UTSOLAR D

BLOOMhouse

Univeristy of Texas at Austin

Construction Documents Submittal
August 7th, 2007

PROJECT SPECIFICATIONS MANUAL

TABLE OF CONTENTS

TABLE OF CONTENTS

TABLE OF CONTENTS

SUMMARY OF CHANGES (Since March 6th)

Overview / Comments :

1. Duradeck is used as an exterior decking material only. Page 76 specifies a Duradeck as a“flame retardent product”
2. Spacing in the Duradeck is 3/8”, ramps and stairs will be altered to provide a solid surface
3. Fagor oven, cooktop, and dishwasher were replaced by Kuppersbusch products, found starting on page 113
4. Addition of information for CB26 Heat Exchanger for use in Dutchtub Heat Loop

Calculations:
Loads (wind, bearing, overturning), Deck, PV panels

UT SOLAR DECATHLON

DETERMINE DESIGN LOADS

GRAVITY LOADS: (PER IBC 2006, CHAPTER 16)

- FLOORS -

DEAD -

SIP'S -	5 PSF
STEEL FRAMING -	5 PSF
FINISH FLOORING -	
1" PLYWOOD	3 PSF
3/4" MESQUITE	3 PSF
	16 PSF

SAY DL = 20 PSF, USE 0.8D FOR UPLIFT CALCULATIONS

LIVE -

LL = 50 PSF

- ROOFS -

DEAD -

SIPS -	5 PSF
ROOFING -	
3-PLY READY ROOFING	1 PSF
CEILING -	4 PSF
PV'S -	4 PSF
	14 PSF

SAY DL = 15 PSF, USE 0.9D FOR UPLIFT CALCULATIONS

LIVE -

LL = 20 PSF

WIND LOADS: (PER ASCE 7-05, CHAPTER 6) TREAT AS FLAT ROOF STRUCTURE WITH FREE ROOF (PV ARRAY) ABOVE

- BASIC WIND SPEED; V = 90 MPH (3-SECOND GUST)
- WIND DIRECTIONALITY FACTOR; K_d = 0.85 [TABLE 6-4]
- EXPOSURE CATEGORY; ASSUME 'C', AS FINAL SITE GROUND SURFACE ROUGHNESS IS UNKNOWN.
- VELOCITY PRESSURE EXPOSURE COEFFICIENT FOR h = 0-15 FT.; K_h & K_z = 0.85
- TOPOGRAPHIC FACTOR: K_{zt} = 1.0, ASSUMES NO HILL OR ESCARPMENT
- GUST EFFECT FACTOR:

TEST FLEXIBLE STRUCTURE -

FOR STEEL MOMENT-RESISTING FRAMES, $n_1 = \frac{22.2}{H^{0.8}}$ [EQ. C6-14, COMMENTARY]

H = 15 FT. MAX

$n_1 = 2.5\ H_z$

$n_1 > 1\ H_z$, ∴ BUILDING IS CLASSIFIED AS RIGID

G = 0.85

- IMPORTANCE FACTOR: I_w = 1.0

2

WIND LOADS, CONT'D.

- ENCLOSURE CLASSIFICATION:

TEST PARTIALLY ENCLOSED –

NORTH ELEVATION ① – $A_{o①} = 24\,FT^2 + 24\,FT^2 + 9\,FT^2 + 7\,FT^2 + 45\,FT^2 = 109\,FT^2$

EAST ELEVATION ② – $A_{o②} = 24\,FT^2 \times 4 = 96\,FT^2$

SOUTH ELEVATION ③ – $A_{o③} = 16\,FT^2 + 46\,FT^2 + 24\,FT^2 + 45\,FT^2 = 131\,FT^2$

WEST ELEVATION ④ – $A_{o④} = \phi\,FT^2$

WIND DIRECTION | N–S:

$A_o = 109\,FT^2 \quad A_{oi} = 96\,FT^2 + 131\,FT^2 + 0 = 227\,FT^2$

$\frac{A_o}{A_{oi}} = \frac{109}{227} = 0.48 < 1.1 \quad \therefore$ NOT PARTIALLY ENCLOSED

WIND DIRECTION E–W

$A_o = 96\,FT^2 \quad A_{oi} = 109\,FT^2 + 131\,FT^2 + 0 = 240\,FT^2$

$\frac{A_o}{A_{oi}} = \frac{96}{240} = 0.40 < 1.1 \quad \therefore$ NOT PARTIALLY ENCLOSED

WIND DIRECTION S–N

$A_o = 131\,FT^2 \quad A_{oi} = 109\,FT^2 + 96\,FT^2 + 0 = 205\,FT^2$

$\frac{A_o}{A_{oi}} = \frac{131}{205} = 0.64 < 1.1 \quad \therefore$ NOT PARTIALLY ENCLOSED

WIND DIRECTION W–E

$A_o = 0 \quad \therefore \frac{A_o}{A_{oi}} = 0 < 1.1$, NOT PARTIALLY ENCLOSED

BUILDING IS ENCLOSED FOR ALL WIND DIRECTIONS

- INTERNAL PRESSURE COEFFICIENT: $GC_{pi} = \pm 0.18$ [FIGURE 6-5]

- EXTERNAL PRESSURE COEFFICIENTS

MAIN WIND FORCE RESISTING SYSTEM (MWFRS)

WIND DIRECTION N-S/S-N $\left(L/B = \frac{50'}{137'} \approx 1\right)\left(\frac{h}{L} = \frac{12}{50} \approx 0.25\right)$

WINDWARD WALL – $C_p = 0.8$
LEEWARD WALL – $C_p = -0.2$
SIDE WALLS – $C_p = -0.7$

ROOF – $C_p = -0.9$ TO 12' FROM WW EDGE
$C_p = -0.5$ TO 25' FROM WW EDGE
$C_p = -0.3$ REMAINDER

WIND DIRECTION E-W/W-E $\left(L/B = \frac{12}{50} \approx 0.25\right)\left(\frac{h}{L} = \frac{12}{12} \approx 1.0\right)$

WINDWARD WALL – $C_p = 0.8$
LEEWARD WALL – $C_p = -0.5$
SIDE WALLS – $C_p = -0.7$

ROOF – $C_p = -1.3$ TO 6' FROM WW EDGE
$C_p = -0.7$ REMAINDER

3

WIND LOADS, CONT'D.

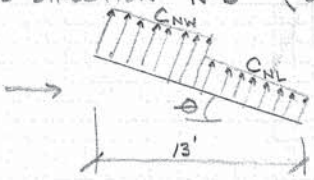
• EXTERNAL PRESSURE COEFFICIENTS, CONT'D. CONSIDER PARAPETS

GCP_n = +1.5 FOR WINDWARD PARAPET

= −1.0 FOR LEEWARD PARAPET

FREE ROOF: (ASSUME OBSTRUCTED WIND FLOW DUE TO PROXIMITY OF BLDG. BELOW

WIND DIRECTION N-S (θ = 18°)

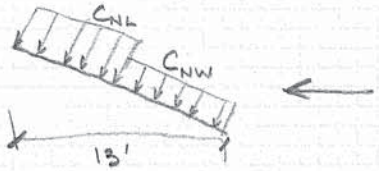


C_{NW} = −2.2
C_{NL} = −0.8

WIND DIRECTION E-W/W-E

C_N = −1.2 to 12'
−0.9 12' to 24'
−0.6 24' to 50'

WIND DIRECTION S-N



C_{NW} = 1.3
C_{NL} = 0

COMPONENTS AND CLADDING

ZONE	EFFECTIVE AREA	GCp
1	10	−1.4
	20	−1.3
	50	−1.2
	100	−1.1
	200	−1.0
	500	−0.9
2	10	−2.3
	20	−2.2
	50	−2.0
	100	−1.9
	200	−1.8
	500	−1.6
3	10	−3.2
	20	−3.0
	50	−2.8
	100	−2.7
	200	−2.5
	500	−2.3

ZONE	EFFECTIVE AREA	GCp
4	10	+0.9, −0.9
	20	+0.9, −0.9
	50	+0.8, −0.85
	100	+0.76, −0.8
	200	+0.73, −0.75
	500	+0.6, −0.70
5	10	+0.9, −1.8
	20	+0.9, −1.8
	50	+0.8, −1.6
	100	+0.76, −1.9
	200	+0.73, −1.2
	500	+0.6, −1.0

4

WIND LOADS, CONT'D

- EXTERNAL PRESSURE COEFFICIENTS, CONT'D

COMPONENTS & CLADDING PRESSURES FOR PV ARRAY

$A_{EFF} \approx 15\ FT^2$ FOR SINGLE MODULE

$C_N = +2.1, -3.3$ [INTERPOLATION – FIG. 6-19A]

- VELOCITY PRESSURE: $q_z = 0.00256\, K_z K_{zt} K_d V^2 I$ ← DO NOT APPLY FOR SERVICE LOAD COMBINATION FOR DEFLECTION/DRIFT CHECK

$q_z = 0.00256(0.85)(1.0)(0.85)(90)^2(1.0) = 15$ PSF (STRENGTH DESIGN)

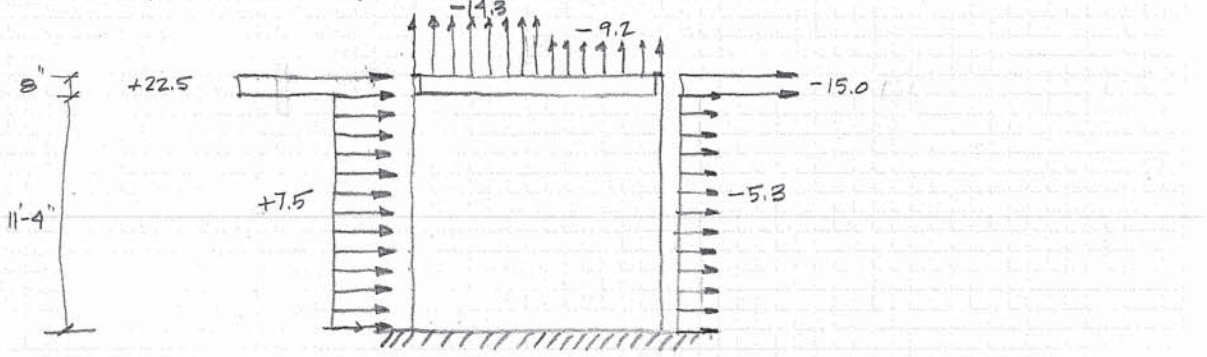
$q_z' = 0.00256(0.85)(1.0)(90)^2(1.0) = 18$ PSF (SERVICEABILITY CHECK)

MWFRS PRESSURES FOR WIND NORMAL TO 50' (TRANSVERSE)

$p = q_h[(GC_p) - (GC_{pi})]$

	C_p	GC_p	$+GC_{pi}$	$-GC_{pi}$	POS. INTERNAL $q_h[(GC_p)-(+GC_{pi})]$	NEG. INTERNAL $q_h[(GC_p)-(-GC_{pi})]$
WINDWARD WALL	0.8	+0.68	+0.18	-0.18	+7.5 PSF	+12.9 PSF
LEEWARD WALL	-0.2	-0.17	+0.18	-0.18	-5.3 PSF	+0.1 PSF
SIDE WALLS	-0.7	-0.60	+0.18	-0.18	-11.7 PSF	-6.3 PSF
ROOF 0 TO 12.5'	-0.9	-0.77	+0.18	-0.18	-14.3 PSF	-8.9 PSF
ROOF 12.5 TO 25'	-0.5	-0.43	+0.18	-0.18	-9.2 PSF	-3.8 PSF
ROOF 25' TO 50'	-0.3	-0.26	+0.18	-0.18	-7.2 PSF	-1.8 PSF
WINDWARD PARAPET		+1.5	0	0	+22.5 PSF	+22.5 PSF
LEEWARD PARAPET		-1.0	0	0	-15.0 PSF	-15.0 PSF

WLY SUMMARY (POS. INTERNAL PRESS. CONTROLS



BASE SHEAR = $(11.3\ FT)(50\ FT)(7.5-(-5.3)) + (0.67\ FT)(50\ FT)(22.5-(-15))$

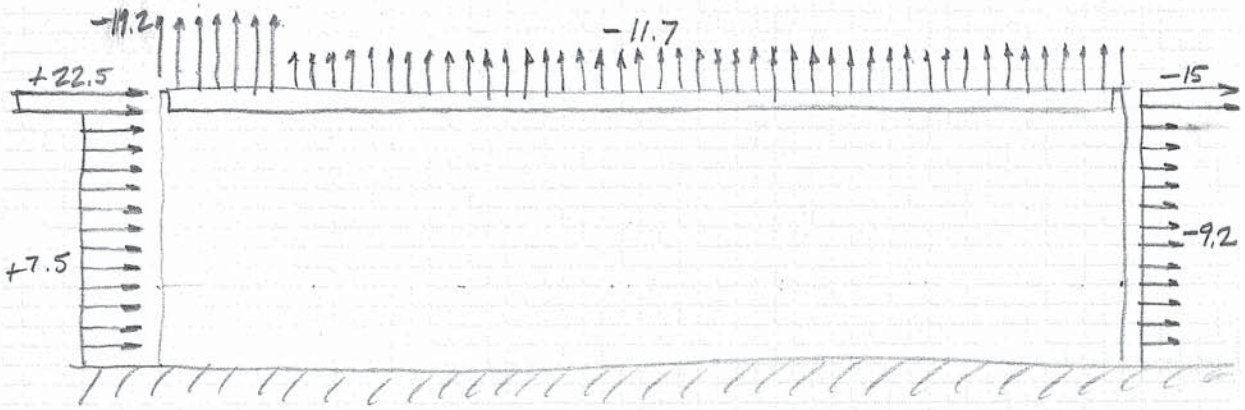
BASE SHEAR = 8.5 K

5

WIND LOADS, CONT'D

MWFRS PRESSURES FOR WIND NORMAL TO 13' (LONGITUDINAL)

