000 kelvin (+250/-50K) 3500 kelvin (+/- 150K) 6500 Kelvin (+/- 500K)
SOURCE	4 white high power LEDs
BEAM ANGLE	18°
MIN. BEAM DISTANCE	6 inches, (15 cm)
HOUSING	Painted silver, die cast zinc, 2" (5 cm) diameter
BASE	GX5.3

ENVIRONMENTAL SPECIFICATIONS

TEMPERATURE RANGE	Ambient: - 4°F to 104°F (- 20°C to 40°C); Surface: 167°F (75°C)
HUMIDITY RANGE	0 to 95% non-condensing humidity

ELECTRICAL SPECIFICATIONS

POWER REQUIREMENT	12VAC
POWER CONSUMPTION	Maximum: 4 Watt
TRANSFORMER	Low-voltage magnetic or electronic to provide 12VAC

LED SOURCE LIFE

In traditional lamp sources, lifetime is defined as the point at which 50% of the lamps fail. This is also termed Mean Time Between Failure [MTBF]. LEDs are semiconductor devices and have a much longer MTBF than conventional sources. However, MTBF is not the only consideration in determining useful life. Color Kinetics uses the concept of useful light output for rating source lifetimes. Like traditional sources, LED output degrades over time (lumen depreciation) and this is the metric for SSL lifetime.

LED lumen depreciation is affected by numerous environmental conditions such as ambient temperature, humidity, and ventilation. Lumen depreciation is also affected by means of control, thermal management, current levels, and a host of other electrical design considerations. Color Kinetics systems are expertly engineered to optimize LED life when used under normal operating conditions. Lumen depreciation information is based on LED manufacturers' source life data as well as other third party testing. Low temperatures and controlled effects have a beneficial effect on lumen depreciation. Overall system lifetime could vary substantially based on usage and the environment in which the system is installed.

Temperature and effects will affect lifetime. Color Kinetics rates product lifetime using lumen depreciation to 70% of original light output. When the fixture is running on warm or cool, at room temperature, the LED lifetime is in the range 50,000 – 70,000 hours. This is LED manufacturers' test data. High output is defined as any LED device that is 1/2 watt or above. For more detailed information on source life, please see www.colorkinetics.com/lifetime.

OPTIBIN®

There are inherent variations in the fabrication processes of all semiconductor materials. For LEDs, this variance results in differences in the color and intensity of light output as well as electrical characteristics. Due to these differences, LED manufacturers sort production into "bins," but insuring the availability of a single bin is very difficult. To minimize this issue and achieve optimal color consistency in its products, Color Kinetics has developed and uses a proprietary technology called Optibin. Optibin is an advanced production binning optimization process that minimizes the effects of LED variance for the best possible output uniformity in the final product. Color Kinetics Optibin technology gives you the most consistent control of color and intensity from product to product.

DRY

ITEM# 500-000002-00 (3000 K)
ITEM# 500-000002-01 (3500 K)
ITEM# 500-000002-02 (6500 K)

This product is protected by one or more of the following patents: U.S. Patent Nos. 6,016,038, 6,150,774 and other patents listed at http://colorkinetics.com/patents/. Other patents pending.

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BRO142 Rev 03

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iW MR 3000K, 3500K, and 6500K

PHOTOMETRIC PERFORMANCE

Photometric data is based on test results from an independent testing lab.

SOURCE SPECIFICATIONS

Optics:	Metalized polycarbonate reflectors
Lens:	Tempered clear glass lens
Source:	4 LEDs
Beam Angle:	18°
Distribution:	Symmetric direct illumination
CCT:	3000K, 3500K, 6500K
CRI:	72 (3000K), 77 (3500K), 83 (6500K)

ILLUMINANCE DISTRIBUTION PARAMETERS

Units: Footcandles (top)/Lux (bottom)
Location: 1.5′/0.6m from, and perpendicular to surface
Measured reflectance: 50

CANDLE POWER DISTRIBUTION

Measured on: All
Beam center: 285 cd (3000K), 272 cd (3500K), 309cd (6500K)
Dashed lined: Indicates 50% of peak

ILLUMINANCE

CCT	0.5′ / 0.15m	1′ / 0.3m	2′ / 0.6m	3′ / 1m
3000K	1161.0 / 12497.0	287.0 / 3089.3	71.6 / 770.7	31.8 / 342.3
3500K	1108.0 / 11926.5	274.0 / 2949.3	68.3 / 735.2	30.3 / 326.1
6500K	1259.0 / 13551.9	312.0 / 3358.4	77.6 / 835.3	34.4 / 370.3

Measured in Footcandles (top)/Lux (bottom) on axis
Measured on: Reflectance 0

LIGHT OUTPUT

	TOTAL OUTPUT (lumens)	POWER (Watts)	EFFICACY (lm/W)
3000K	41	3.5	11.7
3500K	38	3.4	11.2
6500K	49	3.7	13.2

Note: Efficacy figures are for a complete tested fixture not simply a lamp source.

ILLUMINANCE DISTRIBUTION 3000K

0.7 / 7.5	2.0 / 21.5	2.2 / 23.7	3.5 / 37.7	2.1 / 22.6	0.7 / 7.5	1.5′/0.5m
2.0 / 21.5	4.7 / 50.6	7.3 / 78.6	7.3 / 78.6	4.7 / 50.6	2.1 / 22.6	
3.4 / 36.6	7.3 / 78.6	12.4 / 133.5	11.2 / 120.6	7.3 / 78.6	3.5 / 37.7	0′/0m
2.2 / 23.7	7.3 / 78.6	11.2 / 120.6	12.4 / 133.5	7.3 / 78.6	2.3 / 24.8	
2.1 / 22.6	4.7 / 50.6	7.3 / 78.6	7.3 / 78.6	4.7 / 50.6	2.1 / 22.6	
0.7 / 7.5	2.1 / 22.6	2.3 / 24.8	3.5 / 37.7	2.1 / 22.6	0.7 / 7.5	1.5′/0.5m
1.5′/0.5m		0′/0m			1.5′/0.5m	

ILLUMINANCE DISTRIBUTION 3500K

0.5 / 5.4	1.9 / 20.5	2.0 / 21.5	3.2 / 34.4	1.9 / 20.5	0.5 / 5.4	1.5′/0.5m
1.8 / 19.4	4.4 / 47.4	6.9 / 74.3	6.9 / 74.3	4.4 / 47.2	1.8 / 19.4	
3.2 / 34.4	6.9 / 74.3	11.8 / 127.0	10.6 / 114.1	6.9 / 74.3	3.2 / 34.4	0′/0m
2.0 / 21.5	6.9 / 74.3	10.6 / 114.1	11.8 / 127.0	6.9 / 74.3	2.0 / 21.5	
1.9 / 20.5	4.4 / 47.4	6.9 / 74.3	6.9 / 74.3	4.4 / 47.4	1.9 / 20.5	
0.6 / 6.5	1.9 / 20.5	2.1 / 22.6	3.2 / 34.4	1.9 / 20.5	0.5 / 5.4	1.5′/0.5m
1.5′/0.5m		0′/0m			1.5′/0.5m	

ILLUMINANCE DISTRIBUTION 6500K

0.8 / 8.6	2.4 / 25.8	2.6 / 28.0	4.2 / 45.2	2.4 / 25.8	0.8 / 8.6	1.5′/0.5m
2.4 / 25.8	5.4 / 58.1	8.5 / 91.5	8.5 / 91.5	5.5 / 59.2	2.4 / 25.8	
4.0 / 43.1	8.5 / 91.5	14.4 / 155.0	13.0 / 139.9	8.5 / 91.5	4.0 / 43.1	0′/0m
2.6 / 28.0	8.5 / 91.5	13.0 / 139.9	14.4 / 155.0	8.5 / 91.5	2.6 / 28.0	
2.4 / 25.8	5.5 / 59.2	8.6 / 92.6	8.6 / 92.6	5.5 / 59.2	2.4 / 25.8	
0.8 / 8.6	2.5 / 26.9	2.7 / 29.1	4.1 / 44.1	2.4 / 25.8	0.8 / 8.6	1.5′/0.5m
1.5′/0.5m		0′/0m			1.5′/0.5m	

Units: Footcandles (top)/Lux (bottom); 10.8 lux = 1 fc
Location: 1.5' (0.46 m) perpendicular from surface
Measured on: Reflectance model 50%

For complete installation instructions and safety precautions, refer to the iW MR User Guide located at www.colorkinetics.com/support.

iW MR ITEM# 500-000002-00/01/02	
WEIGHT	3.4oz (96g)
POWER CONNECTOR	Standard MR16 fixture
POWER CONSUMPTION	4 Watts

Two types of low-voltage transformers are used with traditional MR16 lamps: magnetic and electronic. Consider the following when selecting the appropriate transformer for use with iW MR.

- **MAGNETIC**: iW MR is compatible with all types of magnetic transformers used with 12 volt lighting. Additionally, magnetic transformers are considered more reliable than electronic transformers; however, magnetic transformers are heavier, less efficient, and sometimes make noise (buzzing).
- **ELECTRONIC**: iW MR is not compatible with all electronic transformers due to its low power consumption of only 4 watts. Most electronic transformers require a minimum load greater than 4 watts in order to work properly. This is especially true of lighting fixtures that have an integral transformer for each. See Fig. 1. Symptoms of incompatibility include: no light output, flickering, strobing, or random shutdown.

Fig. 1

- Transformers can be integral to the fixture or remotely located, and can be used to power a group of fixtures, tracks, cables, or rails See Fig. 2.

Fig. 2

CRI

It is common practice in the lighting industry to use color rendering index (CRI) to compare the properties of various light sources. There are known deficiencies and limitations associated with CRI and as a result, it is not always an accurate indicator of good object color appearance. This is especially true for LED-based sources. Until a better method for measuring color rendering in LEDs is accepted, Color Kinetics measures CRI in accordance with the current CIE 13.3-1995 standard using the Ra calculation. The reference illuminants employed are the Planckian locus below 5000K and CIE Daylight reference above 5000K. All measurements for Color Kinetics products are performed by third party laboratories using NIST-traceable instruments.

iW MR

INSTALLATION GUIDE

An INTELLIWHITE™ Product

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iW MR
ITEM# 500-000002-00 (3000 K)
ITEM# 500-000002-01 (3500 K)
ITEM# 500-000002-02 (6500 K)

This product is protected by one or more of the following patents: U.S. Patent Nos. 6,016,038, 6,150,774 and other patents listed at http://colorkinetics.com/patents/. Other patents pending.

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Specifications subject to change without notice. Refer to www.colorkinetics.com for the most recent user guide versions.

GETTING STARTED

Color Kinetics® iW™ MR dimmable lamp is available in three temperatures of white light—a cool white and two variations of warm. iW MR fits most standard, low voltage MR16 lighting fixtures, including: track, cable, and rail styles. This guide contains important information not only for operating your new iW® MR lamp, but also for using it safely. For your protection, read it carefully and save it for future reference.

INCLUDED IN THIS BOX

- (1) iW MR
- Installation Guide

ADDITIONAL ITEMS NEEDED

- Suitable fixtures designed for MR16 lamps—track, cable, rail, pendent, etc.
- Low-voltage transformer to provide 12VAC to the fixtures.

OPTIONAL ITEMS

- MR Adapter ring (101-000050-00)
- A dimmer designed for use with the low-voltage transformer.

SCOPE OF THIS USER GUIDE

The goal of this user guide is to explain in easily understandable language the necessary steps to install iW MR and assure peak performance. Its intended use is for reference only, by a fully qualified electrician or technician. This document should never be considered a substitute for any provision of a regulation or state and/or local code.

OWNER/USER RESPONSIBILITIES

It is the responsibility of the contractor, installer, purchaser, owner, and user to install, maintain, and operate iW MR in such a manner as to comply with all state and local laws, ordinances, regulations, and the American National Standards Institute Safety Code.

IDENTIFICATION AND WARNINGS OF SAFETY HAZARDS

In accordance with ANSI Z535.4-2002 the following system of identifying the severity of the hazards associated with the products is used:

"**DANGER**" Imminently hazardous situation which, if not avoided, will result in death or serious injury.

"**WARNING**" Potentially hazardous situation that, if not avoided, could result in death or serious injury.

"**CAUTION**" Potentially hazardous situation that, if not avoided, may result in minor or moderate injury or property damage.

DANGER: Ensure that main power source (AC line) is off before installing or wiring iW MR lamps. Failure to adhere to these instructions will result in death or serious injury.

WARNING: iW MR must be installed by a qualified electrician or technician in accordance with NEC and relevant local codes. Failure to comply could result in death, serious injury, or property damage.

WARNING: Do not attempt to install or use iW MR until you read and understand the installation instructions. Failure to adhere to these instructions could result in serious injury or property damage.

WARNING: Do not use iW MR if any fixture cables are damaged. Doing so can result in death, serious injury, or property damage.

CAUTION: Use appropriate low voltage, MR16 lighting fixture and transformer. Follow the manufacturer's installation instructions and safety precautions. Failure to do so will result in product damage and void the warranty.

CAUTION: iW MR has no serviceable parts. Do not attempt to open the lights. Doing so will result in property damage and void the warranty.

CAUTION: Ensure that fixture, tracks, cables, rails, etc. are securely attached, properly mounted, and free of excessive vibration. Failure to do so will result in property damage and void the warranty.

CAUTION: Do not use sharp tools near or on the fixture lens or cables. Doing so will result in property damage and void the warranty.

CAUTION: Do not hot swap. Ensure that power supply is off before connecting or disconnecting fixtures. Hot swapping will result in property damage and void the warranty.

CAUTION: iW MR does not fit all MR16 lighting fixtures. Verify fit prior to installation. Optional adapter rings are available to reduce the overall dimension of the lamp.

CAUTION: iW MR housing becomes hot after extended use. Exercise caution when handling the heated lamp. Failure to do so will result in minor to moderate burns.

CAUTION: Risk of electric shock. Use in dry location only. Installing in wet locations will result in property damage and void the warranty.

CAUTION: This device is not intended for use with emergency exit fixtures or emergency exit lights.

NOTE: The instructions and precautions set forth in this user guide are not necessarily all-inclusive, all conceivable, or relevant to all applications as Color Kinetics cannot anticipate all conceivable or unique situations.

PLAN THE INSTALLATION

The nature of iW MR installation requires third-party fixtures, transformers, and/or dimmers. Whether the installation is new or a retrofit, compatible lighting components are necessary for successful installations and operations. Follow the guidelines for compatible components to ensure that your components are suitable for use with iW MR.

FIXTURE COMPATIBILITY

iW MR is not compatible with all MR16 lighting fixtures. To ensure that your fixture is compatible with iW MR, adhere to the following guidelines.

The iW MR:

- Requires adequate ventilation around the lamp housing to ensure peak performance and lifetime expectancy, see temperature specifications on page 2.
- Is not recommended for use in sealed fixtures.
- Is not recommended for use with recessed fixtures or within small enclosures unless air exchange or cooling within the enclosed air space is provided, *see Providing Adequate Ventilation on page 2*.
- Is not designed for outdoor use or for use in wet environments.
- Is not compatible with all fixtures having integral electronic transformers, see *Selecting a Transformer*.
- Does not fit all MR16 fixtures. Verify fit prior to installation. Optional adapter rings are available to reduce the overall dimension of the lamp, but does not guarantee to fit all fixtures.
- Has an integral primary optic to focus the light. If the fixture includes a protective lens, remove it if possible.

TRANSFORMER COMPATIBILITY

Two types of low-voltage transformers are used with traditional MR16 lamps: magnetic and electronic. Consider the following when selecting the appropriate transformer for use with the iW MR.

- **MAGNETIC**: iW MR is compatible with all types of magnetic transformers used with 12 volt lighting. Additionally, magnetic transformers are considered more reliable than electronic transformers; however, magnetic transformers are heavier, less efficient, and sometimes make noise (buzzing).
- **ELECTRONIC**: iW MR is not compatible with all electronic transformers due to its low power consumption of only 4 watts. Most electronic transformers require a minimum load greater than 4 Watts in order to work properly. This is especially true of lighting fixtures that have integral transformer for each fixture. See Fig. 1. Symptoms of incompatibility include: no light output, flickering, strobing, or random shutdown.

Fig. 1

- Transformers can be integral to the fixture or remotely located, and can be used to power a group of fixtures, tracks, cables or rails See Fig. 2.

Fig. 2

- Total power consumption of the iW MR lamps on a circuit must not exceed the rated output of transformer powering that circuit, regardless of type.
  Example: 20 iW MR lamps on a track powered by a single transformer consumes 80 watts maximum. Therefore, a transformer rated for more than 80 watts is required.

DIMMER COMPATIBILITY

Utilizing Color Kinetics patented DIMand™ technology, iW MR is designed to be dimmable. Using dimmers will reduce the temperature and power consumption of the iW MR, save energy, and maximize its useful lifetime. Consider the following when selecting the appropriate dimmer:

- Dimmers must be intended for use with the type of low-voltage transformer used to power the iW MR.
  NOTE: Common dimmers designed for use with 120V incandescent light will not work. Most dimmer manufacturers offer dimmers specifically designed to work with magnetic transformers or with electronic transformers.
- Dimmers must be rated for a maximum load that exceeds the rated load of all transformers used on the dimmer circuit.
- Most dimmers specify a certain minimum load required for the dimmers to work. Symptoms of insufficient load may include: limited dimming range, flickering, strobing, and random shutdown of the iW MR or the transformer (if electronic type).
- At very low dimmer settings, rapid flickering of the iW MR can occur. This is not harmful to the lamp, and may only be noticeable in low-light situations.
- Dimmers must be installed on the primary (line voltage) side of the transformer, not on the secondary (lamp) side.
- Dimmers compatible with the transformer and the iW MR may still have points in its dimming range where strobing can occur. This is usually the result of not meeting the minimum dimmer load, and will not harm the iW MR. If a dimmer has adjustable pre-set levels available, set them to avoid any such points in the dimming range. Follow the manufacturer's instructions for setting the pre-set levels.

INSTALLATION CONSIDERATIONS

- Consult an Electrical Inspector to approve all wiring plans.
- Refer to local and state codes for installation compliance.
- Select an appropriate low-voltage MR16 lighting fixture and transformer and follow the manufacturer's instructions for installation and wiring.
- Not intended for use in with enclosed or constricted air flow fixtures, *see Providing Adequate Ventilation*.
- Do not exceed maximum operating temperatures. Refer to specifications on Page 2.
- Employ Color Kinetics Application Engineering Services.

INSTALLING iW MR

The iW MR light system requires low-voltage MR16 fixtures with low-voltage (12VAC) transformers. Installing a dimmer on the light system is optional.

WARNING: iW MR light systems should be installed by a qualified electrician or technician in accordance with NEC and relevant local codes.

- Install and wire the MR16 fixtures according to the manufacturer's instructions.
- Install and wire the low-voltage, 12VAC, transformer according to the manufacturer's instructions.
- Optional, install a dimmer suitable for the selected transformer according to the manufacturer's instructions.

CAUTION: Ensure the power is off before installing iW MR lights. Failure to do so can result in property damage.

- With power disconnected, plug iW MR lamps into fixtures.

CAUTION: At 3.4 ounces, iW MR weights more than traditional MR16 lamps and could loosen with use and vibration. Use fixtures and lamp holders that have locking devices. Failure to do so can result in property damage and personal injury.

OPERATING TEMPERATURE

The iW MR is designed with the latest LED technology to provide the maximum possible light output in a standard MR16 package. Although iW MR operates at much cooler temperatures than a standard halogen MR16 bulb, the housing can reach temperatures of 167° F (75C). For this reason, handle with care to prevent injuries and provide adequate ventilation to the lamp and fixture.

During normal operation, the iW MR housing becomes very hot and remains hot for an extended time after operation is suspended. Exercise caution when handling the lamp after extended operation to prevent burns.

It is necessary to provide adequate ventilation around the lamp. Adequate ventilation refers to the airflow over the surface of the lamp and air flow within the room, not the room temperature. An iW MR in a hot (40C) room with a fan or ventilation system that keeps air moving can actually run cooler on its surface than in a cool (20C) room with stagnant air.

If any problems occur during usage, unplug the product immediately and call or email:
Color Kinetics Technical Support Group:
1-888-FULL RGB or 617-423-9999 or
www.colorkinetics.com/support

iW MR SPECIFICATIONS

SOURCE	4 high brightness white LEDs
COLOR TEMPERATURES	3000, 3500, and 6500 Kelvin
MIN. SPOT DISTANCE	6 inches (15 cm)
HOUSING	Die-cast zinc, approx. 1.8" (4.6 cm) MOL, 2" (5 cm) DIA.
BASE	GX5.3
WEIGHT	3.5 oz. (0.1 kg)
POWER CONSUMPTION	4W Max.
POWER REQUIREMENT	12VAC
ENVIRONMENTAL SPECIFICATIONS	
AMBIENT TEMP	-4°F to 104°F (-20°C to 40°C)
LAMP SURFACE TEMP	167°F (75°C)
HUMIDITY	0 to 95% non-condensing

LED SOURCE LIFE

In traditional lamp sources, lifetime is defined as the point at which 50% of the lamps fail. This is also termed Mean Time Between Failure [MTBF]. LEDs are semiconductor devices and have a much longer MTBF than conventional sources. However, MTBF is not the only consideration in determining useful life. Color Kinetics uses the concept of useful light output for rating source lifetimes. Like traditional sources, LED output degrades over time (lumen depreciation) and this is the metric for SSL lifetime.

LED lumen depreciation is affected by numerous environmental conditions such as ambient temperature, humidity, and ventilation. Lumen depreciation is also affected by means of control, thermal management, current levels, and a host of other electrical design considerations. Color Kinetics systems are expertly engineered to optimize LED life when used under normal operating conditions. Lumen depreciation information is based on LED manufacturers' source life data as well as other third party testing. Low temperatures and controlled effects have a beneficial effect on lumen depreciation. Overall system lifetime could vary substantially based on usage and the environment in which the system is installed.

Temperature and effects will affect lifetime. Color Kinetics rates product lifetime using lumen depreciation to 70% of original light output. When the fixture is running on warm or cool, at room temperature, the LED lifetime is in the range 50,000 – 70,000 hours. This is LED manufacturers' test data. High output is defined as any LED device that is 1/2 watt or above. For more detailed information on source life, please see www.colorkinetics.com/lifetime.

WARRANTY

This product is sold pursuant to CK's Standard Terms and Conditions (the "T&Cs") which may be found at http://colorkinetics.com/howtobuy/buy/terms and which contain important provisions, including, among others, Limited Warranty, exclusions and limitations on CK's liability for damages, and restrictions on the remedies that are available to you.

iW COVE POWERCORE

An IntelliWhite™ Product

The iW™ Cove Powercore fixture combines the intelligent white LED illumination systems of the IntelliWhite™ family with the versatile housing of the iColor Cove® MX fixture. This high performance 12" (30.2 cm) linear fixture is designed for common interior alcove applications, such as lobbies, atriums, schools, museums, malls, or other public spaces. Integrated Powercore® technology provides greater operational efficiency and simplified installation.

Powercore technology, a digital power processing technology that drives LED systems, integrates power and data management directly into the fixture and eliminates the need for an external power supply. Powercore surpasses traditional power supply technology by streamlining multiple conversion and regulation stages into a single, flexible, microprocessor-controlled power stage that controls power output to LED systems directly from line voltage and significantly increases overall system efficiency.

iW Cove Powercore is available in medium and asymmetric beam angles. The asymmetric version provides a true forward-throw asymmetric projection of light. This option is designed to deliver superior surface uniformity with no waste, resulting in a better ratio of light projected onto the receiving surface with an even distribution from top to bottom when used in alcove applications.

iW Cove Powercore's integral, two-point mounting bracket simplifies installation. It permits 180° of rotation, with detents every 10°. This provides adjustable aiming to tailor the illumination performance to the application. The fixture can be rotated to the desired position and locked in place with the included set screws. The end-to-end locking connectors, capable of making 180° turns, make iW Cove Powercore extremely versatile and easily adaptable to even the most challenging mounting requirements. An optional mounting track is available for linear runs.

iW Cove Powercore receives data via Color Kinetics® iW Data Enabler – a data formatting device specifically designed for use with Color Kinetics IntelliWhite Powercore based fixtures and line of iW controllers. Each iW Data Enabler will support up to 48 (110VAC), 74 (220VAC), or 78 (240VAC) iW Cove Powercore fixtures, using a 40-foot (12 m) field-cuttable leader cable. One-foot (0.3 m) and five-foot (1.5 m) jumper cables are available for installations that require spacing between fixtures.

iW COVE POWERCORE SPECIFICATIONS

COLOR TEMP RANGE	3000K to 6500K adjustable
SOURCE	High intensity LEDs
BEAM ANGLE	Medium (50° x 50°), Forward-Throw Asymmetric (20° x 30° x 160°)
HOUSING	Die cast aluminum, powder coated 12.00" x 2.00" x 1.54" (30.48 cm x 5.09 cm x 3.90 cm)
CONNECTORS	Integral male/female connectors
LISTINGS	UL/cUL, CE

COMMUNICATION SPECIFICATIONS

DATA INTERFACE	Color Kinetics iW Data Enabler
CONTROL	Color Kinetics full line of controllers including iW Scene Controller or Light System Manager**

ELECTRICAL SPECIFICATIONS

POWER REQUIREMENT	100-240VAC, 50-60 Hz
POWER CONSUMPTION	15W
POWER FACTOR	0.95 or greater at 120VAC

ENVIRONMENTAL SPECIFICATIONS

TEMPERATURE RANGE	-4˚F to 122˚F (-20˚C to 50˚C) based on testing of specific product
PROTECTION RATING	IP50

** For large or complex installations, consider controlling iW Cove Powercore with Light System Manager (LSM). Refer to the LSM data sheets or contact support@colorkinetics.com for more information.

LED SOURCE LIFE

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LED lumen depreciation is affected by numerous environmental conditions such as ambient temperature, humidity, and ventilation. Lumen depreciation is also affected by means of control, thermal management, current levels, and a host of other electrical design considerations. Color Kinetics systems are expertly engineered to optimize LED life when used under normal operating conditions. Lumen depreciation information is based on LED manufacturers' source life data as well as other third party testing. Low temperatures and controlled effects have a beneficial effect on lumen depreciation. Overall system lifetime could vary substantially based on usage and the environment in which the system is installed.

Temperature and effects will affect lifetime. Color Kinetics rates product lifetime using lumen depreciation to 70% of original light output. When the fixture is running on warm or cool, at room temperature, the LED lifetime is in the range 50,000 – 70,000 hours. This is based on LED manufacturers' test data. High output is defined as any LED device that is 1/2 watt or above. For more detailed information on source life, please see www.colorkinetics.com/lifetime.

CHROMACORE® BY COLOR KINETICS

POWERCORE® BY COLOR KINETICS

OPTIBIN® BY COLOR KINETICS

DRY

DAMP

LISTED 13PE

ITEM# 523-000002-00 (Medium)
ITEM # 523-000002-01 (Asymmetric)

This product is protected by one or more of the following patents: U.S. Patent Nos. 6,016,038, 6,150,774 and other patents listed at http://colorkinetics.com/patents/. Other patents pending.

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iW COVE POWERCORE - MEDIUM

PHOTOMETRIC PERFORMANCE

SOURCE SPECIFICATIONS

Lens:	UV-resistant soft-focus polycarbonate lens
Source:	10 LEDs (5 warm white, 5 cool white)
Beam Angle:	50° X 50° (at 50% of peak illuminance)
Distribution:	Symmetric direct illumination
CCT:	Adjustable 3000–6500K
CRI:	81 All, 73 Warm, 86 Cool

ILLUMINANCE DISTRIBUTION

0.2 / 2.2	0.3 / 3.2	0.4 / 4.3	0.3 / 3.2	0.2 / 2.2	0.2 / 2.2	1.0′/0.3m
0.3 / 3.2	3.9 / 42.0	7.4 / 79.7	4.0 / 43.1	0.4 / 4.3	0.2 / 2.2	2.0′/0.6m
0.3 / 3.2	7.4 / 79.7	17.8 / 191.6	14.4 / 155.0	4.0 / 43.1	0.3 / 3.2	3.0′/1.0m
0.3 / 3.2	4.0 / 43.1	14.4 / 155.0	17.8 / 191.6	7.4 / 79.7	0.3 / 3.2	4.0′/1.2m
0.2 / 2.2	0.4 / 4.3	4.0 / 43.1	7.4 / 79.7	3.9 / 42.0	0.3 / 3.2	5.0′/1.5m
0.2 / 2.2	0.2 / 2.2	0.3 / 3.2	0.4 / 4.3	0.3 / 3.2	0.3 / 3.2	6.0′/2.0m

3.0′/1.0m 0′/0m 3.0′/1.0m

Units: Footcandles (top)/Lux (bottom)
10.8 lux = 1 fc
Location: Centered 1′/0.3m from, and perpendicular to, surface
Measured on: All, Reflectance 50%

CANDLE POWER DISTRIBUTION

Measured on: All
Beam peak: 133 cd
Thin dashed line: Indicates 50% of peak

ILLUMINANCE

	3′ / 1m	6′ / 2m	9′ / 3m	15′ / 5m
ALL	19.3 / 207.7	4.2 / 45.2	1.8 / 19.4	0.6 / 6.5

Measured in Footcandles (top)/Lux (bottom) on axis.
Measured on all, reflectance 0.

LIGHT OUTPUT

	TOTAL OUTPUT (lumems)	POWER (Watts)	EFFICACY (lm/W)
ALL	120	15.0	8.0
WARM	109	15.0	7.3
COOL	116	15.0	7.7

Note: Efficacy figures are for a complete tested fixture not simply a lamp source.

CRI

It is common practice in the lighting industry to use color rendering index (CRI) to compare the properties of various light sources. There are known deficiencies and limitations associated with CRI and as a result, it is not always an accurate indicator of good object color appearance. This is especially true for LED-based sources. Until a better method for measuring color rendering in LEDs is accepted, Color Kinetics measures CRI in accordance with the current CIE 13.3-1995 standard using the Ra calculation. The reference illuminants employed are the Planckian locus below 5000K and CIE Daylight reference above 5000K. All measurements for Color Kinetics products are performed by third party laboratories using NIST-traceable instruments.

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iW COVE POWERCORE - ASYMMETRIC

PHOTOMETRIC PERFORMANCE

SOURCE SPECIFICATIONS

Lens:	UV-resistant soft-focus polycarbonate lens
Source:	10 LEDs (5 warm white, 5 cool white)
Beam Angle:	20° x 30° x 160° (at 50% of peak illuminance)
Distribution:	Asymmetric direct illumination
CCT:	Adjustable 3000–6500K
CRI:	84 All, 78 Warm, 87 Cool

ILLUMINANCE DISTRIBUTION

0.7 / 7.5	0.9 / 9.7	0.9 / 9.7	0.9 / 9.7	0.8 / 8.6	0.6 / 6.5	6'/2m
1.1 / 11.8	1.7 / 18.3	1.8 / 19.4	1.7 / 18.3	1.4 / 15.1	0.9 / 9.7	
1.6 / 17.2	3.1 / 33.4	3.9 / 42.0	3.5 / 37.7	2.4 / 25.8	1.3 / 14.0	3'/1m
1.7 / 18.3	4.1 / 44.1	6.0 / 64.6	5.5 / 59.2	3.5 / 37.7	1.7 / 18.3	
1.4 / 15.1	3.6 / 38.8	6.0 / 64.6	6.0 / 64.6	3.8 / 40.9	1.6 / 17.2	
1.1 / 11.8	2.7 / 29.1	4.8 / 51.7	5.0 / 53.8	3.0 / 32.3	1.2 / 12.9	0'/0m
3'/1.0m		0'/0m			3'/1.0m	

Units: Footcandles (top)/Lux (bottom)
10.8 lux = 1 fc
Location: 2'/0.6m from surface, 45° tilt up from surface
Measured on: Reflectance model 50/50/50

ILLUMINANCE

	0.5' / 0.15m	1' / 0.3m	2' / 0.6m	3' / 1m
ALL	4544.0 / 48911.6	182.0 / 1959.0	26.9 / 289.6	10.3 / 110.9

Measured in Footcandles (top)/Lux (bottom).
Measured on: Reflectance 0.

CANDLE POWER DISTRIBUTION

Measured on: All
Beam peak: 107 cd
Thin dashed line: Indicates 50% of peak

LIGHT OUTPUT

	TOTAL OUTPUT (lumems)	POWER (Watts)	EFFICACY (lm/W)
ALL	116	20.8	5.6
WARM	97	21.0	4.6
COOL	119	21.0	5.7

Note: Efficacy figures are for a complete tested fixture not simply a lamp source.

CRI

It is common practice in the lighting industry to use color rendering index (CRI) to compare the properties of various light sources. There are known deficiencies and limitations associated with CRI and as a result, it is not always an accurate indicator of good object color appearance. This is especially true for LED-based sources. Until a better method for measuring color rendering in LEDs is accepted, Color Kinetics measures CRI in accordance with the current CIE 13.3-1995 standard using the Ra calculation. The reference illuminants employed are the Planckian locus below 5000K and CIE Daylight reference above 5000K. All measurements for Color Kinetics products are performed by third party laboratories using NIST-traceable instruments.

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iW COVE POWERCORE

PHYSICAL DIMENSIONS

SIDE

BOTTOM

OPTIONAL MOUNTING TRACK

END **SIDE**

TOP

iW Cove Powercore Specification	
DATA/POWER CONNECTOR	Over-molded cable assembly
POWER REQUIREMENT	100-240VAC
WEIGHT	1.0 lbs (0.45 kg)

iW COVE POWERCORE

FUNCTIONAL FLOW DIAGRAM

For complete installation instructions and safety precautions, refer to the iW Cove Powercore User Guide and wiring diagrams located at www.colorkinetics.com/support.

Additional Items	
Data Device	iW Data Enabler (ITEM# 506-000001)
Controller	Color Kinetics controllers including iW Scene Controller or Light System Manager
Cable	Leader Cable (ITEM# 108-000021; 108-000022)

OPTIBIN®

There are inherent variations in the fabrication processes of all semiconductor materials. For LEDs, this variance results in differences in the color and intensity of light output as well as electrical characteristics. Due to these differences, LED manufacturers sort production into "bins," but insuring the availability of a single bin is very difficult. To minimize this issue and achieve optimal color consistency in its products, Color Kinetics has developed and uses a proprietary technology called Optibin. Optibin is an advanced production binning optimization process that minimizes the effects of LED variance for the best possible output uniformity in the final product. Color Kinetics Optibin technology gives the most consistent control of color and intensity from product to product.

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iW COVE POWERCORE

USER GUIDE

An IntelliWhite™ Product

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DRY

iW Cove Powercore
ITEM# 523-000002-00 (Medium)
ITEM# 523-000002-01 (Asymmetric)

This product is protected by one or more of the following patents: U.S. Patent Nos. 6,016,038, 6,150,774 and other patents listed at http://colorkinetics.com/patents/. Other patents pending.

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LISTED 13PE

GETTING STARTED

iW™ Cove Powercore is a high performance color temperature controllable white light system for use in interior alcove applications. Integrated Powercore® technology provides operational efficiency and simplified installation. This guide contains important information about installing and operating your iW Cove Powercore safely and accurately.

Included In This Box

- iW Cove Powercore fixture
- User Guide

Additional Items Needed

- Color Kinetics iW Data Enabler (ITEM# 506-000001-00)
- Indoor Cove Powercore 40-Foot (12 m) Leader Cable with terminator (ITEM# 108-000021-00 US, 108-000021-01 EU)
- Four #6 (M3.5) mounting screws and tools
- Hex key wrench (2mm)
- Color Kinetics line of controllers, including iW Scene Controller or Light System Manager

Optional Items

- Indoor Cove Powercore 1-Foot (0.3 m) Jumper Cable (ITEM# 108-000022-00)
- Indoor Cove Powercore 5-Foot (1.5 m) Jumper Cable (ITEM# 108-000022-01)
- Indoor Cove Powercore 4-Foot (1.2 m) Mounting Track (ITEM# 123-000006-00)

Scope of This User Guide

The goal of this user guide is to explain the steps necessary to install iW Cove Powercore and assure peak performance. Its intended use is for reference only, by persons who are fully qualified. This document should never be considered a substitute for any provision of a regulation or state and/or local code.

Identification and Warnings of Safety Hazards

In accordance with ANSI Z535.4-2002 the following system of identifying the severity of the hazards associated with the products is used:

"**DANGER**" Imminently hazardous situation which, if not avoided, will result in death or serious injury.

"**WARNING**" Potentially hazardous situation which, if not avoided, could result in death or serious injury.

"**CAUTION**" Potentially hazardous situation which, if not avoided, may result in minor or moderate injury or property damage. Also used to alert against unsafe practices.

IGNORING A HAZARD WILL VOID ANY WARRANTY.

WARNING: Ensure that main power supply is off before installing or wiring iW Cove Powercore.

WARNING: iW Cove Powercore must be installed by a qualified electrician in accordance with NEC and relevant local codes.

WARNING: Do not attempt to install or use iW Cove Powercore until you read and understand the installation instructions and safety labels.

WARNING: Do not use iW Cove Powercore if the power cables are damaged.

WARNING: Use appropriate hardware and mounting methods to support the fixture adequately.

CAUTION: iW Cove Powercore has no user serviceable parts. Do not attempt to open the fixture.

CAUTION: Do not exceed the specified voltage and current input.

CAUTION: Do not exceed the maximum number of specified fixtures in a light run. Doing so will result in current overload.

CAUTION: Do not use sharp tools near or on the fixture lens.

CAUTION: Do not hot swap. Ensure that power to the fixture is off before connecting or disconnecting fixtures.

CAUTION: iW Cove Powercore is a Class 2 LED product with LED radiation. Do not stare into beam or view directly with optical instruments.

NOTE: The instructions and precautions set forth in this user guide are not necessarily all-inclusive, or relevant to all applications as Color Kinetics cannot anticipate all conceivable or unique situations.

Owner/User Responsibilities

It is the responsibility of the contractor, installer, purchaser, owner, and user to install, maintain, and operate iW Cove Powercore in such a manner as to comply with all state and local laws, ordinances, regulations, and the American National Standards Institute Safety Code.

PLANNING THE INSTALLATION

The iW Cove Powercore installation requires in-depth planning to ensure timely, successful installation with minimal complications and down time.

Planning Suggestions

When planning iW Cove Powercore installation, Color Kinetics suggests doing the following:

- Consult an Electrical Inspector to review all wiring plans.
- Refer to local and state codes for installation compliance.
- Create a Layout Plan drawing.
- Consult Color Kinetics Application Engineering Services, as needed at support@colorkinetics.com.

Installation Considerations

When creating your installation plan, consider the following:

- **Zones.** iW Cove Powercore fixtures are dimmable, color temperature adjustable fixtures that are controlled by zones. Using the iW Scene Controller, you can set the brightness level and color temperature, from cool to warm, for all fixtures within a specified zone.

  Create zones by internally designating each iW Data Enabler as a specific alphanumeric zone, 1-9 or A-F. All fixtures attached to that iW Data Enabler reside within the designated zone. For example, in an installation with two iW Data Enablers where the first Data Enabler is set to Zone 1 and the second is set to Zone 2, the fixtures attached to the first Data Enabler are in Zone 1 and the fixtures attached to the second Data Enabler are in Zone 2.

  For installations where all fixtures are controlled in unison, set each iW Data Enabler in the installation to the same zone designator. For installations where groups of lights are controlled individually, set unique zone designators for each iW Data Enabler.

- **Location of iW Data Enabler in relationship to iW Cove Powercore fixtures.** Each iW Data Enabler supports one Powercore product leader cable with up to 48 (at 120VAC), 74 (at 220VAC), or 78 (at 240VAC) Powercore fixtures run in series, using a 40-foot (12 m), field-cuttable leader cable. The leader cable can be cut to a desired length. Shortening the leader cable increases the number of fixtures that the iW Data Enabler will support. The leader cable can be lengthened when the distance between iW Data Enabler and the first fixture in the series is greater than 40 feet (12 m). Lengthening the leader cable decreases the number of fixtures that the iW Data Enabler will support. A junction box will be required for the leader extension connections.

  NOTE: Adhere to all state and local wiring codes when making the leader extension connections.

- **Calculate the number of fixtures per iW Data Enabler.** Use the *Configuration Calculator* located at www.colorkinetics.com/support to calculate the number of fixtures you can put on an iW Data Enabler. The fixtures to iW Data Enabler ratio is determined by the parameters of your installation. Installation parameters include all or part of the following: line voltage, fixture type, leader length, jumper lengths, and wire gauge.
- **Location of the fixture and method of attaching.** Mounting hardware is dictated by the mounting surface. Ensure that the hardware used is appropriate for the mounting surface.
- **Install and wire the iW Data Enabler before installing iW Cove Powercore fixtures.** Refer to the iW Data Enabler Installation Guide.

INSTALLING iW COVE POWERCORE

Steps to a Successful Installation

1. Set the zone(s) for the iW Data Enabler.
2. Install the iW Data Enablers.
3. Install iW Cove Powercore fixtures.
4. Install the iW Scene Controller.
5. Connect power and data from the iW Data Enabler to the fixtures.

Setting the iW Data Enabler Zone

To minimize installation time and effort, set the zone for each iW Data Enabler prior to installing. Zones can be set or changed after installing the Data Enabler; however, any settings or changes made after power is applied requires a power cycle to recognize the change.

Using a small, flat-head screw driver, set the zone for the iW Data Enabler by rotating the zone switch, located next to the LED indicators, to a specific designator–1 to 9 or A to F. The designator zero (0) is reserved for future features. See Fig. 1.

Fig. 1

Installing the iW Data Enabler

Determine a location for the iW Data Enabler. One iW Data Enabler can support as many as 48 (at 120VAC), 74 (at 220VAC), or 78 (at 240VAC) iW Cove Powercore fixtures in a single zone. Multiple iW Data Enablers are needed for installations that require multiple zones or that exceed the calculated number of fixtures allowed in a single zone.

Refer to the iW Data Enabler Installation Guide for complete installation, wiring and zone setting instructions. After running power and data to the iW Data Enabler and setting the zone, you are ready to attach the iW Cove Powercore fixtures. Figure 2 shows iW Cove Powercore fixtures connected to iW Data Enabler.

Fig. 2

Installing the Fixtures

WARNING: Ensure that the power source is off before wiring the iW Data Enabler or connecting fixtures. Failure to do so could result in death or serious injury and will void the warranty.

iW Cove Powercore fixtures are installed in series. The in-line connectors allow the fixtures to be installed end-to-end in a continuous run for the best visual effects. The connectors have enough slack to allow for 1" spacing between fixtures. Jumper cables are available to add space between the fixtures when needed.

iW Cove Powercore fixtures can be surface mounted or can be installed in a track.

Surface Mounting

To mount iW Cove Powercore directly to a surface, rotate the fixture from the horizontal position to the left or right 90 degrees to provide unobstructed access to the mounting holes. Use hardware suitable for the mounting surface. See Fig. 3.

Fig. 3

Note: The iW Cove Powercore fixture base can be used as a template when pre-drilled pilot holes are required. Hold the fixture in place and mark the two screw holes. Refer to Fig. 4 for minimum and maximum fixture positioning dimensions.

Fig. 4

Mounting Track

The use of the optional mounting track aids in linear installations of iW Cove Powercore by ensuring straight runs and providing fixture support during the installation.

Fig. 5

- The plastic track can be field cut with a hacksaw or tin snips. Cut track to desired length. See Fig. 5.
- Install track using hardware suitable for the mounting surface. Hardware used must not extend above the track standoffs after installation to ensure proper fixture fit. The recommended maximum spacing between screws is 12 inches (30 cm). See Fig. 6.

Fig. 6

- When using mounting tracks on a horizontal surface, install the track first, and then snap the fixture into the track to complete the mounting installation. See Fig. 7.
- When using mounting tracks on vertical or overhead surfaces, install the track first, then snap the fixture into the track, and then insert the mounting screws through the fixture and track. The mounting track will hold the fixture in place while you attach the mounting screws. See Fig. 8.

Fig. 7

Fig. 8

WARNING: For vertical and overhead track installations, the fixtures must be attached using mounting screws. Failure to attach the fixtures with mounting screws could result in death or serious injury and will void the warranty.

Installing iW Scene Controller

All fixtures connected to iW Data Enabler reside in the zone designated on iW Data Enabler. iW Scene Controller allows you to control all fixtures within specified zones. iW Scene Controller allows you to adjust the color temperature of the fixtures from warm to cool and set the brightness level for all fixtures within a zone.

After installing iW Data Enabler and attaching fixtures, install iW Scene Controller. Simply plug one end of the 4-pin, 50 foot (15 m) leader cable into the connector located on the back of iW Scene Controller, and the other end into the controller connector within iW Data Enabler. iW Scene Controller fits into a standard single-gang wall box. iW Scene Controller must be located within 50 feet (15 m) of iW Data Enabler. Refer to the iW Data Enabler and iW Scene Controller Installation Guides for complete installation, wiring, and operating instructions.

Making Electrical Connections

1. Position the first iW Cove Powercore fixture in a series. Either attach the fixture with four #6 (M3.5) mounting screws suitable for the mounting surface or snap it into the track. Ensure that the male connector is in position to receive data and power from the leader cable's female connector. See Fig. 9.
2. Position the next fixture in the series, matching the male connector end to the female connector of the previously mounted fixture. Attach the fixture to the surface or snap it into the track.

   The flexible connector cables allow for a maximum 180° turning radius.
3. Continue mounting the fixtures, making power/data connections as you go, until all fixtures in the series are mounted.
4. Once all fixtures are mounted and connected, connect the leader cable from iW Data Enabler to the first fixture in the series. Ensure that the power is off when making this connection.

Fig. 9

CAUTION: Ensure a terminator is inserted into the last fixture of each series. Failure to do so may result in minor or moderate injury or property damage and will void the warranty.

5. Insert the terminator into the last fixture of each series.
6. Repeat Steps 1 through 5 for each iW Data Enabler in the installation until all fixtures are installed.

Aiming and Locking the Fixtures

iW Cove Powercore can be aimed and locked into position either during installation or after the fixtures have been installed and powered on. To aim and lock the fixture:

1. Rotate the fixture to the desired position.
2. Using a hex key wrench, tighten the set screw located on each end of the fixture to lock the fixture in place. See Fig. 10.

CAUTION: Do not overtighten set screws. Failure to do so may result in minor or moderate injury or property damage and will void the warranty.

Fig. 10

Aiming Fixtures

For the Medium beam angle fixtures, the position of the track determines how the fixtures are aimed. For the Asymmetric beam angle fixtures, refer to the label on the female connector end of the end caps of each fixture to determine where the majority of the light will be directed. Position the fixture in the track accordingly. The light direction arrow should point in the direction where the majority of light will be projected. For example, to use iW Cove Powercore in a Cove application, position the fixture in the track so the arrow points out of the cove. (See Fig. 11).

Fig. 11

IMPORTANT INFORMATION

Strobe Warning

There is some anecdotal evidence that strobe lighting may induce epileptic symptoms in certain susceptible individuals, although no associated product warnings have been issued by United States government according to the Food and Drug Administration.

If strobe lights are used, some international regulatory agencies[1] recommend keeping flicker rates at or below four flashes per second (as less of the flicker-sensitive population will then be at risk of an attack). This flicker rate applies only to the overall output of any group of lights in direct view. However, when more than one strobe light is used, the flashes should be synchronized. End users should also consider issuing a warning, alerting audience or viewers to the presence of strobe lighting.

Temperature Monitoring

For protection from extreme temperatures, the iW Cove Powercore has been designed with a temperature monitoring feature. If operating temperatures rise to an unsafe level, a compensation circuit is triggered and the iW Cove Powercore operation is interrupted causing the lights to turn a dim warm (3000K). After 30 minutes the lights will return to normal operation. The lights can also be reset by cycling the power.

To prevent additional shut-downs, determine the cause of the overheating and correct the problem. If any additional problems occur during usage, unplug the product immediately and call or email: Color Kinetics Technical Support Group: 1-888-FULL-RGB or 617-423-9999 or support@colorkinetics.com.

iW COVE POWERCORE SPECIFICATIONS

COLOR TEMP RANGE	3000K to 6500K adjustable
SOURCE	High intensity LEDs
BEAM ANGLE	50° x 50° (Medium) 20° x 30° x 160° (Asymmetric)
HOUSING	Die cast aluminum, powder coated 12.00" x 2.00" x 154" (30.48 cm x 5.09 cm x 3.90 cm)
CONNECTORS	Integral male/female connectors
LISTINGS	UL/cUL, CE
DATA INTERFACE	Color Kinetics iW Data Enabler
CONTROL	Color Kinetics full line of controllers including iW Scene Controller or Light System Manager**
INPUT/OUTPUT	100-240VAC, 50-60 Hz
CONSUMPTION	15 Watts
POWER FACTOR	0.95 or greater @120VAC
TEMPERATURE RANGE	-4°F to 122°F (-20°C to 50°C) based on testing of specific product
PROTECTION RATING	IP50

** For large or complex installations, consider controlling iW Cove Powercore with Light System Manager (LSM). Refer to the LSM data sheets or contact support@colorkinetics.com for more information.

LED Source Life

In traditional lamp sources, lifetime is defined as the point at which 50% of the lamps fail. This is also termed Mean Time Between Failure [MTBF]. LEDs are semiconductor devices and have a much longer MTBF than conventional sources. However, MTBF is not the only consideration in determining useful life. Color Kinetics uses the concept of useful light output for rating source lifetimes. Like traditional sources, LED output degrades over time (lumen depreciation) and this is the metric for SSL lifetime.

LED lumen depreciation is affected by numerous environmental conditions such as ambient temperature, humidity, and ventilation. Lumen depreciation is also affected by means of control, thermal management, current levels, and a host of other electrical design considerations. Color Kinetics systems are expertly engineered to optimize LED life when used under normal operating conditions. Lumen depreciation information is based on LED manufacturers' source life data as well as other third party testing. Low temperatures and controlled effects have a beneficial effect on lumen depreciation. Overall system lifetime could vary substantially based on usage and the environment in which the system is installed.

Temperature and effects will affect lifetime. Color Kinetics rates product lifetime using lumen depreciation to 70% of original light output. When the fixture is running on warm or cool, at room temperature, the LED lifetime is in the range 50,000 – 70,000 hours. This is LED manufacturers' test data. High output is defined as any LED device that is 1/2 watt or above. For more detailed information on source life, please see www.colorkinetics.com/lifetime.

Warranty

This product is sold pursuant to CK's Standard Terms and Conditions (the "T&Cs") which may be found at http://colorkinetics.com/howtobuy/buy/terms and which contain important provisions, including, among others, Limited Warranty, exclusions and limitations on CK's liability for damages, and restrictions on the remedies that are available to you.