	C_p	GC_p	$+GC_{pi}$	$-GC_{pi}$	$q_h[(GC_p)-(+GC_{pi})]$ POS. INT. PRESS	$q_h[(GC_p)-(-GC_{pi})]$ NEG. INT. PRESS
WINDWARD WALL	0.8	+0.68	+0.18	-0.18	+7.5 PSF	+12.9 PSF
LEEWARD WALL	-0.5	-0.93	+0.18	-0.18	-9.2 PSF	-3.8 PSF
SIDE WALLS	-0.7	-0.60	+0.18	-0.18	-11.7 PSF	-6.3 PSF
ROOF 0 TO 6.5'	-1.3	-1.1	+0.18	-0.18	-19.2 PSF	-13.8 PSF
ROOF 6.5" TO 50'	-0.7	-0.60	+0.18	-0.18	-11.7 PSF	-6.3 PSF
WINDWARD PARAPET	—	+1.5	0	0	+22.5 PSF	+22.5 PSF
LEEWARD PARAPET	—	-1.0	0	0	-15.0 PSF	-15.0 PSF



BASE SHEAR = (11.3)(13)(7.5-(-9.2)) + (0.67)(13)(22.5-(-15))

BASE SHEAR = 2.8 K

COMPONENTS & CLADDING PRESSURES

+10 PSF MIN. q_h = 15 PSF

ZONE	AEFF	$+GC_p$	$-GC_p$	$+GC_{pi}$	$-GC_{pi}$	$q_h[GC_p-(-GC_{pi})]$	$q_h[GC_p-(GC_{pi})]$
1	10		-1.4	+0.18	-0.18	+10 PSF	-28.7 PSF
	20		-1.3			+10 PSF	-27.2 PSF
	50		-1.2			+10 PSF	-20.7 PSF
	100		-1.1			+10 PSF	-19.2 PSF
	200		-1.0			+10 PSF	-17.7 PSF
	500		-0.9			+10 PSF	-16.2 PSF
2	10		-2.3	+0.18	-0.18	+10 PSF	-37.2 PSF
	20		-2.2			+10 PSF	-35.7 PSF
	50		-2.0			+10 PSF	-32.7 PSF
	100		-1.9			+10 PSF	-31.2 PSF
	200		-1.8			+10 PSF	-29.7 PSF
	500		-1.6			+10 PSF	-26.7 PSF
3	10		-3.2	+0.18	-0.18	+10 PSF	-50.7 PSF
	20		-3.0			+10 PSF	-47.7 PSF
	50		-2.8			+10 PSF	-44.7 PSF
	100		-2.7			+10 PSF	-43.2 PSF
	200		-2.5			+10 PSF	-40.2 PSF
	500		-2.3			+10 PSF	-37.2 PSF

6

WIND LOADS, CONT'D:

COMPONENTS & CLADDING, CONT'D

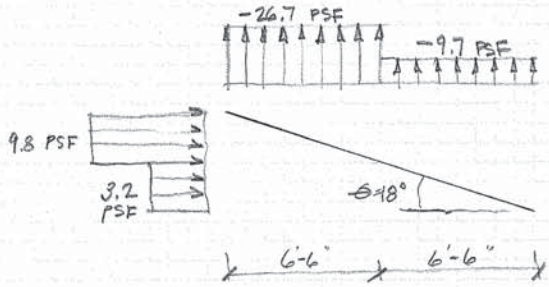
ZONE	A_{EFF}	$+GC_p$	$-GC_p$	$+GC_{pi}$	$-GC_{pi}$	$q_h[+GC_p-(-GC_{pi})]$	$q_h[-GC_p-(GC_{pi})]$
4	10	+0.9	-0.9	+0.18	-0.18	+16.2 PSF	-16.2 PSF
	20	+0.9	-0.9			+16.2 PSF	-16.2 PSF
	50	+0.8	-0.85			+14.7 PSF	-15.5 PSF
	100	+0.76	-0.8			+14.1 PSF	-14.7 PSF
	200	+0.73	-0.75			+13.7 PSF	-14.0 PSF
	500	+0.6	-0.70			+11.7 PSF	-13.2 PSF
5	10	+0.9	-1.8	+0.18	-0.18	+16.2 PSF	-29.7 PSF
	20	+0.9	-1.8			+16.2 PSF	-29.7 PSF
	50	+0.8	-1.6			+14.7 PSF	-26.7 PSF
	100	+0.76	-1.4			+14.1 PSF	-23.7 PSF
	200	+0.73	-1.2			+13.7 PSF	-20.7 PSF
	500	+0.6	-1.0			+11.7 PSF	-17.7 PSF

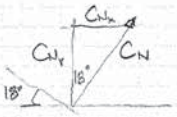
P-V ARRAY

MWFRS DESIGN PRESSURES FOR FREE ROOF $P_x = q_h G C_N \sin 18°$ $G = 0.85$

$P_y = q_h G C_N \cos 18°$

WIND DIRECTION N-S $C_{NW} = -2.2$ $C_{NL} = -0.8$



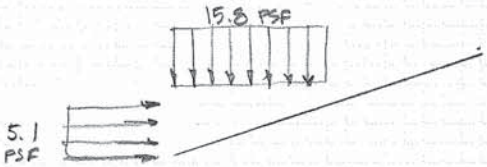


$C_{N_y} = C_N \cos 18°$

$C_{N_x} = C_N \sin 18°$

WIND DIRECTION S-N $C_{NW} = 1.3$ $C_{NL} = 0$

$(15)(0.85)(1.3)(\cos 18°) = 15.8$



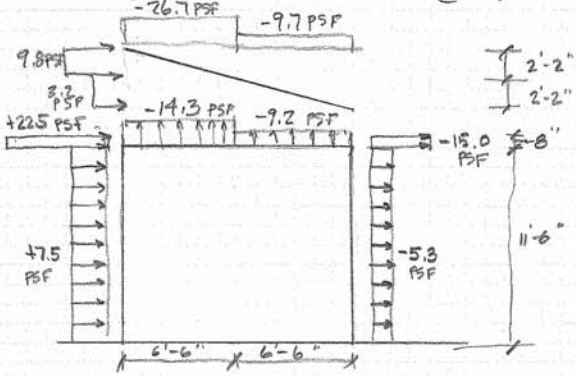
WIND DIRECTION E-W, W-E $C_N = -1.2, -0.9, -0.6$

7

WIND LOADS, CONT'D.

MWFRS DESIGN LOADS SUMMARY

WIND DIRECTION N-S (WLY)



$(7.5\ PSF)(\frac{11.5\ FT}{2}) = 43.1\ PLF$

$(22.5\ PSF)(\frac{8}{12}\ FT) + (7.5\ PSF)(11.5) = 58.1\ PLF$

$(5.3\ PSF)(\frac{11.5}{2}) = 30.5\ PLF$

$(15.0\ PSF)(\frac{8}{12}\ FT) + (5.375F)(11.5/2) = 40.5\ PLF$

$\frac{(9.8\ PSF)(2.167\ FT) + (3.2)(2.167\ FT)}{2} = 14.1\ PLF$

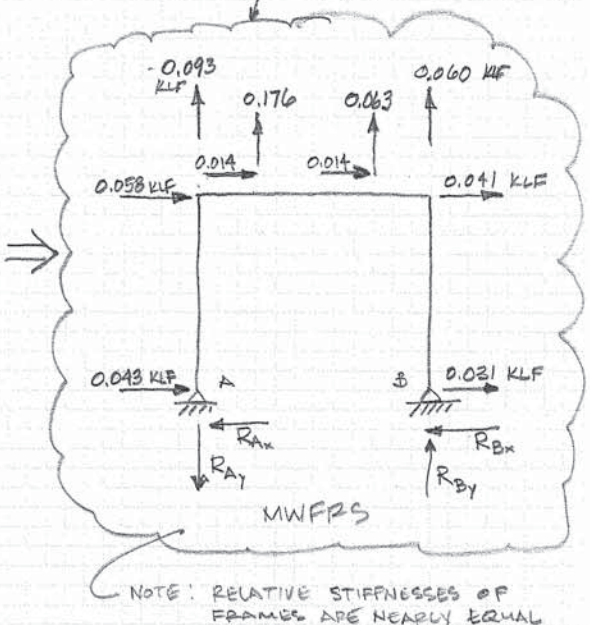
$(14.3\ PSF)(6.5\ FT) = 93.0\ PLF$

$(26.7\ PSF)(6.5\ FT) = 173.6\ PLF$

$(-9.2\ PSF)(6.5\ FT) = 59.8\ PLF$

$(9.7\ PSF)(6.5\ FT) = 63.1\ PLF$

INPUT LOADS FOR STRUCTURAL ANALYSIS, TYP.



NOTE: RELATIVE STIFFNESSES OF FRAMES ARE NEARLY EQUAL AND FRAMES ARE APPROXIMATELY UNIFORMLY DISTRIBUTED,

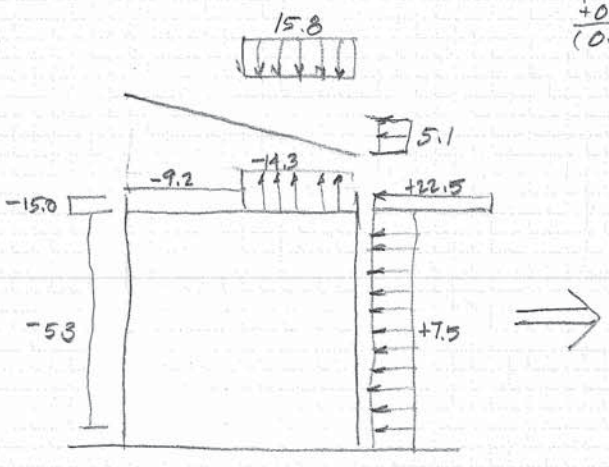
∴ DIVIDE EACH BY 8x50' FOR FRAME LOADS FOR TRANSVERSE LOAD CASE

BASE SHEAR:

0.043
+0.031
+0.058
+0.091
+0.014
+0.014

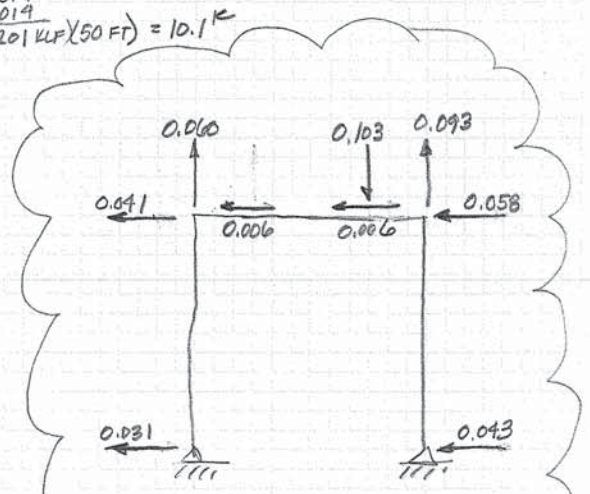
$(0.201\ KLF)(50\ FT) = 10.1^{K}$

WIND DIRECTION S-N



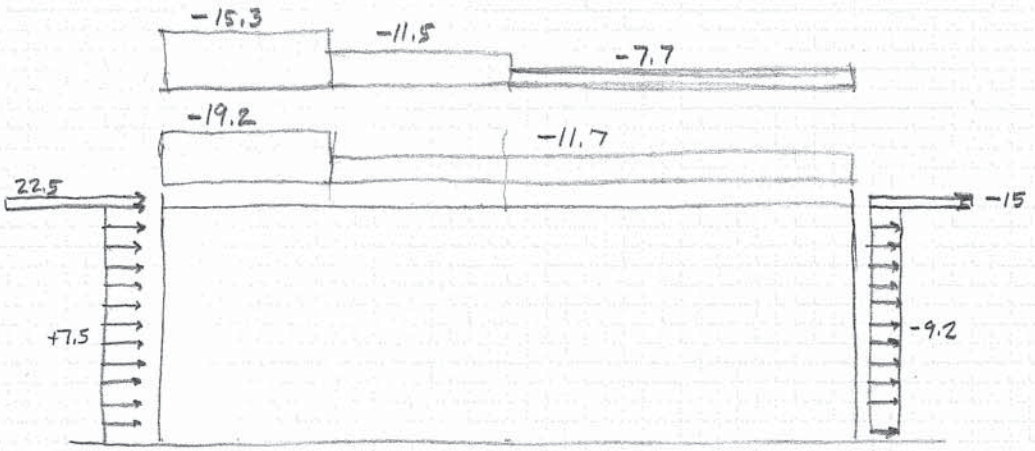
$\frac{(5.1\ PSF)(2.167\ FT)}{2} = 5.5\ PSF$

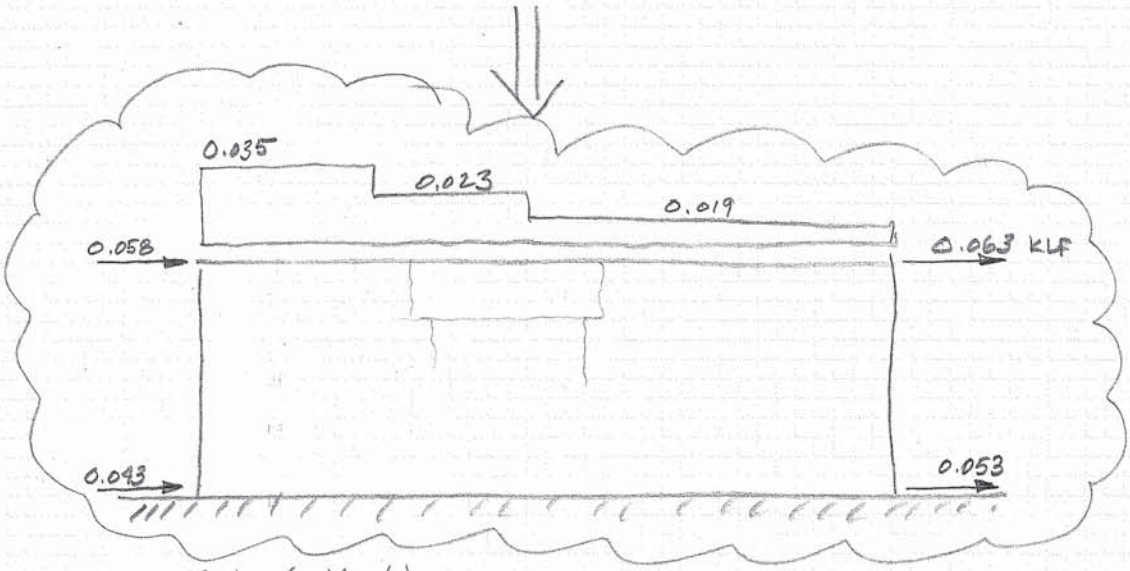
$(15.8\ PSF)(6.5\ FT) = 102.7\ PSF$



8

WIND LOADS, CONT'D WIND DIRECTION E-W / W-E





$(22.5)(8/12) + (7.5)(11.5/2) = 58.1$ PLF
$(7.5)(11.5/2) = 40.5$ PLF
$(15)(8/12) + (9.2)(11.5/2) = 62.9$ PLF
$(9.2)(11.5/2) = 52.9$ PLF
$15.3 + 19.2 = 34.5$ PLF
$11.5 + 11.7 = 23.2$ PLF
$11.5 + 7.7 = 19.2$ PLF

SOIL BEARING | SOLAR D | SAM COVEY

BEARING

GRAVITY

LIVE LOAD = 45.5 k
DEAD LOAD = 24.5 k

TOTAL = 70 k

ALLOWABLE SOIL BEARING = 1500 psf

BEARING AREA REQ = 70 k / 1.5 ksf
= 46.7 ft²

BA ACT = 12 PADS @ 4 ft²
= 48 ft²

WIND

R_B = 40 kips
↳ FROM OVERTURN MOMENT CALC NEEDS TO BE REDUCED B/C CALCULATED W/ FACTORS

R_B = .85 (40k) = 34 k

TOTAL = 2 (R_B) = 68 k

GRAVITY = 70k > WIND = 68k

GRAVITY CONTROLS

12 PADS @ 4 ft² ✓

3-0235 — 50 SHEETS — 5 SQUARES
3-0236 — 100 SHEETS — 5 SQUARES
3-0237 — 200 SHEETS — 5 SQUARES
3-0137 — 200 SHEETS — FILLER
COMET

1/15/7 SAM COVEY

WIND CALCS

WITH EXPOSURE C

MWFRS

1) SPEED $V = 90$
DIRECTION $K_D = .85$

2) IMPORTANT $I = 1$

3) EXPOSURE C: FLAT
CASE 2
for 0 - 15ft $\Rightarrow$ K_H & $K_z = .87$

4) TOP $K_{ZT} = 1$

5) GUST $G_f = .85$

6) ENCLOSED

7) INTERNAL PRESSURE $G C_{pi} = \pm .18$

8) EXTERNAL PRESSURE
WALLS: WIND: $C_p = .8$
LEE: $C_p = -.5$

ROOF: WIND: $C_p = -.5$
LEE: $C_p = -.6$

9) VELOCITY PRESSURE

$q_z = .00256 K_z K_{ZT} K_D V^2 I$

$= .00256(.87)(1)(.85)(90^2)(1)$

$= 15.33 \text{ lb}/\text{ft}^2$

10) DESIGN LOADS

ROOF: WW: $p = q_z G C_p = 15.33(.85)(.5) = 6.5$ psf
LW: $p = 15.33(.85)(.6) = 7.8$ psf

FORCE: $A \cdot \Sigma p = 500\text{ft}^2(6.5 + 7.8\text{psf}) = 7150$ lbs

WALL WW: $p(15.33)(.85)(.8) = 10.42$ psf
FORCE $= 750\text{ft}^2(10.42\text{psf}) = 7815$ lbs
LW: $p = (15.33)(.85)(.5) = 6.5$ psf
FORCE $= 500\text{ft}^2(6.5\text{psf}) = 3250$ lbs

TOTAL $= 7.1 + 7.8 + 3.2$
$= 18.1$ Kips

1/15/7 SAM COVEY

WIND CALCS

C&C WALL

See MWFRS

5) EXPOSURE C

@ 0-15ft K_H & K_Z = .87

7) INTERNAL PRESSURE

GC_{pi} = ± .18

8) EXTERNAL PRESSURE

WALL: POSITIVE : .9

NEG : -1.8

ROOF: AT CORNER : -3.2

9) VELOCITY PRESSURE

q_z = 15.33 lb/ft²

10) DESIGN LOAD

WIND: $p = q_z GC_p - q_h GC_{pi}$

$= 15.33(.9) - (15.33)(.18)$

$= 16.55$ lb/ft²

LEEWARD: $p = 15.33(1.8) + (15.33)(.18)$

$= 30.35$ lb/ft²

DESIGN FOR 30 lb/ft²

C&C ROOF

8) EXTERNAL PRESSURE

MONOSLOPE $10° < \phi < 30°$

AT CORNER: POS: .4 NEG: -2.9

10) DESIGN LOAD

LEEWARD: $p = 15.33(2.9) + 15.33(.18)$

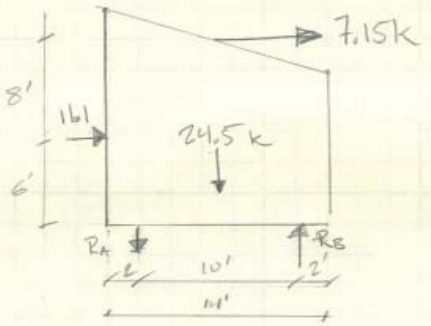
$= 47.2$ lb/ft²

DESIGN FOR 47.2 lb/ft²

OVERTURN | SOLAR D | Sam Covey

OVERTURNING

LOADS
DEAD - 24.5 k
WIND WALL - 11.1 k
WIND ROOF - 7.15 k



$$\Sigma M_B{}^{+}\circlearrowleft = R_A(10') + 24.5k(5')(.9)_{\phi} - 11.1k(6')(1.6)_{\phi} - 7.15k(14')(1.6)_{\phi}$$

$R_A = 15.6$ k

$$\Sigma F_y{}^{+}\uparrow = R_B - R_A - 24.5k$$

$R_B = 40.1$ k

UPLIFT

R_A UPLIFT = 15.6 k

TIE DOWN = 2.5 k

NEED 6 TIE DOWNS TO SATISFY UPLIFT REQ.

SOIL BEARING | SOLAR D | SAM COVEY

BEARING

GRAVITY

LIVE LOAD = 45.5 k
DEAD LOAD = 24.5 k

TOTAL = 70 k

ALLOWABLE SOIL BEARING = 1500 psf

BEARING AREA REQ = 70 k / 1.5 ksf
= 46.7 ft²

BA ACT = 12 PADS @ 4 ft²
= 48 ft²

WIND

R_B = 40 kips
↳ FROM OVERTURN MOMENT CALC NEEDS TO BE REDUCED B/C CALCULATED W/ FACTORS

R_B = .85 (40k) = 34 k

TOTAL = 2 (R_B) = 68 k

GRAVITY = 70k > WIND = 68k

GRAVITY CONTROLS

12 PADS @ 4 ft² ✓

3-0235 — 50 SHEETS — 5 SQUARES
3-0236 — 100 SHEETS — 5 SQUARES
3-0237 — 200 SHEETS — 5 SQUARES
3-0137 — 200 SHEETS — FILLER
COMET

DECK	SOLAR D	SAM COVEY	1/7

COMET 3-0235 — 50 SHEETS — 5 SQUARES
3-0236 — 100 SHEETS — 5 SQUARES
3-0237 — 200 SHEETS — 5 SQUARES
3-0137 — 200 SHEETS — FILLER

LOADS

LIVE - 50 psf
DEAD - 10 psf

TUB = 200 gallons | 0.1337 ft³ / 1 gal | 62.4 lbs / 1 ft³ ≈ 1800 lbs

AREA - 5' x 5' = 25ft²

DL TUB = 65 lb/ft²

DECKING

MS T-1215 McNICHOLS WIDE T GRATING
SEE SPAN CHART

ASSUME 3' SPAN @ TUB
LOAD = 160 lb/ft² = U

ΔU @200 lb/ft² @ 3' SPAN = .088

$\Delta = \frac{3'(12)}{240} = .015$ ✓

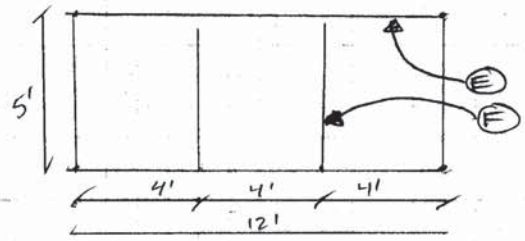
ASSUME 4' SPAN @ EVERYWHERE
LOAD = 60 lb/ft²

ΔU @ 100 lb/ft @ 48" SPAN = .131

$\Delta = \frac{4(12)}{240} = .2$ ✓

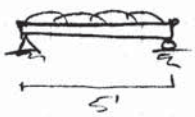
DECK | SOLAR D | SAM COVEY | 2/7

LAYOUT @ PANEL 1, 2, 3, & 4



ϕ_W = 92 psf

MEMBER F



TRIBUTE = 4'
ϕ_W = 92 psf → LOAD = 368 plf

$$M_{MAX} = \frac{368\ plf\ (5')^2}{8} = 1150\ lb\text{-}ft = 13.8\ k\text{-}in$$

$$S_x = \frac{13.8\ k\text{-}in}{36\ ksi} = .38\ in^3$$

TRY L 5x3x 1/4"
↳ S_x = .569 in^3 I = 1.23 Wt = 4.9

$$\Delta = \frac{5}{384}\frac{(240)(4)^4(12)^3}{29{,}10^6(1.23)} = .04$$

$$\Delta = \frac{48}{240} = .2 \checkmark$$

MEMBER E

LOAD = 92 psf @ 2.5' tribute = 230 plf

$$M_{MAX} = \frac{230\ (12')^2}{8} = 4140\ lb\text{-}ft = 49.7\ k\text{-}in$$

$$S_x = \frac{49.7\ k\text{-}in}{36\ ksi} = 1.38$$

USE L 5x3x 5/16
↳ S_x = 1.87 I = 6.58 in^4 Wt = 8.2 lb/ft

$$\Delta = \frac{5}{384}\frac{(60\cdot 2.5)(12)^4(12)^3}{29{,}10^6(6.58)} = .36\ in$$

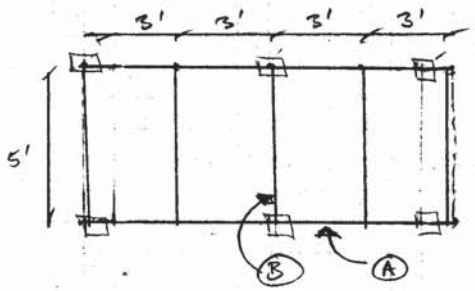
$$\Delta_{ALL} = \frac{12(12)}{240} = .6\ in \checkmark$$

COMET 3-0235 — 50 SHEETS — 5 SQUARES
3-0236 — 100 SHEETS — 5 SQUARES
3-0237 — 200 SHEETS — 5 SQUARES
3-0137 — 200 SHEETS — FILLER

DECK | SAM COVEY | 3/7

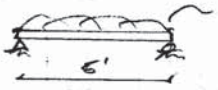
3-0235 — 50 SHEETS — 5 SQUARES
3-0236 — 100 SHEETS — 5 SQUARES
3-0237 — 200 SHEETS — 5 SQUARES
3-0137 — 200 SHEETS — FILLER
COMET