[1] Guide to Health, Safety and Welfare at Pop Concerts and Similar Events, HMSO Publications (UK)

iW CAST 14 POWERCORE

IntelliWhite™ iW Cast 14 Powercore is a first-of-its kind LED white light fixture. It is a high-performance union of linear fixture design with maximized light intensity for wall washing, highlighting architectural detail, designs, and lit surfaces to complement ambient scenes and moods. iW Cast Powercore provides flexible color temperature and brightness control through Chromacore®, the proven technology that underlies Color Kinetics' existing intelligent solid-state lighting systems. When applied to IntelliWhite products, Chromacore controls channels of warm white and cool white LEDs to produce output of color temperatures within the range of 3000 - 6500 kelvin from within a single fixture. iW Cast 14 Powercore allows the adjustment of intensity while providing the option to either maintain constant color temperature or vary the color temperature.

iW Cast 14 Powercore, designed to meet the rugged requirements of outdoor applications, is completely sealed and meets specifications for wet locations. iW Cast 14 Powercore is available with either a narrow or wide beam angle. The attached, two-point mounting plate simplifies installation and minimizes required tools. The over-molded, end-to-end locking connectors, capable of making 180° turns, make iW Cast 14 Powercore extremely versatile and easily adaptable for even the most challenging mounting environments.

iW Cast 14 Powercore incorporates patent-pending Powercore® digital power processing technology to drive LED systems, integrating power and data management directly into the fixture and eliminating the need for an external power supply. Powercore surpasses traditional power supply technology by streamlining multiple conversion and regulation stages into a single, flexible, microprocessor-controlled power stage that controls power output to LED systems directly from line voltage and significantly increases overall system efficiency. Built-in active power factor correction (PFC) yields higher system efficiencies and minimizes stress on building wiring making the installation and system more cost effective.

iW Cast 14 Powercore receives data via Color Kinetics iW Data Enabler—a data formatting device specifically designed for use with Color Kinetics IntelliWhite Powercore based fixtures and Color Kinetics line of iW controllers. Each iW Data Enabler will support up to 36 (110VAC) or 61 (240VAC) iW Cast 14 Powercore fixtures, using a 50-foot, field-cuttable leader cable. The Data Enabler supports a slightly greater or fewer number of fixtures depending on customized installation parameters, including line voltage, leader and jumper cable lengths. One-foot (30 cm) and five-foot (152 cm) jumper cables are available for installations that require spacing between fixtures.

iW CAST 14 SPECIFICATIONS

TEMPERATURE RANGE	3000K to 6500K
SOURCE	High intensity, power LEDs
BEAM ANGLE	18° or 112°
HOUSING	Die cast aluminum, black or white powder coated 13.5" x 2.7" x 2.7" (34.3 cm) x (6.9 cm) x (6.9 cm)
LENS	Polycarbonate with UV and scratch resistant silicone hard coat
CONNECTORS	Over-molded, integral male/female connectors
LISTINGS	UL/cUL, CE

COMMUNICATION SPECIFICATIONS

DATA INTERFACE	Color Kinetics iW Data Enabler
CONTROL	Color Kinetics line of iW Controllers including iW Scene Controller

ELECTRICAL SPECIFICATIONS

POWER REQUIREMENT	100-240VAC, 50-60 Hz
POWER CONSUMPTION	30W at full output
POWER FACTOR	0.95 or greater at 120VAC

ENVIRONMENTAL SPECIFICATIONS

TEMPERATURE RANGE	-40°F to 122°F (-40°C to 50°C) operating temperature -4°F to 122°F (-20°C to 50°C) starting temperature
PROTECTION RATING	IP66

LED SOURCE LIFE

In traditional lamp sources, lifetime is defined as the point at which 50% of the lamps fail. This is also termed Mean Time Between Failure [MTBF]. LEDs are semiconductor devices and have a much longer MTBF than conventional sources. However, MTBF is not the only consideration in determining useful life. Color Kinetics uses the concept of useful light output for rating source lifetimes. Like traditional sources, LED output degrades over time (lumen depreciation) and this is the metric for SSL lifetime.

LED lumen depreciation is affected by numerous environmental conditions such as ambient temperature, humidity, and ventilation. Lumen depreciation is also affected by means of control, thermal management, current levels, and a host of other electrical design considerations. Color Kinetics systems are expertly engineered to optimize LED life when used under normal operating conditions. Lumen depreciation information is based on LED manufacturers' source life data as well as other third party testing. Low temperatures and controlled effects have a beneficial effect on lumen depreciation. Overall system lifetime could vary substantially based on usage and the environment in which the system is installed.

Temperature and effects will affect lifetime. Color Kinetics rates product lifetime using lumen depreciation to 70% of original light output. When the fixture is running on warm or cool, at room temperature, the LED lifetime is in the range 50,000 – 70,000 hours. This is LED manufacturers' test data. High output is defined as any LED device that is 1/2 watt or above. For more detailed information on source life, please see www.colorkinetics.com/lifetime.

CHROMACORE® BY COLOR KINETICS

POWERCORE® BY COLOR KINETICS

OPTIBIN® BY COLOR KINETICS

DRY

DAMP

WET

LISTED 13PE

ITEM# 501-000002-00 (White, Narrow)
501-000002-01 (Black, Narrow)
501-000009-00 (White, Wide)
501-000009-01 (Black, Wide)

This product is protected by one or more of the following patents: U.S. Patent Nos. 6,016,038, 6,150,774 and other patents listed at http://colorkinetics.com/patents/. Other patents pending.

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BRO144 Rev 03

Specifications subject to change without notice. Refer to www.colorkinetics.com for the most recent data sheet versions.

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iW CAST 14 POWERCORE - NARROW

PHOTOMETRIC PERFORMANCE

Photometric data is based on test results from an independent testing lab.

SOURCE SPECIFICATIONS

Optics:	Metalized polycarbonate reflectors
Lens:	UV resistant soft focus polycarbonate lens
Source:	18 LEDs (12 warm white, 6 cool white)
Beam Angle:	18° (at 50% of peak illuminance)
Distribution:	Symmetric direct illumination
CCT:	Adjustable 3,000–6,500K
CRI:	82 All, 74 Warm, 87 Cool

ILLUMINANCE DISTRIBUTION

1.4 / 15.1	4.4 / 47.4	7.6 / 81.8	6.5 / 70.0	3.0 / 32.3	0.9 / 9.7	1.0′/0.3m
1.8 / 19.4	6.5 / 70.0	12.3 / 132.4	11.0 / 118.4	5.3 / 57.0	1.8 / 19.4	2.0′/0.6m
1.7 / 18.3	6.2 / 66.7	13.2 / 142.1	13.2 / 142.1	6.4 / 68.9	2.0 / 21.5	3.0′/1.0m
1.4 / 15.1	3.8 / 40.9	8.8 / 94.7	10.6 / 114.1	5.6 / 60.3	1.7 / 18.3	4.0′/1.2m
1.1 / 11.8	2.1 / 22.6	4.3 / 46.3	5.3 / 57.0	3.2 / 34.4	1.3 / 14.0	5.0′/1.5m
0.9 / 9.7	1.3 / 14.0	2.0 / 21.5	2.3 / 24.8	1.7 / 18.3	1.0 / 10.8	6.0′/2.0m
3.0′/1.0m		0′/0m			3.0′/1.0m	

Units: Footcandles (top)/Lux (bottom)
Location: Ceiling mount. 2′/0.6m from wall with light at a 60° angle off horizontal.
Measured all on, reflectance model: 80 ceiling, 50 wall, 20 floor

CANDLE POWER DISTRIBUTION

Measured on: All
Beam center: 1093 cd
Thin dashed lined: Indicates 50% of peak

ILLUMINANCE

	3′ / 1m	6′ / 2m	9′ / 3m	15′ / 5m
ALL	110.0 / 1184.0	28.9 / 311.1	13.1 / 141.0	4.8 / 51.7

Measured in Footcandles (top)/Lux (bottom) on axis.
Measured on all, reflectance 0.

LIGHT OUTPUT

	TOTAL OUTPUT (lumens)	POWER (Watts)	EFFICACY (lm/W)
ALL	208	37.3	5.6
WARM	135	28.5	4.7
COOL	80	19.8	4.0

Note: Efficacy figures are for a complete tested fixture not simply a lamp source.

CRI

It is common practice in the lighting industry to use color rendering index (CRI) to compare the properties of various light sources. There are known deficiencies and limitations associated with CRI and as a result, it is not always an accurate indicator of good object color appearance. This is especially true for LED-based sources. Until a better method for measuring color rendering in LEDs is accepted, Color Kinetics measures CRI in accordance with the current CIE 13.3-1995 standard using the Ra calculation. The reference illuminants employed are the Planckian locus below 5000K and CIE Daylight reference above 5000K. All measurements for Color Kinetics products are performed by third party laboratories using NIST-traceable instruments.

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iW CAST 14 POWERCORE - WIDE

PHOTOMETRIC PERFORMANCE

Photometric data is based on test results from an independent testing lab.

SOURCE SPECIFICATIONS

Optics:	Metalized polycarbonate reflectors
Lens:	UV resistant soft focus polycarbonate lens
Source:	18 LEDs (12 warm white, 6 cool white)
Beam Angle:	112°
Distribution:	Symmetric direct illumination
CCT:	Adjustable 3,000–6,500K
CRI:	82 All, 74 Warm, 87 Cool

ILLUMINANCE DISTRIBUTION

2.1 / 22.6	5.2 / 56.0	8.6 / 92.6	8.7 / 93.6	5.5 / 59.2	2.4 / 25.8	1.0′/0.3m
3.0 / 32.3	5.9 / 63.5	9.1 / 98.0	9.4 / 101.2	6.3 / 67.8	3.0 / 32.3	2.0′/0.6m
2.6 / 28.0	4.5 / 48.4	6.6 / 71.0	7.3 / 78.6	5.5 / 59.2	3.1 / 33.4	3.0′/1.0m
1.9 / 20.5	2.9 / 31.2	3.7 / 39.8	4.0 / 43.1	3.3 / 35.5	2.2 / 23.7	4.0′/1.2m
1.4 / 15.1	1.8 / 19.4	2.2 / 23.7	2.2 / 23.7	2.0 / 21.5	1.5 / 16.1	5.0′/1.5m
1.1 / 11.8	1.3 / 14.0	1.4 / 15.1	1.4 / 15.1	1.3 / 14.0	1.1 / 11.8	6.0′/2.0m
3.0′/1.0m		0′/0m			3.0′/1.0m	

Units: Footcandles (top)/Lux (bottom)
10.8 lux = 1 fc

Location: Ceiling mount, 2'/0.6m from surface, light at a 60° angle off horizontal

Measured on: All, reflectance model 80/50/20%

CANDLE POWER DISTRIBUTION

Measured on: All
Beam center: 90 cd
Thin dashed lined: Indicates 50% of peak

ILLUMINANCE

	3′ / 1m	6′ / 2m	9′ / 3m	15′ / 5m
ALL	12.9 / 138.9	2.8 / 30.1	1.2 / 12.9	0.4 / 4.3

Measured in Footcandles (top)/Lux (bottom) on axis
Measured on all, reflectance 0

LIGHT OUTPUT

	TOTAL OUTPUT (lumens)	POWER (Watts)	EFFICACY (Lm/W)
ALL	229	30.6	7.5
WARM	138	21.4	6.4
COOL	99	12.8	7.7

Note: Efficacy figures are for a complete tested fixture not simply a lamp source.

CRI

It is common practice in the lighting industry to use color rendering index (CRI) to compare the properties of various light sources. There are known deficiencies and limitations associated with CRI and as a result, it is not always an accurate indicator of good object color appearance. This is especially true for LED-based sources. Until a better method for measuring color rendering in LEDs is accepted, Color Kinetics measures CRI in accordance with the current CIE 13.3-1995 standard using the Ra calculation. The reference illuminants employed are the Planckian locus below 5000K and CIE Daylight reference above 5000K. All measurements for Color Kinetics products are performed by third party laboratories using NIST-traceable instruments.

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iW CAST 14 POWERCORE

PHYSICAL DIMENSIONS

iW CAST 14 POWERCORE SPECIFICATIONS	
DATA/POWER CONNECTOR	Over-molded cable assembly
POWER REQUIREMENT	100-240VAC

iW CAST 14 POWERCORE

FUNCTIONAL FLOW DIAGRAM

End-to-End Connection
Maximum lights per iW Data Enabler: 36 @ 110VAC, 58 @ 220VAC, 61@ 240VAC with standard leader cable
To calculate the number of fixtures per iW Data Enabler for your customized installation,
refer to the *Configuration Calculator* located at www.colorkinetics.com/support/install_tool

U.S.
LINE - BLACK
NEUTRAL - WHITE
GROUND - GREEN/YELLOW
DATA - RED

EUROPE
LINE - BROWN
NEUTRAL - BLUE
GROUND - GREEN/YELLOW
DATA - BLACK

For complete installation instructions and safety precautions, refer to the iW Cast 14 Powercore User Guide and wiring diagrams located at www.colorkinetics.com/support.

ADDITIONAL ITEMS	
Data Device	iW Data Enabler (ITEM# 506-000001-00)
Controller	Any Color Kinetics iW Controller
Cable	Leader Cable (ITEM# 108-000017-00)

OPTIBIN®
There are inherent variations in the fabrication processes of all semiconductor materials. For LEDs, this variance results in differences in the color and intensity of light output as well as electrical characteristics. Due to these differences, LED manufacturers sort production into "bins," but insuring the availability of a single bin is very difficult. To minimize this issue and achieve optimal color consistency in its products, Color Kinetics has developed and uses a proprietary technology called Optibin. Optibin is an advanced production binning optimization process that minimizes the effects of LED variance for the best possible output uniformity in the final product. Color Kinetics Optibin technology gives the most consistent control of color and intensity from product to product.

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iW CAST 14 POWERCORE

INSTALLATION GUIDE

An INTELLIWHITE™ Product

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iW Cast 14 Powercore
ITEM# 501-000002-00, (White)
501-000002-01, (Black)
501-000002-02, (Aluminum)

This product is protected by one or more of the following patents: U.S. Patent Nos. 6,016,038, 6,150,774 and other patents listed at http://colorkinetics.com/patents/. Other patents pending.

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All other brand or product names are trademarks or registered trademarks of their respective owners.

PUB-000119-00 Rev 01

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GETTING STARTED

Color Kinetics® iW™ Cast 14 Powercore offers indoor/outdoor controllable white light wall washing, up to 15 feet, and large alcove lighting in a compact linear housing. It's patented Powercore™ technology makes it easy to install.

This guide contains important information on planning, installing, and operating your new iW Cast 14 Powercore. For your protection, read it carefully and save it for future reference.

INCLUDED IN THIS BOX

- 1 iW Cast 14 Powercore fixture
- Installation Guide
- Warranty and Registration cards

ADDITIONAL ITEMS NEEDED

- Color Kinetics iW Data Enabler (ITEM# 506-000003-06)
- Color Kinetics iW Scene Controller (ITEM# 503-000001-00/02)
- ColorCast 14 Leader Cable with terminator (ITEM# 108-000017-00 US or 108-000017-01 EU)
- #10 mounting screws (M5) and tools

OPTIONAL ITEMS NEEDED

- ColorCast 14 Jumper Cables (ITEM# 108-000016-00/01)
- 3/16" OD braided safety cable and hardware as required.

SCOPE OF THIS USER GUIDE

The goal of this user guide is to explain in an easily understandable language the necessary steps to install iW Cast 14 Powercore and assure peak performance. Its intended use is for reference only, by persons who are fully qualified. This document should never be considered a substitute for any provision of a regulation or state and/or local code.

IDENTIFICATION AND WARNINGS OF SAFETY HAZARDS

In accordance with ANSI Z535.4-2002 the following system of identifying the severity of the hazards associated with the products is used:

"**DANGER**" Imminently hazardous situation which, if not avoided, will result in death or serious injury.

"**WARNING**" Potentially hazardous situation that, if not avoided, could result in death or serious injury.

"**CAUTION**" Potentially hazardous situation that, if not avoided, may result in minor or moderate injury or property damage.

DANGER: Ensure that main power supply is off before installation or wiring, iW Cast 14 Powercore. Failure to adhere to these instructions will result in death or serious injury.

DANGER: iW Cast 14 Powercore must be installed by a qualified electrician in accordance with NEC and relevant local codes. Failure to comply will result in death, serious injury, or property damage.

WARNING: Do not install or use iW Cast 14 Powercore until you read and understand the installation instructions and safety labels. Failure to do so could result in serious injury or property damage.

WARNING: Do not use iW Cast 14 Powercore if the power cables are damaged. Doing so can result in death, serious injury, and property damage.

WARNING: As dictated by a Structural Engineer and/or local code, install safety cables to iW Cast 14 Powercore fixtures. Failure to do so can result in injuries or property damage.

WARNING: When using safety cables, ensure that they comply to the specifications given in this user guide. Failure to comply can result in injuries or property damage.

CAUTION: Use appropriate materials and mounting methods to support the fixture adequately. Failure to do so can result in property damage and void the warranty

CAUTION: iW Cast 14 Powercore has no user serviceable parts. Do not attempt to open the fixture. Doing so will result in property damage and void the warranty.

CAUTION: Do not exceed the specified voltage and current input. Doing so will result in property damage and void the warranty.

CAUTION: Do not exceed the maximum number of specified fixtures in a light run. Doing so will result in current overload.

CAUTION: Do not use sharp tools near or on the fixture lens. Doing so will result in property damage and void the warranty.

CAUTION: Do not hot swap. Ensure that power to the fixture is off before connecting or disconnecting fixtures. Hot swapping will result in property damage and void the warranty.

CAUTION: iW Cast 14 Powercore is a Class 2 LED product with LED radiation. Do not stare into beam or view directly with optical instruments.

NOTE: The instructions and precautions set forth in this user guide are not necessarily all-inclusive, all conceivable, or relevant to all applications as Color Kinetics cannot anticipate all conceivable or unique situations.

OWNER/USER RESPONSIBILITIES

It is the responsibility of the contractor, installer, purchaser, owner, and user to install, maintain, and operate iW Cast 14 Powercore in such a manner as to comply with all state and local laws, ordinances, regulations, and the American National Standard Institute Safety Code.

PLAN THE INSTALLATION

The nature and complexity of iW Cast 14 Powercore installation requires in-depth planning to ensure timely, successful installation with minimal complications and down time.

PLANNING SUGGESTIONS

When planning iW Cast 14 Powercore installation, Color Kinetics suggests doing the following:

- Consult an Electrical Inspector to approve all wiring plans.
- Refer to local and state codes for installation compliance.
- Employ Color Kinetics Application Engineering Services.

INSTALLATION CONSIDERATIONS

When creating your installation plan, consider the following:

- Zones. iW Cast 14 Powercore fixtures are dimmable, color temperature adjustable fixtures that are controlled by zones. Using the iW Controller, you can set the brightness level and color temperature, from cool to warm, for all lights within a specified zone.

  You create zones by internally designating each iW Data Enabler as a specific alphanumeric zone, 1-9 or A-F. All fixtures attached to that Data Enabler reside within the designated zone. For example, in an installation with two iW Data Enablers where the first Data Enabler is set to Zone 1 and the second is set to Zone 2, the lights attached to the first Data Enabler are in Zone 1 and the lights attached to the second Data Enabler are in Zone 2.

  For installations where all lights are controlled in unison, set each iW Data Enabler in the installation to the same zone designator. For installations where groups of lights are controlled individually, set unique zone designators for each Data Enabler.
- Location of iW Data Enabler in relationship to lights. Each data enabler supports one Powercore product leader cable with up to 36 (120VAC) or 61 (240VAC) Powercore fixtures run in series, using a 50-foot, field-cuttable leader cable. The leader cable can be cut to a desired length. Shortening the leader cable increases the number of fixtures that the iW Data Enabler will support. The leader cable can be lengthened when the distance between the data enabler and the first fixture in the series is greater than 50 feet (15m). Lengthening the leader cable decreases the number of fixtures that the iW Data Enabler will support. A junction box will be required for the leader extension connections.

NOTE: Adhere to all state and local wiring codes when making the leader extension connections.

- Calculate the number of fixtures per iW Data Enabler. Use the *Configuration Calculator* located at www.colorkinetics.com/support to calculate the number of fixtures you can put on a data enabler. The fixtures to iW Data Enabler ratio is determined by the parameters of your installation. Installation parameters include all or part of the following: line voltage, fixture type, leader length, jumper lengths, and wire gauge.
- Location of the fixture and method of attaching. Mounting hardware is dictated by the mounting surface. Ensure that the hardware used is appropriate for the mounting surface.
- Install and wire the iW Data Enabler before installing iW Cast 14 Powercore fixtures. Refer to the iW Data Enabler Installation Guide.

STEPS TO A SUCCESSFUL INSTALLATION

1. Set the zone(s) for the iW Data Enablers
2. Install the iW Data Enablers.
3. Install fixtures.
4. Install iW Controller.
5. Connect power and data from the iW Data Enabler to the fixtures.

SET THE iW DATA ENABLER ZONE

To minimize installation time and effort, set the zone for each iW Data Enabler prior to installing. Zones can be set or changed after installing the Data Enabler; however, any settings or changes made after power is engaged requires a power cycle to recognize the change.

Using a small, flat-head screw driver, set the zone for the iW Data Enabler by rotating the zone switch, located next to the LED indicators, to a specific designator–1 to 9 or A to F. The designator zero (0) is reserved for future features. See Fig. 1.

Fig. 1

INSTALL THE iW DATA ENABLER

Determine a location for the iW Data Enabler. One iW Data Enabler can support as many as 36 (120VAC) to 61 (240VAC) iW Cast 14 fixtures in a single zone. Use the *Configuration Calculator* located at www.colorkinetics.com/support to determine the exact number of allowed fixtures per iW Data Enabler for your application. Multiple iW Data Enablers are needed for installation that require multiple zones or that exceed the calculated number of fixtures allowed in a single zone.

Things to remember:

- Install the iW Data Enabler according to state and local codes.
- Consult a Electrical Inspector to approve all wiring plans.

Refer to the iW Data Enabler Installation Guide for complete installation, wiring and zone setting instructions. After running power and data to the iW Data Enabler and setting the zone, you are ready to attach the iW Cast 14 Powercore fixtures.

DANGER: Ensure that the power source is off before wiring the Data Enabler or connecting fixtures. Failure to do so can can result in serious injuries or death.

INSTALL THE FIXTURE

iW Cast 14 Powercore fixtures are installed in series. The in-line connectors provide an end-to-end fixture butt for the best visual effects. Jumper cables are available to add space between the fixtures when needed.

Mount fixtures by using the two mounting holes located on the base. Use hardware suitable for the mounting surface. See Fig. 2.

Fig. 2

NOTE: The iW Cast 14 Powercore fixture can be used as a template when pre-drilled pilot holes are required. Hold the fixture in place and mark the two screw holes.

1. Position the first fixture in a series and attach with two #10 mounting screws suitable for the mounting surface. Ensure that the male connector is in position to receive data and power from the leader cable. See Fig. 3.
2. Position the next fixture in the series, matching the male connector end to the female connector of the previously mounted fixture. Attach the fixture to the surface. See Fig. 3.

   The flexible connector cables allow for up to 180° turning radius.

Fig. 3

3. Continue mounting the fixtures, making power/data connections as you go, until all lights in the series are mounted.
4. Once all fixtures are mounted and connected, connect the leader cable from the iW Data Enabler to the first fixture in the series. Ensure power is off when making this connection.
5. Insert the terminator into the last fixture of each light series.
6. Repeat Steps 1 through 5 for each iW Data Enabler in the installation until all lights are installed. See Fig. 4.

Fig. 4

CAUTION: Ensure terminator is inserted into last fixture of each series. Failure to do so can result in product failure and void the warranty.

INSTALL IW CONTROLLER

All lights connected to an iW Data Enabler reside in the zone designated on the data enabler. The iW Controller allows you to control all lights within specified zones. With the iW Controller you can adjust the temperature of the lights from warm to cool and set the brightness level for all lights within a zone.

After installing the iW Data Enablers and attaching lights, install the iW Controller. Simply plug one end of the 4-pin, 50-foot cable into the plug located on the back of the iW Controller, and the other end into the controller plug located next to the zone rotary switch located within the iW Data Enabler. The iW Controller fits into a standard single-gang wall box and must be located within 50 feet of the iW Data Enabler.

Refer to the iW Data Enabler and iW Controller Installation Guides for complete installation, wiring, and operation instructions.

ATTACH SAFETY CABLE

Each fixture is designed for use with a safety cable. When dictated by local or state code, or by a Structural Engineer, attach a safety cable from the fixture to the mounting surface.

1. Locate the four cable holes are designed into each fixture—two at each end of the fixture. See Fig. 5.
2. Thread a cable through one of the cable holes.
3. Attach the safety cable to the mounting surface.

   For the proper mounting method of the safety cable to the installation surface, refer to a Structural Engineer or applicable standards for your specific application.

Fig. 5

The safety cables used in the installation should meet the following minimal requirements:

MATERIAL:	316 Stainless Steel
SIZE:	5/64-inch (0.78-inch nominal diameter) or larger, minimum break load must be greater than 400 pounds. Maximum diameter is 3/16-inch.
CONSTRUCTION:	7 x 7 (49 wires) preformed stranded
END TERMINATIONS:	Determined by installer and/or owner
MOUNTING METHOD:	Determined by installer or owner

iW CAST 14 POWERCORE SPECIFICATIONS

COLOR TEMPERATURE	Approximately 3000 K to 6000 K
HOUSING	Die cast aluminum, powder coated
CONNECTORS	Over-molded, integral male/female connectors
LISTINGS	C-UL US, CE

COMMUNICATION SPECIFICATIONS

SOURCE	Color Kinetics iW Data Enabler and iW Controller

ELECTRICAL SPECIFICATIONS

INPUT	100-240VAC, 50-60 Hz
OUTPUT	100-240VAC, 50-60 Hz
POWER SUPPLY	Powercore™

ENVIRONMENTAL SPECIFICATIONS

TEMPERATURE RANGE	-4°F to 122°F (-20°C to 50°C)
PROTECTION RATING	IP66 (Suitable for wet locations)

LED SOURCE LIFE

In traditional lamp sources, lifetime is defined as the point at which 50% of the lamps fail. This is also termed Mean Time Between Failure [MTBF]. LEDs are semiconductor devices and have a much longer MTBF than conventional sources. However, MTBF is not the only consideration in determining useful life. Color Kinetics uses the concept of useful light output for rating source lifetimes. Like traditional sources, LED output degrades over time (lumen depreciation) and this is the metric for SSL lifetime.

LED lumen depreciation is affected by numerous environmental conditions such as ambient temperature, humidity, and ventilation. Lumen depreciation is also affected by means of control, thermal management, current levels, and a host of other electrical design considerations. Color Kinetics systems are expertly engineered to optimize LED life when used under normal operating conditions. Lumen depreciation information is based on LED manufacturers' source life data as well as other third party testing. Low temperatures and controlled effects have a beneficial effect on lumen depreciation. Overall system lifetime could vary substantially based on usage and the environment in which the system is installed.

Temperature and effects will affect lifetime. Color Kinetics rates product lifetime using lumen depreciation to 70% of original light output. When the fixture is running on warm or cool, at room temperature, the LED lifetime is in the range 50,000 – 70,000 hours. This is LED manufacturers' test data. High output is defined as any LED device that is 1/2 watt or above. For more detailed information on source life, please see www.colorkinetics.com/lifetime.

WARRANTY

This product is sold pursuant to CK's Standard Terms and Conditions (the "T&Cs") which may be found at http://colorkinetics.com/howtobuy/buy/terms and which contain important provisions, including, among others, Limited Warranty, exclusions and limitations on CK's liability for damages, and restrictions on the remedies that are available to you.

PRELIMINARY INFORMATION
ALL SPECIFICATIONS SUBJECT TO CHANGE

iW BLAST 12 POWERCORE

An IntelliWhite Product™

iW™ Blast 12 Powercore combines the Color Kinetics® iW Blast 12 fixture with Powercore® technology, resulting in a robust, high-performance white light system with improved operational efficiency and simplified installation for interior or exterior wall-washing and grazing applications.

The iW Blast 12 Powercore fixture is a color-temperature controllable, high-quality white light with fixture-to-fixture color consistency which is well suited for enhancing architectural detail, theatrical stage, and studio lighting. The fixture provides flexible color temperature and brightness control through Chromacore®, the proven technology that underlies Color Kinetics existing intelligent solid-state lighting systems. When applied to IntelliWhite products, Chromacore controls channels of warm white and cool white LEDs to produce outputs of color temperatures in the range of 3000–6500 Kelvin from a single fixture. iW Blast 12 Powercore allows the adjustment of intensity while either maintaining constant color temperature or varying the color temperature.

Powercore technology drives LED systems, integrating power and data management directly into the fixture, eliminating the need for an external power supply. Powercore surpasses traditional power supply technology by streamlining multiple conversion and regulation stages into a single, flexible, microprocessor-controlled power stage that controls power output to LED systems directly from line voltage.

iW Blast 12 Powercore is a stylish, rugged, sealed product designed for indoor and outdoor installations. It is available with a soft-focus or a clear tempered glass lens and either a black or white powder coat finish. The fixture has a single 4-conductor cable and can attach to standard junction boxes with 3.5″ center-to-center hole spacing. The pre-assembled mounting base provides smooth, friction-free rotation. The base is designed to simplify installation and to offer a versatile range of light positioning.

iW Blast 12 Powercore receives data via iW Data Enabler – a data formatting device designed for use with IntelliWhite color temperature controllable fixtures featuring Powercore technology. When used in conjunction with any iW controller, varying color temperature and brightness control can be achieved at the push of a button.

iW BLAST 12 POWERCORE SPECIFICATIONS

COLOR TEMP RANGE	3000K to 6500K adjustable
SOURCE	High intensity power LEDs
BEAM ANGLE	Narrow Spot clear lens, Narrow Flood frosted lens (FWHM) intensity
HOUSING	Die Cast Aluminum, black or white powder coat finish
LENS	Soft-focus tempered glass or clear tempered glass
CONNECTORS	Unified power and data cable (4C 18 AWG SJTW or 4C 1mm^2 H07RNF)
LISTINGS	UL/cUL, CE

COMMUNICATIONS SPECIFICATIONS

DATA INTERFACE	Color Kinetics iW Data Enabler
CONTROL	Color Kinetics line of controllers including iW Scene Controller or Light System Manager**

ELECTRICAL SPECIFICATIONS

INPUT POWER	100-240VAC, 50-60 Hz
POWER CONSUMPTION	50W at 110-240VAC (60W at 100VAC)
POWER FACTOR	0.95 or greater at 120VAC

ENVIRONMENTAL SPECIFICATIONS

TEMPERATURE RANGE	-4°F to 122°F (-20°C to 50°C) based on testing of specific product
PROTECTION RATING	IP66

** For large or complex installations, consider controlling iW Blast Powercore with Light System Manager (LSM). Refer to the LSM data sheets or contact support@colorkinetics.com for more information.

LIFETIME OF SOLID STATE LIGHTING SYSTEMS

In traditional lamp sources, lifetime is defined as the point at which 50% of the lamps fail. This is also termed Mean Time Between Failure [MTBF]. LEDs are semiconductor devices and have a much longer MTBF than conventional sources. However, MTBF is not the only consideration in determining useful life. Color Kinetics uses the concept of useful light output for rating source lifetimes. Like traditional sources, LED output degrades over time (lumen depreciation) and this is the metric for SSL lifetime.

LED lumen depreciation is affected by numerous environmental conditions such as ambient temperature, humidity, and ventilation. Lumen depreciation is also affected by means of control, thermal management, current levels, and a host of other electrical design considerations. Color Kinetics systems are expertly engineered to optimize LED life when used under normal operating conditions. Lumen depreciation information is based on LED manufacturers' source life data as well as other third party testing. Low temperatures and controlled effects have a beneficial effect on lumen depreciation. Overall system lifetime could vary substantially based on usage and the environment in which the system is installed.

Temperature and effects will affect lifetime. Color Kinetics rates product lifetime using lumen depreciation to 70% of original light output. When the fixture is running on warm or cool, at room temperature, the LED lifetime is in the range 50,000 – 70,000 hours. This is LED manufacturers' test data. High output is defined as any LED device that is 1/2 watt or above. For more detailed information on source life, please see www.colorkinetics.com/lifetime.

CHROMACORE® BY COLOR KINETICS

POWERCORE® BY COLOR KINETICS

OPTIBIN® BY COLOR KINETICS

DRY

DAMP

WET

LISTED 13PE

ITEM# **523-000001-00 (White, Frosted)**
523-000001-01 (Black, Frosted)
523-000001-02 (White, Clear)
523-000001-03 (Black, Clear)
523-000001-04 (White, Frosted, CE)
523-000001-05 (Black, Frosted, CE)
523-000001-06 (White, Clear, CE
523-000001-07 (Black, Clear, CE)

This product is protected by one or more of the following U.S. Patents and their foreign counterparts: 6,016,038, 6,150,774, 6,292,901, 6,340,868, 6,636,003, 6,777,891, 6,969,954, 6,975,079, 7,038,399, and 7,161,313. Other patents pending.

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BR0183 Rev 02

Specifications subject to change without notice. Refer to www.colorkinetics.com for the most recent data sheet versions.

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PRELIMINARY INFORMATION
ALL SPECIFICATIONS SUBJECT TO CHANGE

iW Blast 12 Powercore

PHYSICAL DIMENSIONS

iW Blast 12 Powercore ITEM# 523-000001- 00/01/02/03/04/05/06/07	
DATA/POWER CONNECTOR	Unified power and data cable
POWER REQUIREMENT	50W@110-240VDC (60W@100VAC)
WEIGHT	8 lb (3.6 kg) with cord

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PRELIMINARY INFORMATION
ALL SPECIFICATIONS SUBJECT TO CHANGE

iW Blast 12 Powercore

FUNCTIONAL FLOW DIAGRAM

Daisy Chain Connection

Home Run Connection

For complete installation instructions and safety precautions, refer to the iW Blast 12 Powercore User Guide and wiring diagrams located at www.colorkinetics.com/support.

Additional Items	
Power/Data Supply	iW Data Enabler (ITEM# 506-000001-00)
Controller	Any Color Kinetics iW Controller

OPTIBIN®
There are inherent variations in the fabrication processes of all semiconductor materials. For LEDs, this variance results in differences in the color and intensity of light output as well as electrical characteristics. Due to these differences, LED manufacturers sort production into "bins," but insuring the availability of a single bin is very difficult. To minimize this issue and achieve optimal color consistency in its products, Color Kinetics has developed and uses a proprietary technology called Optibin. Optibin is an advanced production binning optimization process that minimizes the effects of LED variance for the best possible output uniformity in the final product. Color Kinetics Optibin technology gives you the most consistent control of color and intensity from product to product.

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Fig. 4

Home Run Connection

Installing iW Blast 12 Powercore

WARNING: Power must be off before installing the iW Blast 12 Powercore. Failure to do so could result in death or serious injury and will void the warranty.

iW Blast 12 Powercore can be installed indoors or outdoors, with or without a junction box. When using an electrical junction box, ensure that it is rated for your application and has 3-1/2" (8.9 cm) center-on-center fixture mounting holes.

Through-Base Cable Assembly

For all installations where the cable must go through the canopy base, follow the directions below to prevent cable damage and to create a water-tight seal for outdoor installations.

1. Screw the liquid-tight fitting into the canopy base. The O-ring must be seated against the canopy opening to ensure a water-tight seal.
2. Insert the fixture cable through the dome nut. Loosen dome nut if necessary. Pull the cable through the fitting. Leave enough cable above the fitting to ensure full fixture head rotation. See Fig. 5.

Fig. 5

3. Tighten dome nut to seal the cable. After 24 hours, tighten the dome nut again to ensure proper sealing force and water-tight seal.

Daisy Chain Fixtures

1. Pull 12AWG TYPICAL, 4-conductor copper cable between junction boxes in a series. The maximum cable run from iW Data Enabler to the last fixture in a series is 175 feet (53 m).
2. Trim fixture cable to fit in junction box leaving enough cable to make wiring connections.
3. Use wire nuts to connect line (Black/Brown), neutral (White/Blue), ground (Green/Yellow), and data (Red/Black).

   NOTE: For outdoor installations, insert fixture cable through junction box gasket before making wire connections.
4. Tuck wire connections into the junction box and use the provided screws to attach the fixture to the junction box. See Fig. 3.

   NOTE: For outdoor installations, ensure that the gasket is compressed evenly for a water-tight installation.
5. In the common junction box, connect the wires from each fixture to the lead wire from the iW Data Enabler. Tuck the wire connections into the junction box and use the provided screws to attach the fixture to the junction box. See Fig. 3.

   NOTE: For outdoor installations, ensure that the gasket is compressed evenly for a water-tight installation.

Home Run Fixtures

1. Pull 12AWG TYPICAL, 4-conductor, copper wiring from iW Data Enabler to a common junction box, and from the common junction box to each fixture's junction box. The maximum cable run from iW Data Enabler to any fixture in a series is 175 feet (53 m), and the maximum total cable run is 400 feet (122 m)
2. Trim fixture cable to fit in junction box leaving enough cable to make wiring connections.
3. Use wire nuts to connect line (Black/Brown), neutral (White/Blue), ground (Green/Yellow), and data (Red/Black).

   NOTE: For outdoor installations, insert fixture cable through junction box gasket before making wire connections.
4. Tuck wire connections into junction box and use provided screws to attach the fixtures to junction boxes.

   NOTE: For outdoor installations, ensure that the gasket is compressed evenly for a water-tight seal.
5. In the common junction box, connect the wires from each fixture to the lead wire from iW Data Enabler. See Fig. 4.

Indoor: Wall or Ceiling Mount

1. Pull the fixture leader cable through the junction box ensuring that the junction box is located within 175 feet (53 m) of the iW Data Enabler.
2. Using the provided screws, attach the canopy of the fixture to the junction box. See Fig. 6.

Fig. 6

Outdoor: Wall or Ceiling Mount

For outdoor installations, iW Blast 12 Powercore must be used with an outdoor rated junction box and the gasket must be used to ensure a watertight seal.

1. Thread leader cable through provided gasket. Pull fixture leader cable through junction box ensuring that the junction box is located within 175 feet (53 m) of the iW Data Enabler.
2. Using the provided screws, attach the canopy of the fixture to the outdoor rated junction box. See Fig. 7.

Fig. 7

Floor Mount

iW Blast 12 Powercore can be mounted without a junction box. Ensure that the fixture sits flush to the surface and use mounting hardware suitable for the mounting surface.

1. Attach the canopy to the mounting surface.
2. Thread the flying lead cable into a suitable junction box with proper conduit hubs and fittings.

Positioning Fixture

Rotate the light fixture to the desired position. Using the provided hex wrench, tighten the set screws located on the base to lock in place. Tilt the fixture to the desired angle and tighten the set screws located on the front of housing to lock. See Fig. 8 for location of set screws.

NOTE: For permanent installations, use of thread locker is recommended, to prevent loosening.

Fig. 8

Installing iW Scene Controller

All fixtures connected to iW Data Enabler reside in the zone designated on iW Data Enabler. iW Scene Controller allows you to control all fixtures within specified zones. iW Scene Controller allows you to adjust the color temperature of the fixtures from warm to cool and set the brightness level for all fixtures within a zone.

After installing iW Data Enabler and attaching fixtures, install iW Scene Controller. Simply plug one end of the 4-pin, 50 foot (15 m) leader cable into the connector located on the back of iW Scene Controller, and the other end into the controller connector within iW Data Enabler. iW Scene Controller fits into a standard single-gang wall box. iW Scene Controller must be located within 50 feet (15 m) of iW Data Enabler. Refer to the iW Data Enabler and iW Scene Controller Installation Guides for complete installation, wiring, and operating instructions.

Attaching Safety Cable

Each fixture is designed for use with a safety cable. When dictated by local or state code, or by a Structural Engineer, attach a safety cable from the fixture to the mounting surface.

1. Located on the back of the iW Blast 12 Powercore fixture is a safety cable bracket. See Fig. 9.

Fig. 9

2. Remove the two screws that attach the cable bracket to the fixture. Loop the safety cable over the cable bracket and reattach the bracket to the fixture. Use thread locker to secure the bracket.
3. Attach the safety cable to the mounting surface. For the proper mounting method of the safety cable to the installation surface, refer to a Structural Engineer or applicable standards for your specific application.

The safety cables used in the installation should meet the following minimal requirements:

MATERIAL:	316 Stainless Steel
SIZE:	5/64-inch (0.2 cm) or larger, minimum break load must be greater than 400 pounds. Maximum diameter is 3/16-inch (0.48 cm)
CONSTRUCTION:	7 x 7 (49 wires) preformed stranded
END TERMINATIONS:	Determined by installer and/or owner
MOUNTING METHOD:	Determined by installer and/or owner

ROUTINE MAINTENANCE

To clean the surface, use a soft cloth with mild soap and water or window cleaner. To lubricate, apply light household oil to the hinge.

IMPORTANT INFORMATION

Strobe Warning

There is some anecdotal evidence that strobe lighting may induce epileptic symptoms in certain susceptible individuals, although no associated product warnings have been issued by the United States government according to the Food and Drug Administration.

If strobe lights are used, some international regulatory agencies recommend keeping flicker rates at or below four flashes per second (as less of the flicker-sensitive population will then be at risk of an attack). This flicker rate applies only to the overall output of any group of lights in direct view. However, when more than one strobe light is used, the flashes should be synchronized. End users should also consider issuing a warning, alerting audience or viewers to the presence of strobe lighting.

Temperature Monitoring

For protection from extreme temperatures, the iW Blast 12 Powercore has been designed with a temperature monitoring feature. If operating temperatures rise to an unsafe level, a compensation circuit is triggered and the iW Blast 12 Powercore operation is interrupted causing the lights to turn dull warm. After 30 minutes the lights will return to normal operation. The lights can also be reset by cycling the power. To prevent additional power shut-downs, determine the cause of the overheating and correct the problem. If any problems occur during usage, unplug the product immediately and call or email: Color Kinetics Technical Support Group at 1-888-FULL RGB or 617-423-9999 or support@colorkinetics.com.

iW BLAST POWERCORE SPECIFICATIONS

COLOR TEMP RANGE	3000K to 6500K adjustable
SOURCE	High intensity power LEDs
BEAM ANGLE	12˚ clear lens, 18˚ frosted lens (FWHM) intensity
HOUSING	Die Cast Aluminum, black or white power coat finish
CONNECTORS	Unified power and data cable (4C 18AWG SJTW or 4C 1mm^2 H07RNF)
LISTINGS	UL/cUL, CE
DATA INTERFACE	Color Kinetics iW Data Enabler
CONTROL	Color Kinetics line of controllers, including iW Scene Controller or Light System Manager** Manager
NPUT POWER	100-240VAC, 50-60 Hz
CONSUMPTION	50W at 110-240VAC (60W at 100VAC)
POWER FACTOR	0.95 or greater at 120VAC
TEMPERATURE RANGE	-4°F to 122°F (-20°C to 50°C) based on testing of specific product
PROTECTION RATING	IP66

** For large or complex installations, consider controlling iW Blast Powercore with Light System Manager (LSM). Refer to the LSM data sheets or contact support@colorkinetics.com for more information.

LED SOURCE LIFE

In traditional lamp sources, lifetime is defined as the point at which 50% of the lamps fail. This is also termed Mean Time Between Failure (MTBF). LEDs are semiconductor devices and have a much longer MTBF than conventional sources. However, MTBF is not the only consideration in determining useful life. Color Kinetics uses the concept of useful light output for rating source lifetimes. Like traditional sources, LED output degrades over time (lumen depreciation) and this is the metric for SSL lifetime.

LED lumen depreciation is affected by numerous environmental conditions such as ambient temperature, humidity, and ventilation. Lumen depreciation is also affected by means of control, thermal management, current levels, and a host of other electrical design considerations. Color Kinetics systems are expertly engineered to optimize LED life when used under normal operating conditions. Lumen depreciation information is based on LED manufacturers' source life data as well as other third party testing. Low temperatures and controlled effects have a beneficial effect on lumen depreciation. Overall system lifetime could vary substantially based on usage and the environment in which the system is installed.

Temperature and effects will affect lifetime. Color Kinetics rates product lifetime using lumen depreciation to 70% of original light output. When the fixture is running on warm or cool, at room temperature, the LED lifetime is in the range 50,000 – 70,000 hours. This is LED manufacturers' test data. High output is defined as any LED device that is 1/2 watt or above. For more detailed information on source life, please see www.colorkinetics.com/lifetime.

WARRANTY

This product is sold pursuant to CK's Standard Terms and Conditions (the "T&Cs") which may be found at http://colorkinetics.com/howtobuy/buy/terms and which contain important provisions, including, among others, Limited Warranty, exclusions and limitations on CK's liability for damages, and restrictions on the remedies that are available to you.

iW BLAST 12 POWERCORE

USER GUIDE

An IntelliWhite™ Product

Color Kinetics Incorporated
10 Milk Street, Suite 1100
Boston, MA 02108 USA
Tel 888 Full RGB
Tel 617 423 9999
Fax 617 423 9998
info@colorkinetics.com
www.colorkinetics.com

CHROMACORE® BY COLOR KINETICS

POWERCORE® BY COLOR KINETICS

OPTIBIN® BY COLOR KINETICS

DRY

DAMP

WET

ITEM# 523-000001-00 (White, Frosted Lens)
523-000001-01 (Black, Frosted Lens)
523-000001-02 (White, Clear Lens)
523-000001-03 (Black, Clear Lens)
523-000001-04 (White, Frosted Lens, CE)
523-000001-05 (Black, Frosted Lens, CE)
523-000001-06 (White, Clear Lens, CE)
523-000001-07 (Black, Clear Lens, CE)

This product is protected by one or more of the following U.S. Patents and their foreign counterparts: 6,016,038, 6,150,774, 6,292,901, 6,340,868, 6,636,003, 6,777,891, 6,969,954, 6,975,079, 7,038,399, and 7,161,313. Other patents pending.

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PUB-000147-00 Rev. 02

Specifications subject to change without notice. Refer to www.colorkinetics.com for the most recent version..

c UL us LISTED 78GF

GETTING STARTED

iW™ Blast 12 Powercore is a robust, high performance controllable white light system for interior or exterior wall-washing and grazing applications. Integrated Powercore® technology provides operational efficiency and simplified installation. This guide contains important information about installing and operating your new iW Blast 12 Powercore safely.

Included in this Box

- iW Blast 12 Powercore
- Two 8-32 screws for indoor installations
- Gasket for outdoor installations
- Four 10-24 stainless steel screws for outdoor installations
- 3/32" Hex key wrench (0.08 cm)
- User Guide

Additional Items Needed

- 4" (10.2 cm) Electrical junction box (rated for application) with 3.5" (8.9 cm) center to center distance for mounting locations
- Color Kinetics iW Data Enabler (Item# 506-000001-00)
- Color Kinetics line of controllers, including iW Scene Controller or Light System Manager
- Adjustable wrench
- 12 AWG TYPICAL 4 conductor, copper wire (stranded or solid, 90C minimum rated), or equivalent. Refer to the *Configuration Calculator* located at www.colorkinetics.com/support/install_tool.
- Phillips head screw driver and small Flat head screw driver

Optional Items

- 3/16" (0.48 cm) OD braided safety cable and hardware, as required
- Thread locker (90C rated), as required

Scope of this User Guide

The goal of this user guide is to explain the steps necessary to install iW Blast 12 Powercore and assure peak performance. Its intended use is for reference only, by persons who are fully qualified. This document should never be considered a substitute for any provisions of a regulation or state/local code.

Identification and Warnings of Safety Hazards

In accordance with ANSI Z535.4-2002, the following system of identifying the severity of the hazards associated with the products is used:

"**DANGER**" Imminently hazardous situation which, if not avoided, will result in death or serious injury.

"**WARNING**" Potentially hazardous situation which, if not avoided, could result in death or serious injury.

"**CAUTION**" Potentially hazardous situation which, if not avoided, may result in minor or moderate injury or property damage. Also used to alert against unsafe practices.

IGNORING A HAZARD WILL VOID ANY WARRANTY.

WARNING: Risk of electric shock! Ensure that main power supply is off before installing or wiring iW Blast 12 Powercore.

WARNING: iW Blast 12 Powercore must be installed by a qualified electrician in accordance with NEC and relevant local codes.

WARNING: Do not install or use iW Blast 12 Powercore until you read and understand the installation instructions and safety labels.

WARNING: Do not use iW Blast 12 Powercore if the power cables are damaged.

WARNING: As dictated by a Structural Engineer and/or state/local code, install safety cables to iW Blast 12 Powercore fixtures.

WARNING: When using safety cables, ensure that they comply with the specifications given in this user guide.

CAUTION: Use appropriate materials and mounting methods to support the fixture adequately.

CAUTION: iW Blast 12 Powercore has no user serviceable parts. Do not attempt to open the fixture.

CAUTION: Do not exceed the specified voltage and current input.

CAUTION: Do not exceed the maximum number of specified fixtures in a light run.

CAUTION: Do not use sharp tools near or on the fixture lens.

CAUTION: Do not hot swap. Ensure that power to the fixture is off before connecting or disconnecting fixtures.

CAUTION: iW Blast 12 Powercore is a Class 2 LED product with LED radiation. Do not stare into beam or view directly with optical instruments.

NOTE: The instructions and precautions set forth in this user guide are not necessarily all-inclusive, or relevant to all applications as Color Kinetics cannot anticipate all conceivable or unique situations.

Owner/User Responsibilities

It is the responsibility of the contractor, installer, purchaser, owner and user to install, maintain, and operate iW Blast 12 Powercore in such a manner as to comply with all state and local laws, ordinances, regulations, and the American National Standards Institute Safety Code.

PLANNING THE INSTALLATION

iW Blast 12 Powercore installation requires planning to ensure a timely, successful installation with minimal complications and down time.

Planning Suggestions

When planning an iW Blast 12 Powercore installation, Color Kinetics suggests doing the following:

- Consult an Electrical Inspector to review all wiring plans.
- Refer to local and state codes for installation compliance.
- Create a Layout Plan drawing, per Lighting Designer or Architect.
- Consult Color Kinetics Application Engineering Services, as needed at support@colorkinetics.com.
- Obtain detailed wiring diagrams and additional support from www.colorkinetics.com/support.

Installation Considerations

When creating your installation plan, consider the following:

- **Zones.** iW Blast 12 Powercore fixtures are dimmable, color temperature adjustable fixtures that are controlled by zones. Using iW Scene Controller, you can set the brightness level and color temperature, from cool to warm, for all fixtures within a specified zone.