LAYOUT @ TUB – PANEL 5



LOADS
LIVE - 50 psf
DL - 10 psf
TUB - 65 psf

MEMBER B



$\phi w = 1.6(50) + 1.2(75)$
$= 170$ psf

$w = 170$ psf $(3$ ft$) = 510$ plf ← tributo

$M_{MAX} = \frac{wL^2}{8} = \frac{510 \text{ plf } (5')^2}{8} = 1593$ lb-ft
19.1 k-in

$S_x = \frac{M_{MAX}}{f_y} = \frac{19.1 \text{ k-in}}{36 \text{ ksi}} = .53 \text{ in}^3$

TRY L3x3x1/4
→ $S_x = .569 \text{ in}^3$ $I_x = 1.23$ $wt = 4.9$ lb/ft

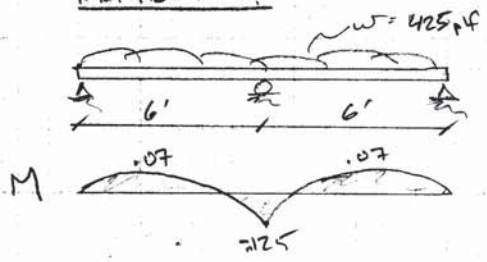
$\Delta = \frac{5}{384} \frac{(375 \text{ plf})(5')^4 (12)^3}{(29 \times 10^6)(1.23 \text{ in}^4)} = .148$ in ← 125 · 3 ft

$\Delta_{ALLOW} = \frac{L}{240} = \frac{5(12)}{240} = .25$ ✓

DECK | | STM COVER | 4/7

LAYOUT @ TUB PANELS

MEMBER A



LOADS
LIVE - 50
DEAD - 70
TUB - 65

ϕw = 170 psf (tributary)

ϕw = 170 (2.5 ft) = 425 plf

$M_{MAX} = .125\ wL^2 = .125\ (425\ plf)(6)^2 =$

$= 1912$ lb-ft

$= 22.9$ k-in

$S_x = \frac{22.9\ k\text{-}in}{36\ ksi} = .64$

USE 5 x 3 x 5/16

↳ $S_x = 1.37$ $I_{xx} = 6.53\ in^3$ $W_t = 8.2$ lb/ft

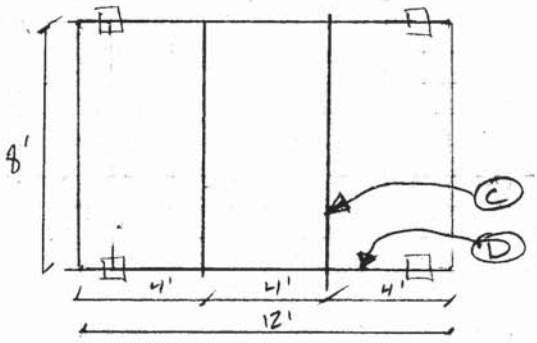
TO MATCH OTHERS

3-0235 — 50 SHEETS — 5 SQUARES
3-0236 — 100 SHEETS — 5 SQUARES
3-0237 — 200 SHEETS — 5 SQUARES
3-0137 — 200 SHEETS — FILLER
COMET

DECK | SAM CONLEY | 5/17

COMET
3-0235 — 50 SHEETS — 5 SQUARES
3-0236 — 100 SHEETS — 5 SQUARES
3-0237 — 200 SHEETS — 5 SQUARES
3-0137 — 200 SHEETS — FILLER

LAYOUT PANEL G

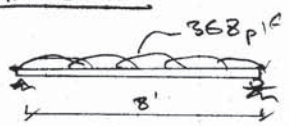


LOAD
LIVE - 50 psf
DEAD - 10 psf

$w = 60$ psf

$\phi w = 1.6(50) + 1.2(10)$
$= 92$ psf

MEMBER C



TRIBUT - 4'
LOAD: 92 psf (4') = 368 plf

$M_{MAX} = \frac{wL^2}{8} = \frac{368\ plf\ (8)^2}{8} = 2944\ lb\text{-}ft$
$35.3\ k\text{-}in$

$S_x = \frac{M}{f_y} = \frac{35.3}{36\ ksi} = .981\ in^3$

TRY $\angle$ 5 x 3 x 5/16
↳ $S_x = 1.37$ $I_{xx} = 6.58$ $W_t = 8.2\ lb/ft$

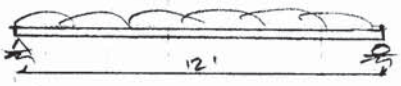
$\Delta_{ACT} = \frac{5}{384} \frac{(60.4)(8')^4 (12)^3}{29,10^6\ (6.58\ in^4)} = .11\ in$

$\Delta_{ALL} = \frac{8(12)}{240} = .4\ in$ ✓

DECK | SAM COVEY | 6/7

LAYOUT @ PANEL 12

MEMBER D



ϕw = 92 psf
TRIBUTE = 3'
LOAD = 92 psf (3') = 276 plf

$$M_{MAX} = \frac{wL^2}{8} = \frac{276\,(12^2)}{8} = 4968 \text{ lb-ft}$$
$$= 59.5 \text{ k-in}$$

$$S_x = \frac{59.5 \text{ k-in}}{36 \text{ ksi}} = 1.65 \text{ in}^3$$

TRY L 5x3x5/16
↳ S_x = 1.87 in³ I_{xx} = 6.581 in⁴ W_L = 8.2 lb/ft

$$\Delta_{ACT} = \frac{5}{384} \frac{(60.4)\,(12)^4\,(12^3)}{29{,}10^6\,(6.58')} = .58 \text{ in}$$

$$\Delta_{ALL} = \frac{12\,(12)}{240} = .6 \text{ in} \quad \checkmark$$

DECK 7/7

COMET 3-0235 — 50 SHEETS — 5 SQUARES
3-0236 — 100 SHEETS — 5 SQUARES
3-0237 — 200 SHEETS — 5 SQUARES
3-0137 — 200 SHEETS — FILLER

SIZING SUMMARY

PANEL 5

(A) - L 3x 3x 1/4 @ 8' O.C. wt = 4.9 lb/ft
(B) - L 5x 3x 5/16 wt = 8.2 lb/ft

PANEL 6

(C) - L 5x 3x 5/16 @ 4' O.C. wt = 8.2 lb/ft
(D) - L 5x 3x 5/16 wt = 8.2 lb/ft

PANEL 1, 2, 3, 4

(F) - L 3x 3x 1/4 @ 4' O.C. wt = 4.9 lb/ft
(E) - L 5x 3x 5/16 wt = 8.2 lb/ft

SOIL BEARING

DECK AREA ≈ 800 ft²

LOAD = 50 psf + 10 psf TUB = 1600 lbs

TOTAL = 800 ft² (60 psf) + 1600
= 49600 lbs

ALLOWABLE BEARING = 1500 psf

~~FOOTING~~ [IN ft²] = $\frac{49600}{1500}$ = 33 ft²

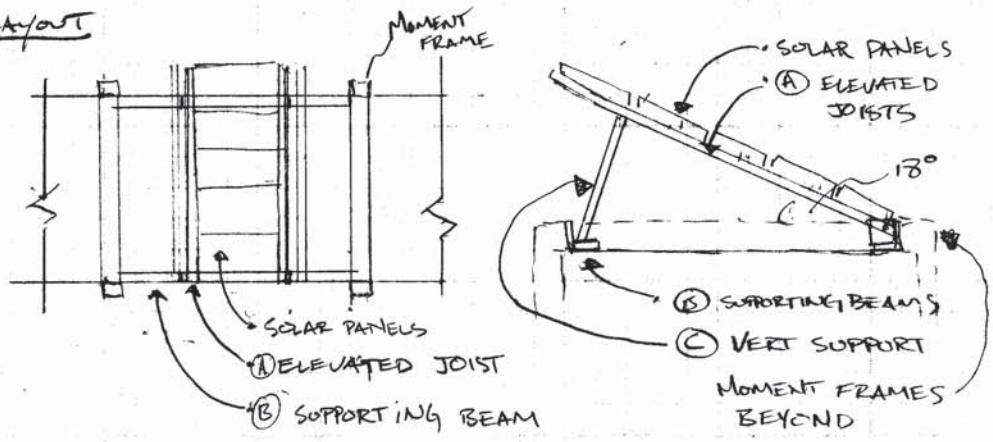
FOOTING = $\frac{33 ft^2}{2 ft^2}$ ≈ 17 footings minimum

Size of footing

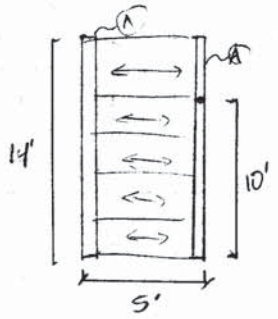
PV-RACK | SOLAR D | SAM COVEY | 1

COMET 3-0235 — 50 SHEETS — 5 SQUARES
3-0236 — 100 SHEETS — 5 SQUARES
3-0237 — 200 SHEETS — 5 SQUARES
3-0137 — 200 SHEETS — FILLER

LAYOUT



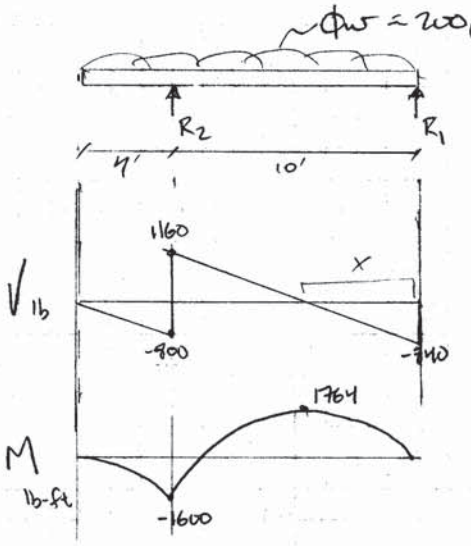
MEMBER A



DL = 5 PANELS @ 30 lbs = 150 lbs
STRUCT (ASSUME) = 10 plf

WL = 45 psf @ 2.5 ft
= 112.5 lb/ft

$\phi w = 1.6(112.5) + 1.2(10 + 6)$
$= 199.2$ plf $\approx$ 200 plf



$\Sigma M_1 = 200(14)(7) - R_2(10)$

$\Sigma F_y = R_2 + R_1 - 200(14)$

$R_2 = 1960$ lbs $R_1 = 840$

$\frac{2000 \text{ lbs}}{10'} = \frac{840}{x}$ $x = 4.2'$

$V_{max} = 1160$ lbs

$M_{MAX} = 1764$ ft-lb
$= 21.2$ kip-in

PV RACK | SOLAR D | | 2

COMET 3-0235 — 50 SHEETS — 5 SQUARES
3-0236 — 100 SHEETS — 5 SQUARES
3-0237 — 200 SHEETS — 5 SQUARES
3-0137 — 200 SHEETS — FILLER

MEMBER A

FLEXURE

$M_{MAX} = 21.2$ k-in

$S_x = \frac{M_y}{f_y} = \frac{21.2 \text{ k-in}}{36 \text{ ksi}} = .58 \text{ in}^3$

TRY 3 x 3 x 1/4 → $S_x = .569$ $I = 1.23 \text{ in}^3$
Wt = 11.9 lb/ft

DEFLECT

IDEALIZE AS SIMPLE SUPPORT @ 10'
↳ EASIER & CONSERVATIVE

$\Delta_{max} = \frac{L}{240} = \frac{10'(12)}{180} = .67$ in

$\Delta_{ACT} = \frac{5}{384} \frac{wL^4}{EI}$ LL = 45 lb/ft @ 2.5ft = 112.5 plf

$= \frac{5}{384} \frac{(112.5)(10 \text{ ft})^4 (12^3)}{(29 \cdot 10^6)(1.23 \text{ in}^4)} = .7$ in

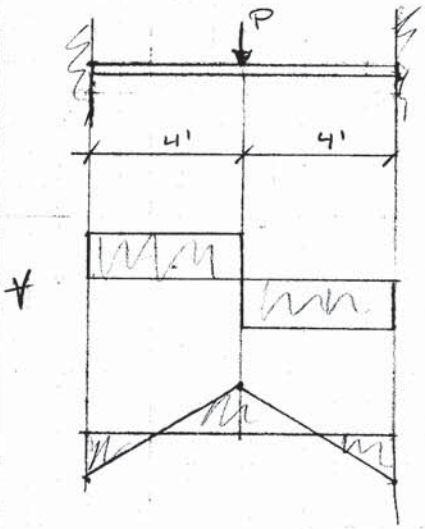
$\Delta_{ACT} < \Delta_{max}$ ✓
close enough