  Create zones by internally designating each iW Data Enabler as a specific alphanumeric zone, 1-9 or A-F. All fixtures attached to that iW Data Enabler reside within the designated zone. For example, in an installation with two iW Data Enablers where the first iW Data Enabler is set to Zone 1 and the second is set to Zone 2, the fixtures attached to the first iW Data Enabler are in Zone 1 and the fixtures attached to the second iW Data Enabler are in Zone 2.

  For installations where all fixtures are controlled in unison, set each iW Data Enabler in the installation to the same zone designator. For installations where groups of fixtures are controlled individually, set unique zone designators for each iW Data Enabler.
- **Location of iW Data Enabler in relationship to iW Blast 12 Powercore.** The maximum distance that iW Data Enabler can be located from the last fixture in a series, or each individual fixture in a home-run installation is 175 feet (53m). The maximum total cable run is 400 feet (122 m). Each iW Blast 12 Powercore has a 6-foot (1.8 m) flying lead cable. The cable can be shortened or it can be lengthened by attaching it to a junction box.
- **Calculate the number of fixtures per iW Data Enabler.** Use the *Configuration Calculator* located at www.colorkinetics.com/support/install_tool to calculate the number of fixtures you can put on an iW Data Enabler. The fixtures-to-iW Data Enabler ratio is determined by the parameters of your installation. Installation parameters include all or part of the following: line voltage, circuit load, voltage drop, and cable lengths.
- **Location of the fixture and method of attaching.** Mounting hardware is dictated by the mounting surface. Ensure that the hardware used is appropriate for the mounting surface.
- **Install and wire iW Data Enabler before installing iW Blast 12 Powercore fixtures.** Refer to the iW Data Enabler Installation Guide.

INSTALLING iW BLAST 12 POWERCORE

Steps to a Successful Installation

1. Set the zone(s) for the iW Data Enabler.
2. Install iW Data Enabler.
3. Install iW Blast 12 Powercore fixtures.
4. Install iW Scene Controller.
5. Attach a safety cable.

Setting the iW Data Enabler Zone(s)

To minimize installation time and effort, set the zone for each iW Data Enabler prior to installing. Zones can be set or changed after installing iW Data Enabler, however, any settings or changes made after power is applied require a power cycle to recognize the change.

Using a small, flat-head screw driver, set the zone for iW Data Enabler by rotating the zone switch, located next to the LED indicators, to a specific designator–1 to 9 or A to F. The designator zero (0) is reserved for future features. See Fig. 1.

Fig. 1

Installing the iW Data Enabler

1. Determine the number of iW Data Enablers needed for your installation and the location of each.

   NOTE: Install iW Data Enabler according to state and local codes.
2. Run power and data to iW Data Enabler and make connections. Refer to the iW Data Enabler Installation Guide for complete instructions.

WARNING: Power must be off before installing iW Data Enabler or iW Blast 12 Powercore. Failure to do so could result in death or serious injury and will void the warranty.

3. Connect the fixtures to the iW Data Enabler. Refer to Fig. 2 for fixture-to-iW Data Enabler wire color correspondence.

Fig. 2

Daisy Chain Wiring

After the fixtures are installed and fixture-to-fixture wiring is complete, run the leader cable from the first fixture in the daisy chain run to iW Data Enabler. See Fig. 3.

Fig. 3

Home Run Wiring

After the fixtures are installed and each fixture is wired to the leader cable in a common junction box, run the leader cable from the common junction box to iW Data Enabler. See Fig. 4.

ISO17020 (IAS AA-682)
ISO17025 (IAS TL-259)

Listing Report: PIE060106-24

PRODUCT: ***The Ultimate Pier***
DIVISION: **Site Construction (02)**
SECTION: **Foundation and Load-Bearing Elements (02450)**
APPLICATION: **Manufactured Housing (24 CFR §3280)**

Manufacturer:
Pieramid Foundation Systems, Inc.
14525 North Newport Highway
Mead, Washington 99021
Web: www.pieramids.com

Manufacturing Locations(s):
As noted above

1. SUBJECT
***The Ultimate Pier* adjustable pier stand.**

2. SCOPE
NTA, Inc. has evaluated the above product(s) for compliance with the following codes:

- Federal Manufactured Home Construction and Safety Standards, 24 CFR §3280
- *2003 International Residential Code* (IRC), Appendix E

NTA, Inc. has evaluated the following properties of the above product(s):

- Axial load capacity

3. USES
The Ultimate Pier is to be used as a prefabricated load bearing device to resist only vertical forces acting in a downward direction. The top plate of the stand is designed to clamp directly to the main-frame I-beam of a manufactured home. The pier is a suitable substitute for double-stack concrete masonry unit piers as specified in 2003 IRC, Section AE603.1.

4. DESCRIPTION
The Ultimate Pier consists of three ½-in. O.D., schedule 40, ASTM A513, Grade 44, steel pipes arranged to form a acute triangular pyramid 17-inches tall. The three angled pipes converge at a single 1-in. O.D., schedule 40 pipe positioned vertically and open on both ends. The based of the pyramid is triangular and constructed of 1-1/2-inch wide x 1/8-inch thick ASTM A513, Grade 35 steel plates. Each side of the base measures 14-inches. The pipes and base forming the pier are joined by fillets welds, with welds fully around each pipe at each connection. The base is painted with gloss black paint for corrosion protection.

A 3/4-inch diameter galvanized threaded rod (3/4-10 UNC), Grade 2, passes through the vertical 1-inch pipe. Welded to one end of the threaded rod is a 1/8-inch galvanized bearing plate. A nut on the threaded rod permits a vertical adjustment in the height of the stand. Figure 1 provides the basic dimensions of the pier.

5. INSTALLATION
5.1. General. Each pier stand or carton of pier stands shall be provided with assembly instructions and general installation instructions. This listing report does not address use of the pier stand with other foundation components such as footers and/or means for resisting lateral loads. Proper foundation installation and design involves factors related to the complete foundation system which must be certified by the Registered Design Professional responsible for approval of the overall foundation design.

Piers must be installed at all blocking locations required on the foundation design supplied with the manufactured home to be supported.

5.2. Allowable Axial Loads. Individual pier loads must not exceed the values listed herein and the load must not exceed the capacity of the spread footing or supporting soil. The maximum allowable axial loads for the listed pier stand are provided in Table 1.

5.3. Pier Assembly. The threaded rod shall be adjusted to bring the bearing plate into full contact with the main I-beam of the manufactured home with a maximum vertical adjustment of 6-inches; however, the rod shall not be extended to provide less full engagement of the threaded rod in the vertical 1-inch diameter pipe.

5.4. Alignment and Attachment. Piers shall be spaced along the main I-beam and perimeter of the home as required in the complete foundation design provided by the home manufacturer. Piers shall be installed so that the pier is substantially plumb and centered under the framing member to be supported within the installation tolerances provided in Table 1. The triangular base may be aligned in any manner that permits proper bearing on the footing. If necessary, metal or hardwood shims may be used to provide uniform bearing on the pier or spread footer. In all cases the pier stand shall be bolted to the supporting spread footing using ½-inch

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

diameter bolts, or equivalent, placed in the holes provided in the base pier base plate.

Once the pier is properly positioned, the supported framing member shall be secured to the pier bearing plate using suitable screw-type clamps.

6. CONDITIONS OF USE

The Ultimate Pier described in this report comply with the codes listed in Section 2.0 of this report, subject to the following conditions:

6.1. Installation complies with this report and the manufacturer's installation instructions.

6.2. All manufactured home foundation systems utilizing *The Ultimate Pier* shall be designed and constructed to sustain all code required loads required by the authority having jurisdiction.

6.3. The installation instructions as provided by the manufacturer of the manufactured home shall be used to determine permissible points of support for vertical loads and points of attachment for anchorage systems used to resist horizontal and uplift forces.

6.4. The design pier load does not exceed the lesser of the spread footing capacity, soil capacity, or pier capacity.

6.5. The piers are manufactured in the production facility(ies) noted in this report and under a quality control program approved by NTA, Inc.

7. EVIDENCE SUBMITTED

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

7.1. Review of plant quality assurance manual

7.2. Plant certification inspection of manufacturer's production facilities, test procedures, frequency and quality control sampling methods, test equipment and equipment calibration procedures, test records, dates and causes of failures when applicable.

7.3. Qualification test data in accordance with 24 CFR §3280.401(b).

7.4. Follow-up quality assurance audits of the production/distribution facility(ies) in accordance with NTA Inspection Method 7 (IM007).

Evaluation evidence and data are on file with NTA, Inc.

8. FINDINGS:

All *The Ultimate Pier* stands are manufactured under an in-plant Quality Assurance program to insure that the production quality meets or exceeds the requirements of 24 CFR §3280 and the criteria as established by NTA, Inc. Furthermore, pier stands must comply with the conditions of this report.

This report expires one year from the issue date noted below.

9. IDENTIFICATION

Each eligible pier stand shall be marked to provide the following information:

a) The NTA, Inc. listing mark, shown below;
b) NTA's Listing No. PIE060106-24;
c) name & address of manufacturer;
d) pier stand model number;
e) rated load capacity;
f) lot number or date of manufacture.

LISTED
PIE060106-24

Table 1: Pier Models and Maximum Load Capacity

Model	Footing Attachment	Minimum Attachment Shear Strength[1] (lbf)	Minimum Height (in.)	Maximum Height (in.)	Maximum Axial Load (lbf)	Maximum Load Eccentricity[2] (in.)
PFS101	(4) ½ Bolts	2560	17.5"	23.0"	9,800	+/-0.125"

[1] Minimum total shear strength of threaded embedment(s) or attachment(s) to footer.
[2] Maximum horizontal misalignment distance between the web of the supported beam and the center of the pier stand top plate.

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The Ultimate Pier

Pieramid Foundation Systems Inc. was incorporated to develop solutions for the manufactured housing industry. Introducing the Pieramid Foundation System permanent foundation system. Here is what you need to know about permanent foundations. FHA/VA does not approve foundation systems. FHA/VA guidelines require a site specific certification be included in the loan package. This certification must have been issued by a licensed engineer or architect, and include the appropriate verbiage and seal, indicating that the foundation of a Manufactured Home is in compliance with the Permanent Foundations Guide for Manufactured Housing, dated September 1996.

Permanent foundations allows manufactured homeowners to take advantage of the lowest interest rates in over 40 years. Existing manufactured homeowners can realize the equity in their existing home. Recent actions by the Federal government and the Federal backed financial institutions, such as Freddie Mac and Fannie Mae, have dramatically changed the landscape of the manufactured housing industry. Today anyone wanting to finance a manufactured home with FHA/VA or USDA mortgage must have a HUD compliant foundation. The Pieramid permanent foundations are a fully engineered tested and patented permanent foundation system, furnished with site-specific calculations and drawings for each home.

Convert your real estate with a HUD compliant foundation AND, UNLOCK THE EQUITY IN YOUR HOME. With Pieramid Foundation Systems Inc. your home will be installed on a real foundation just like any other home and you will be entitled to the same benefits as any other homeowner - TROUBLE FREE HOMEOWNERSHIP! Don't be fooled by companies who claim to have HUD compliant foundation. Make sure you have SITE AND MODEL SPECIFIC ENGINEERING sealed by a licensed engineer.

Notice: There is no blanket approval for foundations and no such thing as FHA/VA or HUD approved foundations. Compliant foundations require engineering that is designed to the site conditions and the home. Advances in foundation technology invented by Pieramid Foundation Systems Inc. has made it possible to put both new and existing HUD-Code manufactured homes, including those in parks, on a permanent foundation in compliance with the Federal standards. Homeowners with HUD-approved foundation systems will enjoy greater appreciation, less maintenance and repair costs and peace of mind for years to come. Your home is your greatest investment. Protect it with a Pieramid Foundation System Inc. permanent foundation.

Foundation Guide Complete! This handbook is a guide for those approving HUD-code manufactured homes on permanent foundations, including engineers, manufacturers, and site owners seeking approval. It provides current technical information, recommendations, and tables of analytical data, expanding and clarifying the definition of a permanent foundation.

It updates 1989 loading requirements for snow, wind, and seismic forces. Because of the increased use of multi-section manufactured homes, the guide now includes consideration of large openings along the length of marriage walls in multi-section units.

The construction recommendations assure that the home, foundation, and site are all compatible. In addition to the new technical recommendations, the guide has been expanded and reorganized for easy reference with more illustrations and clarifications. The handbook can greatly assist preparation of the worksheets needed to apply for an FHA mortgage.

Figure 1: *The Ultimate Pier* Adjustable Pier Stand

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

Brushless Servo Control

Features: Basic brushless servo or linear motor control. Input command signal may be industry standard ± 10 VDC (velocity or torque), or pulse and direction. Software provided to set up via RS232 to auto-tune and configure. Fully protected unit.

MicroFlex

Input Voltage		115-230 VAC		
Bus Voltage		160-320 VDC		
Output Current Amps (rms)		Catalog Number ①②	List Price	Multiplier Symbol
Continuous	Peak			
Encoder/SSI Feedback				
3	6	FMH2A03TR-EN23	997	E3
6	12	FMH2A06TR-EN23 ③	1094	E3
9	18	FMH2A09TR-EN23 ③	1359	E3
3	6	FMH2A03TR-EN43	997	E3
6	12	FMH2A06TR-EN43 ③	1094	E3
9	18	FMH2A09TR-EN43 ③	1359	E3
Resolver Feedback				
3	6	FMH2A03TR-RN23	1106	E3
6	12	FMH2A06TR-RN23 ③	1203	E3
9	18	FMH2A09TR-RN23 ③	1468	E3
3	6	FMH2A03TR-RN43	1106	E3
6	12	FMH2A06TR-RN43 ③	1203	E3
9	18	FMH2A09TR-RN43 ③	1468	E3

NOTE: ① Order regen resistor separately. ② Customer must supply +24 Vdc for I/O operation. ③ Requires external ventilation. See fan kits.

ETHERNET MicroFlex e100-Encoder Feedback

Input Voltage		115-230 VAC		
Bus Voltage		160-320 VDC		
Output Current Amps (rms)		Catalog Number	List Price	Multiplier Symbol
Continuous	Peak			
3	6	MFE230A003 ③	1312	E3
6	12	MFE230A006 ③	1409	E3
9	18	MFE230A009 ③	1674	E3

Fan Kits for use with MicroFlex only

Description	Catalog Number	List Price	Multiplier Symbol
Fan Assembly, 24 VDC	FAN001-024	137	E8

Shaded areas are stocked products.

search

MAGDRIVE
RUNNER
MATRIX
ECOMAG
ILD
MAGFORCE
MAGTOP
VARIMAG
MAGRACK

MAGRACK

MAGRACK
The MAGRACK 1S9 tooth rod actuators are made for windows, skylights and domes as well as for smoke exhausting systems. Available in single or tandem versions and in 24 VDC or 230 V AC.

Control Unit
A complete range of control units ist available for the Magrack actuator with 24 VDC. Control units for the day to day ventilation as well as for smoke exhausting systems are available.

Applications

MAGRACK

Technical data	1S9...114A00	1S9...132A00	1S9...918A00	1S9...939A00
Pushforce/Pullforce	600 N	200 N	800 N	300 N
Speed (without load)	8 mm/sec.	14 mm/sec.	12 mm/sec.	20 mm/sec.
Stroke length	max. 1000 mm	max. 1000 mm	max. 1000 mm	max. 1000 mm
No-load operation	125 sec.	72 sec.	84 sec.	42 sec.
Voltage	230/50 V /Hz /AC	230/50 V /Hz /AC	24 VDC	24VDC
Power consumption	25 W	25 W	24 W	24 W
Current consumption	0.1 A	0.1 A	1.0 A	1.0 A
Degree of protection	IP 55	IP 55	IP 55	IP 55
Interference protection	yes	yes	yes	yes

TOP

Gear rack actuators

MAGRACK CK

Description/function
The CK type electric Magrack gear rack actuator is an actuator designed especially for utilisation on large dome lights, windows and for the RWA sector. The actuators can be used in single or tandem versions. This system is extremely reliable and can be used for a multitude of tasks. The actuator motors can be supplied in single-phase alternative current (AC) or direct current (DC). Two different gears make possible different forces and speeds. Power limiters ensure precise deactivation of the actuators. Operations in multiple series connections are possible. The motor housing is made from high quality aluminium and withstands high temperatures. The fixing parts fall under the scope of supply. The articulated section and mounting bracket within the scope of supply for the gear rack.

Electrical connections
Only trained staff may undertake the processes of setting into motion and connecting up to power sources. All valid specifications must be observed. Connections to the power supply are made using the 4x1 mm^2 connection cord (AC) or 2x1 mm^2 connection cord (DC), following the diagram shown overleaf.

Assembly
The special installation instructions in the operating instructions must be observed. The actuators must be installed using the fixing parts provided (see accessories). Actuators and fixing supports must be flush. No lateral forces may act on the rack gear. Fine adjustments for the closing points should be undertaken at the eye bolt. Safe functions must be checked and guaranteed. All electric cables (connection cord) must be routed so that damage resulting from crushing, defl ection or traction is not possible.

Maintenance
The actuators contain greasing, which under normal operating conditions will suffice for around 10 000 double strokes. Only the gear rack should be cleaned and a thin layer of grease applied from time to time when the actuator is stationary and extended. The duration of life of the actuator depends greatly on the application for which it is used (e.g. temperature, relationship between stroke-force-cycles and environmental factors) and must if necessary be calculated separately. Defective actuators may only be opened and repaired in our factory.

Accessories/version
- Standard strokes 180, 230, 350, 550, 750, 1 000 mm
- 1S69045 articulated section on window
- 1S69046 rear bracket for bar mounting (on request)
- 1S69048 mounting bracket with screws
- Winter garden control

Technical data:	Unit	CK...230 V-600 N	CK...230 V-200 N	CK...24 V-800 N	CK...24 V-300 N
Push and pull force	N	600	200	800	300
Stroke (see accessories)	mm	180/230/350/	180/230/350/	180/230/350/	180/230/350/
	-	550/750/1 000	550/750/1 000	550/750/1 000	550/750/1 000
Pushing speed	mm/s	5 to 7	14 to 18	10 to 12	20 to 22
Idle time (at 1 000 mm)	sec.	125	72	84	42
Voltage/frequency	V/Hz	230/50	230/50	-	-
Voltage	V	-	-	24	24
Motor speed	rpm	13	22	24	39
Motor torque	Ncm	360	129	500	230
Duty cycle	%	50	50	50	50
Power input	W	20	20	24	24
Current input	A	0,1	0,1	1,0	1,0
Protection class	IP	55	55	55	55

Gear rack actuators MAGRACK CK

230 V connection pattern

24 V connection pattern

Articulated section 1S69045
(within scope of supply)

Mounting bracket 1S69048
(within scope of supply)

Overview

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Publication **L5321,1590EN.0/07.01**

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FPW Series Watertight Induction Motors

Check up to five results to perform an action.

larger image

The FPW series motors are watertight, dust-resistant geared induction motors which conform to the IEC standard IP67. They can be used where they are periodically splashed or washed with water.

- High corrosion resistance from special paint coating and stainless steel shaft
- Conform to safety standards and global power supply voltages

SEARCH ITEMS

Results 1 - 25 of 132

1 2 3 4 5 »

Item #	Item Name	Motor Frame Size	Output Power HP (W)	Voltage (VAC)	Gear Ratio (X:1)	Rated Torque (lb-in)	Rated Speed (rpm)	Permissible Load Inertia	Available to Ship	RoHS Compliant	Safety Standards	Web Price
FPW425A-3.6U	Watertight Induction Motor	3.15 in. sq.	1/30 HP (25W)	Single-Phase 110/115 VAC	3.6 :1	4.4	500	22 oz-in^2	7 Business Days (1-5 pcs)	No	UL CE CSA EN	$280.00
FPW425C-3.6E	Watertight Induction Motor	3.15 in. sq.	1/30 HP (25W)	Single-Phase 220/230 VAC	3.6 :1	3 5.3	500 417	22 oz-in^2	7 Business Days (1-5 pcs)	No	UL CE CSA EN	$284.00
FPW425S-3.6	Watertight Induction Motor	3.15 in. sq.	1/30 HP (25W)	Three-Phase 200/220/230 VAC	3.6 :1	4.1	500	22 oz-in^2	7 Business Days (1-5 pcs)	No	UL CE CSA EN	$284.00
FPW425A-6U	Watertight Induction Motor	3.15 in. sq.	1/30 HP (25W)	Single-Phase 110/115 VAC	6 :1	7.3	300	61 oz-in^2	7 Business Days (1-5 pcs)	No	UL CE CSA EN	$280.00
FPW425C-6E	Watertight Induction Motor	3.15 in. sq.	1/30 HP (25W)	Single-Phase 220/230 VAC	6 :1	8.5 5.1	300 250	61 oz-in^2	7 Business Days (1-5 pcs)	No	UL CE CSA EN	$284.00
FPW425S-6	Watertight Induction Motor	3.15 in. sq.	1/30 HP (25W)	Three-Phase 200/220/230 VAC	6 :1	6.9	300	61 oz-in^2	7 Business Days (1-5 pcs)	No	UL CE CSA EN	$284.00
FPW425A-9U	Watertight Induction Motor	3.15 in. sq.	1/30 HP (25W)	Single-Phase 110/115 VAC	9 :1	10.6	200	137 oz-in^2	7 Business Days (1-5 pcs)	No	UL CE CSA EN	$280.00
FPW425C-9E	Watertight Induction Motor	3.15 in. sq.	1/30 HP (25W)	Single-Phase 220/230 VAC	9 :1	13.2 7.6	200 167	137 oz-in^2	7 Business Days (1-5 pcs)	No	UL CE CSA EN	$284.00
FPW425S-9	Watertight Induction Motor	3.15 in. sq.	1/30 HP (25W)	Three-Phase 200/220/230 VAC	9 :1	10.6	200	137 oz-in^2	7 Business Days (1-5 pcs)	No	UL CE CSA EN	$284.00
FPW425A-15U	Watertight Induction Motor	3.15 in. sq.	1/30 HP (25W)	Single-Phase 110/115 VAC	15 :1	18.5	120	380 oz-in^2	7 Business Days (1-5 pcs)	No	UL CE CSA EN	$280.00

☐	FPW425C-15E	Watertight Induction Motor	3.15 in. sq.	1/30 HP (25W)	Single-Phase 220/230 VAC	15 :1	22 13.2	120 100	380 oz-in^2	7 Business Days (1-5 pcs)	No	UL CE CSA EN	$284.00
☐	FPW425S-15	Watertight Induction Motor	3.15 in. sq.	1/30 HP (25W)	Three-Phase 200/220/230 VAC	15 :1	16.8	120	380 oz-in^2	7 Business Days (1-5 pcs)	No	UL CE CSA EN	$284.00
☐	FPW425A-18U	Watertight Induction Motor	3.15 in. sq.	1/30 HP (25W)	Single-Phase 110/115 VAC	18 :1	22	100	550 oz-in^2	7 Business Days (1-5 pcs)	No	UL CE CSA EN	$280.00
☐	FPW425C-18E	Watertight Induction Motor	3.15 in. sq.	1/30 HP (25W)	Single-Phase 220/230 VAC	18 :1	26 15	100 83	550 oz-in^2	7 Business Days (1-5 pcs)	No	UL CE CSA EN	$284.00
☐	FPW425S-18	Watertight Induction Motor	3.15 in. sq.	1/30 HP (25W)	Three-Phase 200/220/230 VAC	18 :1	20	100	550 oz-in^2	7 Business Days (1-5 pcs)	No	UL CE CSA EN	$284.00
☐	FPW425A-30U	Watertight Induction Motor	3.15 in. sq.	1/30 HP (25W)	Single-Phase 110/115 VAC	30 :1	32	60	1530 oz-in^2	7 Business Days (1-5 pcs)	No	UL CE CSA EN	$289.00
☐	FPW425C-30E	Watertight Induction Motor	3.15 in. sq.	1/30 HP (25W)	Single-Phase 220/230 VAC	30 :1	23 39	60 50	1530 oz-in^2	7 Business Days (1-5 pcs)	No	UL CE CSA EN	$293.00
☐	FPW425S-30	Watertight Induction Motor	3.15 in. sq.	1/30 HP (25W)	Three-Phase 200/220/230 VAC	30 :1	30	60	1530 oz-in^2	7 Business Days (1-5 pcs)	No	UL CE CSA EN	$293.00
☐	FPW425A-36U	Watertight Induction Motor	3.15 in. sq.	1/30 HP (25W)	Single-Phase 110/115 VAC	36 :1	39	50	2200 oz-in^2	7 Business Days (1-5 pcs)	No	UL CE CSA EN	$289.00
☐	FPW425C-36E	Watertight Induction Motor	3.15 in. sq.	1/30 HP (25W)	Single-Phase 220/230 VAC	36 :1	28 47	50 42	2200 oz-in^2	7 Business Days (1-5 pcs)	No	UL CE CSA EN	$293.00
☐	FPW425S-36	Watertight Induction Motor	3.15 in. sq.	1/30 HP (25W)	Three-Phase 200/220/230 VAC	36 :1	37	50	2200 oz-in^2	7 Business Days (1-5 pcs)	No	UL CE CSA EN	$293.00

☐	FPW425A-60U	Watertight Induction Motor	3.15 in. sq.	1/30 HP (25W)	Single-Phase 110/115 VAC	60 :1	59	30	4200 oz-in^2	7 Business Days (1-5 pcs)	No	UL CE CSA EN	$300.00
☐	FPW425C-60E	Watertight Induction Motor	3.15 in. sq.	1/30 HP (25W)	Single-Phase 220/230 VAC	60 :1	42 70	30 25	4200 oz-in^2	7 Business Days (1-5 pcs)	No	UL CE CSA EN	$304.00
☐	FPW425S-60	Watertight Induction Motor	3.15 in. sq.	1/30 HP (25W)	Three-Phase 200/220/230 VAC	60 :1	55	30	4200 oz-in^2	7 Business Days (1-5 pcs)	No	UL CE CSA EN	$304.00
☐	FPW425A-90U	Watertight Induction Motor	3.15 in. sq.	1/30 HP (25W)	Single-Phase 110/115 VAC	90 :1	70	20	4200 oz-in^2	7 Business Days (1-5 pcs)	No	UL CE CSA EN	$300.00

Results 1 - 25 of 132

1 2 3 4 5 »

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Stainless Steel Brushless
AC Servo Motors - SSBSM Series

Features: Designed for harsh, corrosive, or food/liquid, high hygiene environments. Pharmaceutical, washdown, packaging, food handling, beverage & dairy processing applications. Durable to handle IP67 and 1500 psi washdown conditions. All stainless steel to provide protection in harsh environments and washdown conditions. Reliable potted stator provides environmental, current spike and high voltage protection. Grease proven to provide 4 times greater life. Insulation UL rated and potted for extra high insulation/safety. Teflon stainless steel seal with Viton O-rings. Laser etched nameplate.

Continuous Stall Torque		Continuous Stall Amps	Nominal Bus Volts	Motor Speed (RPM)	Motor Catalog Number with Resolver	List Price	Motor Catalog Number with Encoder	List Price	Multiplier Symbol
Lb-In	N-m								
3.9	0.45	0.8	300	4000	SSBSM50N-175CA	1991	SSBSM50N-175CF	2062	E4
7.9	0.9	1.4	300	4000	SSBSM50N-275CA	2107	SSBSM50N-275CF	2179	E4
12	1.3	2.4	300	4000	SSBSM50N-375CA	2224	SSBSM50N-375CF	2297	E4
11	1.2	1.7	300	4000	SSBSM63N-275CA	2625	SSBSM63N-275CF	2697	E4
18.5	1.7	2.5	300	4000	SSBSM63N-375CA	2774	SSBSM63N-375CF	2846	E4
23	2.5	3.1	300	4000	SSBSM80N-275CA	2593	SSBSM80N-275CF	2665	E4
32	3.6	4.4	300	4000	SSBSM80N-375CA	2780	SSBSM80N-375CF	2852	E4
42	4.8	3.3	300	2000	SSBSM90N-1150CA	3085	SSBSM90N-1150CF	3157	E4
70	7.9	5	300	2000	SSBSM90N-2150CA	3351	SSBSM90N-2150CF	3422	E4
94	10	7.1	300	2000	SSBSM90N-3150CA	3863	SSBSM90N-3150CF	3936	E4
163	18	13.4	300	2000	SSBSM100N-2150CA	4261	SSBSM100N-2150CF	4333	E4
240	27	18.3	300	2000	SSBSM100N-3150CA	4742	SSBSM100N-3150CF	4814	E4
283	32	14.4	300	1200	SSBSM100N-4250CA	5425	SSBSM100N-4250CF	5497	E4
8	0.9	1.9	300	4000	SSBSM80C-175CA	2035	SSBSM80C-175CF	2107	E4
16.8	1.9	2.6	300	4000	SSBSM80C-275CA	2086	SSBSM80C-275CF	2158	E4
25	2.8	5	300	4000	SSBSM80C-375CA	2115	SSBSM80C-375CF	2187	E4
30	3.4	5	300	4000	SSBSM80C-475CA	2146	SSBSM80C-475CF	2218	E4
37	4.2	3.5	300	2000	SSBSM90C-2150CA	2348	SSBSM90C-2150CF	2420	E4
55	6.2	4.8	300	2000	SSBSM90C-3150CA	2456	SSBSM90C-3150CF	2528	E4
71	8	6.4	300	2400	SSBSM100C-2150CA	3067	SSBSM100C-2150CF	3139	E4
100	11.3	9.1	300	2400	SSBSM100C-3150CA	3243	SSBSM100C-3150CF	3314	E4
142	16	13.5	300	2400	SSBSM100C-4150CA	3515	SSBSM100C-4150CF	3587	E4
177	20	16.8	300	2400	SSBSM100C-5150CA	3762	SSBSM100C-5150CF	3833	E4
212	24	19.2	300	2400	SSBSM100C-6150CA	3894	SSBSM100C-6150CF	3966	E4

NOTE: Standard SSBSM series includes IEC mounting flange.
Standard SSBSM50 has an standard no keyway and no tap on shaft end.
Standard SSBSM50/63/80/90/100 include two threaded stainless steel connectors for feedback and motor termination.
Order feedback and power cables separately.
Standard motor has teflon stainless steel seal with Viton O-rings.
Standard encoder is 2500 ppr.

Shaded areas are stocked products

Stainless Steel Gearheads Designed Specifically For SSBSM Servo

Features: Designed for packaging, food handling, pharmaceutical, washdown applications. Durable to handle IP67 and washdown conditions. High efficient, low backlash stainless servo rated gearheads.

Higher Torque / Lower Backlash Gearhead

	Number of Stages	Ratios Available	Standard Arc-min Backlash	List Price	Mult. Sym.
MSS 080	1	3-4-5-7-10	10	3136	E4
	2	16-20-25-35-40-50-70-100	10	4073	E4
	3	125-175 & UP	10	5003	E4
MSS 115	1	3-4-5-7-10	10	4371	E4
	2	16-20-25-35-40-50-70-100	10	5396	E4
	3	125-175 & UP	10	6419	E4
MSS 140	1	3-4-5-7-10	10	6300	E4
	2	16-20-25-35-40-50-70-100	10	7773	E4
	3	125-175 & UP	10	9253	E4

Right Angle Gearhead

	Number of Stages	Ratios Available	Standard Arc-min Backlash	List Price	Reduced Arc-min Backlash	List Price	Mult. Sym.
MRS 080	1	3-4-5-7-10	10	5352	5	5889	E4
	2	16-20-25-35-40-50-100	10	6291	5	6924	E4
MRS 115	1	3-4-5-7-10	10	6843	5	7529	E4
	2	16-20-25-35-40-50-100	10	7998	5	8800	E4
MRS 140	1	3-4-5-7-10	10	8602	5	9464	E4
	2	16-20-25-35-40-50-100	10	10381	5	11444	E4

NOTE:
1) How to order custom: email scheduling, the Baldor servo motor model number, gearhead type, ratio and backlash. DO NOT ENTER REQ SET.
2) Ordering nonmenclature: GBSM80-MSS080-3

G BSM90 - MSS115 - 3
Gear Motor Gearhead type Ratio

Heating Ventilation and Air Conditioning (HVAC)

Ajeeta Dhole, Prashanth Irudayaraj, Sean Hay Kim, Rachel Valade
March 2007

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1. Introduction

The Heating Ventilation and Air Conditioning (HVAC) system provides the heating, cooling and dehumidification needs of the Solar Decathlon House. It has its own sequence of operations that are all and in part coordinated with the overall control logic of the house. It shares information with other subsystems in order to achieve optimal energy use.

The criteria of the system design are to achieve the maximum allowable points during the competition. The point distribution is as follows:

- 100 points for comfort zone
- 150 points for engineering
- 100 points for energy balance

For the comfort zone competition, there is a delicate balance in which our indoor environments comfortably operate. The HVAC system must be effectively designed to consistently achieve the predetermined target temperature and humidity. The tight temperature range of 72-76°F and relative humidity of 40-55% are defined as the optimal comfort zones.

For the engineering competition, a model will be used to predict the annual energy performance of the house. The model will be assessed on the building envelope, indoor environmental control, mechanical, electrical, and plumbing systems. The indoor environmental control and the mechanical systems are the focus of the HVAC team.

For the energy balance competition, the HVAC system will need to work succinctly with the other components of the house as to allow for cohesion within the house. Similarly, the HVAC system must consume least amount of energy provided by the photovoltaic system as possible.

The HVAC system for the Georgia Institute of Technology's Solar Decathlon House consists of one outdoor heat pump unit, two indoor fan coil units, one energy recovery ventilation unit, one dehumidifier, and ducts. Please refer to section 3 for the sequence of operations and section 4 for the mechanical drawings.

2. System Specifications

The HVAC system for the Georgia Tech Solar Decathlon House currently consists of one outdoor heat pump unit, two indoor fan coil units, one energy recovery ventilation system, one dehumidifier, and ducts. Specific information regarding each piece of equipment is detailed out in the next couple sub-sections. Please note that the HVAC system is continually being updated. Therefore, some of the information might be not be completely up-to-date.

2.1. Heat Pump

Table 1: Heat Pump System Specifications

Unit	Outdoor Condenser
Manufacturer	Daikin
Model	RXYMQ36MVJU
Sound Rating (dB)	58
Air Flow (CFM)	3740
Heating Capacity (BTU)	40,000
Cooling Capacity (BTU)	36,000
SEER	13
HSPF	7.7
Dimensions (in)	35-3/8 x 13-3/4 x 52-7/8
Weight (lbs)	310
Supply Voltage (V)	208
Power Supply (W)	3050-3270

Figure 1: Daikin RXYMQ36MVJU Heat Pump

2.2. Fan Coil Unit

Table 2: Fan Coil Unit System Specifications

Unit	Indoor Fan Coil
Manufacturer	Daikin
Model	FX-A-Q-12-M-VJ-U
Sound Rating (dB)	33-34-42
Air Flow (L-M-H) (CFM)	152-240-350
Cooling Capacity (BTU)	13,600
Dimensions (in)	41.3 x 11.4 x 9.1
Weight (lbs)	23
Supply Voltage (V)	208
Power Supply (W)	32-27
Quantity	2

Unfortunately, no image is currently available of the Daikin FX-A-Q-12-M-VJ-U fan coil units which are to be used in Georgia Tech's Solar Decathlon House.

2.3. Energy Recovery Ventilation Unit

Table 3: Energy Recovery Ventilation Unit System Specifications

Unit	ERV
Manufacturer	UltimateAire
Model	200DX
Air Flow (CFM)	60-210
Dimensions (in)	25 x 25 x 19
Weight (lbs)	72
Supply Voltage (V)	120
Power Supply (W)	34-200
Quantity	1

Figure 2: UltimateAire 200DX Energy Recovery Ventilation Unit

2.4. Dehumidifier

Table 4: Dehumidifier Unit System Specifications

Unit	Dehumidifier
Manufacturer	Santa Fe
Model	4025699
Capacity (Pints/day)	90
Blower (CFM)	240
Dimensions (in)	19 x 14.5 x 33
Weight (lbs)	71
Supply Voltage (V)	115
Power Supply (W)	750
Quantity	1

Figure 3: Santa Fe 4025699 Dehumidifier Unit

3. Sequence of Operations

The sequence of operation of the HVAC system describes which subsystem has to take control to maintain the desired set point and in what order this series of actions will be performed. The flow chart depicts the whole map of decisions based on scenarios (heating/cooling mode, occupied/unoccupied mode), while the description of operation specifically focuses on the sequential operations of the main systems (ERV, Dehumidifier and Heat Pump/FCUs).

3.1. Flow Chart

Depending on scenarios of occupancy heating/cooling modes, control decision processes are described in terms of conditions and expected system status. Additional sensing actions are included in conditions and subsequent control actions for the dehumidifier and dampers are incorporated into the expected system status.

Figure 4: Mode selection by occupancy level

Figure 5: Cooling mode and Economizer Cycle

Figure 65: Cooling using Heat Pump

Figure 7: Heating mode

Figure 8: Heating using Heat Pump

3.2. Description of Operation

The description of operation describes the operation of specific controls. Since the following controls take the most critical part of system operation, further detail of the flow chart is included. Sensing and control actions for fans and dampers are incorporated into the operation of the main controls.

A. Controls shall be provided with required sensors and programming. Controls shall control the following functions:

a) Heating modulation or staging based on supply temperature
b) Cooling modulation or staging based on supply temperature
c) Cooling and heating lockouts based on air temperature entering the wheel
d) Outside air and exhaust air fan ON/OFF
e) Remote manual ON/OFF input
f) Various level of occupied/unoccupied mode

B. The following features will be controlled:
a) Temperature lockout option via energy wheel modulation based on air temperature entering the wheel
b) Economizer control based on outside air temperature
c) Supply discharge set point is reset up/down based on zone room temperature
d) Supply discharge humidity set point is reset up/down based on zone humidity
f) Outside air and return air dirty filter switch inputs and alarm output
g) Wheel rotation sensing and alarm output

C. Unit Start Command
i) Outdoor air and exhaust air damper actuators are powered
ii) Exhaust fan starts after a 15 second delay (adjustable)
iii) Supply fan starts 5 sec (adjustable) after the exhaust fan
iv) Heating, cooling, dehumidifier and wheel operation per below

D. Unit Stop Command
i) Outdoor air and exhaust air damper actuators are de-energized and dampers spring return closed
ii) Supply fan, exhaust fan and wheel are de-energized

E. ERV Temperature Lockout
a) The ERV will be locked out when air temperature entering the wheel is below set point
b) When ERV temperature lockout functions are inactive, the heat wheel VFD modulates the wheel to 100% speed
c) The wheel VFD modulates wheel speed to maintain the supply temperature set point
d) The supply temperature is automatically reset up/down to maintain the room temperature set point

F. Economizer cycle

a) The economizer cycle is active only if the outside air temperature is less than supply temperature set point
b) When dehumidification is needed, the dehumidifier operates to maintain room humidity
c) The supply temperature is automatically reset up/down to maintain the room temperature set point
d) The return and outside air mixing dampers will be modulated open on a call for cooling from the discharge temperature control signal. If the discharge temperature set point cannot be maintained by the mixing dampers, the heat pump will operate in sequence. A mixed air low limit program will modulate the mixing dampers closed on a fall in mixed air temperature below set point.

G. Cooling Sequence

a) ERV Lockout : The cooling will be locked out when the outside air is less than 55F (-2F hysteresis, adjustable)
b) Supply temperature reset : The supply temperature is automatically reset up/down to maintain the room/return temperature set point

H. Heating Sequence

a) ERV Lockout : The heating will be locked out when the outside air is more than 70F (+2F hyteresis, adjustable)
b) Supply temperature reset : The supply temperature is automatically reset up/down to maintain the room temperature set point or outdoor air temperature

I. Dehumidification Sequence

a) Supply humidity reset : The supply humidity is automatically reset up/down to maintain the room humidity set point

J. Supply Set Point Reset Function

a) The initial supply temperature set point is 55F (adjustable). The controller will reset the initial supply temperature set point to 70F (adjustable) when outdoor air is below the economizer lock off temperature (40F).
b) The controller will reset the supply temperature set point up and down between the values listed below in order to maintain the room temperature set point.
Supply discharge minimum set point : 50F (adjustable)
Supply discharge maximum set point : 100F (adjustable)

K. Fan and Damper Control

a) Supply fan shall be controlled by VSD per the occupied/unoccupied schedule and similar for temperature set points of the minimum operation/relaxed occupied mode.
b) Room thermostats shall actuate their associated dampers to maintain set point. The VSD shall monitor differential duct static pressure across the fan and modulate fan as required to maintain set point established for duct system at design flow rate. This provides for both temperature control and space pressurization control al all times to minimize odors
c) Exhaust fan shall be interlocked to run whenever the supply fan operates

d) The controller will sense the status of the supply fan via current sensing switches. Upon sensing that the supply fan is off, the controller will close the outside air damper, open the return air damper, open diverting damper fully open, and send a 0% command to the supply variable speed drives and relief fans starter

d) Individual room dampers shall be controlled by room thermostat. Damper shall be set to close to maximum of 50% of flow set by balancing damper actuators. Space temperature sensors shall be set for 74F when cooling and 70F when heating. Temperature shall be reset if either damper reaches minimum setting in accordance with approved schedules

e) The mixing damper will be at minimum position and the heat pump will operate to maintain discharge temperature set point.

L. Ventilation Control through CO2 level and Pressure difference

a) Controller shall start FCUs in sequence to maintain positive space differential pressure at 0.05 inch as measured at differential static pressure sensor at the entrance.

b) Return unit mounted CO2 sensor shall modulate outside air damper and return damper as required to maintain CO2 set point, approximately 500 PPM above ambient CO2 level.

M. Occupied/Unoccupied modes

a) The schedule will be scheduled or manually set by the end user

b) When a manual override is initiated by a user input, the controller will switch modes from one to another. The controller will return to the scheduled mode after the override time has expired (60min, adjustable)

c) Occupied mode (from minimal operation mode to high occupied mode) setups are as follows:
Supply fan ON
Exhaust fan ON
Heating per above
Cooling per above
Dehumidification per above
Wheel control per above

d) Unoccupied mode setups are as follows:
On a call for heating (heating low limit is 50F): Fans cycles on and the heating increase the room temperature. Unit cycles off when room temperature reaches the unoccupied set point (55F, adjustable)
On a call for cooling (cooling upper limit is 85F): Fans cycles on and the cooling decreases the room temperature. Unit cycles off when room temperature reaches the unoccupied set point (80F, adjustable)

Submittal Data: RXYMQ36MVJU

3 Ton Outdoor Unit – Heat Pump
VRV-S

Job Name:	Location:
Purchaser:	
Engineer:	
Submitted To:	For: ☐ Reference ☐ Approval ☐ Construction
Submitted By:	Date:
Unit Designation: Schedule #:	Model No.:

Capacities:

Cooling Capacity	36,000 Btu/h
Cooling Input Power	3.05 kW
Heating Capacity	40,000 Btu/h
Heating Input Power	3.27 kW (11,157 Btu/h)

Cooling Mode Nominal Conditions:
Indoor: 80°F DB / 67°F WB
Outdoor: 95°F DB
Pipe Length: 25 ft
Level Difference: 0 ft

Heating Mode Nominal Conditions:
Indoor: 70°F DB
Outdoor: 47°F DB / 43°F WB
Pipe Length: 25 ft
Level Difference: 0 ft

Operating Range:

Cooling	23°F – 115°F DB
Heating	0°F DB – 64°F DB -5°F WB – 60°F WB

Compressor:

Type	Hermetically Sealed Scroll
Quantity	1
Capacity Control Range	29% - 100%
Motor Rating Output	2.3 kW

Fan:

Fan Type x Quantity	Propeller Fan x 2
Fan Motor Output	0.070 kW
Airflow Rate	3,740 CFM
Drive	Direct Drive

Power Supply:

V/PH/Hz	208-230/1/60
Minimum Circuit Amps (MCA)	27 Amps
Maximum Fuse Amps (MFA)	30 Amps
Maximum Starting Current (MSC)	17.6 Amps
Total Overcurrent Amps (TOCA)	27 Amps

Refrigerant & Piping:

Refrigerant Type/Charge	R-410A / 12.8 lbs
Control	Electronic Expansion Valve
Liquid Refrigerant Piping	ϕ3/8" Flare
Suction Gas Refrigerant Piping	ϕ5/8" Flare

Unit Data:

Max. Number of Indoor Units	6
Sound Pressure Level at 3 ft	58 dBA
Weight	310 lbs

Standard Features:

- Six year compressor warranty
- One year parts warranty
- One year limited labor warranty
- Heating or cooling operation
- Inverter driven (variable speed) scroll compressor
- VFD controlled outdoor motor fan

(Daikin's products are subject to continuous improvements. Daikin reserves the right to modify product design, specifications and information in this data sheet without notice and without incurring any obligations)

Revolutionary comfort. Anywhere and everywhere.

The Multi-talented VRV-S.

VRV®-S

DAIKIN® AC™

absolute comfort™

LIGHT COMMERCIAL :: RESIDENTIAL :: RENOVATION :: NEW CONSTRUCTION

The singular pursuit of Absolute Comfort.

Daikin® is a leading innovator and provider of air conditioning solutions for residential, commercial and industrial applications. Over the past 80 years, Daikin has sold millions of systems throughout Asia, Europe and South America.

Today, Daikin is revolutionizing air conditioning in North America with some of the most technologically and aesthetically advanced solutions ever introduced. These intelligent, energy-efficient systems provide an unprecedented level of individual comfort and control. It's a leap beyond air conditioning to the experience of complete comfort. A notion so unique that it's an integral part of our U.S. brand.
We are Daikin® AC™ — Absolute Comfort.™

The Daikin difference.

Daikin is the only company in the world dedicated to manufacturing both air conditioning systems and refrigerants. We develop and optimize every system, so that each component works flawlessly with the next, delivering maximum performance and Absolute Comfort.

Protection for the environment.

Daikin is recognized as a global leader in applying environmentally friendly practices at every level of development. Our systems are designed to reduce fluorocarbon and CO_2 emissions.

They employ zero-ozone-depleting R410A refrigerants. And they consume less energy, so they're easier on the ecosystem. It's Absolute Comfort for the world outside.

Introducing the VRV®-S

One outdoor unit connects to up to five indoor units for advanced zoning capabilities.

Small wonder.

Daikin developed the world's first Variable Refrigerant Volume (VRV®) system and has installed more than 500,000 worldwide. At the core of our major VRV product is built-in intelligence that gives you independent zoning control and maximum flexibility. Those same advantages are at the heart of this simplified VRV-S system.

VRV-S: Simply sensational.

Single-Phase Technology. Perfect for light commercial and residential applications.

Smaller Capacity. Allows you to maintain precise temperature control over every square inch of space.

Space-Saving Design. Slim outdoor unit (just 12 5/8") and flexible indoor unit options offer quick and easy installation.

Superior Energy Efficiency. Results in lower operating costs, especially under partial load conditions.

Silent Operation. Whisper-quiet sound levels ensure comfortable fit in any room.

Single-Supplier Reliability. Delivers 80% complete and fully optimized by Daikin, plus has self-diagnostics and one of the best warranties in the industry.

www.daikinac.com

Perfect fit for virtually any space.

The versatility of the VRV-S makes it ideal for most light commercial or residential projects — retail store, small office, restaurant, hotel, healthcare facility, school, multi-family townhouse, condo or single-family home.

And, with two outdoor units and twenty-six different indoor unit options available, there's a VRV-S system that's right for your building plans and interior design. Our Daikin AC specialists can help you put together the best solution for your needs.

Indoor Units

Type		Model Number	Cooling Capacity (Btu/h)	Heating Capacity (Btu/h)	Sound Pressure Level (dBA)	Power (V/Ph/Hz)	Airflow Rate H/L (cfm)	Weight (lbs)	Height (inches)	Width (inches)	Depth (inches)
	Concealed Ceiling Unit	FXSQ12MVJU	12,000	13,500	41[1]	208-230/1/60	340/230	69	11 7/8	21 5/8	31 1/2
		FXSQ18MVJU	18,000	20,000	44[1]	208-230/1/60	530/390	73	11 7/8	27 1/2	31 1/2
		FXSQ24MVJU	24,000	27,000	44[1]	208-230/1/60	740/490	95	11 7/8	39 3/8	31 1/2
		FXSQ30MVJU	30,000	34,000	45[1]	208-230/1/60	950/720	119	11 7/8	55 1/8	31 1/2
		FXSQ36MVJU	36,000	40,000	45[1]	208-230/1/60	990/740	119	11 7/8	55 1/8	31 1/2
		FXSQ48MVJU	48,000	54,000	48[1]	208-230/1/60	1300/950	122	11 7/8	55 1/8	31 1/2
	Concealed Ceiling Unit (medium static)	FXMQ30MVJU	30,000	34,000	45[2]	208-230/1/60	690/565	99	15 3/8	28 3/8	27 1/8
		FXMQ36MVJU	36,000	40,000	45[2]	208-230/1/60	1020/565	139	15 3/8	43 3/4	27 1/8
		FXMQ48MVJU	48,000	54,000	48[2]	208-230/1/60	1270/1020	144	15 3/8	43 3/4	27 1/8
	4-Way Ceiling-Mounted Cassette Unit	FXFQ12MVJU	12,000	13,500	31[2]	208-230/1/60	460/350	55	9 1/8	33 1/8	33 1/8
		FXFQ18MVJU	18,000	20,000	33[2]	208-230/1/60	570/390	55	9 1/8	33 1/8	33 1/8
		FXFQ24MVJU	24,000	27,000	34[2]	208-230/1/60	670/490	55	9 1/8	33 1/8	33 1/8
		FXFQ30MVJU	30,000	34,000	38[2]	208-230/1/60	990/710	66	11 3/8	33 1/8	33 1/8
		FXFQ36MVJU	36,000	40,000	40[2]	208-230/1/60	990/740	66	11 3/8	33 1/8	33 1/8

Indoor Units, cont.