LTB

ASSUME PANELS GIVE CONTINUOUS LATERAL SUPPORT

PV RACK 3

MEMBER B



$P = R_2(2)$
$= 1960\ (2) = 3920\ lbs$

REACTION $= P/2 = 1960\ lbs$

$V_{MAX} = 1960\ lbs$

$M_{MAX} = \frac{PL}{8}$

$= \frac{3920(8')}{8}$

$= 3920\ lb\text{-}ft$

$= 47\ k\text{-}in$

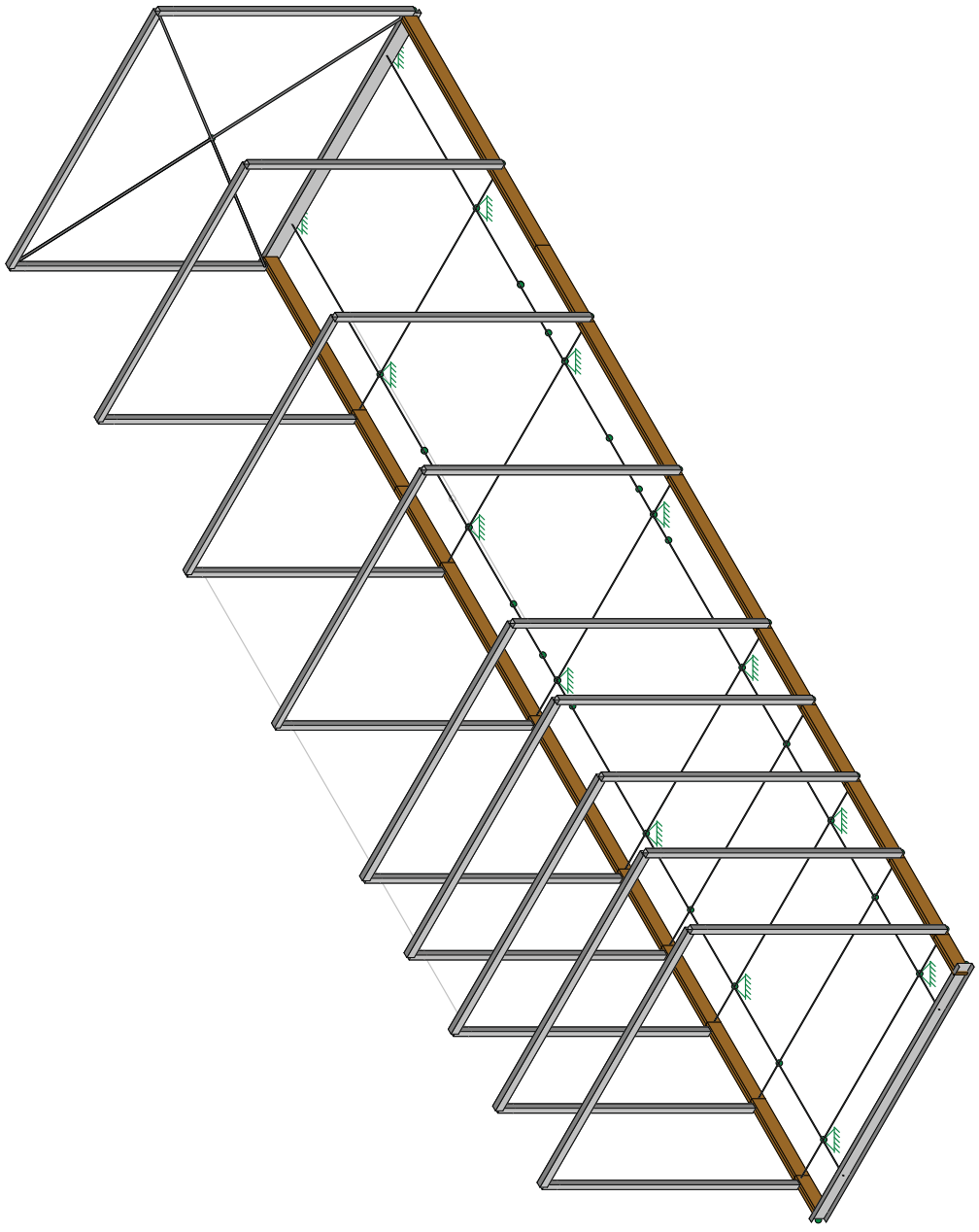
$S_x = \frac{47\ k\text{-}in}{36\ ksi} = 1.3\ in^3$

USE 4 x 4 x 5/16

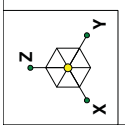
$S_x = 1.27\ in^3$ $I_x = 3.67$ $wt = 8.2\ lb/ft$

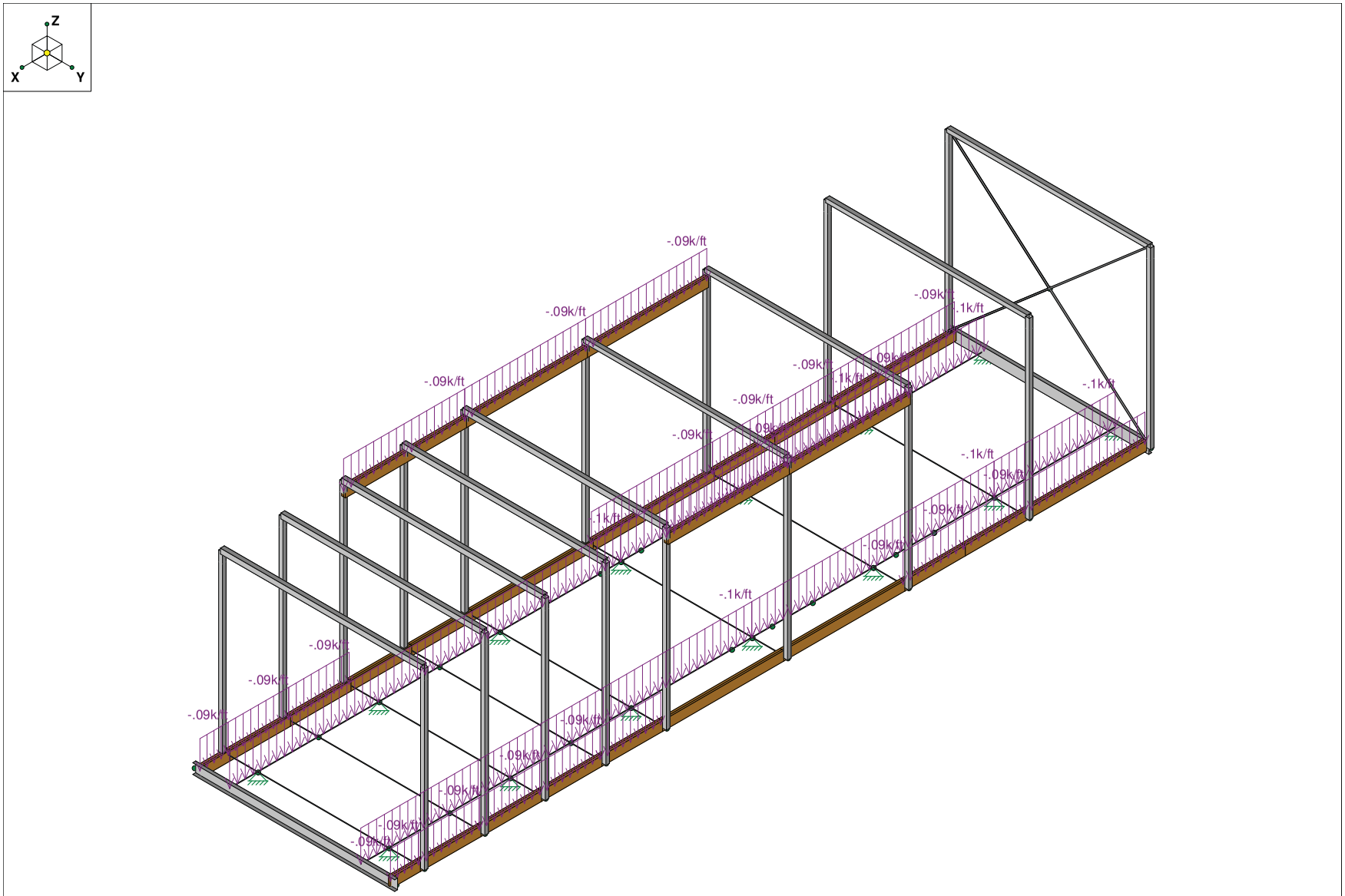
3-0235 — 50 SHEETS — 5 SQUARES
3-0236 — 100 SHEETS — 5 SQUARES
3-0237 — 200 SHEETS — 5 SQUARES
3-0137 — 200 SHEETS — FILLER
COMET

UT Solar Decathlon
BLOOMhouse
Building Framing (On Site Configuration)



Building Framing and Boundry Conditions (On Site Configuration)

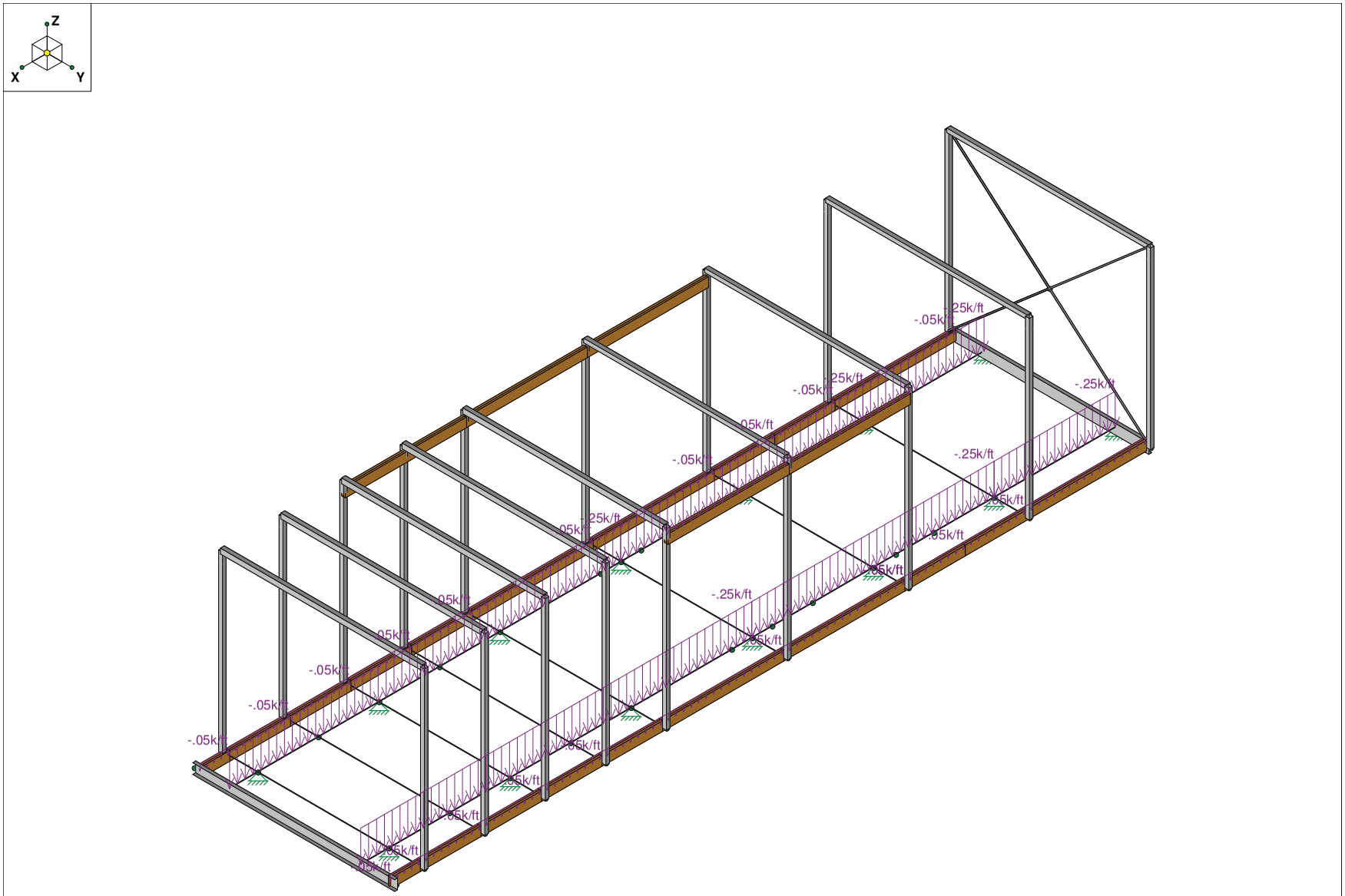




Design Dead Loads (On Site Configuration)

Loads: DL - Dead Load

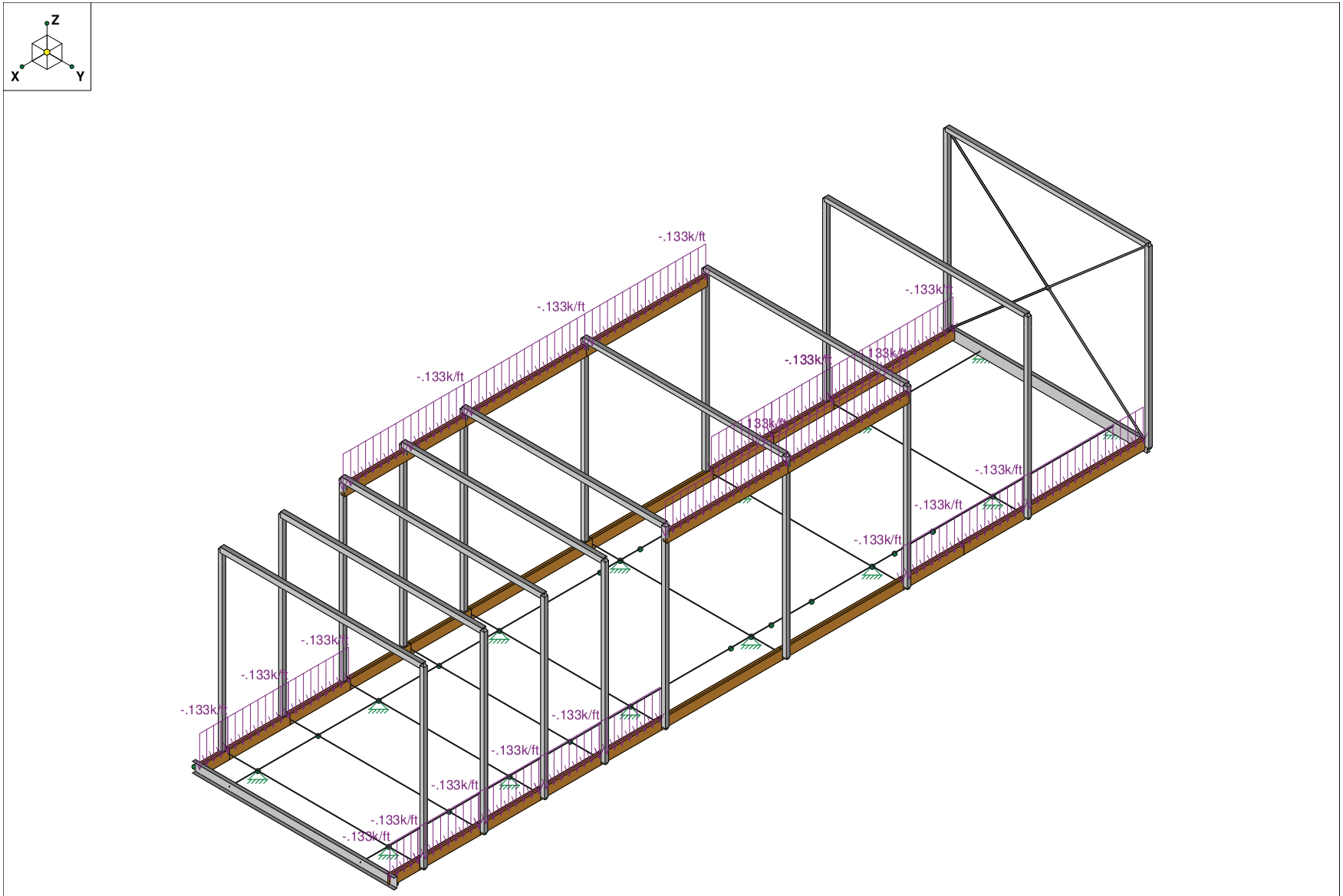
UTSOLAR



Design Floor Live Loads (On Site Configuration)

Loads: LL - Live Load

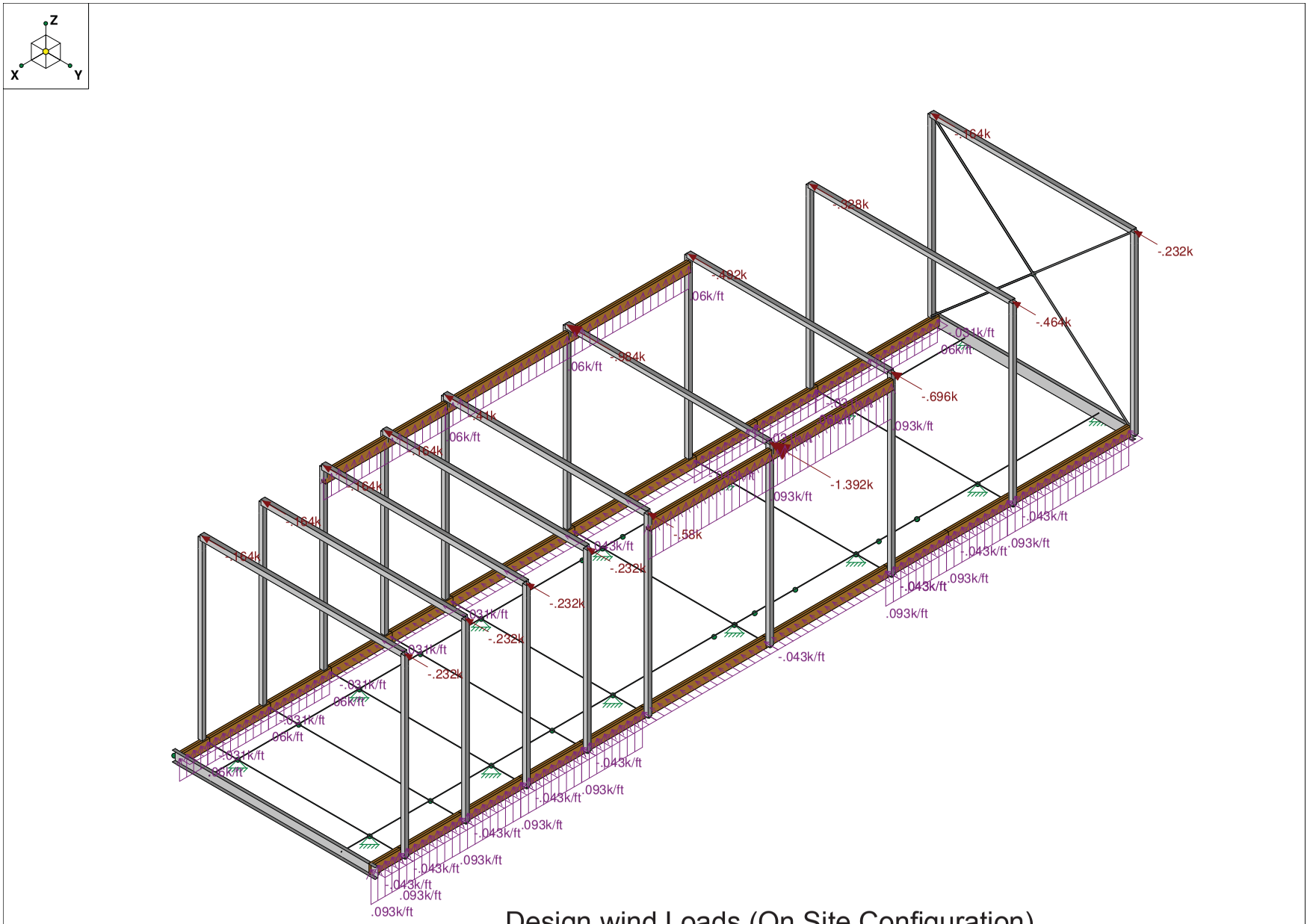
UTSOLAR



Design Roof Live Loads (On Site Configuration)

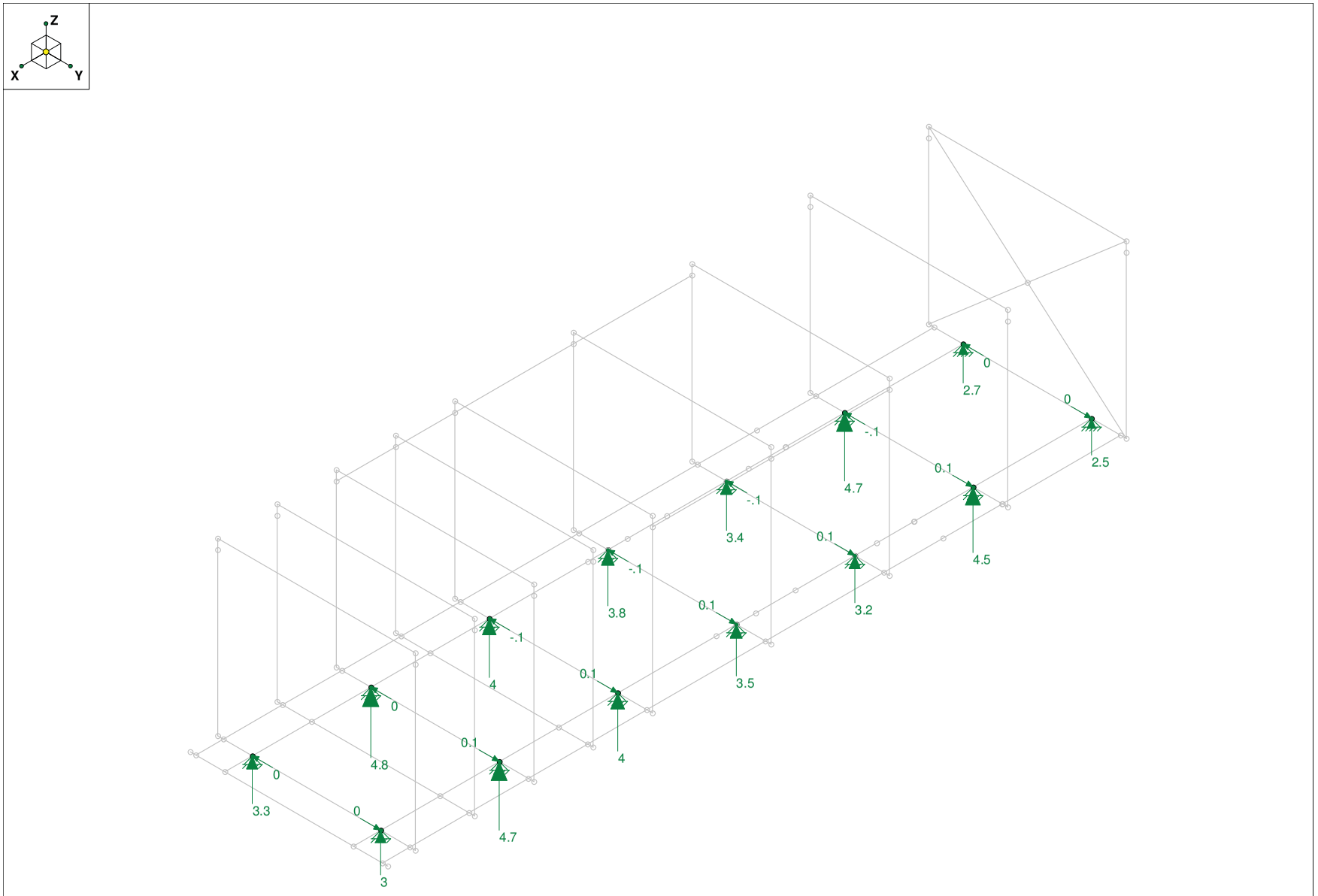
Loads: RLL - Roof Live Load

UTSOLAR



Design wind Loads (On Site Configuration)

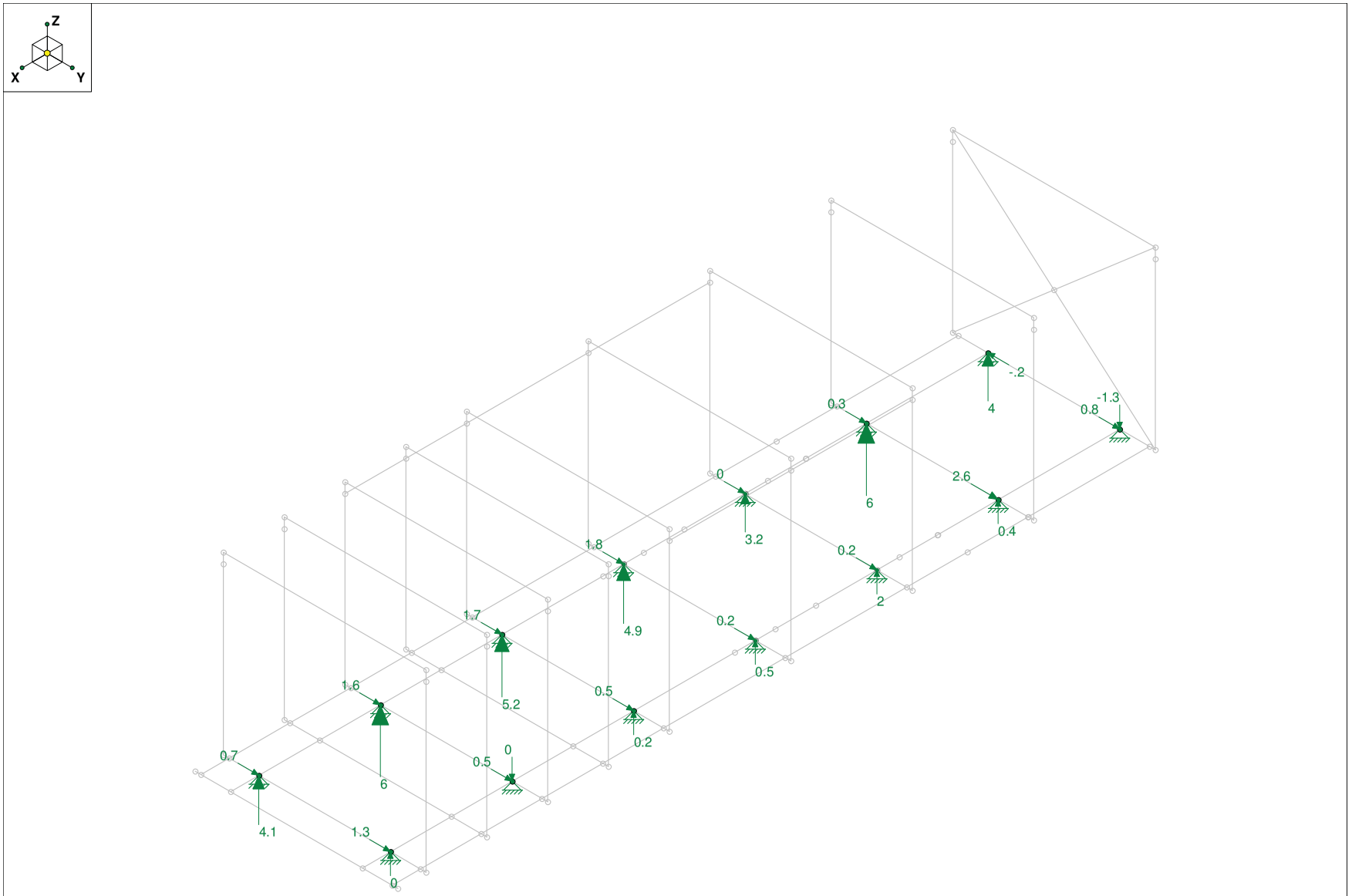
Loads: BLC 4, Wind N-S on Bldg.