Type		Model Number	Cooling Capacity (Btu/h)	Heating Capacity (Btu/h)	Sound Pressure Level (dBA)	Power (V/Ph/Hz)	Airflow Rate H/L (cfm)	Weight (lbs)	Height (inches)	Width (inches)	Depth (inches)
	Wall-Mounted Unit	FXAQ12MVJU	12,000	13,500	37[3]	208-230/1/60	300/180	25	11 3/8	31 1/4	9
		FXAQ18MVJU	18,000	20,000	42[3]	208-230/1/60	500/400	32	11 3/8	41 3/8	9
		FXAQ24MVJU	24,000	27,000	46[3]	208-230/1/60	635/470	32	11 3/8	41 3/8	9
	Floor Console Unit	FXLQ12MVJU	12,000	13,500	35[4]	208-230/1/60	280/210	67	23 5/8	44 7/8	8 3/4
		FXLQ18MVJU	18,000	20,000	39[4]	208-230/1/60	490/380	80	23 5/8	55 7/8	8 3/4
		FXLQ24MVJU	24,000	27,000	40[4]	208-230/1/60	560/420	80	23 5/8	55 7/8	8 3/4
	Concealed Floor Console Unit	FXNQ12MVJU	12,000	13,500	35[4]	208-230/1/60	280/210	51	24	42 1/8	8 5/8
		FXNQ18MVJU	18,000	20,000	39[4]	208-230/1/60	490/380	51	24	53 1/8	8 5/8
		FXNQ24MVJU	24,000	27,000	40[4]	208-230/1/60	560/420	61	24	53 1/8	8 5/8
	Ceiling-Suspended Cassette Unit	FXHQ12MVJU	12,000	13,500	37[3]	208-230/1/60	430/360	55	7 11/16	37 13/16	26 3/4
		FXHQ24MVJU	24,000	27,000	40[3]	208-230/1/60	990/830	80	7 11/16	55 1/8	26 3/4
		FXHQ36MVJU	36,000	40,000	46[3]	208-230/1/60	1060/890	90	7 11/16	62 5/8	26 3/4

See the back of this brochure for complete outdoor unit specifications. Complete specifications for each indoor unit are available at **www.daikinac.com**.

1 At 5 ft. below bottom suction grille of unit.
2 At 5 ft. below the unit.
3 At 3.3 ft. below and away from the unit.
4 Measured at 5 ft. away, 5 ft. high.

DAIKIN® AC™
absolute comfort™

Control every inch of comfort.

The advanced VRV-S enables precise temperature control for each individual zone. Each indoor unit has an electronic expansion valve that continually controls the flow of refrigerant. So as climate, lighting and occupancy cause temperature and humidity fluctuations, the intelligent VRV-S inverter-driven compressor continually adjusts to maintain the desired comfort level — to within ±1.0°F of the set point.

It's this cutting-edge technology that gives you total control over your entire building. And an experience of Absolute Comfort for everyone inside.

Depending on the model, one outdoor unit can be connected to four or five indoor units and provides either heating OR cooling from one system.

Inverter technology reduces start-up time and keeps temperatures closer to the set point without the greater fluctuations of conventional ON/OFF systems.

Santa Fe®
ULTRA EFFICIENT DEHUMIDIFIER
ADVANCE

Santa Fe Advance Performance and Technical Specifications

Part Number:	4025699
Blower:	240 CFM (0 IWG)
Kilowatts:	.75 (80°F, 60% RH)
Supply Voltage:	115 volt – 1phase – 60 Hz
Amps:	6.35
Energy Factor:	2.37
Operating Temp:	56°F Min., 95°F Max.
Capacity:	90 Pints/Day (80°F, 60% RH)
Sized for:	2200 Sq. Ft. - Typical

CHANGE FOR THE BETTER WITH ENERGY STAR

Minimum Performance at Set Conditions

Intake Air:	80°F, 60% RH
Water Removal:	90 Pints/Day
Pints/KWH:	5.1
Filter Efficiency:	MERV-11 (12" x 12" x 1") Standard 65% Efficient ASHRAE Dust Spot Test
Power Cord:	12' – 115 volt grounded plug
Drain Hose:	.50" ID x 8'

Advance Dimensions:		**Packing Dimensions:**	**Dimensions with Duct Kit:**
Width:	14-1/2"	22"	14-1/12"
Height:	19" w/o feet	25"	22-1/4" w/o feet
Depth:	33"	39"	40-3/8"
Weight:	71 lbs	78-1/2 lbs	

Optional Accessories for the Santa Fe Advance

Part No.	Description
4026055	Santa Fe Duct Kit: 8" supply and 8" return collars
4025845	Condensate Pump Kit: 3/8" ID x 20' long hose with 15' lift, pump, mounting bracket
4020175	Honeywell Dehumidistat (Professional Installation Required)
4026607	Casters Kit
4025831	Aluminum Mesh/Foam Pre-Filter
4025568	Standard Filter (12" x 12" x 1") MERV-11

CHANGE FOR THE BETTER WITH ENERGY STAR

Santa Fe Advance Technical Illustrations

Santa Fe Advance Control Panel with Duct Kit (Front View)

Santa Fe Advance Low-Profile Condensate Pump Kit

Santa Fe Advance with Duct Kit, Cord and Condensate Hose

Sante Fe Advance Installation

The Santa Fe Advance is designed for installation in crawlspaces which experience short- to long-term high humidity conditions. This high capacity unit fits in low clearance areas and is 14 1/2" wide to fit through a standard stud wall cavity.

The Santa Fe Advance is the most energy-efficient unit in the industry. It is designed to operate in temperatures between 56˚F and 95˚F, which typically include the lower temperatures found in crawlspaces.

The optional ducting capability promotes airflow to remote areas in crawlspaces. This ducting option also allows the dehumidifier to be installed in a remote location such as a garage or closet.

Call for More Information 800-934-9194

UltimateAir®
RecoupAerator®

Whole-house ventilation and filtration

Standard Features

95% Efficiency

Self-balancing

Reliable, low maintenance

Variable speed control

Multi-function timer

Patented design

GM ECM brushless motors

Merv 12 filtration + aluminum pre-filter

Frost prevention

No drain

Humidity regulation without desiccants

Economic Cooling mode

5-year Warranty

Award-winner for energy efficiency, design and easy install

Filters/ core material: Easily washable/replaceable high filtration polymer material.

Case: 16 and 20 Gauge powder coated steel.

Controls: Standard, remote located, low voltage, variable speed wall controller. Standard 0-10 vds input control. Standard furnace input control.

EconoCool: To perform night time cooling / home air flush

Options:
PressureGuard: To control indoor pressure real-time
Co2 Guard: To automate ventilation with the increase in occupancy
HEPA: Add on HEPA filtration package

Boost Inputs: To boost ventilation using a bathroom switch

Mounting: Four rubber feet to set on a horizontal surface, or four metal D-rings for hanging from ceiling joinsts.

Weight: 72 lbs. Shipped weight: 80 lbs.

Certification:
All units are ETL certified to UL 1812. Third party performance testing done by Bodycote Materials Testing, Mississauga Ontario, Canada and by the Maryland Aviation Administration.

Variable air exchange rate:	60 - 210 cfm
Temperature effectiveness at full flow:	up to 95%
Latent efficiency (max):	88%
Dimensions:	25"H X 19"W X 25"D
Filter class of core material:	MERV 12
Pre-filter:	Washable aluminum mesh
Heat exchange material:	Washable polyester fiber
Duct connections:	6 inch
Certifications:	HVI, CE
Avg. electrical consumption	210 cfm = 200W
	60 cfm = 34W
Motor option	GE ECM 84 mm
Electrical	120 VAC / 5Amp

178 Mil Street, Athens, OH 45701
www.ultimateair.com / info@ultimateair.com / 800-535-3448

Energy-efficient technology keeps costs under control, too.

The VRV-S also saves money by reducing energy consumption and improving efficiency. The inverter technology enables compressor speed to vary according to the cooling/heating load so the system consumes only the power necessary to match that load. When a room requires lower capacity for heating or cooling, the system automatically decreases the power supply frequency and uses less energy.

Best for partial load efficiency.

What's more, by controlling the rotational speed of the compressor, the VRV-S allows the amount of refrigerant flowing in the system to vary depending on fluctuating needs. This delivers greater efficiency during partial load conditions than conventional, non-inverter systems by abbreviating the control steps into smaller units, resulting in precise temperature control for all zones.

Fully optimized for maximum performance.

Like all Daikin systems, the VRV-S operates with R410A refrigerant, fast becoming the industry standard of the future due to its energy-efficient and zero-ozone-depleting properties. Daikin not only produces R410A, but also optimizes every major VRV-S component to work with it, resulting in higher system performance, higher EER ratings and lower energy costs.

Space-saving, modular design offers plenty of options.

Whether you're working with space constraints or want to maximize the amount of commercial space available, the VRV-S system gives you the flexibility you need. With its simple, versatile design and long piping, the VRV-S can accommodate practically any floor layout, enabling better use of space. Its advanced zoning capabilities allow floor-by-floor installation so that each floor can be occupied quickly upon completion. And, because the outdoor units are lightweight and vibration-free, there's no need to reinforce floors, reducing both installation time and costs.

Long piping means you can install outdoor units on a rooftop (or even a terrace) and take full advantage of interior space.

Compared to standard T-joints and headers, Daikin's own advanced REFNET™ connectors are easier to install, optimize refrigerant flow and increase system reliability.

REFNET™ Header

REFNET™ Joint

Piping Specifications	Ft.
Actual Piping Length	330
Equivalent Piping Length	410
Max. Piping Length from First Distribution Point to Indoor Unit	130
Total Piping Length	1,000
Max. Height between Outdoor & Indoor Units	165
Max. Height between Indoor Units	50

Intelligent to the core.

All major components of the VRV-S outdoor units are engineered and manufactured by Daikin to ensure maximum performance, efficiency and Absolute Comfort.

1 **Noise-Reducing Air Inlet Bell Mouth & Aero Spiral Fan.** Bell mouth guides and bent-edge fan blades also reduce turbulence.

2 **DC Fan Motor.** Improves efficiency compared to conventional AC motors, especially during low-speed rotation.

3 **Super Aero Grille.** Spiral-shaped ribs align with direction of discharge flow to minimize turbulence and reduce noise.

4 **Reluctance Brushless DC Compressor.** Significantly increases efficiency over AC inverter motors by using both normal *and* reluctance torque to produce extra power from small electric currents.

5 **e-Bridge Circuit.** Increases evaporative capacity by adding super cooling prior to expansion cycle. This prevents accumulation of refrigerant in the condenser for greater energy efficiency.

6 **i-Demand Function.** Optimizes energy consumption by using a current sensor to minimize the difference between actual and predefined power consumption.

7 **e-Pass Heat Exchanger.** Improves operating efficiency by preventing heat transfer from the overheated gas section to the sub-cooled liquid section.

DC motor efficiency
(comparison with a conventional AC motor)

DC fan motor structure

Note:
Data are based on studies conducted under controlled conditions at a Daikin laboratory.

Compressor has neodymium magnets that are nearly 12 times stronger than ferrite to create energy-saving reluctance torque.

DAIKIN AC
absolute comfort™

Quiet operation indoors and out.

One thing you'll notice about the VRV-S system is how little you notice it. All indoor units come with fan speed control and operate extremely softly — as low as 25 decibels, the equivalent of rustling leaves. Outdoor units have built-in noise-reducing features, including an automatic night mode function that lowers the sound level for any period of time you specify.

Reliability and customer service from a single supplier.

A major advantage of selecting the VRV-S system is having Daikin AC as your service partner. The VRV-S is delivered 80% complete, virtually eliminating the installation, commissioning and service problems that can arise with conventional AC systems.

If issues do occur, the system has built-in self-diagnostics that can pinpoint trouble spots accurately for quicker repairs. And, because you control each zone individually, any troubles can be resolved room-by-room or floor-by-floor without affecting the entire building.

The VRV-S also comes with one of the best warranties in the industry. Best of all, as nearly everything is made by Daikin—from the major components and refrigerant, down to the controllers — you never have to worry about getting the runaround. One supplier. One phone call.

Daikin AC sales and service professionals in the U.S. have vast skills and knowledge from years of industry experience and must pass advanced training. They give you the confidence of knowing that you'll have **the right solution . . . from start to finish**. That's Absolute Comfort. Only from Daikin AC.

The Multi-talented VRV-S.
Advantage: everyone.

VRV-S System Benefits	Engineer/Architect	Contractor	Building Owner	Occupant/End User
Versatility	Freedom of design allows for unique indoor solutions	Flexible installation	Multiple options; Ability to renovate or make additions in stages	Multiple options; Wide range of indoor units
Zoning Capability	Can customize system for the individual client and space	Easy to install; Can stagger floor-by-floor or even zone-by-zone	Offers central or individual temperature control over building; Each floor can be occupied upon completion	Precise and individual temperature control at the touch of a button; Eliminates hot and cold rooms
Energy Efficiency	Cost-effective solution	Cost-effective solution	Reduces operating costs	Saves on electrical bill
Modular Design/ Long Piping	Easy to integrate into virtually any space	Simpler and quicker to install than conventional systems	Shorter installation time; Efficient use of interior space	Units are discreet and blend into space
R410A Refrigerant	Maximizes system efficiency; Future-proof	Smaller piping and no complex ductwork	Maximizes system efficiency; Future-proof	Better for the environment; Future-proof
Quiet Operation	Works discreetly inside and out	Enhances customer satisfaction	More comfortable for tenants	Enhances comfort
Reliability/ Self-Diagnostics	Can recommend system confidently	Eliminates or reduces mistakes; Fewer follow-up visits and repairs	Can target and fix problems on one floor or zone without disrupting rest of building	Eliminates or reduces system problems
Customer Service & Support	Daikin AC specialists can help put together the right solution	Daikin AC provides training; Easier to deal with single supplier	Daikin AC on-site specialists ensure smooth and correct installation	Confidence of system backed by Daikin AC
Other Benefits	Easy integration with BMS (LonWorks® and BACnet®)	More compact and lightweight than most conventional units	Individual monitoring of energy consumption	Absolute control = Absolute Comfort™

DAIKIN® AC™
absolute comfort™

VRV-S Outdoor Units.
Compact. Robust. Cost-efficient.

Model Name		RXYMQ36MVJU	RXYMQ48MVJU
Unit Type		Heat Pump	Heat Pump
Max No. of Indoor Units		4	5
Power Supply		1ph 208 – 230V 60Hz	1ph 208 – 230V 60Hz
Nominal Cooling Capacity	Btu/h	36,000	48,000
Cooling Input Power	kW	3.05	4.73
Nominal Heating Capacity	Btu/h	40,000	54,000
Heating Input Power	kW	3.27	4.26
EER - Cooling Mode	Btu/h/W	11.8	10.1
Refrigerant - R410A	lbs.	12.8	12.8
Operating Range - Cooling	°Fdb	23 – 115	23 – 115
Operating Range - Heating	°Fdb/°Fwb	0 – 64/-5 – 60	0 – 64/-5 – 60
Condensing Unit Weight	lbs.	310	310
Condensing Unit Height	in.	52 15/16"	52 15/16"
Condensing Unit Width	in.	35 7/16"	35 7/16"
Condensing Unit Depth	in.	12 5/8"	12 5/8"
Outdoor Fan Airflow Volume	cfm	3,740	3,740
Compressor Type		Hermetically Sealed Scroll	Hermetically Sealed Scroll
Compressor Set-up		1 INV	1 INV
Connection Flexibility Index	Btu/h 1000	18 – 46	24 – 62
Sound Pressure Level	dB(A)	58	58
Pipe Connections	Suction Gas in.	5/8" Flare	5/8" Flare
	Liquid in.	3/8" Flare	3/8" Flare
Protection Devices	High Pressure Switch, Fan Driver Overload Protector, Inverter Overload Protector, Fusible Plugs , Fuse		
Recommended Fuse/Breaker	A	30	30

Nominal Conditions:

Cooling Mode
Indoor: 80 Fdb / 67 Fwb
Outdoor: 95 Fdb
Pipe Length: 25 ft.
Level Difference: 0 ft.

Heating Mode
Indoor: 70 Fdb
Outdoor: 47 Fdb / 43 Fwb
Pipe Length: 25 ft.
Level Difference: 0 ft.

Notes:
Specifications are subject to change without notice.

Model Name	RXYMQ36MVJU	RXYMQ48MVJU
Cool/Heat Selector	KRC19-26A	KRC19-26A
Fixing Box	KJB111A	KJB111A
REFNET Joint	KHRP26M22T	KHRP26M22T
REFNET Header - Max. 4 Branch	KHRP26M22H	KHRP26M22H
Central Drain Plug	KKPJ5F180	KKPJ5F180
Fixture for Preventing Overturning	KPT-60B160	KPT-60B160
Wire Fixture for Preventing Overturning	K-KYZP150	K-KYZP150

Visit us online at www.daikinac.com.
Any questions? Send an email to info@daikinac.com or call 972-245-1510.

DAIKIN® AC™
absolute comfort™

VRV-S Controllers.
Automatic. Wireless. Fully integrated.

		Individual Zone Controllers			Multi-Zone Controllers		Time Clock Controllers	
		Wired R/C BRC1C71	Simplified Wired R/C BRC2A71	Wireless R/C BRC4C/BRC7C/BRC7E	Unified On/Off R/C DCS301C71*	Centralized R/C DCS302C71*	Set Back BRC15A71	Schedule DST301B61
	Model							
	No. of Units Controllable	← 1 Group/16 Units →			16 Groups	64 Groups	1 Group	128 Groups
Operation	Start/Stop	✓	✓	✓	✓	✓		✓
Operation	Operation Mode	✓	✓	✓		✓		
Operation	Temperature Setting	✓	✓	✓		✓	✓	
Operation	Set-Point Range	60–90 F	60–90 F	60–90 F		60–90 F	60–90 F	
Operation	Permit/Prohibit Selection				✓	✓		✓
Operation	Fan Speed	✓	✓	✓		✓		
Operation	Airflow Direction	✓		✓		✓		
Monitoring	Status	✓	✓	✓	✓	✓		✓
Monitoring	Malfunction Flashing	✓	✓	✓	✓	✓		
Monitoring	Malfunction Content	✓	✓	✓		✓		
Monitoring	Filter Sign	✓				✓		
Monitoring	Operation Mode	✓	✓	✓		✓		
Monitoring	Temperature Setting	✓	✓	✓		✓		
Monitoring	Permit/Prohibit Selection	✓	✓			✓		
Monitoring	Fan Speed	✓	✓	✓		✓		
Monitoring	Airflow Direction	✓		✓		✓		
Scheduling	Weekly						✓	✓
Scheduling	Timed Starts/Stops Per Day						2	2
Scheduling	No. of Weekly Schedules					8		
Scheduling	Auto ON/OFF Timer	✓		✓				
Data	Error History					✓		
Control Management	Field Setting Mode	✓	✓	✓		✓		
Control Management	Group Setting	✓	✓	✓	✓	✓		✓
Control Management	Auto Re-Start	✓	✓			✓	✓	✓

* Requires fixing box.

LonWorks® NETWORKS COMPATIBLE GATEWAY

- Interface for connection to LonWorks® networks
- Communication via LON® protocol (twisted pair wire)
- 64 units connectable per DMS-IF
- Unlimited site size
- Quick, easy installation

INTEGRATED CONTROL SYSTEM CONNECTING VRV-S SYSTEM WITH BMS SYSTEM

- Interface for BMS system
- Communication via BACnet® protocol (connection via ethernet)
- 256 units connectable per BACnet® gateway
- Unlimited site size
- Quick, easy installation

WARNINGS:

- Always use a licensed installer or contractor to install this product. Do not try to install the product yourself. Improper installation can result in water or refrigerant leakage, electrical shock, fire or explosion.
- Use only those parts and accessories supplied or specified by Daikin. Ask a licensed contractor to install those parts and accessories. Use of unauthorized parts and accessories or improper installation of parts and accessories can result in water or refrigerant leakage, electrical shock, fire or explosion.
- Read the User's Manual carefully before using this product. The User's Manual provides important safety instructions and warnings. Be sure to follow these instructions and warnings.

For any inquiries, contact your local Daikin sales office.

Daikin cares for our environment

10%
TOTAL RECOVERED FIBER
ALL POST-CONSUMER FIBER

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The air conditioners manufactured by Daikin Industries have received **ISO 9000 series** certification for quality assurance.

Certificate Numbers:
(ISO9001) **JMI-0107** (ISO9002) **JQA-1452**
JQA-0495

All Daikin Industries locations and subsidiaries in Japan have received environmental management system standard **ISO 14001** certification.

Daikin Industries, Ltd.
Domestic Group
Certificate Number: EC99J2044

About ISO 14001

ISO 14001 is the standard defined by the International Organization for Standardization (ISO) relating to environmental management systems. Our group has been acknowledged by an internationally accredited compliance organization as having an appropriate program of environmental protection procedures and activities to meet the requirements of ISO 14001.

DAIKIN® AC™
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Dealer Information

PCVSUSE05-05C

Daikin's products are subject to continuous improvements. Daikin reserves the right to modify product design, specifications and information in this brochure without notice and without incurring any obligations.

Electrical Appliances and Wiring

Prepared by

Atefe Makhmalbaf, Nihar Subodhchandr Patel, Shreyansh

03.02.2007

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Appliance/Wiring - Sequence of operation

The role of the team is mostly to monitor the energy usage of the house and ensure the functionality of appliance per the competition contest. The energy monitoring will be performed by branch circuit monitor using current sensor. Refrigerator, dishwasher, washer/dryer, HVAC components (ERV, pumps, and dehumidifier), stove, microwave/oven, hot water back-up, and receptacle/lighting loads will be monitored for energy usage.

Dishwasher - The contest requires that the temperature inside the dishwasher must reach 125°F to receive maximum points. Therefore a thermocouple will be installed in the dishwasher to measure the temperature and information will be fed to controller. The controller will display alert if the temperature does not reach desired value. Manual changing of dishwasher settings will be needed as a result of the alert. In normal operation, the controller will display the temperature of inside the dishwasher, if temperature is greater than 125°F than settings will be adjusted to use as little energy as possible.

Washer/Dryer - The contest requires that the temperature inside the washer must reach 110°F to receive maximum points. Therefore a thermocouple will be installed in the washer to measure the temperature and information will be fed to controller. The controller will display alert if the temperature does not reach desired value. Manual changing of washing cycle will be needed as a result of the alert. In normal operation, the controller will display the temperature of inside the dishwasher, if temperature is greater than 110°F than settings will be adjusted to use as little energy as possible.

Refrigerator - The contest requires that the temperature inside the refrigerator to be in the range of 34°F - 40°F to receive maximum points. Points are reduced for overcooling or under cooling. Therefore a thermocouple will be installed in the refrigerator to measure the temperature and information will be fed to controller. In order to be in the range the controller will display alert if the temperature above 39°F and under 35°F. Manual changing of refrigerator settings will be needed as a result of the alert. Our goal will be to maintain the temperature just below 39°F to be energy efficient.

Freezer - The contest requires that the temperature inside the freezer to be in the range of -20°F - 5°F to receive maximum points. Points are reduced for overcooling or under cooling. Therefore a thermocouple will be installed in the refrigerator to measure the temperature and information will be fed to controller. In order to be in the range the controller will display alert if the temperature above 3°F and under 18°F. Manual changing of refrigerator settings will be needed as a result of the alert. Our goal will be to maintain the temperature just below 3°F to be energy efficient.

Dishwasher

2007 Solar Decathlon Rules and Regulations for the DishWasher:
Minimum capacity: **6** place settings according to the manufacturers' specifications.

Dishwashers must operate automatically and must have a wash and a rinse cycle. (If a heated dry cycle is to be used, the temperature sensor must able to be removed prior to the initiation of the heated dry cycle).

The maximum points may be earned by by running the dishwasher for 4 days of the Contest Week through a complete washing cycle without the intervention during the cycle. A temperature sensor placed in the dishwasher must reach **125 ºF** at some point during the cycle. Cycles including "heated" or "power" dry will be disqualified.

Architecture's Criteria:
1. Size
2. Aesthetic

Potential Option:

Brand:	Fisher&Paykel
Model:	DS603HSS
Height:	16 3/32"
Width:	23 7/16"
Depth:	22 7/16"
Capacity:	6 place settings
Weight:	62 lbs.
Energy Use:	214 kWh/yr
Energy Use:	1.6 KWh/load
NAECA Std.*:	0.46
Energy Factor**:	0.89
Water Use:	2 gal/cycle
Highest Temp:	163 ºF in final rinse
Approximate Cost:	$839.00
Load Time:	10-14 days
Electrical Requirements:	110-120 VAC, 4.5 Amps Min

**NAECA Std.: The National Appliance Energy Conservation Act (NAECA) dictates minimum standards for energy consumption in dishwashers. All standard-sized dishwashers must have an Energy Factor of at least 0.46.*

***Energy Factor: Energy Factor is a number computed for each dishwasher which enables you to compare the relative efficiency of different units. The equation for Energy Factor is estimated loads per year (215) divided by the annual energy usage (kWh/year).*

Refrigerator

2007 Solar Decathlon Rules and Regulations for the Refrigerator:

Minimum combined interior capacity: **15 ft3**
Minimum freezer capacity: **3 ft3**
Any attached freezer compartment must have a separate door from that of the refrigerator.
The interior temperature of the refrigerator must be kept between **34.0ºF** and **40.0ºF**.
The temperature will be tested every 15 minutes to check the consistency.

Refrigerator Temperature Control:

Full Points:	34 ºF	(1.1 ºC)	≤	Temperature	≤	40 ºF	(4.4 ºC)
Reduced Points:	32 ºF	(0.0 ºC)	<	Temperature	<	34 ºF	(1.1 ºC)
or	40 ºF	(4.0 ºC)	<	Temperature	<	42 ºF	(5.6 ºC)
No Points:				Temperature	≤	32 ºF	(0.0 ºC)
or				Temperature	≥	42 ºF	(5.6 ºC)

Freezer Temperature Control:

The interior temperature of the freezer must be kept between **-20.0 ºF** and **5.0ºF**. The temperature will be tested every 15 minutes to check the consistency.

Full Points:	-20 ºF	(-28.9 ºC)	≤	Temperature	≤	5 ºF	(-15.0 ºC)
Reduced Points:	-30 ºF	(-34.4 ºC)	<	Temperature	<	-20 ºF	(-28.9 ºC)
or	5 ºF	(-15.0 ºC)	<	Temperature	<	15 ºF	(-9.4 ºC)
No Points:				Temperature	≤	-30 ºF	(-34.4 ºC)
or				Temperature	≥	15 ºF	(-9.4 ºC)

Architecture's Criteria:
1. Wheelchair accessibility
2. Aesthetics

Potential Option:

Brand :	Libherr
Model:	CI 1601
Volume:	15.5 ft3
Fridge Vol:	11.3 ft3
Freezer Vol:	4.2 ft3
Height:	81.5"
Width:	30"
Depth:	24.5"
Weight:	346 lbs.
Energy Use:	460 kWh/yr
Energy Cost/Year:	$41
Lead Time:	7-10 days
Approximate Cost:	$4,090.00
Electrical Requirements:	115 V, 60Hz, 350 W

Clothes Washer and Dryer

2007 Solar Decathlon Rules and Regulations for the Clothes Washer/Dryer:
Requires to wash 12 large cotton bath towels on several occasions.
Washer must have a wash and rinse cycle.
For combination washer/dryer units, the cycle must be able to be interrupted at the conclusion of wash cycle and before the initiation of the dry cycle to allow for removal of the temperature sensor.

Clothes Washing:
12 bath-size towels provided by the organizers may be washed on 2 days during the Contest Week. The washer should complete the task without any intevention during the cycle. A temperature sensor placed in the clothes washer must reach **110 ºF** at some point during the cycle to earn the points. For combination waher/dryer machines, there should be an interruption between the cycles so that the temperature sensor can be removed.

Clothes Drying:
The towels after coming out of the dryer should have a total weight less than or equal to the towel's total weight before washing. A 6-hour time period will be defined during which the towels must be collected, washed, dried and returned.

Full Points:			Weight	≤	100 %
Reduced Points:	100 %	<	Weight	<	110 %
No Points:			Weight	≥	110 %

Architecture's Criteria:
1. Combo washer/dryer
2. Aesthetics

Potential Option:

Brand:	LG
Model:	WD3274RHD
Volume:	2.37 ft3
Wash Capacity:	15.4 lbs.
Dry Capacity:	8.8 lbs.
Height:	33.5"
Width:	23.625"
Depth:	24.35"
Weight	156.5 lbs
Energy Use:	155 kWh/yr
MEF*:	2.02
Water Use:	10.7 gal/cycle
Water Factor**:	4.5
Maximum Temperature:	120 ºF
Approximate Cost:	$1,257.00
Lead Time:	7-10 days
Electrical Requirements:	120V, 60HZ, 1200 W

MEF: Modified Energy Factor (MEF) is a new equation that replaced Energy Factor as a way to compare the relative efficiency of different units of clothes washers. The higher the Modified Energy Factor, the more efficient the clothes washer is. MEF takes into account the amount of dryer energy used to remove the remaining moisture content in washed items.*

*Water Factor**: The Water Factor is a the number of gallons per cycle per cubic foot that the clothes washer uses. The lower the water factor, the more efficient the washer is. So, if a clothes washer uses 30 gallons per cycle and has a tub volume of 3.0 cubic feet, then the water factor is 10.0.*

SN	TYPE	MATERIAL	SIZES	MANUFACTURER		USE
1	Thin-Wall Rigid Steel Conduit	Steel	1/2"-1 1/2"			Power, data and communication wiring
2	Thin-Wall Rigid-to-Flexible Metal Conduit Couplings	Die cast zinc	3/8"-3/4"			Power, data and communication wiring
3	Rigid PVC conduit	PVC	1/2"-1 1/2"			Power, data and communication wiring
4	Flexible Metal Conduit	Galvanized steel Aluminium Stainless steel	5/16"-2" 5/16"-2" 3/8"-1 1/4"			Power, data and communication wiring
5	Ultra-Flex Flexible Metal Conduit	Galvanized steel Stainless steel				Power, data and communication wiring
6	Single channel raceway system	Aluminium	7/8" W X 7/16"D 15/16"W X 7/16" D 2 1/4"W X 11/16" D	MC-master carr		Power, data and communication wiring
6	Two- channel raceway system	Aluminium	2.1" W X1.04" D	MC-master carr		Branch circuit and low voltage wiring
6	Three- channel raceway system	Aluminium	4.5" W X 1.63" D	MC-master carr		Main distribution raceway

CONTROL MATRIX

	INPUTS				NETWORK OUTPUTS	
	ANALOG				ANALOG	
	KWh	WATER TEMPERATURE	INTERNAL TEMPERATURE			KWh
Appliances						
Plug loads	x					
Refridgerator/Freezer	x		x			
Dishwasher	x	x	x			
Cooktop	x					
Washer/Dryer	x	x	x			
Plumbing						
Hot water back-up	x					x
HVAC						
ERV	x					x
Dehumidifier	x					x
Heat pump (indoor)	x					x
Heat pump (outdoor)	x					x
Lighting	x					
Electric Car	x					

H704 Series

Solid-Core Modbus® RTU Branch Circuit Monitor

The **H704 Series** Branch Circuit Current Monitoring System provides a cost-effective solution for electrical load management, making it ideally suited for applications where load capacity requirements are dynamic, such as the data storage industry, lighting panels, etc.

The H704 monitors the current draw of each breaker in a panelboard. The accumulated information can be transmitted to a Modbus host and/or viewed on an optional local display via an RS-485 network. Data updates occur approximately once per second to provide timely preventative maintenance information. As a circuit approaches capacity, warning and alarm levels trigger (see graph below). Additional capacity can then be added, or loads balanced, to prevent costly downtime from overloaded circuits and unexpected breaker trips. The H704 Series is a UL508 open type device without enclosure.

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APPLICATIONS

- Load based cost allocation
- Overload protection
- Load management
- Load balancing
- Lighting circuits

ORDERING INFORMATION

MODEL	BREAKER SPACING	AMP RANGE	OUTPUT
H704-42	3/4" on center	10-50* (configurable)	RTU Modbus†
H704- 42/1	1" on center	10-50* (configurable)	RTU Modbus†

NOTES:
**Hole size accommodates up to 6 AWG (10mm²) THHN insulated conductors.*
†Other protocols available, consult factory.
***For 240VAC version, order H704-42E or H704-42/1E*

For N2 protocol version, order H726-xx

ACCESSORIES

H8936 Network Display, see page 110

A simple solution for individual circuit current monitoring

- Up to 63 H704s can be networked on one Modbus RS-485 drop... simplified wiring
- A H704-42 reports current consumed on each circuit in the panel board...one product covers multiple points
- 3/4 or 1 inch on center current sensors accomodate standard breakers... easy installation
- Provides Modbus registers for current limit warnings and alarms... prevents breaker trips
- Integrates with available network display for local indication

TYPICAL PANELBOARD INSTALLATION

OPERATION EXAMPLE

**Example represents 20 Amp circuit*
†Configurable time delay for alarm and warning

DIMENSIONAL DRAWINGS

Signal Aquisition Board

Current Sensor Strip

SPECIFICATIONS

General:	
Operating Temp. Range	0 to 60°C (<95%RH, non-condensing)
Storage Temp. Range	-40°C to 70°C
Power Source	120VAC (+10/-25%) line-to-neutral, 50/60Hz. **(240VAC** for H704-42E/H704-42/1E)
Measured Current Inputs:	
Number of Channels	42
Frequency	50/60Hz.
Sample Frequency	1280Hz.
Update Rate	1.2 sec
Accuracy	±5% of reading from 5A to 50A
Overload Capability	≤50A 10kAIC breaker curve
Connection to Conductor	Solid-core toroid†
Network Communications:	
Type	Modbus® RTU
Connection	DIP-switch selectable 2-wire or 4-wire
Address	DIP-switch selectable address 1 to 247
Baud Rate	DIP-switch selectable 2400, 4800, 9600, 19200
Parity	DIP-switch selectable NONE, ODD, EVEN
Communication Format	8 data-bits, 1 start-bit, 1 stop-bit
Termination	5-position pluggable connector; *(TX+ TX- SHIELD TX+/RX+ TX-/RX-)*
Defaults:	
Warning Register	60% of current sensor rating (configurable)
Alarm Register	70% of current sensor rating (configurable)
Current Setting	20 Amp

Dimensions Cir. Board Only :	**H704-42**	**H704-42/1**
CT Strips…(L x W)	19.5" (241mm) x 1.0" (26mm)	24.0" (607mm) x 1.0" (25mm)
Mainboard…(L x W)	7.25" (184mm) x 5.75" (146mm)	7.25" (184mm) x 5.75" (146mm)
Brackets Only:		
CT Strips…(L x W)	20.31" (516mm) x 0.75" (19mm)	25.06" (639mm) x 0.75" (19mm)
Sensor Spacing	0.75" (19mm) on center	1.0" (25mm) on center

† Do not apply 600V Class current transformers to circuits having a phase-to-phase voltage greater than 600V, unless adequate additional insulation is applied between the primary conductor and the current transformers. Veris assumes no responsibility for damage of equipment or personal injury caused by products operated on circuits above their published ratings.

U.S. Patent Number 6,330,516

H704 Series transducers are sold as an open device. Observe handling precautions for static sensitive devices to avoid damage to the circuitry which would not be covered under the factory warranty.

WATTAGES OF EACH APPLIANCE

Appliances	Wattages
TV	80
Computer	200
Refridgerator/Freezer	350
Dishwasher	780
Lighting	
Clothes Washer	1200
Clothes Dryer	

SOLAR PANELS & BATTERY SPECIFICATIONS

Prepared by

Amine Alami
March 2007

I- Solar cell specifications

1. **Copy of manufacturer's solar cell and module specification sheet(s)**
   (Attached)

2. **Manufacturer's name and contact information**

   SunPower Corp.
   3939 N 1st Street
   San Jose, California 95134 USA
   Main: (408) 240-5500
   Fax: (408) 240-5400
   Sales: 1-877-SUN-0123 (1-877-786-0123)

3. **Stock number, type, or description**
   SPR-215-BLK
   SPR-220-BLK

4. **Manufacturer's quote for cell or module area**
   Module Area
   SPR-215-BLK: 1.559 * 0.798 (1.24408 m^2)
   SPR-220-BLK: 1.559 * 0.798 (1.24408 m^2)

5. **Manufacturer's quote for performance**

		SPR-215-BLK	**SPR-220-BLK**
Peak Power	P_{max}	215.0 [W]	220.0 [W]
Rated Voltage	V_{mp}	39.8 [V]	39.8 [V]
Rated Current	I_{mp}	5.4 [A]	5.53 [A]
Open Circuit Voltage	V_{oc}	48.3 [V]	48.3 [V]
Short Circuit Current	I_{sc}	5.8 [A]	5.95 [A]
Series Fuse Rating		15.0 [A]	15.0 [A]
Maximum System Voltage		600 [V] (UL)	600 [V] (UL)
		1000 [V] (IEC)	1000 [V] (IEC)
Temperature Coefficients Power		-0.38% [/ºC]	-0.38% [/ºC]
Voltage		-136.8 [mV/ºC]	-136.8 [mV/ºC]
Current		2.3 [mA/ºC]	2.3 [mA/ºC]
Module Efficiency		17.3%	17.7%
PTC Rating		197.6 [W]	203.2 [W]

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

   ($3.5/watt)
   SPR-215-BLK: $752.5
   SPR-220-BLK: $770.0

II- Battery specifications

1. **Copy of manufacturer's battery specification sheet(s)**
   See Attached

2. **Material Safety Data Sheets (MSDS) obtained from the manufacturer**
   See Attached

3. **Manufacturer's name and contact information**

   GNB Industrial Power
   Lombard, Illinois U.S.A
   TEL: 1.630.629.5200
   FAX : 1.630.629.2635

4. **Stock number, type, or description**
   GNB Absolyte Model # 3-100A33 **(Sealed)**

5. **Module voltage (e.g., 6 V, 12 V, or 24 V)**
   6 Volts

6. **Bus voltage**
   48 Volts

7. **Number of modules to be used in the house**
   8 modules

8. **Manufacturer's specifications,**

   capacity (kWh) : 6[V] * 2100 [Amp-Hr] * 8 [units] = **100800 [Wh]**
   Weight (lb.): 829 [lbs] * 8 = **6632 lbs**
   Total cost (US$): **$ 19,235** (Subject to Discount)

9. **Spill and damage protocols and procedures (if these are not provided in the MSDS, the team must obtain this information from the manufacturer and submit it with the MSDS).**
   See MSDS

Roof Array Bank 1
Roof Array Bank 2
Roof Array Bank 3
Each roof bank consists of 9 Sunpower 220 panels wired in series. DC voltage at maximum power point is 358 volts @ 5.53 amps. Maximum bank voltage with low / no load is 435 volts.
Front wall bank consists of 12 Sunpower 215 panels split into two banks, each wired in series. DC voltage at maximum power point is 239 volts @ 5.53 amps. Maximum voltage with low / no load is 290 volts.
Note: 10A DC breakers can be replaced with 7A fuses in DC panels #1 & #2
DC Panel #1
10A
10A
10A
6000u
Wall Array Bank #1
Wall Array Bank #2
DC Panel #2
10A
10A
3800u
L1
L2
L2
L1
AC LOAD CENTER
neutral
earth ground
Battery bank consists of 8 modules of GNB Batteries (see specifications)
4248u
4248u
In1
In2
Disposal
Kitchen #1
Dishwasher
Bathroom
Commons
10A
15A
15A
15A
20A
6000u 35 amp
3800u 20 amp
HVAC 20 amp
Stove 20 amp
Dryer 25 amp
240 vac circuits
4248u 50 amp
In1 (120 vac)
In2 (120 vac)
10A
15A
20A
15A
15A
Refrig
Kitchen #2
Washroom
Bedroom
Hotwater backup
120 vac In1 circuits
120 vac In2 circuits
Note that the 120 vac output from each 4248u is "stacked" to give 240 vac.
Charges the battery during the day and supplies loads when the PV array isn't supplying power.

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

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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

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Document# 001-06638 Rev *B

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

SUNPOWER

SPR-220
HIGH EFFICIENCY PV MODULE

The SunPower SPR-220 module is designed for use in on-grid residential and commercial systems where the highest module efficiency and energy delivery are critical. Utilizing 72 series-connected A-300 solar cells, the SPR-220 delivers extremely high power density with total module efficiency approaching 18%. Reduced voltage-temperature coefficient, exceptional low-light performance and high sensitivity to light across the entire solar spectrum mean maximum yearly energy harvest.

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

FEATURES & BENEFITS

- Unique all-back contact solar cells with conversion efficiency up to 21.5%
- Low voltage-temperature coefficient enhances high-temperature operation
- Exceptional low-light performance and high sensivity to light across the entire solar spectrum maximize yearly energy delivery
- Highest quality, high-transmission tempered glass provides enhanced stiffness and impact resistance
- Superior aesthetics - back contact cells with no front side gridlines and a black anodized frame
- 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 variety of standard mounting systems

SPR-220 HIGH EFFICIENCY PV MODULE
Unprecedented power density and exceptional energy production per peak kW

LISTED UL 1703, Class C Fire Rating

IEC 61215, Safety Class II Certified

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Engineered in California

SUNPOWER

SPR-220

HIGH EFFICIENCY 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}	220W
Rated Voltage	V_{mp}	39.8V
Rated Current	I_{mp}	5.53A
Open Circuit Voltage	V_{oc}	48.3V
Short Circuit Current	I_{sc}	5.95A
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		17.7%
PTC Rating		203.2W

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

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Document# 001-06637 Rev *B

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Engineered in California

GNB

ABSOLYTE® IIP

Photovoltaic and Alternative Energy Sealed VRLA Batteries

Section 62.61

SPECIFICATIONS

- 5000 cycles at 20% D.O.D. (1200 cycles at 80% D.O.D.)
- 145-6385AH @ 100 Hour Rate
- Single Cell and stackable modules
- Recyclable to world standards
- UL recognized component

GNB

ABSOLYTE® IIP

Photovoltaic and Alternative Energy Batteries

THE WORLD LEADER IN SEALED BATTERY POWER FOR PHOTOVOLTAIC AND ALTERNATIVE ENERGY APPLICATIONS

Proven Field Experience Since 1983. The Absolyte was developed by GNB, in conjunction with Sandia National Laboratories, as the first sealed, large capacity, deep-cycle battery for photovoltaic applications. The Absolyte IIP represents the third generation of the Absolyte product line. Without an increase in size, it offers 15% more capacity than its predecessor, the Absolyte II.

Patented MFX positive grid alloy* provides excellent cycle life. This propriety alloy gives Absolyte IIP superior cycling characteristics (5000 cycles @ 20% D.O.D.; 1200 cycles @ 80% D.O.D.) for photovoltaic applications. The rugged characteristics of this alloy also provide for extended partial state of charge operation and allow for deep discharge recovery.

Wide band of temperature operation. The Absoyte IIP retains more capacity in cold temperatures than traditional flooded batteries and, because it is an absorbent glass mat (AGM) design, it can tolerate freezing without the risk of jar cracking and electrolyte spills that can happen with flooded or gel designs. The modular steel tray design provides excellent heat dissipation in high temperature applications to maximize life.

Reduced Installation and Maintenance Time. Absolyte IIP batteries are housed in protective steel trays designed for maximum installation flexibility. Single cell modules simplify transport to remote locations. Stackable modules meet U.B.C. seismic zone 4 requirements when installed horizontally. Because it is sealed, Absolyte eliminates the need for periodic topping up with water as found in flooded cells. Periodic visual inspections, voltage readings , and connection retorquing is all that is required.

*U.S. Patent 4,401,730

Highest Reliability is Assured by GNB's Quality Program. Cell covers are hermetically sealed using a special GNB double heat-sealing process. Electrolyte volume is controlled through a computerized "fill by weight" process. All cells are capacity tested prior to shipment to verify standards compliance.

APPLICATIONS

Absolyte IIP batteries are ideal for photovoltaic and alternative energy applications including:

- Village Electrification
- Telecommunications
- Residential Power
- Railroad Signal
- Navigational Aids

ADDED FEATURES AND BENEFITS

- Extended partial state of charge operation
- Deep discharge recovery
- Freezing tolerant
- Does not require separate battery room
- Recombination efficiency greater than 99%
- Recyclable to world standards
- Simple cell replacement capability

CELL SPECIFICATIONS

Container and Cover—Polypropylene.

Flame retardant UL94 V-0/28% L.O.I. is optional.

Separators—Spun glass, microporous matrix.

Safety Vent—400mb (6 psi) nominal, self re-sealing (patented).

Terminals—Solid copper alloy.

Positive Plate—Patented MFX grid alloy.*

Negative Plate—Lead calcium grid alloy.

Orientation—50A, 90A, 100A Horizontal.
50A Vertical (Horizontal preferred)

Operating Temperature Range—-40°C - +40°C (-40°F - +104°F) tolerates excursions to +50°C (122°F)

Cycle Life—5000 cycles at 20% D.O.D.; 1200 cycles at 80% D.O.D. [at 25˚C (77˚F)].

Self Discharge—0.5 to 1.0% per week maximum at 25˚C (77˚F).

Charge Controller Upper Voltage Settings— at 25°C (77°F) with a maximum charge current of 5% of nominal C/100 Amp-hour rating.

2.28 ± 0.02 V.P.C. @ 0-2% D.O.D.
2.33 ± 0.02 V.P.C. @ 3-5% D.O.D.
2.38 ± 0.02 V.P.C. @ >5% D.O.D.

For other temperatures and charge currents, contact GNB for recommendations.

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ABSOLYTE® IIP

Photovoltaic and Alternative Energy Batteries

Absolyte IIP Stackable Module Weights and Dimensions

MODULE TYPE	VOLTS	NOM AH CAP (100 HR)	STACKING DIMENSIONS						UNPACKED WEIGHT		DOMESTIC PACKED WEIGHT		EXPORT PACKED WEIGHT	
			LENGTH		WIDTH		DEPTH OR HEIGHT*							
			IN	MM	IN	MM	IN	MM	LBS	KGS	LBS	KGS	LBS	KGS
50A														
6-50A05	12	145	17.19	437	8.53	217	16.22	412	157	71	176	80	228	104
6-50A07	12	220	21.69	551	8.53	217	16.22	412	209	95	228	104	280	127
6-50A09	12	290	26.19	665	8.53	217	16.22	412	252	114	271	123	323	147
6-50A11	12	365	30.69	780	8.53	217	16.22	412	313	142	332	151	384	174
6-50A13	12	440	35.19	894	8.53	217	16.22	412	356	162	381	173	433	197
6-50A15	12	510	39.69	1008	8.59	218	16.22	412	417	189	442	201	494	224
90A														
6-90A05	12	245	17.19	437	8.53	217	23.56	599	235	107	254	115	322	146
6-90A07	12	365	21.69	551	8.53	217	23.56	599	316	143	335	152	413	187
6-90A09	12	490	26.19	665	8.53	217	23.56	599	396	180	415	188	493	224
6-90A11	12	610	30.69	780	8.53	217	23.56	599	477	216	502	228	581	264
6-90A13	12	730	35.19	894	8.53	217	23.56	599	557	253	582	264	661	300
6-90A15	12	855	39.69	1008	8.59	218	23.56	599	637	289	668	303	747	339
3-90A17	6	975	24.50	622	8.59	218	23.56	599	376	171	395	179	474	215
3-90A19	6	1100	26.75	679	8.59	218	23.56	599	416	189	435	197	514	233
3-90A21	6	1220	29.00	737	8.59	218	23.56	599	456	207	478	217	557	253
3-90A23	6	1340	31.25	794	8.59	218	23.56	599	497	226	522	237	601	273
3-90A25	6	1465	33.50	851	8.59	218	23.56	599	538	244	564	256	642	291
3-90A27	6	1585	35.75	908	8.59	218	23.56	599	578	262	606	275	685	311
100A														
3-100A13	6	800	19.93	506	8.53	217	26.38	670	328	149	356	162	436	198
3-100A15	6	930	22.18	563	8.59	218	26.38	670	374	170	408	185	489	222
3-100A17	6	1065	24.50	622	8.59	218	26.38	670	424	192	446	202	528	240
3-100A19	6	1200	26.75	679	8.59	218	26.38	670	470	213	491	223	574	260
3-100A21	6	1330	29.00	737	8.59	218	26.38	670	515	234	539	245	623	283
3-100A23	6	1460	31.25	794	8.59	218	26.38	670	561	255	589	267	674	306
3-100A25	6	1595	33.50	851	8.59	218	26.38	670	608	276	637	289	723	328
3-100A27	6	1730	35.75	908	8.59	218	26.38	670	653	296	684	310	772	350
3-100A29	6	1860	38.00	965	8.59	218	26.38	670	704	319	736	334	824	374
3-100A31	6	1995	40.25	1022	8.59	218	26.38	670	750	340	783	355	873	396
3-100A33	6	2130	42.50	1080	8.59	218	26.38	670	795	361	829	376	920	417
1-100A39	2	2400	19.93	506	8.53	217	26.38	670	328	149	356	162	436	198
1-100A45	2	2795	22.18	563	8.59	218	26.38	670	374	170	408	185	489	222
1-100A51	2	3190	24.50	622	8.59	218	26.38	670	424	192	446	202	528	240
1-100A57	2	3590	26.75	679	8.59	218	26.38	670	470	213	491	223	574	260
1-100A63	2	3990	29.00	737	8.59	218	26.38	670	515	234	539	245	623	283
1-100A69	2	4390	31.25	794	8.59	218	26.38	670	561	255	589	267	674	306
1-100A75	2	4790	33.50	851	8.59	218	26.38	670	608	276	637	289	723	328
1-100A81	2	5185	35.75	908	8.59	218	26.38	670	653	296	684	310	772	350
1-100A87	2	5585	38.00	965	8.59	218	26.38	670	704	319	736	334	824	374
1-100A93	2	5985	40.25	1022	8.59	218	26.38	670	750	340	783	355	873	396
1-100A99	2	6385	42.50	1080	8.59	218	26.38	670	795	361	829	376	920	417

*Includes 77mm (3") additional for Module Cover Assembly

NOTE: Design and / or specification subject to change without notice. If questions arise, contact your local GNB sales representative for clarification.

ASSEMBLY CONFIGURATIONS

Horizontal Stack Assembly (Preferred)

Depth is overall, including module cover assembly. Add 102mm (4″) for bottom I-beam supports to determine total height (width) of assembled horizontal stack.

Vertical Assembly, Side-by-side

Height is overall, including module cover assembly. Add 51mm (2″) for bottom channel support to determine final height.

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ABSOLYTE® IIP

Photovoltaic and Alternative Energy Batteries

Absolyte IIP Single Cell Module Weights and Dimensions

CELL TYPE	NOM AH CAP (100 HR)	LENGTH		WIDTH		DEPTH OR HEIGHT		UNPACKED WEIGHT		DOMESTIC PACKED WEIGHT		EXPORT PACKED WEIGHT	
		IN	MM	IN	MM	IN	MM	LB	KG	LB	KG	LB	KG
50A													
50A05	145	3.80	97	6.49	165	16.00	406	32	15	35	16	44	20
50A07	220	3.80	97	6.49	165	16.00	406	39	18	41	19	51	23
50A09	290	3.80	97	6.49	165	16.00	406	43	20	45	20	54	24
50A11	365	4.55	116	6.49	165	16.00	406	50	23	53	24	61	28
50A13	440	5.30	135	6.49	165	16.00	406	58	26	61	28	69	31
50A15	510	6.05	154	6.55	166	16.00	406	66	30	69	31	77	35
50A17	585	6.92	176	6.67	169	16.00	406	82	37	86	39	103	47
50A19	655	7.67	195	6.67	169	16.00	406	91	41	95	43	112	51
50A21	730	8.40	214	6.67	169	16.00	406	99	45	104	47	121	55
50A23	800	9.17	233	6.67	169	16.00	406	107	49	112	51	129	59
50A25	875	9.92	252	6.67	169	16.00	406	115	52	121	55	137	62
50A27	950	10.67	271	6.67	169	16.00	406	124	56	130	59	147	67
90A													
90A05	245	3.80	97	6.49	165	23.31	592	50	23	54	25	69	31
90A07	365	3.80	97	6.49	165	23.31	592	61	28	65	29	80	36
90A09	490	3.80	97	6.49	165	23.31	592	67	30	70	32	83	38
90A11	610	4.55	116	6.49	165	23.31	592	79	36	83	38	96	44
90A13	730	5.30	135	6.49	165	23.31	592	92	42	96	44	109	50
90A15	855	6.05	154	6.55	166	23.31	592	104	47	109	50	122	55
90A17	975	6.92	176	6.67	169	23.31	592	128	58	134	61	161	73
90A19	1100	7.67	195	6.67	169	23.31	592	141	64	147	67	174	79
90A21	1220	8.40	213	6.67	169	23.31	592	155	70	162	74	189	86
90A23	1340	9.17	233	6.67	169	23.31	592	168	76	176	80	203	92
90A25	1465	9.92	252	6.67	169	23.31	592	180	82	189	86	215	98
90A27	1585	10.67	271	6.67	169	23.31	592	193	88	202	92	229	104

NOTE: Design and/or specifications subject to change without notice. If questions arise, contact your local GNB sales representative for clarification.

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ABSOLYTE® IIP

Photovoltaic and Alternative Energy Batteries

Absolyte IIP Performance Characteristics
Amperes to 1.75 Volts Per Cell @ 25°C (77°F)

CELL TYPE	HOURS									
	120	100	72	48	36	24	20	12	10	8
50A										
50A05	1.2	1.4	1.9	2.8	3.6	5.1	6.0	9.3	11	13
50A07	1.8	2.1	2.9	4.2	5.5	7.7	9.1	14	16	19
50A09	2.4	2.9	3.9	5.6	7.3	10	12	18	22	26
50A11	3.0	3.6	4.9	7.1	9.1	13	15	23	27	33
50A13	3.7	4.3	5.9	8.5	11	15	18	28	33	39
50A15	4.3	5.1	6.9	9.9	12	18	21	32	38	46
50A17	4.8	5.9	7.9	11	15	21	24	37	44	53
50A19	5.4	6.6	8.9	13	16	23	27	42	49	59
50A21	6.0	7.4	9.9	14	18	26	31	47	55	66
50A23	6.6	8.1	11	16	20	29	34	51	60	73
50A25	7.2	8.8	12	17	22	31	37	56	65	79
50A27	7.8	9.6	13	19	24	34	40	61	71	86
90A										
90A05	2.0	2.4	3.2	4.7	6.0	8.6	10	15	18	21
90A07	3.0	3.6	4.9	7.0	9.1	12	15	23	27	32
90A09	4.0	4.8	6.5	9.4	12	17	20	31	36	43
90A11	5.0	6.0	8.1	11	15	21	25	39	46	54
90A13	6.1	7.2	9.8	14	18	25	30	47	55	65
90A15	7.1	8.4	11	16	21	30	35	55	64	76
90A17	8.1	9.6	13	18	24	34	40	63	73	87
90A19	9.1	10	14	21	27	38	45	71	82	98
90A21	10	12	16	23	30	43	50	79	92	109
90A23	11	13	18	26	33	47	55	87	101	120
90A25	12	14	19	28	36	51	60	95	110	131
90A27	13	15	21	30	39	56	65	103	119	142
100A										
100A13	6.7	7.9	10	15	20	29	34	54	62	75
100A15	7.8	9.2	12	18	23	33	40	63	73	87
100A17	8.9	10	14	20	26	38	45	72	83	100
100A19	10	11	16	23	30	43	51	81	94	112
100A21	11	13	17	25	33	48	57	90	104	125
100A23	12	14	19	28	36	53	63	99	115	137
100A25	13	15	21	31	40	58	68	108	125	150
100A27	14	17	23	33	43	62	74	117	135	162
100A29	15	18	25	36	46	67	80	127	146	175
100A31	16	19	26	38	50	72	85	136	156	187
100A33	17	21	28	41	53	77	91	145	167	200
100A39	20	23	30	45	60	87	102	162	186	225
100A45	23	27	36	54	69	99	120	189	219	261
100A51	26	30	42	60	78	114	135	216	249	300
100A57	30	33	48	69	90	129	153	243	282	336
100A63	33	39	51	75	99	144	171	270	312	375
100A69	36	42	57	84	108	159	189	297	345	411
100A75	39	45	63	93	120	174	204	324	375	450
100A81	42	51	69	99	129	186	222	351	405	486
100A87	45	54	75	108	138	201	240	381	438	525
100A93	48	57	78	114	150	216	255	408	468	561
100A99	51	63	84	123	159	231	273	435	501	600

For Additional Ratings, refer to section 26.10B

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ABSOLYTE® IIP

Photovoltaic and Alternative Energy Batteries

Absolyte IIP Performance Characteristics
Amperes to 1.80 Volts Per Cell @ 25°C (77°F)

CELL TYPE	HOURS									
	120	100	72	48	36	24	20	12	10	8
50A										
50A05	1.2	1.4	1.9	2.8	3.6	5.1	6.0	9.2	10	12
50A07	1.8	2.1	2.9	4.2	5.4	7.7	9.0	13	16	19
50A09	2.4	2.8	3.9	5.6	7.2	10	12	18	21	25
50A11	3.0	3.6	4.8	7.0	9.0	12	15	23	26	31
50A13	3.6	4.3	5.8	8.4	10	15	18	27	32	38
50A15	4.2	5.0	6.8	9.8	12	18	21	32	37	44
50A17	4.8	5.8	7.8	11	14	20	24	37	43	51
50A19	5.4	6.5	8.8	13	16	23	27	42	48	58
50A21	6.0	7.3	9.8	14	18	26	30	46	54	64
50A23	6.6	8.0	11	15	20	28	33	51	59	70
50A25	7.2	8.7	12	17	22	31	36	55	64	77
50A27	7.8	9.4	13	18	24	33	39	60	70	83
90A										
90A05	2.0	2.3	3.2	4.6	6.0	8.5	9.9	15	18	21
90A07	3.0	3.5	4.8	6.9	9.0	12	14	23	27	32
90A09	4.0	4.7	6.4	9.3	12	17	19	31	36	43
90A11	5.0	5.9	8.0	11	15	21	24	39	45	53
90A13	6.0	7.1	9.7	13	18	25	29	46	54	64
90A15	7.0	8.3	11	16	21	29	34	54	63	75
90A17	8.0	9.5	12	18	24	34	39	62	72	86
90A19	9.0	10	14	20	27	38	44	70	81	97
90A21	10	11	16	23	30	42	49	78	90	107
90A23	11	13	17	25	33	46	54	85	99	118
90A25	12	14	19	27	36	51	59	93	108	129
90A27	13	15	21	30	39	55	64	101	117	140
100A										
100A13	6.6	7.8	10	15	19	28	33	53	62	73
100A15	7.7	9.1	12	17	23	33	39	62	72	85
100A17	8.8	10	14	20	26	38	45	71	82	97
100A19	9.9	11	15	22	29	42	50	80	93	110
100A21	11	13	17	25	32	47	56	89	103	122
100A23	12	14	19	28	36	52	62	98	113	134
100A25	13	15	21	30	39	57	67	107	124	146
100A27	14	17	22	33	42	61	73	116	134	159
100A29	15	18	24	35	46	66	78	125	144	171
100A31	16	19	26	38	49	71	84	134	155	183
100A33	17	20	28	40	52	76	90	143	165	195
100A39	19	23	30	45	57	84	99	159	186	219
100A45	23	27	36	51	69	99	117	186	216	255
100A51	26	30	42	60	78	114	135	213	246	291
100A57	29	33	45	66	87	126	150	240	279	330
100A63	33	39	51	75	96	141	168	267	309	366
100A69	36	42	57	84	108	156	186	294	339	402
100A75	39	45	63	90	117	171	201	321	372	438
100A81	42	51	66	99	126	183	219	348	402	477
100A87	45	54	72	105	138	198	234	375	432	513
100A93	48	57	78	114	147	213	252	402	465	549
100A99	51	60	84	120	156	228	270	429	495	585

For Additional Ratings, refer to section 26.10B

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ABSOLYTE® IIP

Photovoltaic and Alternative Energy Batteries

Absolyte IIP Performance Characteristics
Amperes to 1.90 Volts Per Cell @ 25°C (77°F)

CELL TYPE	HOURS									
	120	100	72	48	36	24	20	12	10	8
50A										
50A05	1.1	1.3	1.7	2.4	3.1	4.5	5.3	8.3	9	11
50A07	1.6	1.9	2.6	3.7	4.8	6.8	8.0	12	14	16
50A09	2.2	2.6	3.4	4.9	6.3	9.1	10	16	18	22
50A11	2.7	3.2	4.3	6.2	8.0	11	13	21	23	28
50A13	3.3	3.9	5.2	7.4	9.6	13	16	25	28	33
50A15	3.9	4.5	6.1	8.7	11	16	18	29	33	39
50A17	4.4	5.2	7.0	9.9	13	18	21	34	38	45
50A19	5.0	5.9	7.9	11	14	21	24	38	43	51
50A21	5.5	6.6	8.8	12	16	23	27	42	48	56
50A23	6.1	7.2	9.7	14	18	25	29	46	53	62
50A25	6.6	7.9	11	15	19	27	32	51	58	68
50A27	7.2	8.5	11	16	21	30	35	55	62	73
90A										
90A05	1.8	2.1	2.9	4.1	5.3	7.7	9.0	14	16	19
90A07	2.8	3.2	4.3	6.2	8.0	11	13	21	24	28
90A09	3.7	4.3	5.8	8.3	10	15	18	28	32	38
90A11	4.6	5.4	7.3	10	13	19	22	35	40	47
90A13	5.6	6.5	8.7	12	16	23	27	42	48	57
90A15	6.5	7.6	10	14	18	27	31	49	56	67
90A17	7.4	8.7	11	16	21	30	36	56	64	76
90A19	8.4	9.8	13	18	24	34	40	63	72	86
90A21	9.3	10	14	20	26	38	45	71	80	95
90A23	10	12	16	23	29	42	49	78	88	105
90A25	11	13	17	25	32	46	54	85	96	115
90A27	12	14	19	27	35	50	58	92	104	124
100A										
100A13	5.9	7.0	9.4	13	17	25	30	47	54	63
100A15	6.9	8.1	11	15	20	29	35	55	63	74
100A17	7.9	9.3	12	18	23	33	40	63	72	85
100A19	8.9	10	14	20	26	38	45	71	81	95
100A21	9.9	11	15	22	29	42	50	79	90	106
100A23	10	12	17	24	32	46	55	87	99	117
100A25	11	14	18	27	35	50	60	95	108	127
100A27	12	15	20	29	38	55	65	103	117	138
100A29	13	16	22	31	41	59	70	110	126	149
100A31	14	17	23	34	44	63	75	118	135	159
100A33	15	18	25	36	47	67	80	126	144	170
100A39	17	21	28	39	51	75	90	141	162	189
100A45	20	24	33	45	60	87	105	165	189	222
100A51	23	27	36	54	69	99	120	189	216	255
100A57	26	30	42	60	78	114	135	213	243	285
100A63	29	33	45	66	87	126	150	237	270	318
100A69	30	36	51	72	96	138	165	261	297	351
100A75	33	42	54	81	105	150	180	285	324	381
100A81	36	45	60	87	114	165	195	309	351	414
100A87	39	48	66	93	123	177	210	330	378	447
100A93	42	51	69	102	132	189	225	354	405	477
100A99	45	54	75	108	141	201	240	378	432	510

For Additional Ratings, refer to section 26.10B

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ABSOLYTE® IIP

Photovoltaic and Alternative Energy Batteries

Absolyte IIP Performance Characteristics

Cycle Life vs. Depth of Discharge [at 25°C (77°F)]

Open Circuit Voltage vs. State of Charge [at 25°C (77°F)]

Capacity Retention vs. Temperature

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ABSOLYTE® IIP

Photovoltaic and Alternative Energy Batteries

Absolyte IIP Performance Curves @ 25°C (77°F)

50A Series 1 to 10 Hours

50A Series 12 to 100 Hours

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ABSOLYTE® IIP

Photovoltaic and Alternative Energy Batteries

Absolyte IIP Performance Curves @ 25°C (77°F)

90A Series 1 to 10 Hours

90A Series 12 to 100 Hours

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ABSOLYTE® IIP

Photovoltaic and Alternative Energy Batteries

Absolyte IIP Performance Curves @ 25°C (77°F)

100A Series 1 to 10 Hours

100A Series 12 to 100 Hours

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ABSOLYTE® IIP

Photovoltaic and Alternative Energy Sealed-VRLA Batteries

Industry Leader In Network Power

The Network Power Division of Exide Technologies is *the* global leader in stored electrical energy solutions for all major critical reserve power applications and needs. Such network power applications include communication/data networks, UPS systems for computers and control systems, and electrical power generation and distribution systems. With a strong manufacturing base in both North America and Europe and a truly global reach (operations in greater than 80 countries) in sales and service, the Network Power Division has all of the tools necessary to satisfy your power needs.

Based on over 100 years of technological innovation the Network Power Division continues to lead the industry with such recognized global brands as Absolyte, Sonnenschein, Marathon, Sprinter, and Flooded Classic. These products and brands are synonymous with quality, reliability, performance and excellence in all markets served.

In addition to being the leader in delivering premium products to the market, Exide Technologies takes pride in its commitment to the environment. As part of a complete approach to manufacturing, distributing, and recycling lead acid batteries, the Total Battery Management program has been developed to ensure a safe and responsible life cycle for all of our products.

GNB

INDUSTRIAL POWER

A Division of EXIDE *Technologies*

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LEAD RETURN RECYCLE

MATERIAL SAFETY DATA SHEET

I. PRODUCT IDENTIFICATION

MANUFACTURER
Exide Technologies
13000 Deerfield Parkway, Bldg. 200
Alpharetta, GA 30004

FOR INFORMATION
Primary: MACTEC Engineering and Consulting, Inc.
Attention: DeLyn Thompson (770) 421-3364
Secondary: Environmental, Safety & Health
Attention: Fred Ganster (610) 921-4052

FOR EMERGENCY
CHEMTREC (800) 424-9300
24-hour Emergency Response Contact
Ask for Environmental Coordinator

CHEMICAL/TRADE NAME (as used on label): Valve Regulated Lead-Acid Battery (VRLA) Absorbed Electrolyte Battery

CHEMICAL FAMILY/ CLASSIFICATION: Electric Storage Battery

DATE ISSUED: February 24, 2005
Page 1 of 5

CHEMTREC INTERNATIONAL (703) 527-3887 – Collect

II. HAZARDOUS INGREDIENTS/IDENTITY INFORMATION

			Approximate Air Exposure Limits ($\mu g/m^3$)		
Components	CAS Number	% by Wt.	OSHA	ACGIH	NIOSH
Inorganic compounds of: Lead	7439-92-1	75-77	50	50	50
Electrolyte (no fluid/completely absorbed) sulfuric acid/water/solution	7664-93-9	14-16	1000	200	1000
Case Material: Polypropylene	9003-07-0	5-6	N/A	N/A	N/A

NOTE: Inorganic lead and electrolyte (water and sulfuric acid solution) are the primary components of every battery manufactured by Exide Technologies or its subsidiaries. Other ingredients may be present dependent upon battery type. Polypropylene is the principal case material of automotive and commercial batteries.

III. PHYSICAL DATA

Boiling Point	203° F-240° F (for S.G. range)	Specific Gravity (H_20=1)	1.230 to 1.350
Melting Point	Not Applicable	Vapor Pressure (mm Hg) 77° F	17 to 11 (for S.G. range)
Solubility in Water	100%		
Evaporation Rate (Butyl acetate=1)	Less Than 1	Vapor Density (AIR=1)	Greater than 1
Appearance and Odor	A clear liquid with a sharp, penetrating, pungent odor. A battery is a manufactured article; no apparent odor.	% Volatiles by Weight	Not Applicable

IV. FIRE AND EXPLOSION HAZARD DATA

Flash Point: Not Applicable

Flammable Limits: LEL = 4.1% (Hydrogen Gas in air) ; UEL = 74.2%

Extinguishing media: CO_2; foam; dry chemical

Special Fire Fighting Procedures:
Use positive pressure, self-contained breathing apparatus. Beware of acid splatter during water application and wear acid-resistant clothing, gloves, face and eye protection. If batteries are on charge, shut off power to the charging equipment, but, note that strings of series connected batteries may still pose risk of electric shock even when charging equipment is shut down.

IV. FIRE AND EXPLOSION HAZARD DATA (CONTINUED)

Unusual Fire and Explosion Hazards:

In operation, batteries generate and release flammable hydrogen gas. They must always be assumed to contain this gas which, if ignited by burning cigarette, naked flame or spark, may cause battery explosion with dispersion of casing fragments and corrosive liquid electrolyte. Carefully follow manufacturer's instructions for installation and service. Keep away all sources of gas ignition and do not allow metallic articles to simultaneously contact the negative and positive terminals of a battery.

V. REACTIVITY DATA

Stability: Stable X
Unstable ___

Conditions to Avoid: Prolonged overcharge at high current; sources of ignition.

Incompatibility: (materials to avoid)

Electrolyte: Contact with combustibles and organic materials may cause fire and explosion. Also reacts violently with strong reducing agents, metals, sulfur trioxide gas, strong oxidizers, and water. Contact with metals may produce toxic sulfur dioxide fumes and may release flammable hydrogen gas.

Lead compounds: Avoid contact with strong acids, bases, halides, halogenates, potassium nitrate, permanganate, peroxides, nascent hydrogen, and reducing agents.

Hazardous Decomposition Products:

Electrolyte: Sulfur trioxide, carbon monoxide, sulfuric acid mist, sulfur dioxide, hydrogen sulfide.

Lead compounds: Temperatures above the melting point are likely to produce toxic metal fume, vapor, or dust; contact with strong acid or base or presence of nascent hydrogen may generate highly toxic arsine gas.

VI. HEALTH HAZARD DATA

Routes of Entry:

Electrolyte: Harmful by all routes of entry.

Lead compounds: Hazardous exposure can occur only when product is heated above the melting point, oxidized or otherwise processed or damaged to create dust, vapor, or fume.

Inhalation:

Electrolyte: Breathing of sulfuric acid vapors or mists may cause severe respiratory irritation.

Lead compounds: Inhalation of lead dust or fumes may cause irritation of upper respiratory tract and lungs.

Ingestion:

Electrolyte: May cause severe irritation of mouth, throat, esophagus, and stomach.

Lead compounds: Acute ingestion may cause abdominal pain, nausea, vomiting, diarrhea, and severe cramping. This may lead rapidly to systemic toxicity.

Skin Contact:

Electrolyte: Severe irritation, burns, and ulceration.

Lead compounds: Not absorbed through the skin.

Eye Contact:

Electrolyte: Severe irritation, burns, cornea damage, blindness.

Lead compounds: May cause eye irritation.

Effects of Overexposure - Acute:

Electrolyte: Severe skin irritation, damage to cornea may cause blindness, upper respiratory irritation.

Lead compounds: Symptoms of toxicity include headache, fatigue, abdominal pain, loss of appetite, muscular aches and weakness, sleep disturbances, and irritability.

VI. HEALTH HAZARD DATA (CONTINUED)

Effects of Overexposure - Chronic:

Electrolyte: Possible erosion of tooth enamel; inflammation of nose, throat, and bronchial tubes.

Lead compounds: Anemia; neuropathy, particularly of the motor nerves, with wrist drop; kidney damage; reproductive changes in both males and females.

Carcinogenicity:

Electrolyte: The National Toxicology Program (NTP) and the International Agency for Research on Cancer (IARC) have classified "strong inorganic acid mist containing sulfuric acid" as a substance that is carcinogenic to humans. This classification does not apply to sulfuric acid solutions in static liquid state or to electrolyte in batteries. Batteries subjected to abusive charging at excessively high currents for prolonged periods of time without vent caps in place may create a surrounding atmosphere of the offensive strong inorganic acid mist containing sulfuric acid.

Lead compounds: Listed as a 2B carcinogen, likely in animals at extreme doses. Proof of carcinogenicity in humans is lacking at present.

Arsenic: Listed by National Toxicology Program (NTP), International Agency for Research on Cancer (IARC), OSHA and NIOSH as a carcinogen only after prolonged exposure at high levels.

Medical Conditions Generally Aggravated by Exposure:

Overexposure to sulfuric acid mist may cause lung damage and aggravate pulmonary conditions. Contact of electrolyte (water and sulfuric acid solution) with skin may aggravate skin diseases such as eczema and contact dermatitis. Contact of electrolyte (water and sulfuric acid solution) with eyes may damage cornea and/or cause blindness. Lead and its compounds can aggravate some forms of kidney, liver, and neurologic diseases.

Emergency and First Aid Procedures:

Inhalation:

Electrolyte: Remove to fresh air immediately. If breathing is difficult, give oxygen.
Lead compounds: Remove from exposure, gargle, wash nose and lips; consult physician.

Ingestion:

Electrolyte: Give large quantities of water; **do not** induce vomiting; consult physician.
Lead compounds: Consult physician immediately.

Skin:

Electrolyte: Flush with large amounts of water for at least 15 minutes; remove contaminated clothing completely, including shoes.
Lead compounds: Wash immediately with soap and water.

Eyes: Electrolyte and Lead compounds: Flush immediately with large amounts of water for at least 15 minutes; consult physician immediately.

VII. PRECAUTIONS FOR SAFE HANDLING AND USE

Handling and Storage:

Store batteries under roof in cool, dry, well-ventilated areas that are separated from incompatible materials and from activities which may create flames, sparks, or heat. Keep away from metallic objects that could bridge the terminals on a battery and create a dangerous short-circuit. Single batteries pose no risk of electric shock but there may be increasing risk of electric shock from strings of connected batteries exceeding three 12-volt units.

Charging:

There is a possible risk of electric shock from charging equipment and from strings of series connected batteries, whether or not being charged. Shut-off power to chargers whenever not in use and before detachment of any circuit connections. Batteries being charged will generate and release flammable hydrogen gas. Charging space should be ventilated. Keep battery vent caps in position. Prohibit smoking and avoid creation of flames and sparks nearby. Wear face and eye protection when near batteries being charged.

Spill or Leak Procedures:

There is no flow of electrolyte from an Absorbed Electrolyte Battery even if the casing is broken or punctured.

Waste Disposal Methods:

Spent batteries: Send to secondary lead smelter for recycling.

VII. PRECAUTIONS FOR SAFE HANDLING AND USE (CONTINUED)

Precautionary Labeling:

POISON - CAUSES SEVERE BURNS
DANGER - EXPLOSIVE GASES
CORROSIVE - CONTAINS SULFURIC ACID
KEEP AWAY FROM CHILDREN

VIII. CONTROL MEASURES

Engineering Controls and Work Practices:

Store and handle in well-ventilated area. If mechanical ventilation is used, components must be acid-resistant.
Handle batteries cautiously. Make certain vent caps are on securely. If battery case is damaged, avoid bodily contact with internal components. Wear protective clothing, eye and face protection, when charging or handling batteries.

Respiratory Protection:

None required under normal conditions. When concentrations of sulfuric acid mist are known to exceed PEL, use NIOSH or MSHA-approved respiratory protection.

Protective gloves:

None required under normal conditions. If battery case is damaged, rubber or plastic acid-resistant gloves with elbow-length gauntlet.

Eye Protection:

None required under normal conditions. If battery case is damaged, chemical goggles or face shield.

Emergency Flushing:

In areas where water and sulfuric acid solutions are handled in concentrations greater than 1%, emergency eyewash stations and showers should be provided, with unlimited water supply.

IX. OTHER REGULATORY INFORMATION

NFPA Hazard Rating for sulfuric acid:

Flammability (Red)	=	0
Health (Blue)	=	3
Reactivity (Yellow)	=	2

Sulfuric acid is water-reactive if concentrated.

TRANSPORTATION:

Exide VRLA absorbed electrolyte batteries meet test specifications for “non-spillable electric storage batteries”, as required by D.O.T., 49 CFR 173.159(d), and IMO/IMDG, and ICAO/IATA packing instruction 806 and note A67; therefore, are non-regulated when protected against short circuits, kept upright, and securely packaged.

The battery and the outer packaging must be plainly and durably marked “NONSPILLABLE” or “NONSPILLABLE BATTERY”.

RCRA: Spent lead-acid batteries are not regulated as hazardous waste when recycled.

CERCLA (Superfund) and EPCRA:

(a) Reportable Quantity (RQ) for spilled 100% sulfuric acid under CERCLA (Superfund) and EPCRA (Emergency Planning and Community Right to Know Act) is **1,000 lbs.** State and local reportable quantities for spilled sulfuric acid may vary.

(b) Sulfuric acid is a listed "Extremely Hazardous Substance" under EPCRA, with a Threshold Planning Quantity (TPQ) of **1,000 lbs.**

(c) EPCRA Section 302 notification is required if **1,000 lbs** or more of sulfuric acid is present at one site. An average automotive/commercial battery contains approximately 5 lbs of sulfuric acid. Contact your Exide representative for additional information.

(d) EPCRA Section 312 Tier Two reporting is required for non-automotive batteries if sulfuric acid is present in quantities of **500 lbs** or more and/or if lead is present in quantities of 10,000 lbs or more.

(e) **Supplier Notification:** This product contains toxic chemicals that may be reportable under EPCRA Section 313 Toxic Chemical Release Inventory (Form R) requirements. For a manufacturing facility under SIC codes 20 through 39, the following information is provided to enable you to complete the required reports:

IX. OTHER REGULATORY INFORMATION (CONTINUED)

Toxic Chemical	CAS Number	Approximate % by Weight
Lead	7439-92-1	75-77
Sulfuric Acid/Water Solution	7664-93-9	14-16

If you distribute this product to other manufacturers in SIC Codes 20 through 39, this information must be provided with the first shipment of each calendar year.

Note: The Section 313 supplier notification requirement does not apply to batteries that are "consumer products".

CAA:

Exide Technologies supports preventative actions concerning ozone depletion in the atmosphere due to emissions of CFC's and other ozone depleting chemicals (ODC's), defined by the USEPA as Class I substances. Pursuant to Section 611 of the Clean Air Act Amendments (CAAA) of 1990, finalized on January 19, 1993, Exide established a policy to eliminate the use of Class I ODC's prior to the May 15, 1993 deadline.

TSCA:

Ingredients in Exide's batteries are listed in the TSCA Registry as follows:

	CAS NO.	TSCA Status
Electrolyte		
Sulfuric acid (H_2SO_4)	7664-93-9	Listed
Inorganic Lead Compound		
Lead (Pb)	7439-92-1	Listed
Lead Oxide (PbO)	1317-36-8	Listed
Lead Sulfate ($PbSO_4$)	7446-14-2	Listed

CANADIAN REGULATIONS:

All chemical substances in this product are listed on the CEPA DSL/NDSL or are exempt from list requirements.

CALIFORNIA PROPOSITION 65:

"WARNING: This product contains lead, a chemical known to the State of California to cause cancer, or birth defects or other reproductive harm."

PREPARED BY: ENVIRONMENTAL, SAFETY AND HEALTH DEPARTMENT
EXIDE TECHNOLOGIES
13000 DEERFIELD PKWY., BLDG. 200
ALPHARETTA, GA 30004

VENDEE AND THIRD PERSONS ASSUME THE RISK OF INJURY PROXIMATELY CAUSED BY THE MATERIAL IF REASONABLE SAFETY PROCEDURES ARE NOT FOLLOWED AS PROVIDED FOR IN THE DATA SHEET, AND VENDOR SHALL NOT BE LIABLE FOR INJURY TO VENDEE OR THIRD PERSONS PROXIMATELY CAUSED BY ABNORMAL USE OF THE MATERIAL EVEN IF REASONABLE PROCEDURES ARE FOLLOWED.

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ANY PHOTOCOPY MUST BE OF THIS ENTIRE DOCUMENT

Sunny Boy™ 2100U

The ideal inverter for high quality solar powered home systems

- 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 300,000 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.

The Sunny Boy 2100U is the ideal inverter for new or existing home power systems with outstanding quality and performance at a price that is affordable. The 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. 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 Voltage	213-262 (240 V AC)
AC Frequency	59.3 - 60.5 (60 Hz) (50 Hz also available)
DC Input Voltage	250 - 600 V DC
Peak Power Tracking Voltage	234 - 480 V DC
PV Start Voltage	300 V DC
Minimum DC Input Voltage	233 - 256 V DC dependent on available line voltage
Maximum Array Input Power	2600W (240V AC)(DC@STC)
Maximum AC Power Output	2100W (240V AC)
Current THD	< 4%
Power Factor	Unity
Peak Inverter Efficiency	94.8%
CEC Weighted Efficiency	93.0%
Cooling	*Convection cooling (no fan)
Maximum AC Output Current	12A
Maximum DC Input Current	12A

* Optional external fan (Sunny Breeze) available

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 lb (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

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Sunny Boy 6000U

The leading grid-tied photovoltaic inverters in Europe and America

Exceptional reliability, efficiency and energy capture ratio

5-year comprehensive warranty

Rugged stainless steel outdoor enclosure standard

Easy to install wall mount bracket system

Comprehensive SMA communications and data collection options

SMA's modular commercial inverter design is expandable to virtually any size system

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

The SB6000U is SMA's latest addition to the Sunny Boy family of utility interactive inverters. The SB6000U is designed for use with PV, fuel cell, wind-turbine, hydro-turbine and micro-turbine technologies. The SB6000U follows SMA's modular system design philosophy for utility, commercial and residential PV installations from 6kW and up. Automatic sensing of the site utility voltage makes installation on almost any utility system trouble-free. Just wire the inverter into any 208, 277 or 240 VAC system, make one internal jumper setting and the SB6000U does the rest. The wide DC input voltage range allows connection to almost any type or model of PV module. Our proven peak-power-point tracker results in maximum energy capture. The SB6000U uses the same SMA communication accessories as every other inverter in the Sunny Boy family. Choose the system package that best suits your needs. SMA offers a variety of hardware and software solutions from low cost wireless monitoring, to complex data acquisition systems that integrate large numbers of inverters with external sensors to networked PC's and the internet.

Specifications

Inverter Technology	PWM true sine-wave, current source
AC Input Voltage	Automatic sensing 277 VAC Nominal (244-305 VAC) 240 VAC Nominal (211-264 VAC) 208 VAC Nominal (183-229 VAC)
AC Input Frequency	59.3-60.5 (60Hz)
AC Maximum Output Power	6000W (at 277 or 240 VAC) 5200W (at 208 VAC)
AC Maximum Output Current	25A (22A at 277 VAC)
DC Input Voltage	234-600 VDC
DC Minimum Input Voltage	207-256 VDC (dependent on AC line voltage)
DC Voltage Ripple	Less than 5%
DC Maximum Current	25A
Peak Power Tracking Voltage	250-480 VDC
PV Start Voltage (adjustable)	300 VDC (277 or 240 VAC) 270 VDC (208 VAC)
Maximum Recommended PV Power	7500W (STC)
Current THD	Less than 4%
Power Factor	Fixed, unity
Peak Inverter Efficiency	> 95%
Cooling	Temperature regulated fan cooling
Power Consumption	0.1W nighttime 7W standby
Ambient Temperature Rating	-25° to +45° C
Enclosure	NEMA 3R
Dimensions	16.9 W x 23.6 H x 9.8 D (in) 430 W x 600 H x 250 D (mm)
Weight	137 lbs 62 kg
Compliance	Meets requirements of IEEE-519, IEEE-929, IEEE-1547 UL 1741

Available From:

SMA America, Inc
Grass Valley, CA USA
info@sma-america.com
www.sma-america.com

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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

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Solar Water Heating
Domestic Hot Water and
Domestic Cold Water System

Submitted by:

Rannie Daffon & Sang Hoon Lee
3.02, 2007

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Domestic Hot Water and Domestic Cold Water

1. INTRODUCTION

The Domestic How Water (DHW) and Domestic Cold Water (DCW) provides water supply to the Solar Decathlon House. This system is named DHW-DCW for short, and as the name implies, is responsible for the hot and cold water supply. It has its own sequence of operations that are all and in part coordinated with the overall control logic. It shares information to other subsystems in order to achieve optimum energy usage.

The criterion of the system design is to achieve the most points possible during the competition. The points at risk are as follows:

- 100 points for Shower test. The shower test may be administered up to 10 times during the competition. There will be 1 shower in the morning and 1 in the afternoon. Each test shall deliver at least 15 gallons (56.8 liters) of hot water with at least an average temperature of 110 ºF (43.3ºC). The point reduces linearly up to zero when the average temp goes down to 100 ºF or below.
- 10 points for Washing Clothes: A washer dryer supplied with the studio shall be administered once a day for 5 points each for 2 days. The items to be washed are 12 bath size towels using regular wash cycle without intervention. The water temperature must reach 110 ºF at a certain point during washing.
- 10 points for Dishwashing: The Dishwasher will be used for 4 days with up to 2.5 points per day. Similar to the Clothes Washer, it has to use the normal wash settings without intervention and must reach up to 125 ºF at a certain pint during washing.

The heart of the water-heating component is an 80-gallon tank that takes heat from the evacuated tubes using solar energy. In the absence of sunlight, or at night, or during cloudy days, a back up electric heater will be used. Water coming from the main tank will be pre-heated by another solar heated loop to reduce energy requirements for water heating. The drain from grey water drain lines like the shower or lavatory will be used to pre-heat the cold water lines.

2. COMPONENT SPECIFICATIONS

There are more information per attached table that includes estimated pricing. Please note that prices may vary and may need updating.

2.1. Tanks

Unit	Manufacturer/Vendor	Model	Purpose	Size	Dimension	Qty	Price	Link
Auxiliary. Tank	ESS / AET altenergystore.com	12DB10SS	Aux Closed Loop System	15gallon	**19" T x 16" D**	1	$329.00	Web site
Hot Water Tank	RHEEM / AET altenergystore.com	12R80HE	Solar Heat Exchanger, Electric Water Heater	80 gallon	58.75" T x 24.5" D	1	$1,350.51	Web site

Conceptual System Diagram

Auxiliary Tank

Hot Water Tank

Unit	Manufacturer/Vendor	Model	Purpose	Size	Dimension	Qty	Price	Link
Storage Tank	NORWESCO	40181	Potable Tank (H)	525 gal	54" T x 71"L x 49"D	1	$400.00 est	Web site
Storage Tank	NORWESCO	40217	Grey Water Storage Tank (H)	325 gal	43" T x 68"L x 38"D	1	$300.00 est	Web site
Storage Tank	NORWESCO	41861	Black Water Storage Tank(V)	100 gal	43" T x 28" D	1	$300.00 est	Wed site

12ETK30015

Expansion Tank	AET altenergystore.com	12ETK30015	Pre-heating Loop , Evacuated Loop	2.0 gal	app 12 5/8" T x :8"D	2	$59.17	Web site

Glycol Tank Package	Advantage Control Inc.	DAGF-1	Glycol Feed System Pump Built-in	50 gal, 1.5gpm	5'3"T x 26'W	1	Ask price	Web site

2.2. Pumps

Unit	Manufacturer/Vendor	Model	Purpose	Size	Dimension	Qty	Price	Link
Supply Pump	TACO / AET altenergystore.com	13T008F	Main Booster pump	1/25Hp, 14gpm	N/A	1	$128.8	Web site
Solar pump	AET altenergystore.com	ELSID5W	Variable Speed, PV powerd for Evacuated Tube Loop	Max:250F 150PSI	N/A	2	$201.56	Web site
Instant Hot Water Recirculator	Grundfos	UP10-16BU/ATLC	Provide instant hot water		N/A	1	$278.5	Web site

2.3. Major Components

Unit	Manufacturer/Vendor	Model	Purpose	Size	Dimension	Qty	Price	Link
Evacuated Tube	Sunda	Seido 2_8	Evacuated Tubes	8 tubes	2110 x 960 x 125 mm	3	Ask	
PV Cooling Mat	GT Manufacture	N/A	PV Cooling, Water Pre Heat	N/A	N/A	1	N/A	

2.4. Other Components

Unit	Manufacturer/Vendor	Model	Purpose	Size	Dimension	Qty	Price	Link
Shut off Valve	Various retail		Main Hot Water, Cold Water, Across Filter, Across PumpShut off		Ball Valve	6	~$5-$10	
Bypass Valve	Various retail		Filter and Pump Bypass		Ball Valve	2	~$5-$10	
Check Valve	Various retail		Hot and Cold			2	~$5-$10	
Shower Head	Various retail		Low gpm			1		
Faucet, Lavatory	Various retail		Two handle			1		
Kitchen Faucet	Various retail		Single handle			1		
Washer Machine H/C Port	Various retail					1		
Dishwasher port outlet	Various retail					1		
Sink valve 3/8 x3/8	Various retail					2		
Toilet Valve 3/8	Various retail					1		
Whole House Carbon Filter	Various retail							

2.5. Piping and Connectors

Unit	Manufacturer/Vendor	Model	Purpose	Size	Dimension	Qty	Price	Link
PEX Tubing				5/8 in dia		50 ft		
PEX Tubing				½ in dia		200 ft		
PEX Tubing				3/8 in dia		100 ft		
Connectors PEX			Various angles	5/8 dia		10		
Connectors PEX			Various angles	½ in dia		200		
Connectors PEX			Various angles	3/8 dia		100		
Copper Tubing			Evac Loop	3/8 or ½ dia		?		
Copper Tubing			Pre-heating Loop	3/8 or ½ dia		?		
Mounting Clips				various				
Mounting brackets				Various				

3. COMPONENT FUNCTIONALITY DESCRIPTION

The are four (4) sub systems within the DHW-DCW system, namely:

1. Main Water Line (Cold)
2. Hot Water Line (Hot)
3. Evacuated Tubes Cooling Loop
4. PV Panel Pre-heating Loop

The cold water enters the system via a booster pump that boost the pressure from zero to about 30 psi in order to drive the water to the faucets and showers. The first attempt to warm up the water is through the auxiliary tank where the water is heated up by a secondary loop coming from the preheating mat. The preheating secondary loop is circulated by a small pump that turns on when the temperature differential between the aux tank and the pv preheating loop is large enough to exchange heat. A set-point of about 5 degree temperature differential will enable the circulating pump and it is in day time.

The hot water has a similar secondary loop configuration where the evacuated tubes provides the heat. Whenever it is at day time and the differential temperature (>5 deg F) and the hot water is below 140 deg F, the evacuated tube loop circulating pump is turned on. If the evac tubes is below 140 +/- 3 deg F, the backup electric water heater is turned on.

In order to provide quick access to hot water specially during the contest, a hot water circulating loop is added to provide instant hot water. This is described in Section 2.2.7.

The following describes the functionality of each subsection or component.

3.1. Main Water Line

The DHW-DCW starts with an input coming from the City Water. For purposes of portability, the City Water connection is not permanent so a 525-gallon tank holds the water for the duration of the 1-week Decathlon contest. The tank will have the following sensing devices:

3.1.1 Liquid Level Sensor LVL-1

The Liquid Level Sensor senses the level of water in the tank. This enables pump suction for the main pressure booster pump. The purpose is to prevent pump cavitation when operating without water saving the pump from overheating and ruining the bearings, empeller, etc. Setting will be about ~4” above low level point (for settings, see device summary).

3.1.2 Temperature Sensor THRM-1

The temperature Sensor senses the temperature. This enables pump suction for the main pressure booster pump. Similarly, the purpose is to prevent pump cavitation when water icing occurs and pump will cavitate (for settings, see device summary).

3.1.3 Shut Off Valve SHTV-1

This is a manual shut-off valve, preferably Ball Type, designed to manually shut-off all water going to the system. Pipe size is 5/8” dia. Shut-off valve shall be able to accommodate 5/8” dia pipe.

3.1.4 Main Water Filter FLTR-1

This Filter will be using a Carbon Filter to take out deposits, color and odor. This is readily available on hardware stores. A bypass valve is included to enable switching filters without water disruption, if necessary.

3.1.5 Check Valve CHK-1

The Check valve prevents water back flow since the incoming water would probably will have a lower pressure than usage power. Readily available by retail.

3.1.6 Main Pump PMP-M1

The Main Pump is a pressure booster pump designed to push water to the lines between 30 to 50 psi. Designed usage is around 10 to 16 GPM. Current selection is a Gould pump rated single phase that converts the voltage to 3 phase. It will use a 3-phase motor for better efficiency and lower starting current.

A pressure switch is built-in to the device that when the pressure drops below the set point, the pump turns on automatically. A booster tank is included in the assembly to store small amount of water under pressure. A pressure deadband is set so the pressure is allowed to build up and the pump stops. Shut-off and Bypass valves are designed to isolate pump when not in service and enable to connect a back-up pump when necessary (back-up pump not included in the materials list currently).

3.1.7 Pressure Relief Valve RLFV-1C

The Relief valve is a safety device to relieve the system when the pressure goes beyond 60~70 psi. This is to safeguard all other components in the system that can only handle at 50 psi or lower (for settings, see device summary).

3.1.8 Pressure Regulator PREG-1

The regulates the pressure at a constant set point of about 35 psi. While the supply varies as the main pump cycles, the pressure after the regulator should stay no more than the preset point

3.1.9 Cold Water Shut Off Valve SHTV-4

This shuts off the cold water supply after the pump. This may be redundant to the main shut off valve SHTV-1, however, careful examination shows that main pump operation, regulator and relief valve testing will be possible while the rest of the lines are isolated.

3.2. Hot Water Line

The Hot Water Line System starts right after the Auxiliary Tank. Water is fed from the Auxiliary Tank to the large 80 gallon how water tank. This tank supplies all of the hot water supply for the solar decathlon house assisted by the two heat exchanging loops (PV pre-heater and Evacuated Tubes).

3.2.1 Domestic Hot Water Tank

This tank is sized up to 80 gallons and is designed to accommodate an external pre-heating loop from the evacuated tubes. A smaller 30-gallon tank is ideal for this size of house where normal usage is about 30 gallons per day. The competition requirements are a usage of at least 15 gallons of hot water. A smaller sized tank would be faster to heat up either with solar heating through the evac tubes or through the back-up electric heater. Hot water temperature setting should be no less than 140 deg F.

This tank will mainly draw heat from the evacuated tubes through a heat exchanger (see Evacuated Tube loop description in Section 2.3) during daytime. In the absence of sunlight (rainy days or cloudy days) to provide heat to the evacuated tubes, a back-up electric water heater provides the heat. The electric water heater will be rated at 230VAC and draws energy from the batteries through a DC to AC inverter.

3.2.2 Tank Temperature Sensor Temp TEMP-DHW

This thermocouple (type K) will be inserted into a built-in thermo well. The signal will be fed to the controller to be used to compare with the temperature of the evacuated tubes. For testing hours, around 8AM to 6PM, if the temperature of the evacuated tubes is less than the hot water tank, disable the evac tubes circulating pump to save energy. At the same token, if the hot water temperature is less than 140 deg F and the the evac tubes temperature is less than the hot water tank temp, then turn on the back up water heater.

3.2.3 Expansion tank EXP-2

As a code requirement, an expansion tank is required to absorb the pressure fluctuations.

3.2.4 Pressure Relief Valve RLFV-2H

Similar to the Cold Water Relief Valve, this provides a safety release in case the pressure builds up to abnormal levels (>80 psi)

3.2.5 Check Valve CHK-2

This check valve prevents back flow to the hot water tank. Looking at the pressure distribution around the system, it seems to indicate that a check valve may not be necessary. However, an additional “Instant How Water” system is installed after this check valve (defined later).

3.2.6 Shut Off Valve SHTV-5

This provides the ability to shut off the hot water completely. The valve shall be a 90 degree travel ball valve.

3.2.7 Instant Hot Water Kit

The Instant Hot Water kit circulates the hot water using the cold water line as a return line. It is powered by a small pump that is synchronized with a remote valve shunted across the hot and cold water line at the farthest end. When enabled by remote or by pre-set time, the pump engages while the remote valve opens allowing the hot water to jump to the cold water line. The water will then circulate from the hot water to the cold water line and back to the tank until the temperature sensor at the remote valve senses the hot water. This ensures instant hot water even before the faucet or shower is opened, saving precious water.

Preset time for the Kit shall be about 7:30AM before the competition starts to ensure hot water through the line. Also, a manually enabled “timed” switch can be actuated to start the circulation when desired. The timed switch ensures that the circulating pump will not be left on at all times.

There are various models available. Decision will be made based on cost and availability.

3.3. Pre-heating Mat (PHM) Loop

On the southern mounted PV panels, a preheating mat exists. This will be used as a preheater to the cold water entering the auxiliary tank. This is abbreviated as PHM. The components are

3.3.1 Glycol Fluid

Glycol fluid is selected to be used as the liquid since the tubing will be exposed to the extreme weather conditions. It will provide better freezing characteristics. Care will be taken to prevent contaminating the water when the glycol loop ruptures. So for the heat

exchange, the glycol heated tubes will be wrapped around the tank instead of exposed o the water liquid.

3.3.2 PHM Circulating Pump PMP-PVL

The first attempt to warm up the water is through the auxiliary tank where the water is heated up by a secondary loop coming from the preheating mat. The preheating secondary loop is circulated by a small pump that turns on when the temperature differential between the aux tank and the pv preheating loop is large enough to exchange heat. A set-point of about 5 degree temperature differential will enable the circulating pump and by day time only. At night, there is not enough heat to warm up the water nor provide electricity for the circulating pump.

3.3.3 Expansion Tank EXP-4

This tank absorbs pressure fluctuations in this secondary loop.

3.3.4 Temperature Sensor TMP-PHM

Provides the temperature feedback to the controller for comparison with the aux tank temperature.

3.3.5 Pressure Switch PSWT-PHM

This pressure switch is set at 3 psi decreasing. This will enable an alarm to tell operator that there is a leak in the secondary loop. It will also warn of potential water contamination with glycol.

3.3.6 Preheating Mat PHM

Mat is mounted in the southern facing portion of the solar house. This mat shall permit the entry of the liquid to be used for heat exchange.

3.4. Evacuated Tubes Loop (EVT) Loop

Evacuated Tubes are mounted on roof level to maximize exposure to the sun. Solar rays will heat the tubes contained with glycol. This will then be used to exchange heat to be used for heating up water in the hot water tank.

3.4.1 Glycol Fluid

Glycol fluid is selected to be used as the liquid since the tubing will be exposed to the extreme weather conditions. It will provide better freezing characteristics. Care will be taken to prevent contaminating the water when the glycol loop ruptures. So for the heat exchange, the glycol heated tubes will be wrapped around the tank instead of exposed o the water liquid.

3.4.2 Evacuated Tubes Circulating Pump PMP-EVAC

When the sun is up and the evacuated tube temperature is greater than 140 deg F and also greater than the hot water tank temperature, the circulating pump shall be turned on. A set-point of about 5 degree temperature differential will enable the circulating pump and by day time only. At night, there is not enough heat to warm up the water nor provide electricity for the circulating pump.

On cloudy days or at night, a backup electric water heater will be used instead of the evac tubes.

3.4.3 Expansion Tank EXP-4

This tank absorbs pressure fluctuations in this secondary loop.

3.4.4 Temperature Sensor TMP-EVAC

Provides the temperature feedback to the controller for comparison with the hot water tank temperature.

3.4.5 Pressure Switch PSW-EVAC

This pressure switch is set at 3 psi decreasing. This will enable an alarm to tell operator that there is a leak in the secondary loop. It will also warn of potential water contamination with glycol.

3.4.6 Evacuated Tubes EVT

The set of evacuated tubes are to be mounted on the roof of the solar house. The evacuated tubes shall have a provision for piping connection.

3.5. Heat Exchangers and Heat Sinks

3.5.1 Heat Exchanging Loops

In order reduce the energy to heat the water from the cold auxiliary water tank, the PHM loop will be used to pre-heat the cold water coming to the aux tank. Another loop, the EVT loop will be used to heat up the water as much as possible without using the backup electric water heater. Shower and sink drains will be closely coupled physically to the incoming cold water to raise water temperature.

3.5.2 Heat sinks

The heat generated by motors driving the pumps can be harvested by mounting the pumps on aluminum heat sinks that act as water preheater. This is an optional device and need only to be added when the cost to energy savings ratio is enough to generate a return of investment.

Caption: The integral liquid cool capabilities on this cast aluminum chill mounting plate help keep electronic control components cool.