Total Design Gravity Load Reactions (On Site Configuration)

Results for LC 54, D+.75L+.75Lr (Service)
Reaction units are k and k-ft

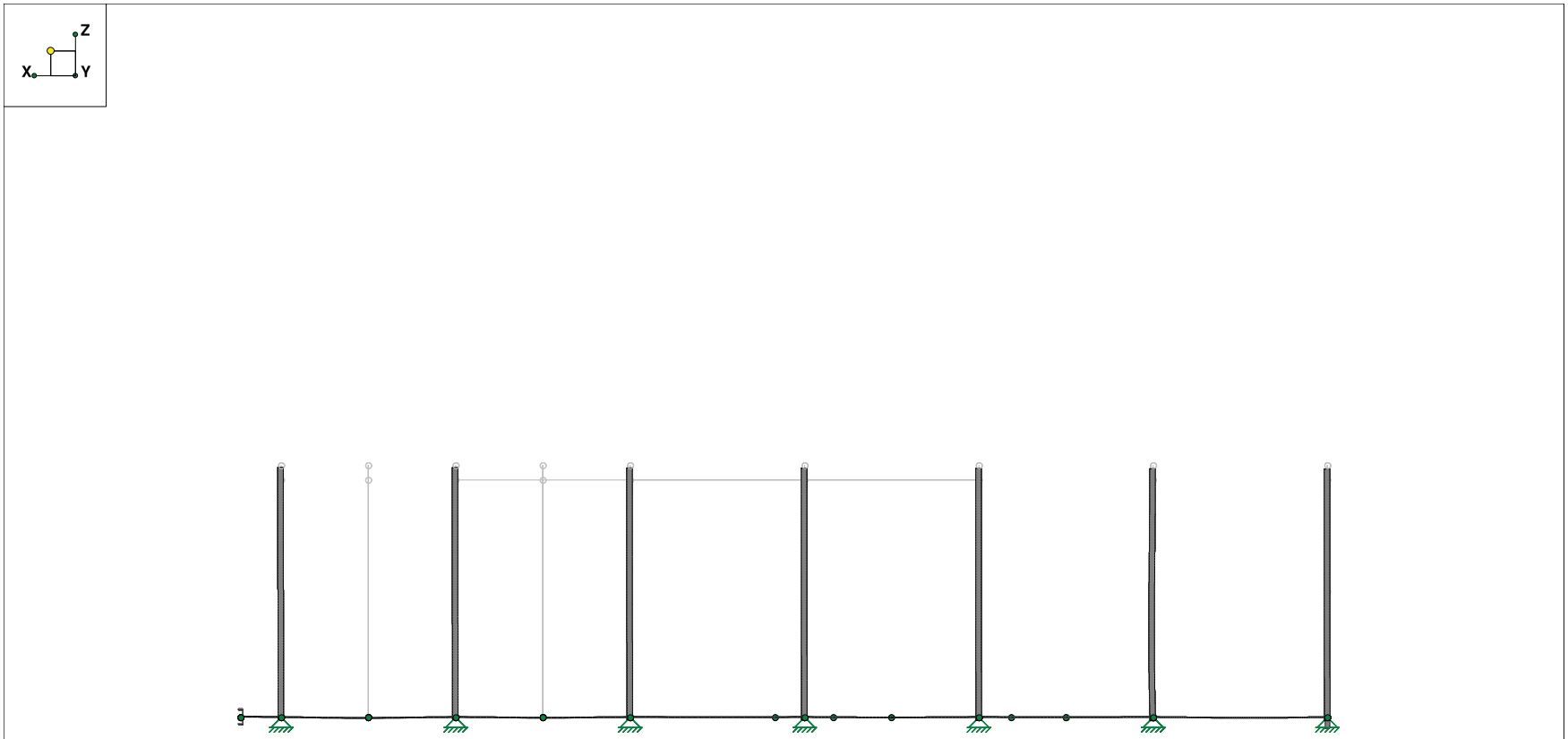
UTSOLAR D



Total Design Gravity + Wind Load Reactions (On Site Configuration)

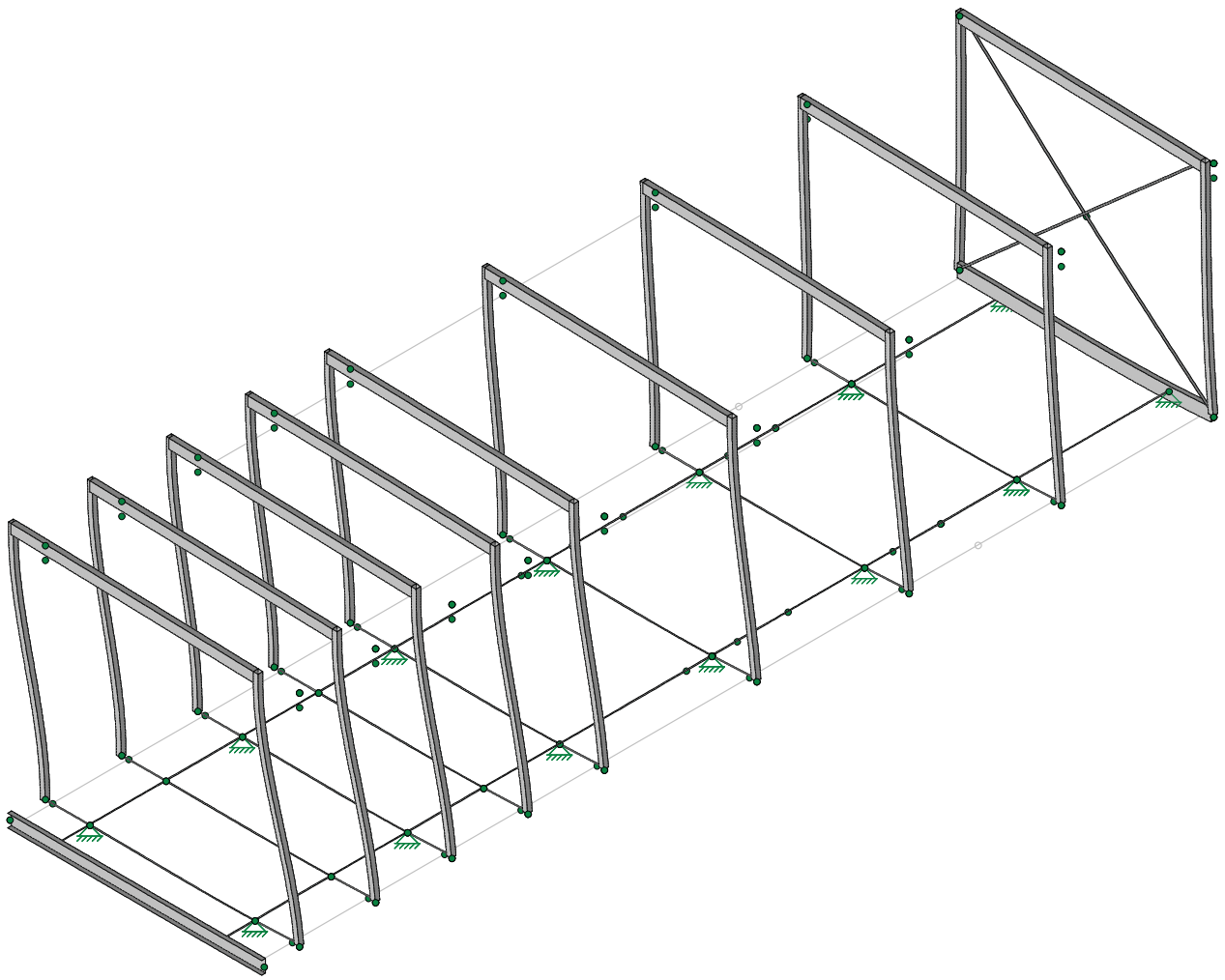
Results for LC 55, D + .75L + 0.75Lr + 0.75W
Reaction units are k and k-ft

UTSOLAR



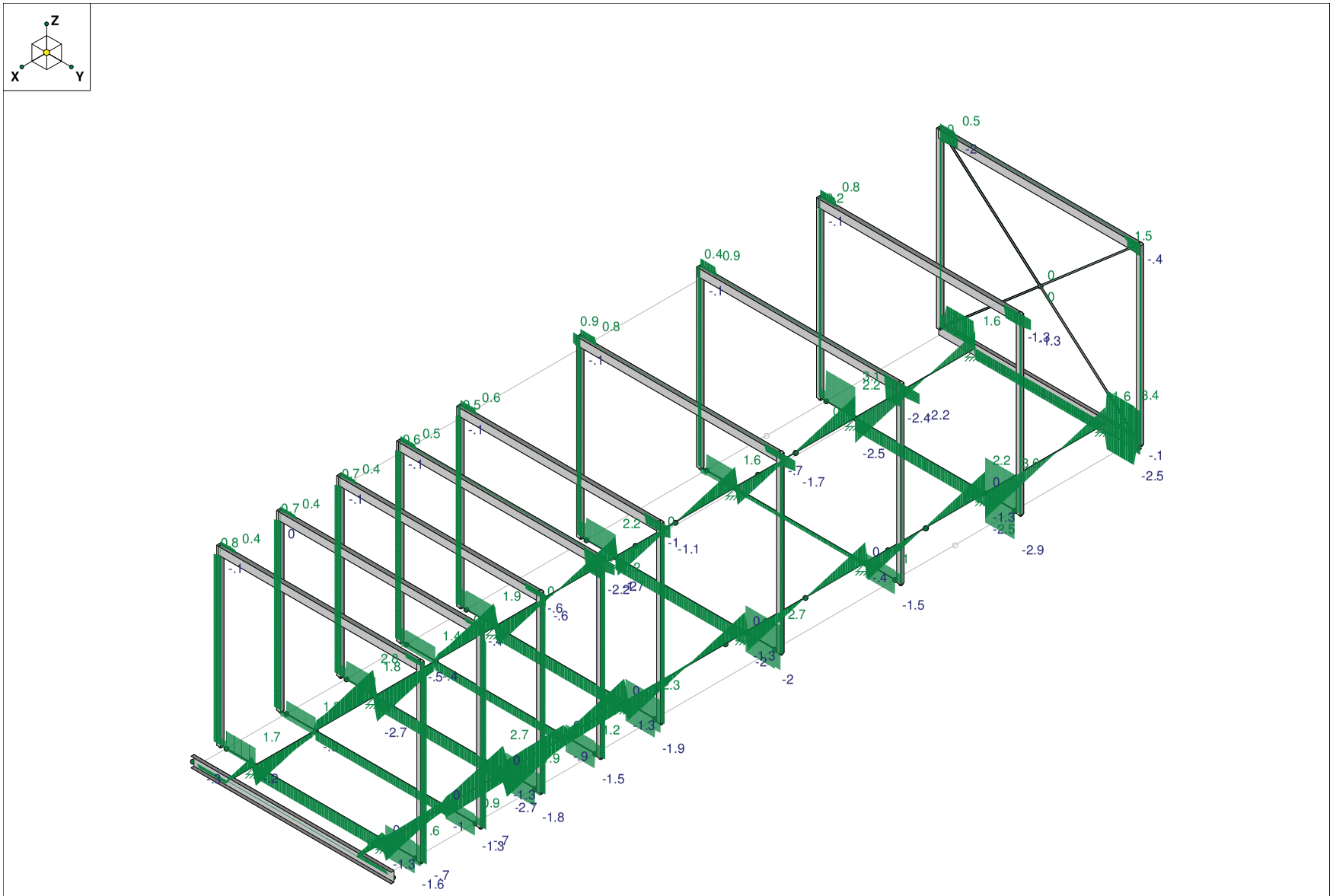
Deflected Shape for Gravity Loads (On Site Configuration)

Results for LC 53, Live (Service)



Deflected Shape for Wind Loads (On Site Configuration)