3.6. Control Sensors and Devices

3.6.1 Cold Water Loop

System	#	Symbol	Description	Function	Settings	Manufacturer / Model	Qty	Price
Cold Water	1	LVL-1	Level Indicator	Enable Main Pump only if Water Level is higher than settings	4 inches decreasing	Alternate Energy Technologies / altenergystore.com	1	
Cold Water	2	THRM-1	Temperature Switch	Senses Temprature of Main Tank Water Temp	30 deg F decreasing ON, 33 deg inc OFF	Alternate Energy Technologies / altenergystore.com	1	
Cold Water	3	PMP-M1	Pump, Supply Pump, Main	Main Pump to maintain water pressure	1 HP, 230V 1Ph, 15 gpm variable speed, constant pressure	Need here	1	
Cold Water	4	PSWT-1	Pressure Switch, Main Pump	Pressure Switch to turn-on and off main pump	30 psi dec - OFF, 50 psi inc - ON	Alternate Energy Technologies / altenergystore.com	1	
Cold Water	5	RLFV-1	Pressure Relief Valve	To relieve abnormal press in the cold water line	set at 80 psi inc.	Alternate Energy Technologies / altenergystore.com	1	
Cold Water	6	PREG-1	Pressure Regulator	to regulate pressure at about 40 psi +/- 10 psi	set at 40 psi	Alternate Energy Technologies / altenergystore.com	1	
Cold Water	7	TEMP-AUXT	Thermocouple, Type K	Thermocouple, to sense the temperature inside the Auxiliary Water Tank	see ladder logic	Alternate Energy Technologies / altenergystore.com	1	

3.6.2 Hot Water Loop

System	#	Symbol	Description	Function	Settings	Manufacturer / Model	Qty	Price
Hot Water	1	TEMP-DHW	Thermocouple, Type K	Thermocouple, to sense the temperature inside the Hot Water Tank	see ladder logic	Alternate Energy Technologies / altenergystore.com	1	
Hot Water	2	RFLV-2H	Relief Valve, Hot Water	Emergency Relief Valve if pressure goes to runaway	80 psi increasing, reset 70 psi dec	Alternate Energy Technologies / altenergystore.com	1	
Hot Water	3	HTR-1	Electric Heater	Back-up Electric Heater to heat up Water Tank, Built-in inside the tank	Turn-on Electric Heater if the water fall below 140 degF AND Temp(Evac) > Temp(DHW)	altenergystore.com / Rheem	1	
Hot Water	4	TEMP-DHW	Thermocouple, Type K	Thermocouple, to sense the temperature inside the Hot Water Tank	see ladder logic	Alternate Energy Technologies / altenergystore.com	1	

3.6.3 Evacuated Tubes Loop

System	#	Symbol	Description	Function	Settings	Manufacturer / Model	Qty	Price
Evac Loop	1	TEMP-EVAC	Thermocouple, Type K	Thermocouple, to sense the glycol inside the Evac Loop, Type K	see ladder logic	Alternate Energy Technologies / altenergystore.com	1	
Evac Loop	2	PSWT-EVAC	Pressure Switch, Evac	Senses leak in glycol with loss of pressure	2 psi decreasing	Alternate Energy Technologies / altenergystore.com	1	
Evac Loop	3	PMP-EVAC	Circulating Pump, Evac Loop	Ciculates Glycol in the Evac Loop	2GPM, rated @ 400 degF	Alternate Energy Technologies / altenergystore.com	1	

3.6.4 Pre-heating Mat Loop

System	#	Symbol	Description	Function	Settings	Manufacturer / Model	Qty	Price
PHM Loop	1	TEMP-PHM	Thermocouple, Type K	Thermocouple, to sense the temperature inside the PHM Loop	see ladder logic	Alternate Energy Technologies / altenergystore.com	1	
PHM Loop	2	PSWT-PHM	Pressure Switch, Evac	Senses leak in glycol with loss of pressure	2 psi decreasing	Alternate Energy Technologies / altenergystore.com	1	
PHM Loop	3	PMP-PHM	Circulating Pump, Evac Loop	Ciculates Glycol in the Evac Loop	2GPM, rated @ 400 degF	Alternate Energy Technologies / altenergystore.com	1	

3.6.5 Waste Water Loop (In case we can not utilize gravity drainage, we consider this system.)

System	#	Symbol	Description	Function	Settings	Manufacturer / Model	Qty	Price
Drain		PMP-BLK1	Sump Pump, Black Water #1	Optional, for disposing black tank content	10 gal capacity, Turn On when level almost full		1	
Drain		PMP-GRY1	Sump Pump, Grey Water #1	To pump out grey water for irrigation	10 gal capacity, Turn On when level almost full		1	

3.7. Wattage

System	#	Symbol	Description	Volts	Amps	Wattage
Cold Water	3	PMP-M1	Pump, Supply Pump, Main	230 VAC	4.2	1000
Drain	1	PMP-GRY1	Sump Pump, Grey Water #1	110 VAC	1.6	185
Evac Loop	3	PMP-EVAC	Circulating Pump, Evac Loop	12 VDC	2.5	30
Hot Water	3	HTR-1	Electric Heater (built in)	240 VAC	18.75	4500
PHM Loop	3	PMP-PHM	Circulating Pump, Pre-Heater Loop	12 VDC	2.5	30
Glycol Pump	1	PMP- GLYCOL	Glycol supply	110 VAC	2.5	100
					TOTAL:	**5845**

4. PROJECT TIME LINE

SEIDO2 series Direct Flow Vacuum Tube Solar Collector

SEIDO2-8	SEIDO2-16

Features

- Higher efficiency
- Direct flow heat transfer
- High vacuum with long-term stability
- Flexible installation angle
- Elegant design for aesthetic appearance
- Reliability and durability
- Easy integration into buildings

Principle

The SEIDO2 series collector module is a kind of direct flow solar collector, which system consists of vacuum tube, inner tube of vacuum tube, manifold and inner manifold. The inner tube is connected with the inner manifold and the vacuum tube. The heat-transfer fluid flows through the inner manifold, inner tube, vacuum tube and manifold in turn. The effective heating position is the space between inner tube and vacuum tube. This system allows any installation angle of the module between 0° and 90° allowing the absorber surface being adjusted to the optimum position towards the sun.

Technical data

Module type	SEIDO2-8	SEIDO2-16
Tube construction	SEIDO2---Direct flow vacuum tube with flat absorber	
Certificate	EN 12975	
Angle of inclination	0 ° to 90 °	
Number of collector tubes	8	16

Absorber area	1.39 m²		2.77 m²	
Aperture area	1.47 m²		2.93 m²	
Gross area	2.04 m²		4.08 m²	
Length x width x height (mm)	2126x960 x150		2126x1920x150	
Weight	50 kg		100 kg	
Efficiency curve				
Pressure drop per module	<7 mbar (100L/h)	<20 mbar (200L/h)	<7 mbar (100L/h)	<20 mbar (200L/h)
Fluid content per module	1.3 L	2.6 L	1.3 L	2.6 L
Glass material	Borosilicate glass			
Glass tube diameter	100			
Wall thickness	2.5mm			
Transmittance	>0.90			
High vacuum, long-term stability	<10-5 mbar			
Absorber material	Aluminium			
Selective coating	Aluminium nitride			

Absorptance	>0.92			
Emittance	<0.08			
Header box material	Aluminium			
Header box size	958x108x126mm	1918x108x126mm	958x108x126mm	1918x108x126mm
Insulation	Polyurethane foam			
Max. Operating pressure	6 bar			
Stagnation temperature, module	190°			
Stagnation temperature, pipe	247°C			
Assembling components	Stainless steel vertical supports and bottom supports, aluminum header box, 30 mm thickness polyurethane insulation			
Connection	Compression fitting , 22mm			

SUNDA
HIGHTECH SOLAR TECHNOLOGY

Montageanleitung für Hochvakuum-Röhrenkollektoren Seido2

Mounting Instruction of Direct Flow Vacuum Tube Collector Seido2

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Www.sunda.de
E-mail: info@sunda.de

Allgemeine Sicherheitshinweise

Alle Installationsarbeiten sind von zugelassenem Fachpersonal auszuführen.
Zu beachten sind insbesondere:

- die bauseitigen Bedingungen
- die örtlichen Vorschriften
- die Regeln der Technik (Insbesondere DIN 4757 Teil 1 und 3)
- der einwandfreie Zustand der vorhandenen Dachkonstruktion
- die Sicherheitsregeln für Arbeiten am und auf Dächern
- die Sicherheitsregeln für Sicherheitsgeschirre
- die Montagehinweise zum Kollektor
- die Sicherheitsvorschriften von VDE und DVGW

Sicherheitshinweise zum Kollektor

Die Kollektorröhren Können auch bei diffuser Sonneneinstrahlung schon vor der Montage am Kondensator (Wärmetauscher) sehr heiß werden (über 200°C). Die Röhren müssen somit vor der Montage lichtundurchlässig abgedeckt werden und vor Stoss geschützt werden.
Der zulässige Betriebsdrunck beläuft sich auf 6 bar.

Transport

Der Kollektor wird in Einzelteilen auf das Dach transportiert, dort erfolgt der Zusammenbau.

Schnee- und Eislast

In schneereichen Gebieten sind für den Aufstellwinkel des Kollektorfeldes die Angaben der zuständigen Baubehörde zu beachten.
Die Regelschneelast könnte durch Schneesackbildungen, Schneeverwehungen und Eisbildung erheblich überschritten werden. Geeignete Vorkehrungen zur Vermeidung dieser Situationen sind vorausschauend zu treffen.

Blitzschutz

Sollte eine Blitzschutzanlage bereits vorhanden sein, müssen die Kollektoren vom Fachpersonal integriert werden. Dazu müssen die Kollektorgestelle (entweder miteinander verbunden oder einzeln) an die Blitzschutzanlage angeschlossen werden. Hierzu bieten sich Schraubverbindungen nach VDE 0185 an, zu denen freibleibende Langlöcher der Seitenschiene verwendet werden können.

General safety requirement

All installations should be accomplished by professional people, especially should pay attention to the following points:

- Construction conditions
- Local government regulations
- Technical regulations (especially DIN 4757 Items1 and 3)
- In hand available roof construction
- Safety regulation for working on roof
- Safety regulation for safe devices
- Installation instructions of collector
- Safety regulation of VDE and DVGW

Safety regulations for collector

The vacuum tubes can be heated by diffuse solar irradiation, the temperature of which condenser can be very high (over 200°C). Therefore, please don’t directly expose tubes under the sun without shade.
Moreover, please pay attention to the safe operation pressure of system: 6 bar.

Transportation

The collector should be transported to roof part by, and then every part is assembled together on roof.

Snow and ice load

In region, where is rich of snow in winter, man should note the regulation of local construction bureau about the collector installation angle of inclination roof.
Considering stacking of snow, moving of snow by wind and freezing of snow, the load of snow will increase, so it is necessary to take measures to avoid this situation happening.

Lighting protection

One lighting rod should be considered to install. If there is ready-made lighting protection device, please connect it with collector.

Sunda is constantly improving its products; therefore specifications are subject to change without prior notice.

Dachneigung

Für eine einwangfreie Funktion der Anlage muss die Dachneigung mindestens 15° (Seido 1), bzw. 25° (Seido 5) betragen. Andernfalls sind entsprechende Unterkonstruktionen, die diesen Neigungswinkel bilden, einzusetzen.

Benötigte Werkzeuge

Gabelschlüssel der Grösse SW 8, 22 und 24
Inbussel der Grösse 8
Trennschleifer

Daten

Abmessung: 2126 x 960 x 150mm (Seido2 -8)
2126 x 1920 x 150 mm (Seido2 -16)
Röhren: 8/16
Brutto-Kollektorfläche: 2,04 qm / 4,08 qm
Absorberfläche: 1,39 qm /2,77 qm
Neigungswinkel: ist für alle Neigungswinkel geeignet
Aluminiumnitrid-Absorber
Hochvakuum: 10^{-5} mbar
Gewicht: ca.50kg/ 100kg
Anschlüsse: obenliegend, Dn22 Klemmring-verschraubung
Stillstandstemperature: 190°C
Druckverlust pro Modul(100l/h): 30 mbar

Rückgabe (Recycling)

Wir verpflichten uns, unsere mit dem Umweltzeichen ausgezeichneten Produkte und die darin eingesetzten Materialien zurückzu-nehmen und einer Wiederverwertung zuzuführen.

Inclination angle of collector

In order to avoid unnecessary problems of utilization of collectors, a minimum inclination angle must be ensured: 15°for Seido1, 35° for Seido5. If the tilt angle of roof isn't enough, please build necessary support.

Tools for installation

Fork wrench: size SW8,19, 22 and 24
Allen key: size 8
Portable tile cutter

Data

Dimension: 2126 x 960 x 150 mm (Seido2-8)
2126 x 1920 x 150 mm (Seido2-16)
Tube: 8/16
Gross collector area: 2.04 m^2 / 4.08 m^2
Net absorber area: 1.39 m^2/ 2.77 m^2
Inclination angle: 15°~90°
Aluminum nitride Absorber
Vacuum grade: 10^{-5} mbar
Gross weight: 50kg / 100 kg
Connection: Dn22 mm fitting
Stagnation temperature: 190°C
Prossure drop per module at 100l/h: 30 mbar
Test type: 022/2000R

Recycling

We are responsible to use environment friendly materials in our products and to gather these materials for recycling.

Kollektormontage

I. Einmessen des Montageortes

Dachhaut betrachten und entsprechendes Befestigungs-paket wählen. Position der Anlage festlegen und markieren, dabei mögliche Verschattung (Dachaufbauten Bäume) berücksichtigen. Anzeichnen der Dachhakenposition bzw. Der Befestigungspunkte entsprechend der Maßvorgaben:

Seido2:	A	350 - 790 mm
	B	850 - 1880 mm
Seido2:	A	570 - 1190 mm
	B	850 - 1880 mm

Collector assembly

I. Measure the installation area

Observe the roof and select the available roof position without shade from trees or other buildings, then mark the corner positons of the collector field. Provisionally, determinate the roof hook positions (4 per collector module) according to the following ranges:

Seido2:	A	500 - 700 mm
	B	1600 - 2000 mm
Seido2:	A	970 - 1690 mm
	B	1600 - 2000 mm

II. Dachhaken anbringen

a) Anbringen von Dachhaken auf Ziegeldächern

Die Montage erfolgt zuerst an der Traufe (unten), anschließend am First (oben). Die Dachhaken werden auf dem Sparren mit zwei Schrauben befestigt.

II. Mounting of roof hooks
a) Install roof hook on tile roof

First install roof hook on the eaves then on the ridge, and tighten it on rafter with bolt and screw.

Falls nötig, verwenden Sie eine Lochplatte, um die erforderliche Distanz zu erreichen (siehe Masse bei Punkt 1). Die Dachhaken sollten in der Falllinie sowie horizontal zueinander fluchten.

Bei Ziegeldächern muss der Dachhaken immer an der Talsohle herausragen!

If necessary use the attached perforated plates to achieve the above measure (see data in item 1). The roof hooks must be mounted vertically and horizontally in alignment.

Zeichnen Sie nun die Position an, an welcher der Ziegel auf dem Dachhaken aufliegt. An dieser Stelle entfernen Sie mit Hilfe eines Trennschleifers den Tropffalz. Bei einer Biberschwanzeindeckung trennen Sie den entsprechenden Streifen aus dem Ziegel heraus.

As picture shows, put tiles on the roof hooks, and it must be made water-proofed.

Montieren Sie die Seitenschiene. Der Überstand oben und unten sollte gleich sein. Verschraubungen im Langloch müssen am oberen Ende des Langloches die Verschraubung zunächst nur lose. (Fortsetzung bei Punkt III)

Install vertical supports on the roof hooks as picture shows, keeping the same extended length on top and bottom of the supports and install the bolts on the long hole according to drawing to avoid vertical supports slip. Then only fix screws slightly. (Continue to item 3)

b) Anbringen von Dachhaken auf Blechdächern

Mitgelieferte Befestigungselemente werden am senkrecht stehenden Falz montiert. Durch die Schraubung werden die Backen am Falz festgeklemmt, Bohrungen sind daher nicht erforderlich.

b) Install the roof hook on steel plate roof.

Firstly install the fixing components on the bite seam, then with screw let the Back plates clamp the bite seam, but don’t need to bore.

An der Traufe (unten) verwenden Sie ein zusäzliches Distanzstück.

Use spacer plate if necessary.

Montieren Sie die vertikale Lochschiene. Der Überstand oben und unten sollte gleich sein. Verschraubungen im Langloch müssen am oberen Ende des Langloches erfolgen, um ein Verrutschen zu verhindern. Fixieren Sie die Verschraubung zunächst nur lose.
(Fortsetzung bei Punkt III)

Installing vertical supports on the roof hooks as picture shows, to keep the same stretched length between up and down and then fasten the bolts on the long hole according to the drawing to avoid vertical supports slip. Then only fix screw slightly.
(Continue to item 3)

c) Anbringen von Dachhaken auf Eternitdächern
Montieren Sie die Gewindestange auf die Sparren. Montieren Sie die Vertikale Lochschiene. Der Überstand oben und unten sollte gleich sein. Verschraubungen im Langloch müssen am oberen Ende des Langloches erfolgen, um ein Verrutschen zu verhindern. Fixieren Sie die Verschraubung zunächst nur lose.
(Fortsetzung bei Punkt III)

c) Install the roof hook on eternit corrugated roof
Install the thread pole on the rafter, and then install vertical support with spacer keeping the same stretched length between up and down. Fasten the bolts on the long hole according to drawing to avoid vertical supports slip. Then only fix screw slightly.

III. Montage des Kollektors

Setzen Sie den Sammmlerkasten auf die Schiene. Durch die an der Rückseite befindlichen Langlöcher wird nun der Sammlerkasten an der Schiene (im 4.ten Langloch von aussen) verschraubt. Hierzu zunächste die Isolation, nicht aber das Sammlerrohr aus dem Sammlerkasten nehmen.
Achtung!
Beachten Sie die Durchflussrichtung (Roter Pfeil auf dem Kastendeckel)

III. Montage des Kollektors

Firstly put the header box on the support, fixing the header box on the support with screw through the long holes, which are on the backside of the header box. Then take out the insulation foam from the header box, but please don't take out the copper manifold.
Please note the direction of water flow, (see red arrow on the deck of the header box.)

Bringen Sie an der unteren Schiene den Gummi an.

Install Rubber profile on the bottom support.

Montieren Sie die untere Schiene in das unterste Langloch.

Install the bottom support on the lowest hole of the vertical support; fasten screw to avoid the bottom support slipping.

IV. Einsetzen der äußeren Röhren

Schieben Sie nun die Stüzhülse in die Röhre (dies verhindert eine Verformung beim Verschrauben).

IV. Install the vacuum tubes

Insert the short support pipe in the copper pipe to avoid the deformation of copper pipe when tighten the screw.

Schieben Sie das Innenrohr mit aufgeschobener feder in die Röhre ein.

Insert the inside pipe with clip into the copper pipe.

Das innenliegende Rohr im Sammlerkasten etwas herausziehen und so drehen, dass die Oeffnungen (Loecher 1) nach vorne ziegen, wieder sorgfaetig zurueckschieben. Die Loecher des inneren (Loecher 1) und des auesseren Rohres (Loecher 2) muessen dann buendig liegen (vorsichtig mit Schraubenzieher pruefen), Loecher 2 and Loecher 3 sind entsprechend liegen. der Teilen 7,6, 4,5 so liegen nach der Reihe in der Abbuildung, das Innenrohr 4 in der Locher 1 einschieben, das Ausserrohr 5 in der Locher 2 einschieben, danach fest drehen 6 und 7.

Adjust the inside manifold and let hole 1 face forwards, and keep hole 1 and hole 2 in line (carefully test with screwdriver), then let hole 2 and hole 3 in line too. As picture shows, sequence install the items 7,6,4,5. Insert the inside pipe into hole 1 and the copper pipe into hole 2, and then tighten 6 and 7. (Please note: Hole 1 is on the inside manifold, hole 2 is on the outside manifold; hole 3 is on the header box.)

Innenrohr der Roehre in der Loecher in Uhrzeigerrichtung so drehen und am Innenrohr das Sammlers einsetzen. Dabei auf satten Sitz achten, da sonst kein Durchfluss stattfindet.

Rotate inside pipe clockwise into hole 1, and note the position of inside pipe, in order to avoid leakage problem.

Setzen Sie die beiden äußersten Röhren rechts und links ein. Richten Sie die gesamte Anlage (Halterung und Röhren) parallel aus, ziehen sie nun alle vormoniterten Verschraubungen fest.

Achtung!
Die Verschraubung der Röhren nur handfest anziehen.

From right to left install the vacuum tubes, keep whole collector in parallel and note that the header box is not exact horizontal, but there is a small slope downwards to inlet.
Then measure the slope and tighten all screws.

Sollte das Dach nicht genau nach Süden abfallen, müssen die Kollektorröhren von Ihnen nach folgenden Massen positioniert werden.
Ist die Abweichung um einen Winkel "a" gegeben, verdrehen Sie die Kollektoren um den angegebene Winkel "b" aus der Horizontalen in Richtung Mittagssonne:

Dachneigung 45°:	a	10°	20°	45°
	b	7°	14°	30°
Dachneigung 30°:	a	10°	20°	45°
	b	5°	10°	26°

Adjust vacuum tube and keep the selective coating side to face upward.
In case the roof is not oriented exactly to the south but deviates by an angle "a", the vacuum tube should be turned with anangle of "b" into the direction of the zenith of the sun:

Roof in clination 45°:	a	10°	20°	45°
	b	7°	14°	30°
Roof in clination 30°:	a	10°	20°	45°
	b	5°	10°	26°

Achten Sie nochmals auf den korrekten Sitz des Rohres, bevor Sie die Überwurfmutter (SW 19) im Kasten fest anziehen (ca. 20-22 Nm). Dabei Deformationen am Rohr durch zu festes Anziehen vermeiden.
Lassen Sie den Sammlerkaste noch geöffnet bis zum Abschluss der Inbetriebnahme (Sichtprüfung auf Nässe).

Check the position of collector again, and then tighten the nut, which is inside the header box, in order to avoid deformation of copper pipe.
Don't close the deck of the header box until the operation preparation is finished. Make sure no any leakage happens in all connections.

Die Befestigung der Röhren am unteren Teil erfolgt durch einfaches verschliessen der Halteklammer.

Vorsicht!
Scharfkantig, ggf. Handschuhe tragen

Nun montieren Sie alle übrigen Vakuumröhren.

Put the end cap of tube into the clip, if necessary adjust the location of the bottom support. The end of the tube shall rest on the rubber strip of the bottom suppport. Close clip.

Watch out: Clip is sharp; take gloves!

V. Anschluss von Erweiterungsmodulen
Wenn Ihre Anlage aus mehreren Modulen besteht, kann nun die Montage des nächsten Modules erfolgen. Vermessen Sie erneut den Standort des nächsten Modules und kennzeichnen Sie diesen. Sie verfahren nun erneut wie unter Punkt I-III beschrieben. Die Sammlerkästen werden im Anschluss an die Montage mit der Klemmringverschraubung verbunden.
In Reihe sollten maximal 64 Röhren verbunden werden.

V. Mounting of more collectors
If your collector field has more collectors modules, it needs only to mount collectors one by one, please calculating the size of mounting place again for next module and marking it, then mounting module like the above described points I-III, between two manifold boxes please connect them with tow-end fitting.
In a series row, maximal 64 tubes can be connected together.

Die Fußschienen verbinden Sie mit dem Verbindungswinkel und verschrauben dieses fest miteinander, um eine stimmige Geometrie und mehr Stabilität zu erreichen.

Connect two bottom suppports with L-profile and tighten screws.
Repeat above steps till we get the designed geometric dimensions and stability.

VI. Sammler an Leitung anschließen
Der Sammler sollte nach Möglichkeit immer am höchsten Punkt angebracht werden. Sollte dies nicht möglich sein, wird eine zusätzliche Entlüftung am höchsten Punkt empfohlen.
Achtung!
Durchflussrichtung beachten (roter Pfeil auf Kastendeckel)! Der Anschlussstutzen des Kollektors ist auf der Eintrittseite offen und am Kollecktor-ausgang geschlossen (mit Schraubendreher prüfen).

VI. Connect piping
Lay the header box on the highest place if possible, otherwise use air-vent at the highest place above the collector.
Note: the flow direction is important; a red arrow marks it. The outlet of inner manifold is closed, please try with screwdriver.

Die Leitung füren Sie durch den Solar/Lüfterziegel.

Achtung!
Die UV-beständige Isolation vorher anbringen.

Use air ventilation tiles, which have been modified to allow for space of pipes.

Notice: Use UV-resistant insulation

Nun werden die Fühler am Kollektorausgang montiert. Diese sind an der Leitung, welche das erwärmte Medium
In den Speicher führt, positioniert.

Install thermowell, which is for sensor, on the outlet pipe. Smear some heat transmission paste on sensor and insert the sensor into the thermowell.

Benutzen Sie bei der Montage wie abgebildet zwei Schraubschlüssel, um gegen halten zu könne. Mit dem Multimeter messen Sie bei abgeschalteter Steuerung die Widerstände. Vergleichen Sie den Sollwert in Abhängigkeit zur Temperatur, um die Funktion zu kontrollieren.

As picture shows, tighten the thermowell.
Check and adjust the sensor in order to make it work well.

VII. Inbetriebnahme

Abdrücken

Pressen Sie nach Möglichkeit die Anlage mit 6 bar luft ab, um damit die Dichtheit des gesamten Systems zu prüfen.

Befüllen Sie die Anlage mit der vorgeschriebenen Wärmeträgerflüssigkeit (hochtemperatur-sowie frostschutzbeständig;siehe beligendes Sicherheits-datespülen Sie die Anlage mit einer elektrischen Befüllpumpe (nicht mit der Handpumpe) ausreichend, um damit eventuelle Lufteinschlüsse zu beseitigen. DerWert sollte nun einem Druck von 3 bar entsprechen.

Stellen Sieuerung nach den Herstellerangaben ein. Legen Sie die Durchflussmenge in Abhängigkeit zur Absoberfläche fest und stellen Sie diesen Wert in Ihrer Anlage ein.

VII. Prepare before operation

Leakage checking

Pump air into system till 6 bar and check whether there are leakages of connections in the whole system.

System cleaning
Pump warm transfer medium into system with electrical pump or hand pump, clean system and outgas the air from system.
Adding working medium
After system cleaning, pump working medium into system till pressure to 3 bar.

Adjust the controller according to the requirement of manufacturer; fix the flow rate that relies on the absorber area and adjust it in controller. And not the unit of measuring.

kollektormontage an Fassaden

Vorbemerkung

Die Seido2 Kollektoren eignen sich durch das Prinzip der diekten Durchströmung für alle Neigungswinkel, also auch für die Montage horizontal an Fassaden. Hierzu also auch für die Montage horizontal an Fassaden. Hierzu werden die vormontierten Module Seido2-4 eingesetzt

1. Einmessen des Montageortes

Ermitteln Sie den Platzbedarf entsprechend der Zeichnug. Der Abstand der beiden Befestigungsschienen beträgt ca 1,85 m und ist flexibel an die architektonischen Gegebenheiten anpassbar.

Achtung!
Die Röhre sollten nicht exakt waagrecht liegen, sondern zum Kollektorkasten hin um ca. 1° ansteigen.

Install collector on facade

Preface

According to the direct flow principle of Seido 2 tube, Seido 2 collectors can be installed in diversified inclination angle, even for horizontal installation on facade. Therefore the pre-assembled Seido 2-4 is recommend to use.

1. Measuring the installation place

Area of installation is determined by calculation. The distance between two fixing supports is ca. 1850mm; this distance is flexible to change according to requirement of architecture.

Note: Tubes don't need to lay in exact vertical, but lay 1° high to header box.

2. Montage des Kollektors

Beim Anbringen der Befestigungsschiene bitte auf parallelen Sitz der beiden Schienen achten. Die Schienen sollten dabei nicht exakt im Lot verlaufen, damit die Röhren zum Kollektorkasten hin um ca 1° ansteigen.

2. Installation of collectors

Install two fixing supports in parallel, two supports don't need to be laid exactly vertical, so ensure there is ca 1° height.

Nun die vorgefertigte Module auf die Befestigungs-schienen aufsetzten und mit der Schiebemutter befestigen.
Aus Gründen der leichteren Montage kann es vorteilhaft sein, die Röhren schon vor der montage auszurichten (siehe unter 3.) und dann erst auf den Schienen zu befestigen.

Put the pre-assembled collector module on the fixing support and tighten the screw and bolt.
In order to reduce the manpower cost, we can previously assemble tubes on support.

3. Ausrichten der Aborberfläche

Die fassadenmontierten Röhren müssen optimal zur Sonne hin ausgerichtet werde. Öffnen Sie hierzu den Sammlerkasten und entfernen Sie die Isolierung. Lösen Sie nun die Überwufmuttern an den Rohrenden (Seite 4 "Montage auf Dächern")
Nun verdreht man die Kollektorröhren um ca 25° aus der senkrechten Stellung in Richtung der Waagrechten.

Danach die Überwurfmuttern wieder mit 20-22 Nm anziehen.
Nach Inbetriebnahme und Sichtprüfung auf Dichtheit die Isolierung wieder einlegen und den Sammlerkasten schließen.

3. Adjust the orientation of absorber plate.

On facade mounted vacuum tubes must optimal face to sun, hence, please open the header box, take out the insulation, and loosen the water-proof-nut, which is on the end part of tubes, (see also in this mounting instructions point 4). Rotate the vacuum tubes ca. 25° from the vertical direction to horizontal direction. (See picture)

Screw the nut again, after leakage checking, put the deck on the header box.

Einstellungen Checkliste

Bitte prüfern Sie Ihre Solaranlage anhand der folgenden Liste auf mögliche Fehlerquellen. Sollten dennoch Störungen auftreten odr die Leistung der Anlage nicht ausreichen, können Sie gerne unseren Kenst anfordern.

1. Richtige Ausrichtung des Kollektorfeldes?

Wurde die Südabweichung, Dachneigung und Verschattung berücksichtigt?
Sind alle Röhren im optimalen Winkel ausgerichtet?

2. Wurde der Kollektor korrekt instaliert?

Sitzen die Röhren am Sammlerkasten an?
Wurde das Kollektorgestel stabil montiert?
Wurden die Kollektoren in Reihe oder nach Tichelmann verschaltet?

3. Wurde die vorgeschriebene Wärmeleitpaste verwendet?

4. Sind die Vakuumröhren mängelfrei?

Sichtprüfung auf Glasbruch ?
Befindet Sich Kondenswasser in der Röhre?
Ist der Absorber ausgebleicht?
Sollte die Glastemperatur über 10 K höher sein als die Umgebungstemperatur, besteht der Verdacht auf Vakuumverlust. Hier gegebenenfalls Röhre auswechseln.

5. Sind alle Dämmungen vollständig angebracht?

Prüfen Sie die Trinkwasserleitung (warm), Die Trinkwasser-Zirkulationsleitung, die Solarleitung, den Speicher und seine Speichanschlüsse.

6. Wurde das richtige Wärmeträgermedium eingesetzt?

Nur hochtemperatur-sowie frostschutzbeständiges Medium einsetzen, (Tyfocor LS oder vergleich-bares), ph-Wert darf nicht unter 7 liegen.

7. Ist der Kollektorfühler richtig positioniert?

Der Kollektorfühlre musst an der Vorlaufseite des kollektorausgang (warm Seite) angebracht und vollständig eingeschoben sein.

8. Ist der Speicherfühler richtig opsitioniert?

Der Speicherfühler muss am Vorlauf bzw.

Customer Checking List

Please check your solar collector according to the following list, which are FAQ. If your collector still has problem or the output of energy is not enough, please contact our service team for help.

1.Is the orientation of collector right?

Please note the Deviation to south, inclination angle of roof and shade, and check whether tubes are installed with optimal inclination angle? Is the minimum inclination angle right? Minimum 15° for Seido 1, 35° for Seido 5.

2.Is the Installation of collector correct?

Whether the tubes are inserted in the header box? Whether manifold is tightly fastened and stabile? Whether collector modules connected in series or according to the technical design?

3.Whether the heat transmission paste is properly used?

4. Whether vacuum tubes are in perfect state?

Check whether the glass tubes are broken or crack? Whether there is condensed water in tubes? Whether the selective coating fades upward? If the surface temperature of glass is 10 K higher than ambient temperature, it is worth doubting: the vacuum is lost. In this case we should change the old tubes.

5.Whether all pipes is insulated?

View whether pipe of hot water, circulation pipe, pipe of solar loop, storage tank and relevant fitting all are insulated well?

6.Whether the right heat transfer medium liquid is used?

Only high temperature and anti-freezing medium can be used (Tyfocor LS or comparable one), Ph-value should not be lower than 7.

7.Whether the sensor of collector is in proper position?

Sensor of collector must be installed on the outlet pipe of collector (warm water side) and completely inserted into the manifold.

8.Whether the sensor of storage tank is in proper position?

Sensor must be installed on the output pipe of hot water.

9. Befindet sich Luft im System?

Gibt es Luft-Geräusche wenn die Solarpumpe ein-oder ausschaltet?
Der Sammler muss stets am höchsten Punkt der Anlage positioniert sein, andernfalls ist eine zusätzliche Entlüftung anzubringen.

10. Ist die Maximal Durchflüssmenge korrekt eingestellt?

Zur Einstellung der maximalen Durchflussmenge die Regelung auf manuellen Betrieb stellen (100% Pumpenleistung). Dann die Durchflussmenge begrenzen.

Faustregel für den Durchflussmenge:

Warmwasser-Unterstützende Anlage
40Liter / Stunde x qm Absorberfläche=Durchfluss

DurchHeruntersetzen der Duchflussmenge wird eine Temperatursteigerung des Wärmeträger-mediums erreicht.

Heizungs-Unterstützende Anlage
25 Liter/ Stunde x qm Absorberfläche=Durchfluss

11. Ist der Einschaltpunkt korrekt eingestellt?
Δt ca.7K einstellen. Sind die Prioritäten richtig eingestellt? Ist die Mindestkollektortemperatur zu hoch? Gegebenenfalls am Regler ändern.

12. Ist der Fühlermesswert korrekt?

Vergleichen Sie die Sollwerte, indem Sie die Messwerte überprüfen und die Widerstände messen.

13. Gibt es eineSpeicherentladung über Nacht, durch die Schwerkraft-Eigenzirkulation?

Es darf Nachts keine Temperaturerhöhung an den Solarkreisthermomotern stattfinden.

14. Ist die laufzeit der Brauchwasser-Zirkulationspumpe optimal eingestellt?

Sollte die Laufzeit zu lange sein optimieren Sie dies über den Regler.

9.Whether there is air in system?

Whether there is air- noise when pump is turned on and shut off? If yes, please carry out outgassing.
Manifold should be in the highest position of collector, otherwise one auxiliary air-vent is installed.

10.Whether the maximal area depended flow is correct adjusted?

First set the controller in manual operation (100% pump output) state and then adjust the desired maximal area depended flow .

Rule of thumb for area depended flow:

Collector system for preparation of warm water 40litre/hour x sqm Absorber area =area depended flow

Through reduction of area depended flow can get the desired temperature enhancement of heat transfer medium.

Collector system for heating 25liter/hour x sqm Absorber area = area depended flow

11.Whether the operation point of controller is correct adjusted?
Δt ca. 7K adjust, whether it is properly adjusted in advance? Whether the lowest temperature of collector is too high, if so changed in controller.

12.Whether the measuring value of sensor is correct?
Check the measured value and measure the resistance, please compare the measured value with specific value of sensor.

13. Whether there is unloading of storage in night through gravity self-circulation?

At night the temperature of the thermometer, which is installed in solar loop, should not increase.

14. Whether the operation time of circulation pump of drink water is adjusted in the optimum state?
If the operation time of pump is so long, please adjust it in optimum.

Solar HE Solar Heat Exchanger, Solar Tank, or Electric Storage Water Heater

Available in 80 and 120 Gallon Models

6-Year Limited Tank and Parts Warranty*

- Brass drain valve
- Choice of two models…storage tank or single element water heater
- Temperature and pressure relief valve included
- Collector feed and return fittings located at front of tank for convenient installation
- Isolated tank design for better heat retention
- High efficiency heating element
- Tank lining resists corrosion and prolongs tank life
- Heat exchanger: copper tubing wrapped around and secured to the tank. Double wall, vented design for positive leak detection
- Cold water inlet brings cold water to tank bottom to prevent mixing with heated water
- Anode rod equalizes aggressive water action for prolonged tank life
- Cold water inlet, hot water outlet, relief valve and anode rod at top of tank for easy access and fast, economical installation
- Automatic temperature control
- Over temperature protector

* See Residential Warranty Information Brochure for complete warranty information.

DESCRIPTION				ROUGHING IN DIMENSIONS (SHOWN IN INCHES)			ENERGY INFORMATION
TYPE	GAL. CAP.	MODEL NUMBER	ELEMENT WATTAGE UPPER	HEIGHT A	DIAMETER B	APPROX. SHIP WT. (LBS.)	APPROX. R-FACTOR
	80	S80HE-1	4500 W*	58-3/4	24-1/2	222	R-17.3
	80	S80HE-T	Storage only	58-3/4	24-1/2	222	R-17.3
	120	S120HE-1	4500 W*	62	28-1/4	380	R-17.3
	120	S120HE-T	Storage only	62	28-1/4	380	R-17.3

* Heaters furnished with standard 240 volt AC, single phase non-simultaneous wiring and 4500 watt heating element.
- **If heating elements of different wattages than those shown are demanded by zone requirements, they must be specifically requested.**
- To prevent corrosion, proper pH levels in transfer fluid must be maintained.
- Solar models meet all current state requirements for solar storage tanks.
- The tanks are lined and are designed to operate up to 150 PSI.

A special 1/2" NPT opening is provided for installation of a "probe type" thermostat.

COPPER COIL DATA (Type L Copper)

Maximum pressure = 150 PSI
Maximum temperature = 185° F
Tube I.D. = 5/8"

Solar HE Tank Capacity	Coil Capacity Gallons	Length of Tubing Around Tank (Ft)
80 Gallons	2.2	120
120 Gallons	2.6	143

PRESSURE DROP THROUGH COIL (Feet of H_2O)		
	Head Loss (Feet)	
Flow Rate	80 Gallon	120 Gallon
1 GPM	1.3	1.6
2 GPM	4.8	5.7
3 GPM	10.0	12.0

In keeping with its policy of continuous progress and product improvement, Richmond reserves the right to make changes without notice.

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- Tank Shell 0.040" Copper Construction
- 0.026" Aluminum Jacket with baked enamel finish
- Vertical Site Glass
- 3/4" Copper Pipe Connections
- Available in the following sizes:

DB-10 - 10 gal reservoir
DB-15 - 15 gal reservoir

DB-10 Shown

DB-10-15XC Shown

EagleSun™ "DX" Drainback Reservoir

- Eliminates expensive closed loop solar storage tank
- Now heat open loop storage tanks of any size
- One DX Reservoir can heat storage tanks of any size
- One DX Reservoir can also heat multiple tanks
- Ideally suited for retrofits. Now you can heat and existing water heater without adding a solar storage tank.
- Available in the following sizes:

DB-10-15XC - 10 gal reservoir with 15 ft² Trufin® Coil
DB-15-15XC - 15 gal reservoir with 15 ft² Trufin® Coil

Trufin® Heat Exchanger Coil

Designed for heat transfer, Trufin® is an integral finned tubing. It has 11 fins per inch and has a controlled inside diameter and an average wall thickness. It is designed for diversified heat transfer applications, especially for tank less hot water heater usage since its controlled internal corrugation facilitates winding into the tight coils often needed for such heaters.

EagleSun™ Reservoir Specifications

MODEL NO.	DB-10	DB-15	DB-10-15XC	DB-15-15XC
TANK DIAMETER	16"	16"	16"	16"
TANK HEIGHT	19"	25"	19"	25"
RESERVOIR CAPACITY	9.8 gals	14.4 gals	9.6 gals	14.4 gals
WEIGHT (EMPTY)	30 lbs	42 lbs	44 lbs	52 lbs
WEIGHT (FULL)	112 lbs	162 lbs	124 lbs	172 lbs
EXCHANGER AREA	~	~	15 ft²	15 ft²

ALTERNATE ENERGY TECHNOLOGIES, LLC
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ZONE	REV	DESCRIPTION	DATE
	D	WAS 72 1/2	03DEC04

REVISIONS

ZONE	REV	DESCRIPTION	DATE	APPROVED
	C	REDRAWN	10FEB97	
	C1	CORRECTED, WAS 27-1/2	23SEP02	

NOTE: GALLONAGE MARKS BOTH ENDS

NORWESCO
ST. BONIFACIUS, MN

525 GAL HORIZONTAL TANK

JTP 10FEB97

SIZE	FSCM NO.	DWG NO.	REV
A			D

SCALE 1/16 SHEET

REVISIONS				
ZONE	REV	DESCRIPTION	DATE	APPROVED
	A	REDRAWN	14AUG97	

GALLON MARKS BOTH ENDS

NORWESCO
ST. BONIFACIUS, MN

325 GALLON HORIZONTAL LEG TANK

JTP 14AUG97	SIZE A	FSCM NO.	DWG NO.	REV A
	SCALE 1/16		SHEET	

Above Ground Tanks
Water & Waste Tanks
Below Ground Tanks
Â· Locate Distributor
Â· Septic
Â· Bruiser-Multi-use
Â· Cistern
Â· Spherical Pump
Â· Holding
Â· Accessories
Above Ground Water Tanks
Â· Locate Distributor
Â· Vertical
Â· Black or Dark Green Vertical
Â· Horizontal Leg
Â· Elliptical Leg
Â· Pickup Truck
Â· Mini Bulk
Â· PCO
Â· Specialty Water
Â· Bulkhead Fittings
Â· Lids
Â· Tank Repair Kits
Other
Â· Underground Tank Installation Instructions (PDF)
Â· Holding Tank Installation Instructions (PDF)
Â· Frequently Asked Questions
Â· New Products
Rochester Product Line
Valves, Couplers & Accessories
Locate Distributor

Horizontal Leg Water Tanks

Locate A Distributor

Our horizontal leg water tanks feature built-in, graduated gallon indicators and slosh-proof lids. An installed bulkhead fitting is standard in the horizontal tanks.

ABOVE GROUND HORIZONTAL LEG WATER TANKS

Gallon Capacity	Diameter	Overall Height	Length	Outlet / Drain Specification	Fill Opening	Part No.	Band Part No.	Avail
35Â¤	20"	23"	29"	3/4"	5"	45223	60520	A
55Â¤	23"	26"	34"	3/4"	5"	41873	61745	A
65Â¤	23"	46"	43"	3/4"	5"	45191	61745	A
125	32"	35"	41"	2"	8"	40298	61744	A
225	38"	41"	49"	2"	8"	40299 40299-OK-NY	60478	A
325	38"	43"	68"	2"	16"	40217	60478	A
525	49"	54"	71"	2"	16"	40181 40181-GA	60057	A

Bands are optional - 2 per tank.
Â¤May ship UPS Oversize.

Availability Key: A=All; B=St. Bonifacius, MN; C=Lancaster, OH; D=Griffin, GA; E=Shawnee, OK; F=Tooele, UT; G=Owego, NY; H=Washougal, WA; L=Hanford, CA

Tank dimensions and capacities may vary slightly and are subject to change without notice.

REVISIONS				
ZONE	REV	DESCRIPTION	DATE	APPROVED

NORWESCO
ST. BONIFACIUS, MN

100 GALLON VERTICAL TANK X 28 DIAMETER

JTP 06JUN03	SIZE A	FSCM NO.	DWG NO.	REV
	SCALE 1/12		SHEET	

Above Ground Tanks
Water & Waste Tanks
Below Ground Tanks
- Â· Locate Distributor
- Â· Septic
- Â· Bruiser-Multi-use
- Â· Cistern
- Â· Spherical Pump
- Â· Holding
- Â· Accessories

Above Ground Water Tanks
- Â· Locate Distributor
- Â· Vertical
- Â· Black or Dark Green Vertical
- Â· Horizontal Leg
- Â· Elliptical Leg
- Â· Pickup Truck
- Â· Mini Bulk
- Â· PCO
- Â· Specialty Water
- Â· Bulkhead Fittings
- Â· Lids
- Â· Tank Repair Kits

Other
- Â· Underground Tank Installation Instructions (PDF)
- Â· Holding Tank Installation Instructions (PDF)
- Â· Frequently Asked Questions
- Â· New Products

Rochester Product Line
Valves, Couplers & Accessories
Locate Distributor

Vertical Water Tanks

Locate A Distributor

Our vertical water tanks feature built-in, graduated gallon indicators and slosh-proof lids. An installed bulkhead fitting is standard in our vertical tanks.

ABOVE GROUND VERTICAL WATER TANKS

Gallon Capacity	Diameter	Overall Height	Outlet / Drain Specification	Fill Opening	Part No.	Avail
25Â¤	18"	29"	3/4"	5"	41867	A
50Â¤	18"	53"	3/4"	5"	41865	A
65Â¤	23"	39"	1-1/4"	8"	45192	A
75Â¤	23"	50"	1-1/4"	8"	41863	A
100Â¤	28"	43"	1-1/4"	8"	41861	A
105Â¤	23"	63"	2"	8"	40803	A
150	30"	56"	1-1/4"	8"	41859	A
165	31"	55"	2"	16"	40281	A
200	30"	72"	2"	8"	41856	A
210	32"	69"	2"	16"	47401	A
250	30"	89"	2"	8"	41854	A
300	36"	78"	2"	16"	40213 40213-MN&IA	A
500	48"	72"	2"	16"	40148	A
550	67"	42"	2"	16"	40023	A
1000	64"	79"	2"	16"	40152	A
1100	87"	51"	2"	16"	40070 40070-GA	A
1550	87"	65"	2"	16"	40235 40235-GA	A
2100	87"	87"	2"	16"	40178	B,C,D,E,F,G,L
2500	95"	89"	2"	16"	40051	A
3000	95"	107"	2"	16"	40754	A
5000	102"	152"	3"/2"	16"	40164	A
6100	120"	139"	3"/2"	16"	40659	C,D,F,G,H
6500	120"	150"	3"/2"	16"	40224	B,E,L,X

INSTALLATION INSTRUCTIONS

MANABLOC®

Modular Manifold Plumbing System

For use with Vanguard VANEX®
SDR9 PEX Cross-Linked Polyethylene Tubing

Vanguard
Piping Systems, Inc.

Revised January 27, 2005

FAILURE TO FOLLOW THE INSTALLATION GUIDELINES SET FORTH IN THIS PUBLICATION CAN VOID THE APPLICABLE WARRANTY AND POSSIBLY RESULT IN PLUMBING SYSTEM FAILURE.

IMPORTANT INSTALLATION GUIDELINES
READ THIS FIRST!

These Installation Instructions contain information on the installation of the MANABLOC® hot/cold potable water distribution system with Vanex® cross-linked polyethylene (PEX) tubing.

It is the responsibility of the installer to determine that the selection of the MANABLOC, PEX tubing and other components are the proper ones for the intended application, and that the MANABLOC is installed in accordance with these installation instructions and local plumbing codes.

Nothing in this publication is intended to create any warranty beyond Vanguard's applicable warranty on the MANABLOC manifold plumbing system.

NOTE: These instructions are to be used in the installation of the Vanguard MINIBLOC™. Instructions specific to the MINIBLOC will be covered in an instruction sheet provided with the MINIBLOC.

WARNING!

FAILURE TO FOLLOW THE INSTRUCTIONS AND INSTALLATION GUIDELINES SET FORTH IN THIS PUBLICATION CAN RESULT IN FAILURE OF THE MANABLOC PLUMBING SYSTEM, CAUSING WATER LEAKAGE AND PROPERTY DAMAGE.

DO NOT APPLY CHEMICALS TO THIS MANABLOC PLUMBING SYSTEM

DO NOT Spray or otherwise apply foreign substances onto this MANABLOC or its water distribution lines.

"Installation Instructions for the Vanguard MANABLOC Modular Manifold Plumbing System" is published by Vanguard Piping Systems, Inc., 901 N. Vanguard Street, McPherson, KS 67460
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TEFLON is a registered trademark of the E.I. Dupont Co.

MANABLOC is a U.S. patented product with various foreign patents in force.

- Leave the MANABLOC in the original shipping carton until time of installation. Protect the MANABLOC from debris, wood chips, drywall mud or dust, paint, sand, etc., before, during and after installation. The MANABLOC shall be covered during application of interior finishing materials such as paints, stains and textured coatings.
- The envelope, and its contents, included with the MANABLOC must be left with the MANABLOC for the homeowner. It contains important consumer, warranty and warning information concerning the application of chemicals to this MANABLOC plumbing system.
- DO NOT subject the MANABLOC to impact.
- DO NOT disassemble the MANABLOC.
- DO NOT adjust the tie rod bolts. They are factory preset.
- The Vanguard MANABLOC and Vanex PEX are plastic materials and should not be treated like metal. The MANABLOC and Vanex PEX may melt, crack or distort if exposed to open flame or excessive heat.
- Install the MANABLOC in an accessible location where it will not be exposed to freezing temperatures or direct sunlight. See page 4.
- DO NOT allow fluids to freeze in the MANABLOC. See Warnings, page 19.
- DO NOT use pipe dope, thread sealants or Teflon® paste to seal threaded fittings. All of the connections to the MANABLOC are a mechanical compression type, or seal with a rubber gasket and DO NOT REQUIRE OTHER FORMS OF SEALANT AND NONE SHALL BE USED.
- DO NOT allow the MANABLOC to come into contact with CPVC or PVC cements or cleaners, acids such as solder fluxes, strong oxidizing agents, highly alkaline solutions, lubricants, leak check compounds, bug sprays, cleaners, paints, bleaches, or other chemicals which could adversely affect the plastic. Use of solder flux or solvent cements adjacent to the MANABLOC is to be avoided. See page 18.
- DO NOT use standard pipe fittings on the MANABLOC. All distribution line connections shall be made with compression fittings supplied with each MANABLOC or other Vanguard approved connections. See pages 14 and 15. All supply line connections to the MANABLOC shall be made only with MANABLOC swivel fittings available from Vanguard. See pages 17 and 18.
- Distribution lines shall exit the MANABLOC in a straight line perpendicular to the length of the MANABLOC. See pages 10 and 15.
- Supply lines shall enter or exit the MANABLOC in a straight line parallel to the length of the MANABLOC. See page 18.
- The MANABLOC plumbing system relies upon the proper tightening of distribution line compression connections. Failure to complete ALL connections will result in leakage.
- **IN THE EVENT OF CONFLICT OR INCONSISTENCY BETWEEN THESE INSTALLATION GUIDELINES AND LOCAL BUILDING OR PLUMBING CODES, ANY CODES APPLICABLE TO PARALLEL PLUMBING SYSTEMS SHOULD TAKE PRECEDENCE.**

NOTE: Failure to follow the installation instructions will void the Vanguard MANABLOC system warranty. For additional information contact Vanguard Piping Systems, Inc. at 800.775.5039.

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TERMS USED IN THIS GUIDE:

PEX	Vanguard Vanex cross-linked polyethylene tubing
AHJ	Authority Having Jurisdiction
PPM	Parts Per Million
NSF	NSF International, Inc. (formerly National Sanitation Foundation)
CAN/CSA	Canadian Standards Association
"shall"	Required; a mandatory procedure
"may" or "should"	A suggested optional procedure

THE SYSTEM

IMPORTANT

The MANABLOC plumbing system is intended for potable water distribution in residential and commercial applications. Installation of a MANABLOC plumbing system for purposes other than potable water distribution may constitute a misapplication of the product and void the warranty. Contact Vanguard Piping Systems, Inc. before applying this system for any use other than potable water distribution.

Components utilized in the MANABLOC plumbing system consist of Vanguard Vanex PEX cross-linked polyethylene tubing, fixture transition fittings, water service swivel connections, compression port connections and the MANABLOC control unit. The MANABLOC and Vanex PEX tubing are manufactured to national and international standards and are listed by recognized third-party agencies.

VANEX PEX TUBING

Vanex PEX tubing is flexible, reducing the need for most directional fittings in the distribution lines of a MANABLOC plumbing system.

Vanguard Vanex PEX cross-linked polyethylene tubing is produced to ASTM F876/F877 and is tested and listed by recognized agencies (such as NSF International) to the requirements of these standards. Vanex PEX tubing has a design pressure rating of 100 psi @ 180˚F, and 160 psi @ 73˚F. These are maximum-use ratings.

Vanex PEX tubing and the resin used in the manufacture of Vanex tubing have been tested, and listed by NSF to meet the requirements of ANSI/NSF 14/61, and NSF Protocol P171 CL-R/CL-TD, Chlorine Resistance of Plastic Piping Materials.

Maximum-use ratings are printed on the tubing.

CAUTION!

Tubing that exhibits damage such as cuts, scratches, gouges, kinks, fading or discoloring, evidence of grease, tar or any chemical exposure shall not be used. PEX tubing must be stored away from direct and indirect sunlight.

A damp rag is all that should be required for cleaning the tubing. If any material (other than those allowed in this publication) has adhered itself to the tubing and cannot be removed in this manner, do not use that section of tubing. NEVER use thinners, fuels, pipe sealants, solvent cements, fluxes, lubricants, bleaches, other oxidizing agents or petroleum based materials to seal or clean PEX tubing.

TOOLS REQUIRED

- Electric Drill
- Pencil or Pen
- Framing Square
- Tape Measure
- 3/4" and 1 1/4" Wood Drill Bits
- #2 Phillips Head Screwdriver
- Permanent Marking Pen*
- PEX Crimp Tool(s)*
- Tubing Cutter - Vanguard Part No. HAK6 or HAK67
- MANABLOC Wrench - Vanguard Part No. MW1

ADDITIONAL MATERIALS

- Wood or Drywall Screws - 1/2" or longer
- 1/2" or 3/4" Plywood - only required when not mounting between studs
- Nylon Ties - Vanguard Part No. HB14120
- PEX Distribution Line Tubing - See page 11
- 3/4" or 1" Supply Line Tubing
- MANABLOC 1" Swivel Supply Fittings
- Fixture Transition Fittings - See Pages 17 & 18 for MANABLOC water supply connections.
- Tubing Clamps and Hangers
- MANAPANEL Access Panel*
- Tubing Uncoiler*
- CLSE23 Tube Turnouts (recommended)

* Optional or may not be required for some installations

The MANABLOC control unit is tested to requirements of ASTM F877 and certified by NSF International.

The MANABLOC supply inlet connections utilize a special 1" MANABLOC gasketed swivel connection that requires MANABLOC transition fittings (not included in the MANABLOC package, must be purchased separately). Transition fittings available include NPT male thread, brass insert (PEX crimp) and compression.

Connections for the individual PEX distribution lines are a mechanical-type fitting and will not work with standard pipe fittings. Use only fittings supplied with the MANABLOC or other fittings designed for special port transitions available from Vanguard (see pages 14 and 15).

Warranty coverage applies ONLY if the MANABLOC is installed with Vanguard tubing and in accordance with the *Installation Instructions for the MANABLOC Modular Manifold Plumbing System*.

Protect the MANABLOC from construction debris, direct exposure to sunlight and inadvertant chemical exposure by storing it in its original shipping carton until installation.

SUPPLY AND DISTRIBUTION LINE SIZING

The general sizing information shown below may be appropriate for many MANABLOC installations. These recommendations are based on flow rates of typical fixtures that require 8 psi residual pressure. For more complete and definitive sizing information for distribution line length limitations, request the *MANABLOC Tube Size Guide* from your local supplier or from Vanguard.

Typical Supply line size:

3/4" up to 2 1/2 baths
1" up to 4 1/2 baths

Typical Distribution line size:

3/8" up to 2 1/2 GPM fixture flow requirement
(lavs, toilets, bidets, bar sinks, kitchen sinks, dishwashers, *some showers (no tub fill) and **some washing machines)
1/2" up to 4 GPM fixture flow requirement
(hose bibbs, tubs, showers, washing machines, whirlpool baths, soaking tubs, etc.)

In order to realize the maximum water and energy savings of the MANABLOC system, it is advisable to use the smallest distribution line size that meets the flow and pressure demands of each individual fixture. Using a larger size line than necessary can increase hot water delivery time. Keep in mind that 1/2" PEX contains twice the amount of water that 3/8" PEX does for a given length.

There are times when 3/8" Vanex PEX tubing may not, due to long line lengths or low supply pressure, provide the necessary residual pressure to some fixtures even though the flow requirements are within those stated above. Alternatives such as: increasing line size to 1/2", relocating the MANABLOC to reduce line length(s), installation of a separate MANABLOC close to an outlying group of fixtures, or running the line(s) in a more direct (shorter) path may alleviate a potential problem.

* Due to the many types of shower valves, it is recommended that you consult the valve manufacturer's literature to determine the actual flow rate and required residual pressure demands of the fixture. Use the *MANABLOC Tube Size Guide* to determine distribution line size and length limitations.

** Some washing machines use a timer instead of a water-level sensor to determine when the machine has been filled with the proper amount of water. There are cases in which low supply pressure or excessive distribution line length may cause some machines to fill to a level less than designed. Consult the washing machine manufacturer's literature to determine the actual fill rate and residual pressure requirements for distribution line size.

MANABLOC OVERVIEW & CARTON CONTENTS

MODEL MXBD14-2 SHOWN

The MANABLOC is a manifold water distribution system that operates much like an electrical breaker box. The main water supply lines bring water into the MANABLOC and individual distribution lines move water out to each fixture. MANABLOCs have a built-in valve at each distribution line port which allows you to stop the water flow to any single fixture without shutting down the entire system.

Important Sizing Information

A typical residential plumbing system can not be plumbed with all 3/8" distribution lines. It is the decision of the user to choose a combination of both 3/8" and 1/2" lines or to upsize the entire system to 1/2". However, supplying fixtures with 1/2" lines when it is unnecessary for the fixture demand, will increase the wait time for hot water delivery to those fixtures. The best water and energy savings of a MANABLOC system are realized when distribution lines are sized according to the fixture demand and the length of the individual line (see the *MANABLOC Tube Size Guide* for details on sizing a typical system).

A MANABLOC with ports of all the same size, can easily have some of the ports converted to 1/2" with optional crimp adapter MXLSA33 (3/8" port to 1/2" tube). Conversely, 1/2 " ports can be converted to 3/8" with optional crimp adapter MXLSA24 (1/2" port to 3/8" tube). See page 15 for detailed installation instructions for the crimp adapters. Note: Each port converted to a larger or smaller size requires one adapter and one crimp ring (crimp ring sold separately).

Additional package contents include:
- Surface/Flush Mount Spacers
- Valve T-Handle
- Instruction/Warranty Packet - to be left at installation site
- Port Labels

Port Connection Hardware:
- Lock-In Nuts
- Stainless Steel Insert Stiffeners
- Lock-In Inserts
- Plastic Ferrules

MANABLOC LOCATION

Before installing the MANABLOC, review the following instructions.

NOTE: The MANABLOC is much like an electrical breaker box. When a fixture is in need of repair, the line to that fixture may be shut off at the MANABLOC, eliminating the need to shut down the water supply for the entire house. This feature requires that the MANABLOC be accessible after installation.

1. Under no circumstances shall the MANABLOC be located in an area that is permanently covered (behind sheetrock, plywood, paneling), where freezing temperatures may occur, or in direct sunlight. THE MANABLOC MUST BE ACCESSIBLE and there shall be sufficient clear area in front of the MANABLOC to provide access.

2. When local code allows, the MANABLOC unit can be mounted in a fire rated wall provided that the access door meets the same rating requirements as the wall and is installed over the access opening.

3. When installing the MANABLOC in a location other than between studs, provisions must be made to support the tubing runs as they exit the MANABLOC. See instructions on page 10 for mounting the MANABLOC without studs for tubing support.

4. Any installed cover panel shall allow access to the MANABLOC and its **mounting screws, the port valves, distribution line connections and supply line connections.**

5. To maximize potential water and energy savings, the MANABLOC should be mounted as close as is practical to the hot water source, taking into consideration the following:

A. When the MANABLOC is mounted above the water heater, there shall be a minimum of 36" of connecting tubing between the water heater and the MANABLOC due to chance of heat stacking;

B. When the MANABLOC is mounted beside the water heater and is connected with tubing incorporating a horizontal flow, it shall be connected with at least 18” of tube length. Mounting the MANABLOC within 8 (eight) feet of developed tube length of the water heater will minimize delivery time of hot water to individual fixtures.

The unit should be installed in an area which is centrally located to the most dense concentration of served fixtures. Some applications will require that the MANABLOC be mounted further than eight (8) feet from the hot water source. See page 5 for suggestions to reduce hot water delivery time in these instances.

6. DO NOT install the MANABLOC within a continuously recirculating hot water plumbing loop. The MANABLOC, however, may be supplied from a recirculating hot water loop. See page 5 for details.

7. Position the MANABLOC so that it can be securely fastened through the holes provided in the mounting brackets. The mounting surface should be as flat as possible so as not to induce any twisting or bending forces on the unit. The MBB2 Mounting Straps simplify mounting between studs on 16" centers. See page 7.

A typical MANABLOC installation with a combination of 3/8” and 1/2” distribution lines.

The MANABLOC shall be installed at least 36" away vertically or at least 18" (of connecting tube length) away horizontally from any water heater (DO NOT direct connect flex pipe to MANABLOC inlet.) Mounting the unit as close as practical minimizes hot water delivery time.

MANABLOC PLUMBING SYSTEM GENERAL DESIGN PRACTICES

A MANABLOC system, which has valves on all of the outlet ports, does not require stop valves at the fixtures. However, the Authority Having Jurisdiction (AHJ) may require stop valves at some fixtures.

If a main inlet/outlet will not be used, it must be capped (use Part No. ECAP1).

The main service line to the MANABLOC may include a main shut-off valve, as required by local code. Although a shutoff valve for the main service line at the MANABLOC itself is not required, it can be a beneficial option for a homeowner and is recommended. Local code may also require the installation of a check valve, PRV (pressure reducing valve), back flow preventer, etc.

To prevent debris and other particles from entering the system, a strainer may be installed in the service line.

Continuously Recirculating Hot Water Plumbing Loops

Vanex PEX and the MANABLOC can be used in continuously recirculating domestic hot water plumbing loops, provided:

1. The plumbing loops shall operate with water temperatures of 140°F or lower, as required by most model plumbing codes.

2. The recirculating loop is for supplying hot water more quickly to the MANABLOC, not to circulate through it or the distribution lines. **DO NOT include the MANABLOC within a continuously recirculating loop.**

3. The tubing is marked as rated for "continuous recirculation" as evidenced by the NSF Protocol P171 third party certification marking (CL-R).

NOTE: The distribution lines and the MANABLOC are not to be part of the circulating system. The loop is to provide hot water more quickly to the MANABLOC only.

■ If the MANABLOC must be mounted *further* than eight (8) feet from the hot water source, the MANABLOC may be supplied from a recirculating hot water loop with Vanguard CL-R listed PEX tubing.

Multiple MANABLOC Installation

If a home requires multiple MANABLOCs to service the number of fixtures in the home, these guidelines should be followed if the MANABLOCS are closely located.

- Consider dividing high demand fixtures between the units.
- Consider a reasonable division, i.e. upstairs/downstairs, east/west or front/back.

If space permits, the MANABLOC units can be stacked one above the other. Special care must be given to connecting them. (Only specific configurations will work for this type installation. Contact Vanguard for further clarification on this application.)

Locating a Remote MANABLOC

A remote MANABLOC is sometimes recommended to achieve maximum efficiency from your MANABLOC system.

- It can be advantageous when the line lengths are excessive from one centralized MANABLOC unit.
- When the home requires more than one unit due to the number of fixtures or size of the home, you may want to consider locating a remote unit near an outlying group of fixtures.

PEX TUBING INSTALLATION PRACTICES

Keep the Vanex PEX tubing a MINIMUM of **12" vertically and 6" horizontally** from sources of high heat such as recessed light fixtures (including low voltage type), gas flue vents, heating appliances, or electric motors. Forced air heating ducts are not generally considered sources of high heat. These areas of installation should be rechecked after further construction and other mechanical systems have been installed.

REMEMBER: It is the responsibility of the installer to ensure that further construction, finishing and other mechanical system installations do not compromise the integrity and service life of the Vanex PEX tubing.

12" VERTICAL DISTANCE

6" HORIZONTAL DISTANCE

DO NOT drag the tubing over rough terrain, rocks, or any other surface which could abrade, cut, puncture or damage the tube wall in any way. DO NOT crush or kink the tubing. **Inspect all tubing** before and after installation. Damaged or kinked sections shall be cut out and replaced. DO NOT heat kinked tubing to repair/reform.

Use metallic connectors to attach PEX to gas water heaters (Vanguard Part No. XLSE4418, XLMSE4418 or similar fabricated metallic assembly). Install a minimum 18" of metallic or other piping between the water heater and PEX. For electric water heaters, it is permissible to connect directly to the inlets and outlets with a brass swivel elbow or straight brass swivel fitting.

Use only continuous lengths of Vanex PEX (no fittings) **in or under a concrete slab**. Any connections shall be outside the slab or in an access box. The proper methods of bedding and backfilling shall follow recommendations of ASTM D2774.

Vanex PEX can be used for water heater pressure/temperature relief lines.

Hose bibbs shall not be supported by PEX tubing. Well-anchored metallic pipe or drop-ear fittings shall be used to install hose bibbs. See page 16.

Vanguard Crimpsert® connections **may be direct buried but not under slab**. These fittings, including crimp rings, shall be wrapped securely with self fusing silicone rubber tape (minimum .020 thickness).

When direct burial of metallic water service fittings are used to connect water service tubing coming into the house, those fittings should be made from ASTM B62 UNS C83600 cast bronze (per AWWA standards) or B140 UNS C31400 "DZR" brass (check with fittings manufacturer). In those areas with aggressive soil, such as desert areas, wrapping as referenced above is recommended.

To prevent damage to the tubing from drywall nails and screws, drill tubing-run holes at the center of the studs. **Protect the tubing** where appropriate and/or required by local plumbing code.

Protect the PEX tubing with **non-metallic sleeving material** where it enters and/or exits a slab or at mass penetrations. PEX need not be sleeved its entire length within the slab. However, full-length sleeving is allowed. Penetrations through concrete walls may be sleeved with a larger size metal or plastic tube. Protect the tubing from any sharp edges where it enters and exits larger sleeving material.

Insulating each PEX tube individually or as a group is not generally necessary if the PEX tubing is installed within the insulation envelope of the structure, i.e. the heated area. For example, the tubing may be installed under the insulation in the attic or within an interior wall of a heated space.

DO NOT INSTALL WHERE EXPOSED TO DIRECT OR INDIRECT SUNLIGHT FOR MORE THAN 60 DAYS. PEX tubing shall be stored under cover, shielded from direct and indirect sunlight when the material is stored for any length of time. Short exposure times, not exceeding a total accumulated time of 60 days maximum, are permissible.

INSTALLING THE MANABLOC

BEFORE INSTALLING THE MANABLOC, MAKE SURE THE LOCATION REQUIREMENTS (PAGE 4) HAVE BEEN MET.

COLD WEATHER CAUTION!
The thermoplastic components of the MANABLOC, like all thermoplastics, have decreased resistance to impact under freezing conditions and could be damaged. Increased care must be exercised when installation is to occur under freezing conditions.

Extra caution should be taken in handling the MANABLOC when temperatures are below freezing.

MOUNTING THE MANABLOC BETWEEN STUDS

Dimensions in these instructions are for 16" stud centers, and must be adjusted for other stud spacing.

Once the general location of the MANABLOC has been determined (see page 4 for guidelines), the MANABLOC may be mounted to a suitable surface between a pair of adjacent studs. For 16" stud spacing, the MBB2 Mounting Straps can simplify installation.

If the MBB2 Mounting Straps are not being used for installation, go to Step 5.

1. Lay the MANABLOC, metal brackets down, on a suitable flat surface that is large enough to accommodate the full-length of the MANABLOC. Place a MBB2 Mounting Strap under each metal mounting bracket (located at the top and bottom ends of the MANABLOC). Attach the metal mounting bracket at one end of the MANABLOC to the center two holes of a Mounting Strap using the provided self-tapping pan-head screws. The screw heads must be on the accessible side of the mounting strap. Repeat at the other end of the MANABLOC. Tighten screws securely.

2. Standing behind the studwall, measure up from the floor and make a mark on the back of one of the studs to represent the top of the MANABLOC as shown in the illustration. This mark should be between 4 feet and 6 feet from the floor but may be at any height, provided the height will allow all valves on the MANABLOC to be accessible. With a framing square or level, transfer and mark the noted height on the other stud.

NOTE: A residence intended for disabled persons may require that the MANABLOC be mounted lower in the wall to provide access.

3. Standing behind the stud wall, hold the MANABLOC facing away from you and align the top of the UPPER MBB2 Mounting Strap to the line on the stud that you made in Step 2. Loosely attach this Mounting Strap flush to the back outer edge of one stud using a 3/4" or longer drywall or other suitable wood screw (A). See illustration.

4. Line up the LOWER Mounting Strap with the back outer edge of the stud and attach it in the same manner (B). Attach the remaining strap ends (C & D) to the other stud, and tighten all screws.

GO TO STEP 9.

NOTE: The wall in which the MANABLOC is to be mounted must be accessible from both sides during installation to use the MBB2 Mounting Straps.

Measure up from the floor while standing behind the studwall. Mark a location for the top of the MANABLOC.

(VIEW FROM BACK OF WALL)

MOUNTING THE MANABLOC BETWEEN STUDS (con't)

IF NOT USING THE MBB2 MOUNTING STRAPS:

5. Cut two pieces of lumber (1 x 4 - or 3/4" plywood - about 3 1/2" wide) to a length which provides a snug fit BETWEEN two studs.

6. The top of the MANABLOC should be between 4 ft. and 6 ft. from the floor (but may be at any height provided that it maintains accessibility to all of the ports on the MANABLOC. See NOTE, step 2). Make a mark near the back of the inside of one stud which would represent the top of the MANABLOC. With a framing square or level, transfer the mark to the inside back of the other stud. See illustration page 7.

7. ATTACHING THE MANABLOC BETWEEN THE STUDS:

A. Measure the total length of the MANABLOC, including the metal brackets, and note.

B. Attach the first (UPPER) 1 x 4 inside and flush to the back of the studs (see TOP VIEW) at a height where the center of its width is centered on the marks from step 6.

C. Attach the remaining (LOWER) 1 x 4 inside and flush to the back of the studs at a distance below the upper 1 x 4 that is equal to the length of the MANABLOC (step 7A) when measured from the top of the upper 1 x 4 to the top of the lower 1 x 4. See FRONT VIEW illustration.

8. CENTER THE MANABLOC IN THE STUD CAVITY:
Center the left and right edges of the metal mounting brackets of the MANABLOC between the studs (5 inches if on 16" stud centers). This measurement may vary with different stud spacing. Attach the MANABLOC to the 1 x 4's with four 1/2" - 3/4" drywall or wood screws through the holes provided in the metal brackets as shown. The screw heads must be on the accessible side of the mounting strap.

(TOP VIEW)

1 x 4's attach at the back, inside the studs, and the MANABLOC is centered between the studs.

(FRONT VIEW)

9. Standing in front of the wall, use a framing square or straight edge and mark the center line position of the top and bottom ports onto both studs (see illustration).

When the MANABLOC includes a divider plate, also mark the location of the ports directly above and below the divider plate onto both studs.

10. Detach the MANABLOC from its Mounting Straps (or 1 x 4 brackets) and remove it from the installation area to prevent wood chips or other debris from falling into the unit.

Mark the centers of the top and bottom MANABLOC ports (A,B) and the ports directly above and below any divider plate (C,D) onto the studs.

LEAVE THE MOUNTING STRAPS ATTACHED TO THE STUDS.

11. Transfer the port-location marks made in step 9 to the insides of the stud cavity using a square and pencil.

12. Measure 1 5/8" from the mounting surface. Draw a vertical line on the studs that passes through each of the horizontal port center-lines marked in step 11 (see illustration). Be sure to mark the inside of both studs.

MOUNTING THE MANABLOC BETWEEN STUDS (con't)

The Drill Guide, included with each MANABLOC, is used to mark locations of distribution line holes to be drilled through the studs. The distribution lines pass through these holes as they are attached to the MANABLOC ports. One Drill Guide will be used to mark both studs.

13. Push a small nail through the printed center-line at one end of the Drill Guide (A). Push the nail into the cross formed where the top port mark intersects with the 1 5/8" mark (from step 12). Tap the nail into the stud to hold the drill guide in place.

14. Push a small nail into the printed center-line on the Drill Guide that corresponds with the center line of the port above the divider plate (B). Tap the nail into the stud to hold the drill guide in place.

> If the MANABLOC does not have a divider plate, push the nail into the printed center-line of the bottom-most port (E) and on into the corresponding mark on the stud. Tap the nail into the stud to hold the drill guide in place.

15. Using an awl, nail, or other pointed tool (C), mark the stud by tapping through the Drill Guide at each printed center-line between the two nails. Carefully remove the Drill Guide. If the MANABLOC does not have a divider plate, go to step 17.

MARKING PORT LOCATIONS BELOW A DIVIDER PLATE:

16. Put the top nail in the Drill Guide (D) on the cross formed by the center-line of the first port below the divider plate and the 1 5/8" measurement from the back of the stud (from step 12). Tap the nail into the stud to hold the drill guide in place.

Push another nail (E) through the center-line on the Drill Guide which corresponds to the bottom port of the MANABLOC. Then place the nail at the point on the stud where the bottom port center-line intersects with the 1 5/8" measurement (from step 12). Tap the nail into the stud to hold the drill guide in place. With a nail or awl (F), tap and mark the stud at each center-line between the two nails.

17. Carefully remove the Drill Guide and repeat the marking procedure on the adjacent stud.

18. Drill 3/4" holes through both studs at each marked location. Be sure to hold the drill level and perpendicular to the stud to prevent drilling holes at an angle. Remove any splinters or burrs made during drilling.

19. Mark and drill any holes for main water supply and hot water supply/return lines at this time. A 1 1/4" bit will provide adequate clearance for 3/4" or 1" tubing. The tubing shall enter and/or exit the MANABLOC in a straight line so as not to induce bending stress on the MANABLOC. Necessary elbows, couplings, and tees are allowed in the main water supply lines.

Drill 3/4" holes for distribution lines; 1 1/4" holes for supply lines.

20. Re-attach the MANABLOC to the mounting straps.

GO TO PAGE 11

NOTE: If the wall where the MANABLOC is installed is to be covered, be sure to cut a hole in the wall covering material to allow access to the MANABLOC. Any installed cover panel shall allow access to the MANABLOC and its mounting screws, the port valves, distribution line connections and supply line connections. Vanguard MANAPANEL access panels are available.

> When the MANABLOC is installed prior to wall finishing operations, the unit MUST be protected from paint, texture compounds and drywall dust.

MOUNTING THE MANABLOC WITHOUT STUDS

1. A suitable base for the MANABLOC can be constructed from a section of 1/2" or thicker plywood that is a minimum 22 1/2" wide and slightly longer than the overall length of the MANABLOC, including the metal mounting brackets.

2. Securely attach a length of 2 x 4, or other suitable framing material with a thickness of 1 1/2" and about 3 1/2" wide on the left and right sides of the mounting base and running the full-length of the MANABLOC (see illustration, step 5).The 2 x 4's will be used to secure the distribution lines at the correct height as they exit the MANABLOC.

Note: The critical measurement is the 1 1/4" from the MANABLOC mounting bracket to the support for the distribution lines. This is achieved by using the provided 1/4" bracket spacer when a 2 x 4 is used to secure the distribution lines.

NOTE: A residence intended for disabled persons may require that the MANABLOC be mounted lower in the wall to provide access.

1/4" Spacer (provided)

3. Attach the mounting base to the structure in a suitable location (see page 4). The base should be mounted so the top of the MANABLOC is between 4 feet and 6 feet from the floor but may be at any height provided that the height maintains accessibility to all the ports on the MANABLOC.

4. The mounting base must be firmly attached to a structure solid enough to support, at a minimum, the weight of the MANABLOC filled with water. The base should be square and level.

5. Center the MANABLOC on the base both vertically and horizontally as shown here.

Attach the MANABLOC to the mounting base with four 1/2" or longer drywall or wood screws through the holes in the metal brackets on the MANABLOC. Tighten the screws securely.

6. As the distribution lines are connected to the MANABLOC (see instructions pages 14 & 15), ensure that the tubes exit the unit at a 90 degree angle to the centerline of the MANABLOC so as not to induce bending stress on the MANABLOC.

7. When attaching the distribution line tubing to the 2 x 4 supports, be sure to use appropriately-sized Vanguard tubing clamps (use Part Nos. CLJ2 or CLE2 for 3/8" tubing, CLJ3 or CLE3 for 1/2" tubing). Use one clamp per tube to ensure that the tubing is held securely. Clamps shall be positioned NO FURTHER than six (6) inches from the end of the port. DO NOT pull tubing tight. Leave at least 7" of slack per 50' of tubing run. For distribution line connection instructions, see pages 14 & 15.

INSTALLING DISTRIBUTION LINES

Distribution lines should be run continuously in the most direct route (avoiding heat sources, see page 4) from the MANABLOC to the fixtures. A distribution line may contain a coupling or other fitting for purposes such as repairing a damaged section of tubing, handling a change of direction which cannot be made within the minimum bend radius guidelines (see page 12), accommodating a fixture location change which requires a longer line, or to supply a low-demand accessory (i.e., ice maker). However, several pieces of shorter tubing should not be connected with fittings for the purpose of using up left-over lengths of tubing.

NOTE: It is the responsibility of the installer to ensure that further construction, finishing and other mechanical system installations do not compromise the MANABLOC plumbing system as installed according to these instructions.

RUNNING THE DISTRIBUTION LINES:

1. The tubing coils are usually placed at the MANABLOC location and tubing is pulled to the fixture through stud cavities, holes drilled overhead in floor joists, etc. Several tubes may be pulled at one time. Vanguard's color coded Vanex tubing (available in 3/8" and 1/2") will help prevent cross-connections.

2. Tubing should not be pulled tightly and some slack (typically, 7" per 50') is necessary to accommodate expansion and contraction. Leave enough excess tubing at the beginning and end of runs to make connections without putting strain on the tubing.

3. Care should be exercised when pulling PEX tubing to prevent cutting or abrading. Care also must be taken to prevent kinking of the coiled tubing. If kinking or cutting should occur, these sections must be cut out and a coupling installed.

4. For the best results, connect the distribution lines to fixtures and the MANABLOC immediately upon installation, and label the end-use fixture on the MANABLOC cover plate next to the port.

Self-adhesive labels are supplied with the MANABLOC. Tubes which are pulled as a bundle, or those that will not be connected immediately, should be marked at both ends with a permanent marker designating the fixture supplied.

5. Since plumbing fixtures are generally located in groups, and there may be several Vanex distribution lines running to approximately the same location, it is easiest to run these distribution lines bundled together. Hot and cold lines may be run in the same bundle. For a neat appearance, bundles can be tied with nylon ties (Vanguard Part No. HB14120) or plastic strapping at regular intervals.

NOTE:
Bundles shall be sufficiently tied for tubing support but SHALL NOT restrict tubing expansion and contraction caused by temperature variations.

CAUTION
DO NOT USE DUCT TAPE FOR BUNDLING. Duct tape will not permit tubing movement.

6. Bundles may be supported with hangers designed for larger tubing sizes.

7. The HB14120 can be used to support PEX lines directly from wooden framing members. Other plastic cable ties capable of supporting the weight of the tube or bundle when filled with water can also be used.

8. Holes drilled through studs, joists, plates, headers, etc. must be large enough to accommodate tubing bundles without binding, to allow free movement. Several smaller holes (accommodating a few lines each) may be preferable to drilling a bundle-size hole. In no case should the hole size exceed building code guidelines, as this could weaken the structural support members.

INSTALLATION TIP

The installation of long tubing runs may be simplified by the use of a MANAPAC tubing kit. Each reel fits inside a standard 16" stud cavity. Also, the Vanguard Tubing Uncoiler, Part No. FHUD-1, holds two 1000' coils of 3/8" or 1/2" Vanex PEX tubing for fast and easy installation.

9. Suspended tubes or bundles should be supported at least every 32" horizontally, at each floor level vertically, and at significant changes of direction with clamps, hangers or plastic strapping. Tubes running through holes drilled in joists or studs or laying on top of rafters do not require further support unless the support spacing exceeds 32".

10. Supports may be the same as those commonly used for PEX or other piping systems, keeping in mind bundle size and the weight of the tubing when filled with water.

Support the horizontal tubing at least every 32".

DO NOT use supports that may collapse or cut the tubing. Supports shall NOT have sharp edges which could damage the tubing.

INSTALLATION TIP

Free Standing Hose Bibbs shall not be supported by Vanex PEX. Well-anchored drop-ear fittings or metal pipe shall be used to install hose bibbs.

Hose bibbs supported by the structure can be connected directly.

BENDING THE TUBING:

11. PEX flexibility is a key advantage in the MANABLOC plumbing system. However, care must be exercised in observing the MINIMUM BEND RADIUS of the tubing, particularly when curving the tubing around room corners, stubbing out of walls, and making 90° bends between studs. Drilling holes at shallow angles, rerouting the tubing, or bending the tubing with the natural curve (coils only) are useful solutions to making correctly sized bends. Tubing should appear round and unstrained in a natural bend. Flattening of the tube, however slight, indicates an excessively sharp turn and must be avoided.

CAUTION
DO NOT BEND 1/2" TUBING 90˚ WITHIN A 3 1/2" STUD WIDTH when stubbing out.
Use an elbow or stub-out elbow.

DO NOT bend Vanex PEX tubing in a radius smaller than 8 times the outside diameter of the tubing. Flattened tubing is damaged and must be cut out and replaced.

CORRECT: 8 x O.D.

INCORRECT: FLATTENS TUBING

If bending AGAINST the coil, the allowed bending radius is 24 times the outside diameter of the tubing.

Refer to these dimensions for proper radius bends:

BENDING CROSS-LINKED POLYETHYLENE TUBING

TUBING SIZE	NATURAL RADIUS	RADIUS AGAINST COIL
3/8"	4"	12"
1/2"	5"	15"
3/4"	7"	21"
1"	9"	27"

12. PEX may be stubbed directly out of the wall with the use of the CLSE23 Turn Out (see page 16). At floor levels above a crawl space, basement, or on upper floors, it may be desirable to run the tubing through the floor directly to the fixture, rather than behind the wall.

Care must be taken to avoid imparting severe bending stresses to the tubing when exiting a wall or floor. At basement or slab levels the bend radius restrictions may force the tubing to exit the wall at an angle. An elbow or stubout ell may be also used for this application (see page 13).

13. Tubing penetrations may require sleeving or the installation of an insulator. When the tubing penetrates at an angle in relation to the hole, it may be subject to a sharp edge, which could damage the pipe. Acceptable sleeving materials include flexible plastic tubing, foam pipe insulation or an approved plastic insulator. It is not generally necessary to sleeve PEX when penetrating wooden framing members or non-metallic finished or unfinished walls. However, if there is a doubt, sleeve the pipe or install an insulator.

SLEEVE all penetrations of metal, metal studs, and masonry or concrete.

14. When penetrations must be sealed for air infiltration purposes, there are several options available. A good grade of silicone, acrylic, or siliconized acrylic caulking (DO NOT use oil-base caulks), most of the canned expanding foams, and open- or closed-cell pipe insulation are good sealing materials and may be used in direct contact with PEX tubing. Other materials may be used provided they do not cause short or long term damage to the PEX tubing. If there is no information available on the compatibility of the proposed sealing material, wrap the tubing with several layers of aluminum foil in the area of contact and extending a few inches on both sides before applying any sealing material.

FIRE STOP - Most building codes require the use of a fire-stopping compound when tubing penetrates a fire-rated wall. There are a number of fire stopping compounds readily available that have been listed for use with PEX tubing. These compounds come in standard caulking tubes and are identified as water-based, acrylic or latex. Consult the compound manufacturers' instructions for proper application.

CAUTION DO NOT USE OIL-BASED CAULK FOR SEALING. IF COMPATIBILITY IS IN QUESTION, WRAP THE TUBING WITH ALUMINUM FOIL WHERE IT CONTACTS THE SEALING MATERIAL.

Penetrations may be sealed with caulk, expanding foam, or open- or closed-cell pipe insulation.
If compatibility is in question, wrap the PEX with aluminum foil at the contact area before sealing. See text for specific information.

16. When making swivel connections, keep the tubing and fitting aligned and straight while tightening the swivel nut hand tight plus an additional 1/2 turn.

17. When completing fixture connections, cut the lines carefully and leave sufficient tubing to make the connection without putting undue stress on the tubing, fitting or connection.

NOISE AND WATER HAMMER IN PEX SYSTEMS

As with all plumbing materials under some operating conditions, water hammer can occur in PEX plumbing systems. The inherent flexibility of Vanex PEX drastically reduces the magnitude of pressure surges compared with metallic plumbing materials. Damage to plumbing components in a PEX system due to these pressure surges is highly unlikely, although noise can sometimes result. Fortunately, there are solutions to minimize or eliminate water hammer noise.

- **Install fixtures that are not water hammer prone -** As a general rule, two-handle fixtures are less likely to cause hammer than single-handle fixtures. Single-handle shower valves, which rotate to close and therefore are difficult to close quickly, might be good choices.
- **Clamping or strapping more frequently may help prevent tubing noise.** It is very important that the tubing not be in contact with wallboard, forced air ducts or other high resonance articles. Insufficiently or improperly clamped or strapped tubing may move during fixture operation and hit against these surfaces.
- **Install a water hammer arrester at fixtures where noise is a problem.** A water hammer arrester (Vanguard Part No. XWHA2 or XWHA3 or other size AA) installed as close as possible to the fixture on the cold water side only will eliminate the source of the noise; the pressure wave. It should be noted that even with an arrester, tubing which is clamped or strapped insufficiently may still hit against something as it moves slightly when the water flow is stopped.
- **Avoid operating fixtures in such a way that causes near instantaneous shut off.** Simply closing fixtures in a less abrupt manner can eliminate hammer noise.

INSTALLATION TIP

CLSE23 Turnout provides an acceptable bend radius for 3/8" tubing.

Turnout also accommodates the required elbow for 1/2" tubing.

THAWING PEX TUBING SYSTEMS

PEX tubing systems should not be intentionally subjected to freezing.

Do not use open torch or excessive heat to thaw PEX tubing. Tubing failure or damage can result.

Heat (DO NOT USE A TORCH) must be applied directly to the frozen tubing section. Temperature on tubing shall not exceed 180°F.

Several suitable methods exist to thaw PEX tubing. They include:

- A commercial system which pumps heated water through a tube to the ice blockage, and returns the cooled water for reheating.
- Wet hot towels
- Hot water
- Hand-held hair dryer
- Low wattage electrical heating tape

CONNECTING DISTRIBUTION LINES TO THE MANABLOC

THE WATER SUPPLY TO THE MANABLOC SHALL BE TURNED OFF WHILE MAKING DISTRIBUTION LINE CONNECTIONS.

NOTE: The red caps on the MANABLOC designate hot ports, the blue caps designate cold ports. Make sure the distribution lines are being connected to the correct ports (hot or cold). The use of MANABLOC Vanex color coded PEX tubing also reduces the possibility of cross connections.

WARNING

DO NOT use slip-joint pliers to tighten the Lock-In nuts. Use the MW1 MANABLOC Wrench to tighten the port connections.

1. For each distribution line, slide the Lock-In compression nut (A), Lock-In insert (B) and the plastic ferrule (C) onto the tubing in that order. See illustration below.

The long taper of a 3/8" ferrule (C) must be TOWARD THE END OF THE TUBE; a 1/2" ferrule is symmetrical and may be installed facing either direction. Then insert the stainless steel stiffener (D) COMPLETELY into the end of the tubing.

2. Push the tubing into the port socket (E) until it bottoms out.

Holding the tube so that it does not back out of the fitting, slide the white Lock-In insert and ferrule snugly against the chamfer inside the port socket. While holding the tube against the bottom of the socket, thread the Lock-In compression nut onto the port and tighten hand-tight.

3. While holding the tube securely to prevent turning, finish tightening the nut with the MANABLOC Wrench (Vanguard Part No. MW1) until the white Lock-In insert appears between the lugs and becomes flush with the ends of the lugs, plus 1/4 to 1/2 turn.

Wrench-tighten the nut until the white insert is flush with the lugs, plus 1/4 to 1/2 turn.

Complete the connection as soon as each distribution line is connected to the MANABLOC.

WARNING

DO NOT attempt to install the Lock-In insert backwards as breakage may result. ALWAYS insert the long portion of the insert sleeve over the tube first.

DO NOT attempt to use or re-use inserts that are defective, cracked, broken or otherwise damaged, as connection failure will result.

COMPRESSION CONNECTION CAUTION

This plumbing system relies upon the proper tightening of distribution line compression connections. Failure to properly complete ALL connections will result in failure. Incomplete or improper connections can hold pressure during a system test but will fail at a later date, resulting in water damage.

UNDER NO CIRCUMSTANCES

shall any form of thread sealant (Teflon® paste, pipe dope) be used on the distribution line connections. The carriers present in these compounds can crack the plastic port connections, resulting in leaks and water damage.

DO NOT OVERTIGHTEN

Compression fittings can be OVER TIGHTENED. Overtightening of the Lock-In compression nuts may cause damage to the tubing, nut, valve or fitting body. DO NOT tighten Lock-In nuts beyond the recommendation of these instructions (Step 3).

Each valve should be turned to the open position after completing each connection. See valve information on page 19.

4. After all connections are complete, re-check that all of the Lock-In inserts are visible between the lugs and are flush or protruding slightly beyond the lugs.

5. As the distribution lines are connected to the MANABLOC, they should immediately be labeled on the cover plate as to which fixture that line supplies. Fixture labels are included with each MANABLOC. Affix the appropriate label to the cover plate next to the port.

CONNECTING DISTRIBUTION LINES TO THE MANABLOC (con't)

6. Any unused outlet(s) shall be capped and the valve(s) turned to the "off" position. Use Vanguard Part No. RXPC3 to cap off 3/8" ports, or No. RXPC4 to cap off 1/2" ports.

7. When the MANABLOC is not mounted between studs (page 10), securely anchor the PEX lines to prevent stressing the MANABLOC connection. Anchoring the tubing 4" to 6" from the connection gives best results. Use Vanguard Part Nos. CLJ2 or CLE2 tubing clamps for 3/8" tubing, and CLJ3 or CLE3 for 1/2" tubing. Failure to secure or anchor the tubing could cause misalignment of the O-ring seals in the MANABLOC, creating the potential for a leak. Refer to page 10 for specific instructions about supporting the tubing when mounting the MANABLOC without studs.

Each distribution line must exit the MANABLOC in a straight line and be supported within 4" to 6" from the MANABLOC.

MXLSA23, MXLSA33, MXLSA24, MXLSA34

OPTIONAL CRIMP ADAPTERS

THE WATER SUPPLY TO THE MANABLOC AND THE PORT VALVES SHALL BE TURNED OFF BEFORE ATTEMPTING INSTALLATION OF CRIMP ADAPTERS.

CAUTION
Some O-rings can crack the plastic. Use only O-rings supplied with the adapters.

1. Wet the O-ring (A) with tap water or silicone lubricant only. DO NOT USE Vaseline®, grease, oil, or any other lubricant. Use of petroleum-based lubricant can cause cracking of the plastic and result in a leak. Place the O-ring against the flange of the brass adapter (B).

A *Place the wet O-ring (A)...*

against the brass adapter flange.

2. Slide a crimp ring (C) - XLCR2 for 3/8" tubing; XLCR3 for 1/2" - and the supplied swivel nut (D) onto the tubing (threads of the nut toward the end of the tubing).

Insert the brass adapter (B) fully into the end of the tubing as shown.

3. Slide the swivel nut (D) back to brass adapter and slide the crimp ring (C) to within 1/8" to 1/4" from the end of tube. Crimp the ring with an appropriately sized full-circle crimp tool.
DO NOT CRIMP TWICE.

See page 17 for additional crimping information. The publication *Installation Guidelines for the Vanguard Vanex® PEX System with CRIMPSERT® Insert Fittings*, may also be consulted.

4. With the O-ring still in place, thread the nut onto the MANABLOC port and tighten hand tight plus NO MORE THAN 1/8 turn additional.

DO NOT OVERTIGHTEN

5. Open the port valve(s) before turning on the main water supply. See valve information, page 19.

CONNECTING DISTRIBUTION LINES TO FIXTURES

Depending on the fixture being supplied, local code requirements and crimp tool availability, there are several options available to connect PEX distribution lines to fixtures. The following illustrations apply to fittings available from Vanguard Piping Systems, Inc. See the Vanguard Product Catalog for the complete line of transition fittings.

FLOOR STUB-OUT METHODS

FOR 3/8" DISTRIBUTION LINES

FOR 1/2" DISTRIBUTION LINES

WATER CLOSET CONNECTIONS

3/8" LINE **1/2" LINE**

FAUCET CONNECTIONS - LAV or KITCHEN

3/8" LINE **1/2" LINE**

ICE MAKER HOOK-UP

Install from the cold side of the kitchen faucet or other convenient supply.

HOSE BIBB CONNECTION

NOTE: FREE STANDING HOSE BIBBS SHALL NOT BE SUPPORTED BY VANEX PEX.

Well-anchored drop-ear fittings or metal pipe shall be used to install hose bibbs.

HOSE BIBB CONNECTION

HOSE BIBBS SUPPORTED BY THE STRUCTURE CAN BE CONNECTED DIRECTLY.

WATER HEATER FITTINGS

Use Vanguard connectors or similar fabricated metal assembly.

PEX SHALL BE AT LEAST 18" FROM GAS WATER HEATER.

NOTE: Vanex PEX may be connected with standard metallic termination fittings (swivel elbows and straight swivels) to the water heater inlet and outlet nipples on ELECTRIC, tank type water heaters.

CRIMPING INSTRUCTIONS

1. Cut the pipe cleanly and squarely.

2. Slide a PEX crimp ring over the end of the pipe.

3. FOR CRIMPSERT POLYMER AND CRIMPSERT METALLIC FITTINGS

Insert the fitting into the pipe to the shoulder or tube stop. Position the ring 1/8" to 1/4" from the end of the tubing.

4. The ring must be attached straight. Center the crimping tool jaws exactly over the ring. Keep the tool at 90˚ and close the handles completely.
DO NOT CRIMP TWICE.

5. When checking crimped rings with the GO-NO GO gauge,

Push the gauge straight down over the crimped ring. NEVER slide the gauge in from the side. Do not attempt to gauge the crimp at the jaw overlap area. The overlap area is indicated by a slight removal of the blacking treatment.

6. You have a good crimp if the GO gauge fits the ring and NO-GO does not. Bad crimps must be cut out and replaced.

WATER SUPPLY CONNECTIONS

The main water supply shall be turned off before making water supply connections.

The MANABLOC water supply connection uses a special 1" swivel MANABLOC transition fitting which seals with a rubber washer. This connection is used on the cold water supply and the hot water supply/return lines.

This connection to the MANABLOC does not require any form of thread sealant and none shall be used. DO NOT USE ANY FORM OF THREAD SEALANT TO MAKE THIS CONNECTION.

NOTE: Water Service connections to adapt to any type of plumbing supply materials are available. Consult the *Vanguard Product Catalog* for a complete listing of available connections.

1. Make all connections to water supply piping before attaching the swivel fitting to the MANABLOC. Excessive force from threaded fittings, or solvents from solvent welding (PVC or CPVC) will cause damage to the MANABLOC. Drill all holes in wood members for water supply/return tubing BEFORE mounting the MANABLOC.

2. When using male or female pipe thread transition fittings, use only Teflon® TAPE to seal pipe threads. **DO NOT** use pipe dopes, thread sealers, Teflon® pastes, etc.

3. If copper sweat fittings are used anywhere in the MANABLOC water supply line or water heater feed/return lines, these fittings must be soldered, cooled, and flushed of any flux residue before these lines are connected to the MANABLOC. Soldering creates a tremendous amount of heat which could melt the MANABLOC, and solder flux contains strong acids and may also contain petroleum products. These compounds can attack the plastic materials from which the MANABLOC is made and cause crazing, cracking and failure of the MANABLOC, resulting in leaks and water damage.

4. Ensure that the hot/cold supply lines are connected to the correct supply inlet/outlet on the MANABLOC.

Red valve caps designate hot ports, blue valve caps designate cold ports.

5. Supply lines shall enter and/or exit the MANABLOC in a straight line. If bending of the supply lines is required, the tubing must be anchored to a framing member to isolate the bend stress from the MANABLOC or use a directional fitting.

6. After the supply tubing has been connected to the transition fitting, place the rubber washer onto the swivel adapter, remove the plastic protective cap from the MANABLOC fitting and thread the swivel nut onto the threaded male adapter by hand. DO NOT CROSS THREAD.

Vanguard Part No. MXSC45 is available to connect 3/4" PEX, copper and CPVC lines to the MANABLOC.

IMPORTANT WARNING!
FLUX, PVC AND CPVC SOLVENTS WILL CRACK THE MANABLOC.
See instructions on previous page.

Swivel fittings must be ALIGNED CORRECTLY before being attached to the MANABLOC.
The piping material must not be allowed to put stress on the MANABLOC, as leaking and damage may result.

7. TIGHTENING THE SWIVEL CONNECTIONS ON THE INLET/OUTLET PORTS:

Tighten the 1" swivel nut hand-tight, then a quarter of a turn with channel locks. DO NOT OVERTIGHTEN. Excessive force could damage the MANABLOC.

Repeat for all remaining supply line connections.

DO NOT OVER TIGHTEN

Damage may result if over tightened.

DO NOT OVER TIGHTEN

NOTICE!
Please leave this installation guide for the homeowners reference. Local code may also require additional labeling directly adjacent to the MANABLOC or on the inside of any cover panel.

DO NOT ELECTRICALLY GROUND TO THIS SYSTEM.

FILLING AND TESTING THE MANABLOC SYSTEM

1. Upon completion of the installation, the system should be filled and hydrostatically tested. Use only POTABLE water for testing.

WATER TESTING SHALL BE AVOIDED DURING FREEZING CONDITIONS.

UNDER NO CIRCUMSTANCES SHALL THE SYSTEM BE TESTED AT TEMPERATURES LOWER THAN 10˚F (-12˚C).

2. Open all connected port valves before filling the system with water or air and pressurizing. If the MANABLOC is filled and pressurized before the port valves have been opened, read the following notice:

NOTICE - VALVE INFORMATION!

Opening a port valve to an empty or unpressurized distribution line may cause valve damage. To prevent potential valve damage or failure, open the port valves before filling and pressurizing the lines. The force of water rushing to fill an empty line can cause the valve's sealing O-ring to "clip off", resulting in incomplete sealing or complete valve failure.

CARE must be exercised when opening a port valve to an empty or unpressurized line. The fixture to which the line is connected should be in the OFF position and the valve must be opened slowly until water starts to flow into the line.

DO NOT CONTINUE to open the valve until the line is full and pressurized. Open the valve fully only after the line is up to system pressure. The fixture can then be opened to purge the line of air.

Valve stems are replaceable. Order Vanguard Part No. MBRS4.

3. Hydrostatic testing of the Vanex plumbing system is to be conducted according to local code requirements. Test pressure shall be at least the expected working pressure of the system, but not less than 40 psi nor greater than 225 psi.

NOTE: Some plumbing fixtures may not withstand test pressures greater than 80 psi. Consult fixture manufacturers instructions for pressure limitations or plug all distribution lines at the fixture end. The system shall, at a minimum, withstand the test pressure, without leaking, for a period of 15 minutes.

WARNING!

PRESSURES USED IN TESTING CAN BLOW UNMADE OR INCOMPLETE CONNECTIONS APART WITH TREMENDOUS FORCE! This force is many times greater when air is used as a test medium. To reduce the risk of personal injury, ensure that all connections are completed before testing. Use only the pressure and time required to determine that the system is leak free.

4. Fluid testing the MANABLOC system at temperatures below freezing (less then 32˚F, 0˚C) may be performed using a solution of water and NON-TOXIC antifreeze such as propylene glycol (typically called RV antifreeze). If such a solution is used, the antifreeze solutions must be sufficiently concentrated to withstand the lowest temperature encountered while the testing fluid is in the system.

Antifreeze solutions should be purged and the system flushed with potable water prior to consumer use.

THE WATER HEATER SHALL BE ISOLATED AND NOT INCLUDED IN THE SYSTEM AIR TEST.

5. Air pressure testing of a MANABLOC is acceptable and preferred to hydrostatic testing in areas where cold weather could freeze the system or where water is not available. Vanguard recommends that the installer pressurize the system with compressed air or another acceptable test medium, such as dry nitrogen, after installing and capping distribution lines. MANABLOC valves shall be in the open position during the test, which shall utilize a pressure of not less than 40 psi and not greater than 100 psi. The system shall be tested for a minimum of 15 minutes but no longer than 1 hour. During the test, system pressure shall drop no more than 8 psi in the one hour period.

If the pressure in the system declines more than 8 psi during the mimimum 15 minute period, re-pressurize the system to the original test pressure, and retest.* If the system pressure declines more than 8 psi again during the test period, test the distribution line test caps or any other fittings in the system with the approved leak detection solution. (Any connection found to be in question must be replaced or remade and the pressure test repeated.) If the solution does not show a leak on any of the caps or fittings, isolate the MANABLOC by turning the valves to the "OFF" position, repressurize if needed, and apply the same solution to the MANABLOC manifold components.

For leak detection, use only a mixture of Original Palmolive Green™ dishwashing soap (#46100-46200) or Palmolive Ultra™ (#356140 or 46128) mixed with potable water at a ratio of 2 ounces of soap to one gallon of water (mix Ultra at a ratio of 1.5 ounces per gallon.)

*During the initial test pressurization period, the system pressure indicated on the gauge may decrease due to the initial deformation of the pipe, followed by slow expansion. The pressure drop is dependent on ambient temperature, system capacity, and test pressure but shall not be more than 8 psi in an hour.

TEST SHALL BE CONDUCTED WHEN SIGNIFICANT CHANGES TO TEMPERATURE AREN'T EXPECTED.

Please note significant changes in ambient temperature also can affect system pressure.

6. Due to the normal contraction of the MANABLOC in extremely cold weather, the tie rods may appear loose. This is normal. DO NOT tighten the tie rod nuts! They are factory pre-set.

DO NOT ALLOW FLUIDS TO FREEZE IN THE MANABLOC SYSTEM! Fluids freezing in the MANABLOC will damage the unit.

WATER (NOT ANTIFREEZE SOLUTION) MUST BE PURGED OR DRAINED FROM THE SYSTEM IF TEMPERATURES ARE EXPECTED TO FALL BELOW FREEZING (32˚F, 0˚C). Low pressure compressed air can be used for purging.

FOLLOW ANTIFREEZE MANUFACTURERS INSTRUCTIONS FOR CONCENTRATIONS.

USE ONLY NON-TOXIC ANTIFREEZE APPROVED FOR USE IN DRINKING WATER SYSTEMS.

SYSTEM DISINFECTION AND DRAINING THE MANABLOC SYSTEM

Local codes may require system disinfection. When no other method is available, follow the time limitations and exposure levels shown below:

1. Use one of the chlorine solutions and exposure durations listed to the right.

CONCENTRATION	PERIOD	AUTHORITY
200 PPM	3 HOURS	IPC/UPC
50 PPM	24 HOURS	IPC/UPC

2. Mix the disinfection solution thoroughly before adding it to the system.

3. The chlorine solution must reach all parts of the system. Open all fixtures (both sides) and flow water until a chlorine smell is present. As an alternative, chlorine tablets can be used to detect chlorine at each fixture. Open all unused ports and flow disinfection solution. A section of Vanex PEX tubing can be temporarily attached to these ports to direct the water to a suitable drain.

4. The chlorine source for the solution can be, but is not limited to:

CHLORINE SOURCE	% ACTIVE CHLORINE	FORM	AMOUNT PER 100 GAL WATER FOR A 200 PPM SOLUTION
Laundry Bleach	5.25	LIQUID	3 PINTS (48 oz)

5. After the solution has been in the system for the time required by the AHJ or the exposure durations listed in step 1 above, the system shall be flushed completely with potable water.

6. The system must be purged or drained of all water or protected from freezing.

FAILURE TO FLUSH THE SYSTEM NOTICE!
To prevent reduced service life of system components, disinfection solutions shall not be allowed to stand in the system longer than 24 hours. Flush the system with potable water after disinfection.

DO NOT ALLOW FLUIDS TO FREEZE IN THE MANABLOC SYSTEM
Fluids freezing in the MANABLOC will damage the unit.

DRAINING THE MANABLOC SYSTEM

If the MANABLOC system has been filled with water and there exists the possibility that the ambient temperature will drop close to or below 32° F (0° C), then the MANABLOC unit MUST be drained to prevent irreparable damage.

The process of draining involves loosening and removal of 1 or more supply line connections and 2 distribution lines from the MANABLOC.
Note: Depending on the installation, some of the supply connections may be capped. If that is the case, remove the cap(s) as instructed below.

1. Turn off all water supply(s) feeding the MANABLOC. Open both sides of all fixtures served by the manifold and leave the fixtures open during draining. For each port of the MANABLOC where there is a distribution line connected, make sure that the port valve is in the open position.

2. Loosen and remove the bottom supply connection(s) (or cap(s)) and both of the distribution line connections directly above the divider plate.

3. As the connections are removed, most of the water contained in the MANABLOC main bores and some of the water in the distribution lines should purge from the system.

4. Allow to drain until no more water purges.

5. Reattach the supply line(s) (or cap(s)) and the distribution lines. Tighten the supply connections according to the instructions on pages 17 – 18 of these guidelines. When reconnecting the distribution lines, DO NOT over-tighten the connections. It should require only about 1/8 turn past hand tight when reinstalling connections that were previously tightened to the specifications outlined in this installation guide.

NOTE: The procedure described above will leave a small amount of water in the MANABLOC unit and, depending on the installation, may leave some or most of the water in the distribution lines. This remaining water should not cause damage to the manifold unit or to the PEX distribution lines in the event of a freeze. However, for complete assurance that freeze damage will not occur, perform the following additional steps.

To completely drain the system:

6. Loosen and remove all of the supply line connections (or caps) and all of the distribution lines from the MANABLOC.

7. Remove the 4 attachment screws and withdraw the MANABLOC unit from its mounting. Note: Grasp the unit firmly before removing the last attachment screw to prevent the unit from falling and being damaged.

8. Completely drain the MANABLOC unit by inverting the unit several times until there is no water coming from any of the supply connections or ports.

9. To purge the PEX distribution lines, first make sure that both sides of all of the fixtures are in the open position. Using low pressure air from a tank or compressor, force the water from the lines by connecting the air pressure source to each line one at a time and blow air through the lines until no water flows from the fixtures.

10. Reattach the MANABLOC and reconnect the supply and distribution line connections.

NOTE: When reconnecting the distribution lines, DO NOT over-tighten the connections. It should require only about 1/8 turn past hand tight when reinstalling connections that were previously tightened to the specifications outlined in this installation guide.

VANGUARD LIMITED WARRANTY
VANEX® PIPE AND TUBING MANABLOC® AND INSERT FITTINGS SYSTEMS

Subject to the conditions and limitations in this Limited Warranty, VANGUARD PIPING SYSTEMS, INC. warrants to licensed plumbers, who purchase and properly install in a hot and cold potable water distribution system its VANEX® and VANEX® ULTRA cross-linked polyethylene pipe and tubing (PEX) in a MANABLOC® or Minibloc manifold plumbing system or with crimp insert fittings sold by Vanguard or meeting the specifications of ASTM 1807 and certified/listed for conformance with ANSI/NSF Standards No. 14/61, that the VANEX® and VANEX® ULTRA pipe or tubing, the MANABLOC, Minibloc, and crimp insert fittings sold by Vanguard, under normal conditions of use, will be free from failure caused by manufacturing defect for a period of ten (10) years from date of installation.

Under this warranty, you only have a right to reimbursement if the failure or leak resulted from a manufacturing defect in the products covered by this warranty and occurred during the warranty period. You do not have a remedy or right of reimbursement under this warranty and this warranty does not apply if the failure or any resulting damage is caused by (1) components in the plumbing system other than those manufactured or sold by Vanguard; (2) not designing, installing, inspecting or testing the system in accordance with Vanguard's installation instructions at the time of the installation, applicable code requirements, and good plumbing practices; (3) improper handling and protection of the product prior to or during installation, inadequate freeze protection, exposure to water pressures or temperatures in excess of the limitations on the pipe or tubing, or application of unauthorized solvents or chemicals.; (4) acts of nature such as earthquakes, fire, flood, or lightning. In addition, for MANABLOC or Minibloc systems, there is no warranty if (1) the MANABLOC or Minibloc manifold has been disassembled or modified after leaving Vanguard; (2) the MANABLOC or Minibloc manifold is installed behind a permanent enclosure and is non-accessible through an access panel or other acceptable enclosure; (3) components of or connections to the MANABLOC system are not Vanguard components or connections or crimp insert fittings meeting the specifications of ASTM 1807 and certified/listed for conformance with ANSI/NSF Standards No. 14/61.

In the event of a leak or other failure in the system, it is the responsibility of the property owner to obtain and pay for the repairs. Only if the warranty applies will Vanguard be responsible for reimbursement under this warranty. The part or parts which you claim failed should be kept and Vanguard contacted by writing to the address below or telephoning 800.775.5039 within thirty days after the leak or other failure and identifying yourself as having a warranty claim. You should be prepared to ship, at your expense, the product which you claim failed due to a manufacturing defect, document the date of installation, and the amount of any claimed bills which you wish reimbursed. Within a reasonable time after notification, Vanguard will investigate the reasons for the failure, which includes the right to inspect the product at Vanguard and reasonable access to the site of the damage in order to determine whether the warranty applies. Vanguard will notify you in writing of the results of its review.

In the event that Vanguard determines that the failure or leak and any resulting damages were the result of a manufacturing defect in the products covered by this warranty, Vanguard will reimburse the property owner for reasonable repair or replacement charges to include drywall and painting or plastering costs, as well as damages to personal property resulting from the failure or leak. VANGUARD SHALL NOT BE LIABLE FOR CONSEQUENTIAL ECONOMIC LOSS DAMAGES UNDER ANY LEGAL THEORY AND WHETHER ASSERTED BY DIRECT ACTION, FOR CONTRIBUTION OR INDEMNITY
OR OTHERWISE.

THE ABOVE LIMITED WARRANTY IS IN LIEU OF ALL OTHER WARRANTIES, EXPRESS OR IMPLIED, INCLUDING BUT NOT LIMITED TO, THE IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE. Other than this limited warranty, Vanguard does not authorize any person or firm to create for it any other obligation or liability in connection with its products. Licensed plumbers are authorized to provide this warranty in connection with any warranty extended by them to builders or owners of site built construction.

Some states do not allow the exclusion or limitation of incidental or consequential damages in certain types of transactions, so the above exclusion or limitations may not apply to you. This limited warranty gives you specific legal right and you also may have ther rights which vary from state to state.

1/25/05

Vanguard
Piping Systems, Inc.

For further information about the MANABLOC plumbing system,
answers to specific questions or technical support, contact Vanguard:

901 N. Vanguard Street / McPherson, KS 67460
TEL 620.241.6369 or 800.775.5039
FAX 620.241.2123 or 800.775.4068
For Customers Outside the USA 888.747.3739
www.vanguardpipe.com

QLTP02VS 7/05

VANGUARD

PIPE AND TUBING JOINING SYSTEMS

Installation Guidelines for the Vanguard Vanex® PEX Plumbing System with CRIMPSERT® Insert Fittings

SDR-9 PEX
Cross-linked Polyethylene

For Traditional or Manifold Plumbing Systems

Revised June 30, 2003

Vanguard
Piping Systems, Inc.

IMPORTANT NOTICE

This installation guide is intended for traditional (branch and main) plumbing systems and hybrid plumbing systems using termination manifolds. Separate Installation Instructions for the MANABLOC® Manifold Plumbing System or COMPAX-L® PEX-Aluminum-PEX (PAX) tubing are available from Vanguard. (The MINIBLOC Manifold Plumbing System uses the MANABLOC Manifold Plumbing System Installation Instructions.)

NOTE: References to Vanex® PEX tubing made throughout this publication include the entire line of Vanguard cross-linked polyethylene products.

IN THE EVENT OF CONFLICT OR INCONSISTENCY BETWEEN THESE INSTALLATION GUIDELINES AND LOCAL BUILDING OR PLUMBING CODES, LOCAL CODES SHOULD TAKE PRECEDENCE.

Note: Failure to follow the installation instructions will void the Vanguard Vanex and Insert Fittings System warranty. Nothing in this publication is intended to create any warranty beyond Vanguard's applicable warranty. For additional information, contact Vanguard Piping Systems, Inc. at 1-800-775-5039.

COMPATIBILITY OF SYSTEM COMPONENTS

Vanguard Vanex PEX tubing and CRIMPSERT® fittings are manufactured to nationally recognized ASTM (American Standards for Testing and Materials) standard specifications. Vanex PEX tubing is produced to ASTM F876/F877 and is tested and listed by recognized agencies (such as NSF International) to the requirements of these standards. Vanex PEX tubing has a design pressure rating of 100 psi @ 180°F, and 160 psi @ 100°. These are maximum-use ratings.
Vanex PEX tubing and resin used in the manufacture of Vanex tubing have been tested, and listed by NSF to meet the requirements of ANSI/NSF 14/61, and NSF Protocol P171 CL-R/CL-TD, Chlorine Resistance of Plastic PIping Materials.

CRIMPSERT metallic fittings are manufactured to ASTM F1807 and CRIMPSERT PolyAlloy fittings are manufactured to ASTM F2159. Both fitting types meet the performance and health effects requirements of ANSI/NSF 14/61.

There are competing PEX tubing and fittings suppliers that also manufacture to these same standards. As such, the use of Vanguard Vanex PEX tubing or CRIMPSERT fitting system components, or both, with a competitor's PEX tubing made to ASTM F876 or F877, or fitting system components made to ASTM F1807 or F2159, will not affect Vanguard's product warranty. However, Vanguard warrants only those components that we manufacture or distribute.

Always use the correct fittings and crimp rings in their appropriate fittings systems. Fittings designed for Polybutylene systems must not be used in PEX systems.

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INSTALLATION GUIDELINES FOR THE VANGUARD VANEX PEX PLUMBING SYSTEM WITH CRIMPSERT INSERT FITTINGS
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MANUAL CONTENT AND USE

This book of installation guidelines contains information on the installation of Vanex SDR9 cross-linked polyethylene (PEX) tubing, CRIMPSERT insert fittings and copper crimp rings in hot and cold potable water distribution systems.

The installer shall be thoroughly familiar with the contents of this manual before proceeding. Consult local codes for additional installation requirements and/or Vanguard Piping Systems, Inc. for additional, specific product information.

IMPORTANT: Vanex systems are intended for hot and cold potable water distribution systems, radiant heating systems and other hot and cold water applications. Installation of a Vanex plumbing system for purposes other than those recommended by Vanguard is a misapplication of the product and voids product warranties. Contact Vanguard Piping Systems before applying this system for any use other than those recommended.

USES OF VANEX PEX PIPING

Vanex SDR9 PEX tubing and components must be installed in accordance with good plumbing practices, applicable code requirements, and current installation instructions. It is the responsibility of the contractor or installer to appropriately design the system, determine that the selection of Vanex PEX tubing and the joining system components are the proper ones for the intended application, and that he and/or his employees observe the installation practices recommended by Vanguard. If there is any doubt whether water conditions or other conditions likely to be encountered in the intended application may be harmful to PEX components, call a Vanguard representative at 1-800-775-5039.

⚠ CAUTION!

Tubing that exhibits damage such as cuts, scratches, gouges, kinks, fading or discoloration, evidence of grease, tar or any chemical exposure shall not be used. Vanex PEX tubing must be stored away from direct and indirect sunlight.

A damp rag is all that should be required for cleaning the tubing. If any material (other than those allowed in this publication) has adhered itself to the tubing and cannot be removed in this manner, do not use that section of tubing. NEVER use thinners, pipe sealants, solvent cements, fluxes, lubricants, other oxidizing agents or petroleum based materials to seal or clean Vanex PEX tubing.

FITTINGS AND CRIMP RINGS

CRIMPSERT brass, copper and PolyAlloy insert fittings are installed into the ends of 3/8″ - 1″ Vanex PEX tubing. A permanent, sealed connection is made by properly crimping a ring around the tubing, pressing the PEX into the spaces between the ribs of the inserted fitting.

Vanguard blackened copper rings are marked with (V) and ASTM **F1807** and are annealed for ease of crimping. The rings must be located over the ribs of the inserted fitting and crimped into place with a properly calibrated crimping tool.

DO NOT USE:

- Copper-colored rings designed for polybutylene systems
- Fittings which have defects such as cuts, gouges, or abrasions
- Hose clamps or solvent cements
- Metallic fittings that are not marked PEX and F1807
- Fittings that are not marked as compliant with ANSI/NSF 14/61 such as NSF-pw
- Lubricants of any kind on the tubing or fittings

PEX TUBING

- The tubing shall meet the dimensional and performance requirements of ASTM F876/F877.
- The tubing shall be third-party certified for use in potable water systems; i.e., NSF-pw (NSF International), Standards 14/61, and NSF Protocol P171 CL-R/CL-TD, Chlorine Resistance of Plastic Piping Materials.

DO NOT install tubing that has defects such as:

- Gouges, cuts, deep scratches
- Evidence of grease, tar or any chemical exposure
- Kinks
- Fading or discoloration

LOOK FOR THE PROPER MARKINGS

PROPER USE OF MATERIALS

DO NOT INSTALL WEHRE EXPOSED TO DIRECT OR INDIRECT SUNLIGHT FOR MORE THAN 60 DAYS. PEX tubing shall be stored under cover, shielded from direct and indirect sunlight when the material is stored for any length of time. Short exposure times, not exceeding a total accumulated time of 60 days maximum, are permissible.

USE PROPER TOOLS

HAND CRIMPING TOOLS

Use only FULL CIRCLE crimp tools designed for Vanex PEX CRIMPSERT insert fitting systems. Tools must produce crimps in accordance with dimensional requirements of ASTM F1807 (shown on page 6). DO NOT use tools which produce an "eared" crimp. See pages 7 through 9 for tool calibration and adjustment procedures. Vanguard recommends checking at least the first and last crimp of the day with a GO/NO GO gauge.

Vanguard Model HCM-2 – 3/8″
HCM-3 – 1/2″
HCM-4 – 3/4″

Vanguard Model HAR-2 – 3/8″
HAR-3 – 1/2″
HAR-4 – 3/4″
HAR-5 – 1″

TUBING CUTTERS

The Vanguard TUBING CUTTER will cut PEX cleanly and evenly.
Vanguard Kwik Cutter - Model HAK67

GO/NO GO CRIMP MEASURING GAUGE

Vanguard GO/NO GO Crimp Ring Measuring Gauge
Model HAC34 (3/8″ - 3/4″)
Model HAC5 (1″)

CARE FOR YOUR TOOLS

- Check tool calibration at least twice daily. Vanguard recommends at least the first and last crimp of the day (SEE PAGES 7 - 9).
- Examine tools frequently for loose or missing parts, wear and damage. DO NOT use tools that are in need of repair.
- A tool with worn parts may not calibrate. Return worn tools to the manufacturer for repair or replacement.
- Lubricate all tool pivot points regularly with light oil. Wipe off excess oil before using tools.
- DO NOT use crimp tools for other purposes.
- DO NOT throw or drop tools.
- DO NOT use a crimp gauge which is bent or damaged.
- Keep the tubing cutters sharp. Replace blade as needed.

MAKING CRIMP CONNECTIONS

Follow these instructions carefully to ensure proper crimp connections.

1.

The tubing should be cut squarely and evenly without burrs. Uneven, jagged or irregular cuts will produce unsatisfactory connections.

2.

Slide the correct size blackened copper crimp ring over the tubing end.

3.

Insert the fitting into the pipe to the shoulder or tube stop. Position the ring 1/8" to 1/4" from the end of the tubing.

4.

4. The ring must be attached straight. Center the crimping tool jaws exactly over the ring. Keep the tool at 90° and close the handles completely.
DO NOT CRIMP TWICE.

5.

When checking crimps with a GO/NO GO gauge, push the gauge STRAIGHT DOWN over the crimped ring. NEVER slide the gauge in from the side. Do not attempt to gauge the crimp at the jaw overlap area. The overlap area is indicated by a slight removal of the blackening treatment.

6.

You have a good crimp if the GO gauge fits the ring and the NO GO does not.

You have a bad crimp if the GO gauge does not fit the ring or the NO GO gauge does fit.

Bad crimps must be cut out of the tubing and replaced.

Good crimps can be identified with a marker.

If you check the crimps with a micrometer or caliper, use the dimensions shown below.

CRIMP DIAMETER DIMENSIONS

Crimp outside diameters should fall within these dimensions when measured with a micrometer or caliper.

RING SIZE	*MINIMUM*	*MAXIMUM*
3/8″	0.580″	0.595″
1/2″	0.700″	0.715″
3/4″	0.945″	0.960″
1″	1.175″	1.190″

DAILY TOOL CALIBRATION CHECK

Check tool calibration at least twice daily. Vanguard recommends at least the first and last crimp of the day.

Accurately adjusted crimping tools are critical to the success of this fitting system. If the crimped rings do not gauge properly, the tool needs adjustment. The method for checking the crimping tool for proper calibration is:

1.

Assemble and crimp a fitting (see page 5).

2

the correct size side of the crimp over the crimp at least FOUR . DO NOT gauge imp at the jaw p area.

3.

<u>If the "GO" side of the gauge fails to slide over the ring</u>, the crimp tool requires calibration (ring is under crimped).

REMEMBER: *A crimp tool which has worn parts may not calibrate. Return worn tools for repair or replacement.*

4.

If the "GO" side slides over the crimp ring, attempt to slide the correct size "NO GO" side of the gauge over the crimp ring in at least <u>four</u> places. DO NOT gauge the crimp at the jaw overlap area.

5.

<u>If the "NO GO" side of the gauge slides over the crimp ring</u>, the crimp tool requires calibration (ring is over-crimped).

REMEMBER: *A crimp tool which requires frequent calibration may require repair or replacement.*

ADJUSTING "HAR" TOOLS

An accurately adjusted crimping tool is critical to the success of this fitting system. If the crimped rings do not gauge properly, the tool needs adjustment.

The method for adjusting the HAR tool is:

1.

Open the tool handles.

2.

Note the position of the notched head of the adjustment cam in relation to the Phillips-head retaining screw.

3.

Carefully remove the retaining screw and rotate the cam counter-clockwise slightly until the retaining screw can be installed in the other threaded hole. This provides about 1/2 notch of adjustment.

4.

Test the tool by crimping a joint and checking the crimped ring with the "GO" gauge. If the "GO" gauge slides over the ring then no further adjustment is needed. If the "GO" gauge will not slide over the crimped ring, then repeat the adjustment by rotating the adjustment screw counterclockwise an additional 1/2 notch and reinstalling the retaining screw in the other threaded hole.

A tool adjusted to the middle of the crimp diameter range may reduce the frequency of calibrations.

ADJUSTING THE "HCM" TOOLS

The HCM compact crimp tools are generally not capable of over-crimping (the "NO GO" gauge fits over the crimped ring). However, normal wear may cause the crimp size to increase to above the maximum allowed (the "GO" gauge does NOT fit). Tools manufactured prior to December 1996 must be returned for calibration if they do not crimp to the dimensions shown on page 6. Tools manufactured after that date have an adjustment feature built in and are easily identified by a hex head on the back-pin, see Figure 1. These tools may be adjusted to decrease the crimp diameter up to five times.

When an HCM crimp tool requires adjustment to a smaller crimp dimension, note the number to which the line on the hex head of the back pin points. (See Figure 1)

Carefully remove the retaining clip by inserting a small flat blade screwdriver in the loop of the clip and turning the screwdriver.

Figure 1

CAUTION!
The retaining clip is made from spring steel and may fly off of the pin if not removed carefully, possibly causing eye damage and loss of the clip.

From the clip end of the back pin, push it towards the tool body until the hex head on the other end of the pin just clears the body.

Rotate the pin until the line on the hex head points to the next higher number on the frame. Push the pin back into the frame and replace the retaining clip.

To reduce crimp size, rotate Back Pin to Next Higher Number

Crimp a test joint and check the crimped ring for proper sizing with a GO/NO GO gauge or by measurement. Severely worn tools may require further adjustment. As the tool continues to wear with use, simply repeat these instructions as required.

INSTALLING VANEX PEX TUBING

Vanex PEX tubing is flexible, reducing the need for most directional fittings.

Care should be exercised when pulling PEX tubing to prevent cutting or abrading. Care also must be taken to prevent kinking of the coiled tubing. If kinking should occur, these sections must be cut out and a coupling installed.

CAUTION!
DO NOT BEND 1/2″ TUBING 90° WITHIN A 3 1/2″ STUD WIDTH when stubbing out. Use an elbow or stub-out elbow.

CORRECT: 8 x O.D.

DO NOT bend Vanex PEX in a radius smaller than eight (8) times the outside diameter of the tubing. Flattened tubing is damaged and must be cut out and replaced.

If bending against the coil direction when using coiled tubing, the bending radius is twenty four (24) times the outside diameter of the tubing.

INCORRECT: FLATTENS TUBING

Refer to these dimensions for proper radius bends:

TUBING SIZE	NATURAL RADIUS	RADIUS AGAINST COIL
3/8″	4″	12″
1/2″	5″	15″
3/4″	7″	21″
1″	9″	27″

For bends smaller than 8 x outside tube diameter, install an elbow fitting.

Vanguard Vanex PEX is flexible and requires fewer fittings than conventional piping material. Because of this flexibility, proper and adequate use of clamps, straps or hangers is required for installation.

SUSPENDED TUBES AND BUNDLES should be supported at least every 32″ horizontally, at each floor level vertically and at significant changes of direction with clamps, hangers or plastic strapping. Tubes running through holes drilled in joists or studs or laying on top of rafters do not require further support unless the joist or stud spacing exceeds 32″.

Support horizontal tubing at least every 32″ (or every 48″ in a Manufactured Home or Recreational Vehicle).

Supports may be the same as those commonly used for Vanex PEX or other piping systems, keeping in mind size and weight of the tubing when filled with water.

ALWAYS allow some slack. Typically 7″ per 50′ in the tubing will accommodate contraction when cold temperatures are encountered.

Vanex PEX expands or contracts 1″ in every 100′ of pipe for every 10°F of temperature change. You should allow for this expansion and contraction in your installation procedures. ALWAYS cut the pipe too long.

In the normal process of installing tubing, slack is generally provided by snaking the tubing around obstacles and by some sagging between supports. A change in direction offset or loop can be used when slack requirements are not met by these other installation methods.

OFFSETS AND LOOPS are not required in Vanex PEX lines which have sufficient slack to provide for expansion and contraction. Strapping support should be firm but loose enough to allow the pipe to move as it expands and contracts.

Since plumbing fixtures are generally located in groups, and there may be several distribution lines running to approximately the same location, it is easiest to run these distribution lines bundled together. Hot and cold lines may be run in the same bundle, for neat appearance, bundles can be tied with nylon ties (Vanguard Part No. HB14120) or plastic strapping at regular intervals.

HOLES DRILLED through studs, joists, plates, headers, etc. must be large enough to accommodate tubing bundles without binding, to allow free movement. Several smaller holes (accommodating a few lines each) may be preferable to drilling a bundle-size hole. In no case should the hole size exceed building code guidelines, as this could weaken the structural support members.

INSTALLING VANEX PEX TUBING

DO NOT use supports that may collapse or cut the tubing. Supports shall NOT have sharp edges which could damage the tubing.

DON'T use metal hangers with sharp or abrasive edges or hangers that may pinch or penetrate the pipe. Proper hangers, clamps and straps are available from your Vanguard supplier.

Use only hangers made for use with plastic pipe. Bundles may be supported with hangers designed for larger tubing sizes. The HB17120 can be used to support PEX lines directly from wooden framing members.

Because PEX is flexible it can move slightly when water flow starts in the tube and again when it stops. If the tubing is not strapped sufficiently, it may hit against something and cause a "tick" sound. To ensure a quiet system, tubing should not be installed where it may come in contact with wall board, forced air ducts or other high resonance articles during this movement. Where tubing passes over ceiling joists or trusses where no further support is needed, the tubing should be clamped or strapped at regular intervals to minimize movement. For information on water hammer, see page 16.

DO NOT drag the tubing over rough terrain, rocks, or any other surface which could abrade, cut, puncture or damage the tubing wall in any way. DO NOT crush or kink the tubing. **Inspect all tubing** before and after installation. Damaged or kinked sections shall be cut out and replaced. DO NOT heat kinked tubing to repair/reform.

To prevent damage to the tubing from drywall nails and screws, drill tubing-run holes at the center of the studs. **Protect the tubing** where appropriate.

Keep the Vanex PEX tubing a MINIMUM of **12" vertically and 6" horizontally** from sources of high heat such as recessed light fixtures, gas flue vents, heating appliances, or electric motors. Forced air heating ducts are not generally considered sources of high heat. These areas of installation should be rechecked after further construction and other mechanical systems have been installed. PEX can be run in return air plenums.

REMEMBER: It is the responsibility of the installer to ensure that further construction, finishing and other mechanical system installations do not compromise the integrity and service life of the Vanex PEX tubing.

PEX tubing systems should not be intentionally subjected to freezing.

Do not use open torch or excessive heat to thaw PEX tubing. Tubing failure or damage can result.

Heat must be applied directly to the frozen tubing section. Temperature on tubing shall not exceed 180°F.

Several suitable methods exist to thaw PEX tubing.
They include:
- Hot water
- Wet hot towels
- Hand-held hair dryer
- Low wattage electrical heating tape.
- A commercial system which pumps heated water through a tube to the ice blockage, and returns the cooled water for reheating.

INSULATING each PEX tube individually or as a group is not generally necessary if the PEX tubing is installed within the insulation envelope of the structure, i.e. the heated area. For example, the tubing may be installed under the insulation in the attic or within an interior wall of a heated space.

Protect the Vanex PEX tubing with non-metallic sleeving material where it **enters and/or exits a concrete slab**. Vanex PEX need not be sleeved its entire length within the slab. However, full length sleeving is allowed.

Penetrations **through concrete walls** may be sleeved with a larger, rigid sleeve. Protect Vanex PEX from any sharp edges where it enters and exits larger sleeving material. (See detailed guidelines on page 19.)

Tubing penetrations **through structural members** may require sleeving or the installation of an insulator. When the tubing penetrates at an angle in relation to the hole, it may be subject to a sharp edge which could damage the pipe. Acceptable sleeving materials include flexible plastic tubing, foam-cell pipe insulation or an approved plastic insulator. It is not generally necessary to sleeve Vanex PEX when penetrating wooden framing members or non-metallic finished or unfinished walls. If there is a doubt, sleeve the pipe or install an insulator.

SLEEVE all penetrations of metal, metal studs and masonry or concrete.

When penetrations must be sealed for **AIR INFILTRATION** purposes, there are several options available. A good grade of silicone, acrylic or siliconized acrylic caulking (DO NOT use oil-base caulks), most of the canned expanding foams, and open- or closed-cell pipe insulation are good sealing materials and may be used in direct contact with Vanex PEX tubing. Other materials may be used provided they do not cause short or long-term damage to the Vanex PEX. If there is no information available on the compatibility of the proposed sealing materials, wrap the tubing with several layers of aluminum foil in the area of contact and extending a few inches on both sides before applying any sealing material.

FIRE STOP - Most building codes require the use of a fire-stopping compound when tubing penetrates a fire-rated wall. There are a number of fire stopping compounds readily available that have been listed for use with PEX tubing. These compounds come in standard caulking tubes and are identified as water-based, acrylic or latex. Consult the compound manufacturers' instructions for proper application.

Use metallic connectors to attach Vanex PEX to **GAS WATER HEATERS** (Vanguard Part No. XLSE4418, XLMSE4418 or similar fabricated metallic assembly). Install a minimum 18" of metallic or other piping between the water heater and Vanex PEX.

For **ELECTRIC WATER HEATERS,** Vanex PEX may be connected with standard metallic termination fittings (such as swivel elbows and straight swivels) to the water heater inlet and outlet nipples.

Vanex PEX may be used to connect to **INSTANTANEOUS WATER HEATERS** or other hot water producing devices. However, consult manufacturer's recommendations for use with plastic tubing and ensure temperature and pressure do not exceed the maximum ratings of the Vanex tubing.

Vanex PEX can be used for water heater **PRESSURE/TEMPERATURE RELIEF LINES.**

CORRECT

INCORRECT

Do NOT pull tubing tight at connections. Prevent unnecessary strain on the tubing, fittings and connections with straps or clamps.

When completing fixture connections, cut the lines carefully and leave sufficient tubing to make the connection without putting undue stress on the tubing, fitting or connection.

CORRECT:
Allows a proper radius bend

INCORRECT:
Tubing shall not be pulled tight to make connection

NOTE: When connecting with a compression type fitting, make certain the tubing is fully inserted into the connection and the nut is properly tightened.

CONTINUOUSLY RECIRCULATING HOT WATER PLUMBING LOOPS

Vanex PEX can be used in continuously recirculating domestic hot water plumbing loops, provided:

1. The plumbing loops shall operate with water temperatures of 140°F or lower, as required by most model plumbing codes.

2. The recirculating loop is for supplying hot water more quickly to the fixture.

3. The tubing is marked as rated for "continuous recirculation" as evidenced by the NSF third party certification marking (CL-R).
(See the example marking below.)

VANGUARD VANEX® PEX POTABLE TUBING NSF-pw CL-R/CL-TD

CL-Hot Chlorinated Water

R-Continuous Recirculation Resistance Certification

NOISE AND WATER HAMMER IN PEX SYSTEMS

As with all plumbing materials under some operating conditions, water hammer can occur in PEX plumbing systems. The inherent flexibility of Vanex PEX drastically reduces the magnitude of pressure surges compared with metallic plumbing materials. Damage to plumbing components in a PEX system due to these pressure surges is highly unlikely, although noise can sometimes result. Fortunately, there are solutions to minimize or eliminate water hammer noise.

• Install fixtures that are not water hammer prone - As a general rule, two-handle fixtures are less likely to cause hammer than single-handle fixtures. Single-handle shower valves, which rotate to close and therefore are difficult to close quickly, might be good choices.

• Clamping or strapping more frequently may help prevent tubing noise. It is very important that the tubing not be in contact with wallboard, forced air ducts or other high resonance articles. Insufficiently or improperly clamped or strapped tubing may move during fixture operation and hit against these surfaces.

• Install a water hammer arrester at fixtures where noise is a problem. A water hammer arrester (Vanguard Part No. XWHA2 or XWHA3 or other size AA) installed as close as possible to the fixture on the cold water side only will eliminate the source of the noise; the pressure wave. It should be noted that even with an arrester, tubing which is clamped or strapped insufficiently may still hit against something as it moves slightly when the water flow is stopped.

• Avoid operating fixtures in such a way that causes near instantaneous shut off. Simply closing fixtures in a less abrupt manner can eliminate hammer noise.

TRANSITIONING TO FIXTURES

The connection of Vanex PEX distribution lines to individual fixtures may be accomplished with a variety of fittings available from Vanguard. Vanex PEX may be stubbed directly out of the wall with the use of the CLSE23 Turnout. At floor levels above a crawl space, basement, or on upper floors, it may be desirable to run the tubing through the floor directly to the fixture, rather than behind the wall.

Care must be taken to avoid imparting severe bending stresses to the tubing when exiting a wall or floor. At basement or slab levels the bend radius restrictions may force you to exit the wall at an angle or to install an elbow or stubout elbow in traditional fashion.

CLSE23 Turnout provides an acceptable bend radius for 3/8" tubing.

The Turnout also accommodates the required elbow for 1/2" tubing.

• **THREADED FITTINGS:** Brass or copper threaded fittings should be used to connect with other metallic-threaded fittings. Plastic fittings SHOULD NOT be used because of likely cross-threading, expansion and contraction differences, and varying tolerances of metallic female threads — all resulting in potential leaks. Use Teflon™ tape to lubricate or seal all metallic threaded fittings. CRIMPSERT insert connections do not require a lubricant and none shall be used.

Typical Vanguard PEX/pipe thread adapter fittings include:

XLMC23	3/8" Insert x 1/2" MPT	XLFC20	3/8" Insert x 1/8" FPT
XLMC33	1/2" Insert x 1/2" MPT	XLFC30	1/2" Insert x 1/8" FPT
XLMC34	1/2" Insert x 3/4" MPT	XLFC33	1/2" Insert x 1/2" FPT
XLMC43	3/4" Insert x 1/2" MPT	XLFC34	1/2" Insert x 3/4" FPT
XLMC44	3/4" Insert x 3/4" MPT	XLFC44	3/4" Insert x 3/4" FPT
XLMC55	1" Insert x 1" MPT	XLFC55C	1" Insert x 1" FPT

• **SWEAT COPPER or BRASS FITTINGS:** Always solder sweat adapter fittings into place and allow to cool before attaching Vanex PEX tubing. Heat damage to Vanex PEX may result if it is attached during the heating process.

NOTE: Never expose Vanex PEX to direct flame or high temperatures. Proper installation procedures can help ensure the long life of the Vanex PEX plumbing system.

Braze, solder or weld any metallic fittings and allow to cool BEFORE you connect them to Vanex PEX.

TRANSITIONING TO FIXTURES

WATER CLOSET CONNECTIONS

RISER CONNECTIONS

Slide compression nut and supplied plastic ferrule over tube as shown. The long taper of the ferrule goes towards valve. Thread fixture nut onto valve. Tighten fixture nut hand tight plus an additional 1/2 turn.

Tighten compression nut according to valve manufacturer's recommendations.

FAUCET CONNECTIONS - LAV or KITCHEN

ICE MAKER HOOK-UP

Install from the cold side of the kitchen faucet or other convenient supply.

HOSE BIBB CONNECTIONS

Hose bibbs supported by the structure can be connected directly.

Free Standing Hose Bibbs shall not be supported by Vanex PEX. Well-anchored drop-ear fittings or metal pipe shall be used to install hose bibbs.

Penetrating a Foundation Wall

To prevent shearing or pinching-off of the tube when backfill below the tubing settles, plastic tubing must be properly sleeved. If there is an area of over-excavation through which the tubing must pass, it shall be sleeved with a larger rigid pipe (schedule 40 PVC or equivalent) to undisturbed earth. The foundation end of the rigid pipe must also be supported by the foundation wall. Slight c or less) do not require rigid sleeving when the area bel backfilled and well compacted to the level of penetration. Always sleeve plastic tubing where it passes through concrete.

Sleeve to undisturbed earth with rigid pipe.

A larger, rigid sleeve must be used for foundation penetrations or Vanex can be installed through a drilled hole with other appropriate sleeving materials. The space between PEX and the sleeve or hole can be sealed with silicone, acrylic, or siliconized-acrylic caulking. Do not cast Vanex PEX directly through the foundation using thin, conforming sleeving materials. Normal ground movement can cause severe tubing damage where the tubing penetrates the foundation if these guidelines are not followed.

Ground and Under-Slab Installation

When installing Vanex in the ground and/or under-slab, the tubing should be snaked from side to side in the prepared trench. The trench bottom must be smooth and free of rocks and debris. Lay the tube directly on the trench bottom. Tubing must be continuously supported by the trench bottom.

Bed and haunch the tube with small, loose, easily compacted backfill material. Compact this material to at least 6" above the tube before final backfilling with any larger or coarser materials. For further information on proper backfill, consult ASTM D2774.

Use only continuous lengths of tubing (no fittings) in or under a concrete slab. Any connections shall be outside the slab or in an access box.

Vanguard CRIMPSERT connections may be direct buried but not under a concrete slab. These fittings, including crimp rings, shall be wrapped securely with self fusing silicone rubber tape (minimum .020 thickness).

When direct burial of metallic water service fittings are used to connect water service tubing coming into the house, those fittings should be made from ASTM B62 UNS C83600 cast bronze (per AWWA standards) or B140 UNS C31400 "DZR" brass (check with fittings manufacturer). In those areas with aggressive soil, such as desert areas, wrapping as referenced above is recommended.

Snake tubing from side to side to allow for tube contraction.

Vanex tubing shall not be installed underground in areas of known chemical contamination of the soil, such as organic solvents or petroleum distillates, or where there is a high risk of chemical spills.

SYSTEM TESTING

1. Upon completion of the installation, the system should be filled and hydrostatically tested. Use only POTABLE water for testing.

WATER TESTING SHALL BE AVOIDED DURING FREEZING CONDITIONS. (See options 3 and 4 below.)

2. Hydrostatic testing of the Vanex plumbing system is to be conducted according to local code requirements. Test pressure shall be not less than 100 psi nor greater than 225 psi.

NOTE: Some plumbing fixtures may not withstand test pressures greater than 80 psi. Consult fixture manufacturers instructions for pressure limitations or plug all distribution lines at the fixture end. The system shall, at a minimum, withstand the test pressure, without leaking, for a period of 15 minutes.

WARNING! PRESSURES USED IN TESTING CAN BLOW UNMADE OR INCOMPLETE CONNECTIONS APART WITH TREMENDOUS FORCE!
This force is many times greater when air is used for a test media. To reduce the risk of personal injury, ensure that all connections are completed before testing. Use only the pressure and time required to determine that the system is leak free.

3. Fluid testing the Vanex system at temperatures below freezing (less then 32˚F, 0˚C) may be performed using a solution of water and NON-TOXIC antifreeze such as propylene glycol (typically called RV antifreeze). If such a solution is used, the antifreeze solutions must be sufficiently concentrated to withstand the lowest temperature encountered while the testing fluid is in the system.

Antifreeze solutions should be purged and the system flushed with potable water prior to consumer use.

THE WATER HEATER SHALL BE ISOLATED AND NOT INCLUDED IN THE SYSTEM AIR TEST.

4. Air pressure testing of a Vanex plumbing system is acceptable and preferred to hydrostatic testing in areas where cold weather could freeze the system or where water is not available. Vanguard recommends that the installer pressurize the system with compressed air or another acceptable test medium, such as dry nitrogen, after installing and capping distribution lines. Air testing shall utilize a pressure of not less than 40 psi and not greater than 100 psi. The system shall be tested for a minimum of 15 minutes. During the test, system pressure shall drop no more than 8 psi in the one hour period.

If the pressure in the system declines more than 8 psi during the minimum 15 minute period, re-pressurize the system to the original test pressure, and retest.* If the system pressure declines more than 8 psi again during the test period, test the distribution line test plugs or any other fittings in the system with the approved leak detection solution. (Any connection found to be in question must be replaced or remade and the pressure test repeated.)

If it's determined that the connections are leak free, then the tubing must be inspected for damage. Damaged sections must be cut out and repaired with a coupler or if feasible, the tubing section replaced.

For leak detection, use only a mixture of Original Palmolive Green™ dishwashing soap (#46100-46200) or Palmolive Ultra™ (#356140 or 46128) mixed with potable water at a ratio of 2 ounces of soap to one gallon of water (mix Ultra at a ratio of 1.5 ounces per gallon.)

*During the initial test pressurization period, the system pressure indicated on the gauge

may decrease due to the initial deformation of the pipe, followed by slow expansion. The pressure drop is dependent on ambient temperature, system capacity, and test pressure but shall not be more than 8 psi in an hour.

Test shall be conducted when significant changes to temperature *AREN'T* expected. Please note significant changes in ambient temperature also can affect system pressure.

WATER (NOT ANTIFREEZE SOLUTION) MUST BE PURGED OR DRAINED FROM THE SYSTEM IF TEMPERATURES ARE EXPECTED TO FALL BELOW FREEZING (32˚F, 0˚C). Low pressure compressed air can be used for purging.

FOLLOW ANTIFREEZE MANUFACTURERS INSTRUCTIONS FOR CONCENTRATIONS. USE ONLY NON-TOXIC ANTIFREEZE APPROVED FOR USE IN DRINKING WATER SYSTEMS.

SYSTEM DISINFECTION

Local codes may require system disinfection. When no other method is available, follow the time limitations and exposure levels shown below:

1. Use a chlorine solution and one of the exposure durations listed below:

CONCENTRATION	PERIOD	AUTHORITY
200 PPM	3 HOURS	AWWA
50 PPM	24 HOURS	AWWA

2. Mix the disinfection solution thoroughly before adding it to the system.

3. The chlorine solution must reach all parts of the system. Open all fixtures (both sides) and flow water until a chlorine smell is present. As an alternative, chlorine test tablets can be used to detect chlorine at each fixture.

4. The chlorine source for the solution can be, but is not limited to, the following:

CHLORINE SOURCE	% ACTIVE CHLORINE	FORM	AMOUNT PER 100 GAL WATER FOR A 100 PPM SOLUTION
Laundry bleach	5.25	Liquid	1 1/2 pints (24 oz.)

5. After the solution has been in the system for the time required by the Authority Having Jurisdiction or the exposure durations listed in step 1 above, the system shall be flushed completely with potable water.

6. The system must be purged or drained of all water or protected from freezing.

FAILURE TO FLUSH THE SYSTEM NOTICE!
To prevent reduced service life of system components, disinfection solutions shall not be allowed to stand in the system longer than 24 hours. Thoroughly flush the system with potable water after disinfection.

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GRUNDFOS **INSTRUCTIONS**
Installation and Operation

COMFORT PUMP

BE > THINK > INNOVATE >

GRUNDFOS

Maximum recommended System Head = 4.9 feet
The circulator may not be used to pump flammable or corrosive liquids.
GRUNDFOS

The base packing material is designed to be re-used to insulate the pump housing.

C°						
t_1	2	20	40	65	80	95
t_2	0	20	40	40	40	40

F°						
t_1	36	68	105	150	175	204
t_2	32	68	105	105	105	105

The liquid temperature must always be greater than the ambient temperature to avoid condensation. The table shows the maximum allowed ambient temperature for a given liquid temperature. The maximum allowable fluid temperature is 204 deg F.

CAUTION: During operation the pump may be too hot to touch.

It is preferred that the circulator always remains in a horizontal position. It is acceptable for the circulator to be mounted under the piping in a vertical position. The circulator cannot be mounted over the piping in a vertical position.

It is also preferred that the power cord be located under the circulator.

If it is necessary to rotate the circulator head to relocate the power cord under the circulator, please follow the steps below.

1. Isolate the circulator from the system water pressure by closing the valves on either side of the circulator. If the circulator cannot be isolated, it will be necessary to turn off the main water supply.

2. CAUTION: If operated recently the circulator body may be hot. Check before touching.

3. CAUTION: If the water supply is not turned off or the circulator is not isolated from the system, water damage may occur when proceeding with the next step.

4. Loosen the brass ring holding the circulator head to the pump housing. Be careful a small amount of hot water may still leak from the connection.

5. Rotate the circulator head until the power cord is directly below it.

6. Re-tighten the brass ring.

7. Turn the water back on or open the valves on either side of the circulator.

When the circulator is operating properly it is almost noiseless.

An integrated power indicator (green LED) identifies when power is supplied to the circulator.

The circulator is on when the green LED is illuminated.

If the circulator is noisy there may be air trapped in the system.

To purge the air from the circulator turn the circulator off and on five times.

To purge the air from the system open a faucet until all the air in the line has escaped.

The circulator should now run quietly.

The timer is a 24-hour AM/PM timer with 20-minute interval. For ease of programming the timer head can be swiveled stop to stop almost 360 degrees.

To program the timer:

1. Using a small flatblade screwdriver remove the clear plastic cover from the timer.

2. The time of day is set by turning the programming ring in the direction of the arrow (clockwise) until the correct time is aligned to the arrowhead beneath the clock symbol.

3. Set the required "ON/OFF" times on the programming ring by pushing the programming tabs either away from or toward the center of the ring. Each tab represents a 20-minute time interval. Tabs pushed toward the center turn the circulator OFF and tabs pushed away from the center turn the circulator ON.

4. The timer function may be controlled using the OFF - TIMER - ON switch. Setting the switch to OFF switches the circulator off but does not affect the timer clock operation. The green LED will be off. Setting the switch to TIMER allows the circulator to Start/Stop according to the programming tabs. The green LED will be on or off according to the position of the programming tabs. Setting the switch to ON provides continuous circulator operation. The green LED is on.

5. In case of power outage the timer will not keep time. After power is restored the correct time of day must be reset.

6. After setting the timer re-install the clear plastic cover.

1
2
3
4
ON
OFF
5
ON
6
OFF

The aquastat is an integrated adjustable thermostat controlled by the temperature dial. The aquastat allows the circulator to automatically turn off (the green LED is off) when the water temperature passing through the circulator housing reaches the dial setting selected between 95 deg F and 150 deg F. The circulator will automatically turn back on (the green LED is on) when the water temperature cools down 12 deg F.

Setting the aquastat:

1. The factory preset dial position is 95 deg F.

2. To increase the temperature setting turn the dial clockwise.

3. Turning the dial fully clockwise to the stop defeats the aquastat function and the circulator will not shut off by water temperature. It is recommended that this setting only be used to sanitize/flush the hot water line.

Note: 140 deg F water is the maximum recommended fluid temperature to prevent calcium precipitation in the system.

WARNING: 120 deg F water is the maximum recommended fluid temperature to prevent scalding.

1
2
3
35°C
95°F
65°C
150°F
4
65°C
150°F
35°C
95°F
5
65°C
150°F
35°C
95°F
6
65°C
150°F
35°C
95°F

When the timer and thermostatic controls are used together, the circulator operates **ONLY** at the programmed timer settings **AND ONLY** when the temperature conditions of the aquastat have not been met.

Examples:

With the timer programming tabs in the off position the circulator is off (green LED is off) regardless of the system temperature and aquastat function.

With the timer programming tabs in the on position AND the water temperature at the selected dial setting the circulator is off (green LED is off). With the timer programming tabs in the on position AND the water temperature below the selected dial setting the circulator is on (green LED is on).

PUMP ON
PUMP ON
PUMP ON

In the unlikely event that instant hot water is not available, the circulator impeller may be blocked by calcium/sediment deposits. Follow these steps to clean the impeller:

1. Isolate the circulator from the system water pressure by closing the valves on either side of the circulator. If the circulator cannot be isolated, it will be necessary to turn off the main water supply.

2. Turn off the power supply.

3. Loosen the brass ring holding the circulator head to the pump housing. Be careful a small amount of hot water may still leak from the connection

4. Remove the circulator body from the pump housing.

5. Remove the impeller assembly from the circulator body by pulling gently upward.

6. Clean the impeller assembly using water and a brush.

7. Remove calcium/sediment deposits from the impeller passages.

8. Re-assemble the circulator by reversing steps 1-5 above.

Sound pressure level
The sound pressure level of the pump is lower than 43 dB(A).

Limited Warranty

Products manufactured by GRUNDFOS PUMPS CORPORATION (GRUNDFOS) are warranted to the original user only to be free of defects in material and workmanship for a period of 24 months from date of installation, but not more than 30 months from date of manufacture. GRUNDFOS' liability under this warranty shall be limited to repairing or replacing at GRUNDFOS' option, without charge, F.O.B. GRUNDFOS' factory or authorized service station, any product of GRUNDFOS manufacture. GRUNDFOS will not be liable for any costs of removal, installation, transportation, or any other charges which may arise in connection with a warranty claim. Products which are sold but not manufactured by GRUNDFOS are subject to the warranty provided by the manufacturer of said products and not by GRUNDFOS' warranty. GRUNDFOS will not be liable for damage or wear to products caused by abnormal operating conditions, accident, abuse, misuse, unauthorized alteration or repair, or if the product was not installed in accordance with GRUNDFOS' printed installation and operation instructions.

To obtain service under this warranty, the defective product must be returned to the distributor or dealer of GRUNDFOS products from which it was purchased together with proof of purchase and installation date, failure date, and supporting installation data. Unless otherwise provided, the distributor or dealer will contact the GRUNDFOS factory or authorized service station for instructions. Any defective product to be returned to the factory or service station must be sent freight prepaid; documentation supporting the warranty claim and/or a Return Authorization must be included if so instructed.

GRUNDFOS WILL NOT BE LIABLE FOR ANY INCIDENTAL OR CONSEQUENTIAL DAMAGES, LOSSES, OR EXPENSES ARISING FROM INSTALLATION, USE, OR ANY OTHER CAUSES. THERE ARE NO EXPRESS OR IMPLIED WARRANTIES, INCLUDING MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE, WHICH EXTEND BEYOND THOSE WARRANTIES DESCRIBED OR REFERRED TO ABOVE.

Some jurisdictions do not allow the exclusion or limitation of incidental or consequential damages and some jurisdictions do not allow limitations on how long implied warranties may last. Therefore, the above limitations or exclusions may not apply to you. This warranty gives you specific legal rights and you may also have other rights which vary from jurisdiction to jurisdiction.

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