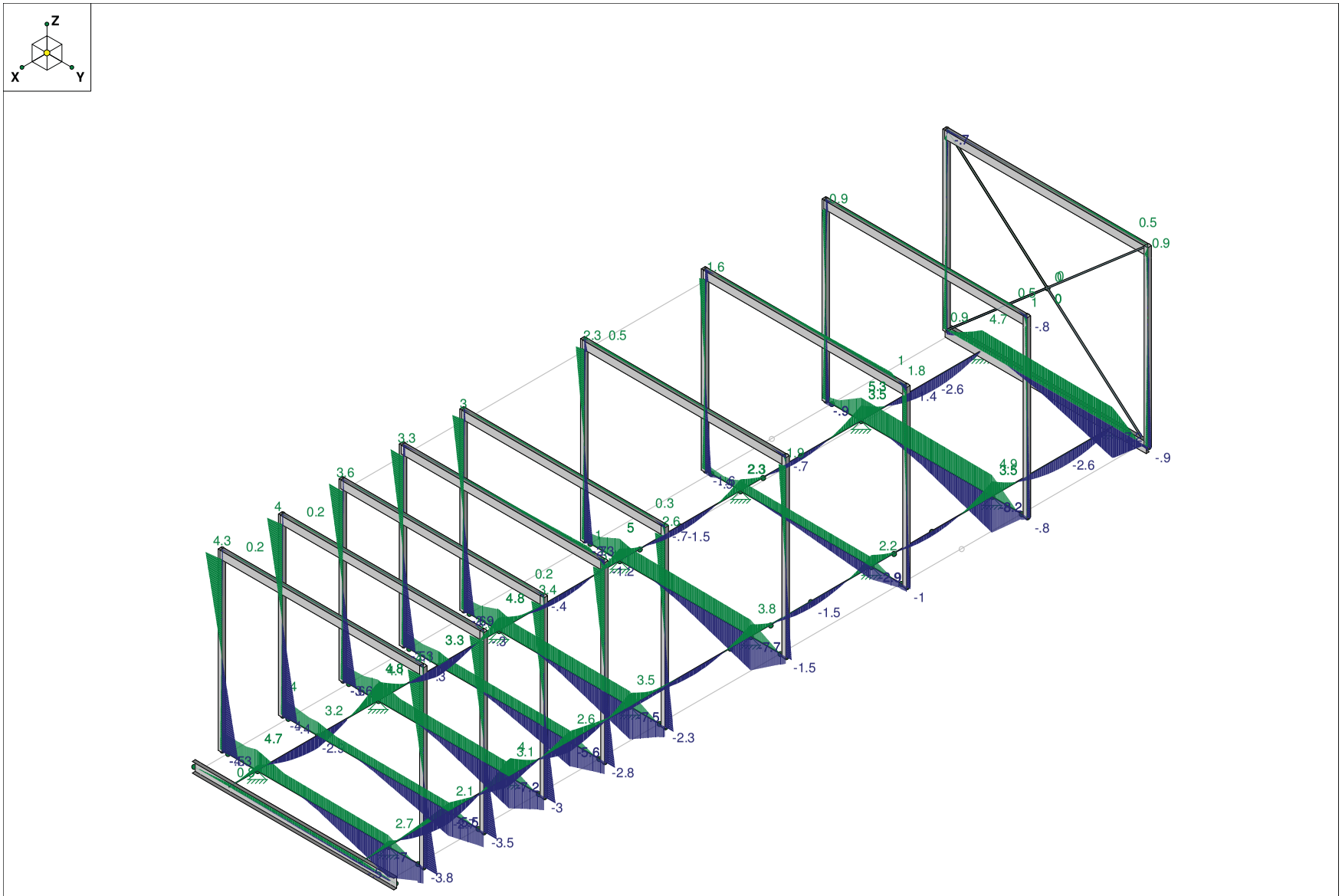
Results for LC 56, WL (Serviceability)



Factored and Combined Design Shear Forces (On Site Configuration)

Solution: Envelope
Member y Shear Forces (k)

UTSOLAR



Factored and Combined Bending Moments (On Site Configuration)

Solution: Envelope
Member z Bending Moments (k-ft)

UTSOLAR

Company : UTSOA with AEC
Designer : RH, SC
Job Number : 06055 UT Solar Decathlon Building Framing - Chassis on Axles Checked By:_____

Basic Load Cases

	BLC Description	Category	X Gra..	Y Gra..	Z Gra...	Joint	Point	Distri...	Area ...	Surfac...
1	Dead Load	DL						26		
2	Floor Live Load	LL						26		
3	Roof Live Load	RLL						20		
4	Wind N-S on Bldg.	WL				20		42		
5	Wind N-S on PV A...	WL					36			

Load Combinations

	Description	Solve	P...	SR...	BLC	Fac...	BLC	Fac...	BLC	Fac...	BLC	Fac...	BLC	Fac...	BLC	Fac...	BLC	Fac...	BLC	Fac...
1	IBC 16-1	Yes	Y		DL	1.4														
2	IBC 16-2 (a)	Yes	Y		DL	1.2	LL	1.6	LLS	1.6	RLL	.5								
3	IBC 16-2 (b)	Yes	Y		DL	1.2	LL	1.6	LLS	1.6	SL	.5	SLN	.5						
4	IBC 16-2 (c)	Yes	Y		DL	1.2	LL	1.6	LLS	1.6	RL	.5								
5	IBC 16-3 (a)	Yes	Y		DL	1.2	RLL	1.6	LL	.5	LLS	1								
6	IBC 16-3 (b) (a)	Yes	Y		DL	1.2	RLL	1.6	WL	.8										
7	IBC 16-4 (a) (a)	Yes	Y		DL	1.2	WL	1.6	LL	.5	LLS	1	RLL	.5						
8	IBC 16-4 (b) (a)	Yes	Y		DL	1.2	WL	1.6	LL	.5	LLS	1	SL	.5	SLN	.5				
9	IBC 16-4 (c) (a)	Yes	Y		DL	1.2	WL	1.6	LL	.5	LLS	1	RL	.5						
10	IBC 16-5	Yes	Y		DL	1.2	EL	1	LL	.5	LLS	1	SL	.2	SLN	.7				
11	IBC 16-6 (a)	Yes	Y		DL	.9	EL	1												
12	IBC 16-6 (b) (a)	Yes	Y		DL	.9	WL	1.6												
13	Dead (Service)	Yes	Y		DL	.85														
14	Live (Service)	Yes	Y		LL	1	RLL	1												
15	D+.75L+.75Lr (S...	Yes	Y		DL	1	LL	.75	RLL	.75										
16	D + .75L + 0.75Lr...	Yes	Y		DL	1	LL	.75	RLL	.75	WL	.75								
17	WL (Serviceability)	Yes	Y		WL	.7														
18	.6D + W	Yes	Y		DL	.6	WL	1												
19																				

Envelope AISC LRFD Steel Code Checks

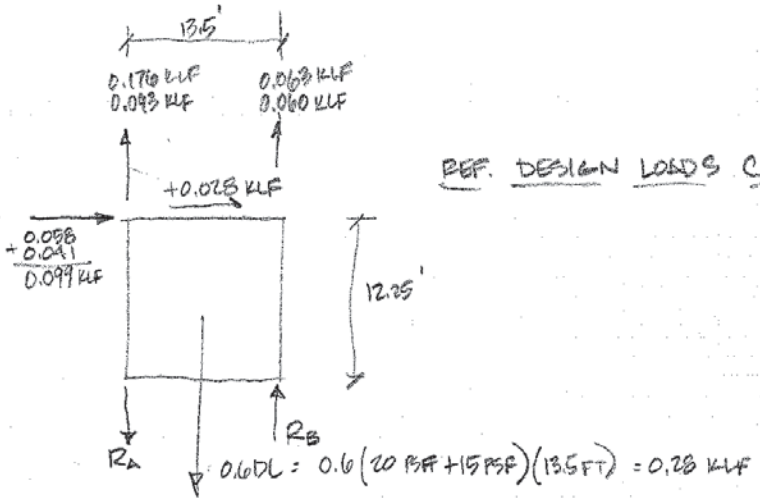
	Member	Shape	Code Check	Loc[ft]	lc	Shear Ch...	Loc[ft]	...	lc	phi*Pnc [k]	phi*Pnt [k]	phi*M...	phi*M...	Cb	LRF...
1	M31	HSS3X3X5	.170	11.5	12	.046	10.901	y	12	38.597	121.391	9.998	9.998	2.7...	HSS ...
2	M32	HSS6X3X5	.060	0	12	.030	0	y	7	55.489	151.499	14.203	23.231	1.6...	HSS ...
3	M33	HSS3X3X5	.223	.719	12	.026	.719	y	12	38.597	121.391	9.998	9.998	2.1...	HSS ...
4	M37	HSS3X3X5	.302	11.5	12	.081	10.901	y	12	38.597	121.391	9.998	9.998	2.5...	HSS ...
5	M38	HSS6X3X5	.105	0	12	.057	0	y	12	55.486	151.499	14.203	23.231	1.7...	HSS ...
6	M39	HSS3X3X5	.315	.719	12	.030	.719	y	12	38.597	121.391	9.998	9.998	2.1...	HSS ...
7	M43	HSS3X3X5	.551	10.781	7	.061	10.901	y	12	38.597	121.391	9.998	9.998	2.0...	HSS ...
8	M44	HSS6X3X5	.088	0	12	.052	0	y	12	55.486	151.499	14.203	23.231	1.7...	HSS ...
9	M45	HSS3X3X5	.586	.719	12	.042	.719	y	12	38.597	121.391	9.998	9.998	2.0...	HSS ...
10	M46	HSS3X3X5	.604	10.781	7	.042	0	y	7	38.597	121.391	9.998	9.998	2.0...	HSS ...
11	M47	HSS6X3X5	.028	0	12	.014	0	y	7	55.486	151.499	14.203	23.231	1.6...	HSS ...
12	M48	HSS3X3X5	.637	.719	12	.044	.719	y	12	38.597	121.391	9.998	9.998	2.0...	HSS ...
13	M49	HSS3X3X5	.661	10.781	7	.045	0	y	7	38.597	121.391	9.998	9.998	2.0...	HSS ...
14	M50	HSS6X3X5	.021	0	12	.010	0	y	7	55.486	151.499	14.203	23.231	1.5...	HSS ...
15	M51	HSS3X3X5	.695	.719	12	.047	.719	y	12	38.597	121.391	9.998	9.998	2.0...	HSS ...
16	M52	HSS3X3X5	.717	10.781	7	.047	0	y	7	38.597	121.391	9.998	9.998	2.0...	HSS ...
17	M53	HSS6X3X5	.024	0	12	.012	0	y	7	55.486	151.499	14.203	23.231	1.6...	HSS ...
18	M54	HSS3X3X5	.743	.719	12	.049	.719	y	12	38.597	121.391	9.998	9.998	2.0...	HSS ...
19	M48A	C8X11.5	.548	2.361	12	.192	.278	y	12	11.002	109.512	3.165	20.988	1.8...	H1-1b
20	M51B	C8X11.5	.068	2.361	5	.024	2.222	y	7	11.002	109.512	3.165	11.751	1.0...	H1-1b
21	M75	HSS3X3X5	.493	10.781	7	.042	10.901	y	12	38.597	121.391	9.998	9.998	2.0...	HSS ...
22	M76	HSS6X3X5	.049	0	12	.024	0	y	12	55.486	151.499	14.203	23.231	1.7...	HSS ...
23	M77	HSS3X3X5	.533	.719	12	.040	.719	y	12	38.597	121.391	9.998	9.998	2.0...	HSS ...
24	M70A	HSS3X3X5	.158	10.901	7	.056	10.901	y	7	38.597	121.391	9.998	9.998	2.8...	HSS ...

Envelope AISC LRFD Steel Code Checks (Continued)

	Member	Shape	Code Check	Loc[ft]	lc	Shear Ch...	Loc[ft]	...	lc	phi*Pnc [k]	phi*Pnt [k]	phi*M...	phi*M...	Cb	LRF...
25	M71B	HSS6X3X5	.046	13.333	12	.011	12.361	y	7	55.489	151.499	14.203	23.231	2.2...	HSS ...
26	M72B	HSS3X3X5	.137	0	12	.075	0	y	12	38.597	121.391	9.998	9.998	3.3...	HSS ...
27	M82	HSS3X3X5	.383	10.781	7	.063	10.901	y	12	38.597	121.391	9.998	9.998	2.0...	HSS ...
28	M83	HSS3X3X5	.426	.719	12	.035	.719	y	12	38.597	121.391	9.998	9.998	2.1...	HSS ...
29	M84	HSS6X3X5	.051	0	12	.018	12.361	y	7	55.486	151.499	14.203	23.231	1.9...	HSS ...

UT SOLAR DECATHLON

DETERMINE MIN. NO. TIE DOWNS FOR OVERTURNING



REF. DESIGN LOADS CALCS

$\Sigma M_A = 0$

$-(0.10\ KLF)(12.25') - (0.028\ KLF)(12.25') + (0.060\ KLF)(13.5\ FT) + R_B(13.5\ FT)$
$-(0.28\ KLF)(13.5\ FT/2) + (0.063\ KLF)(13.5\ FT)$

$R_B(13.5\ FT) = 3.5^{K}$

$R_B = 0.26\ KLF$

$\Sigma F_Y = 0$

$0.093\ KLF + 0.060\ KLF - 0.28\ KLF + 0.196\ KLF + 0.176\ KLF + 0.063^{K} - R_A = 0$

$R_A = 0.31\ KLF$

$R_{A\ MIN.} = \Omega R_A \qquad \Omega = 2$

$R_{A\ MIN} = 0.62\ KLF$

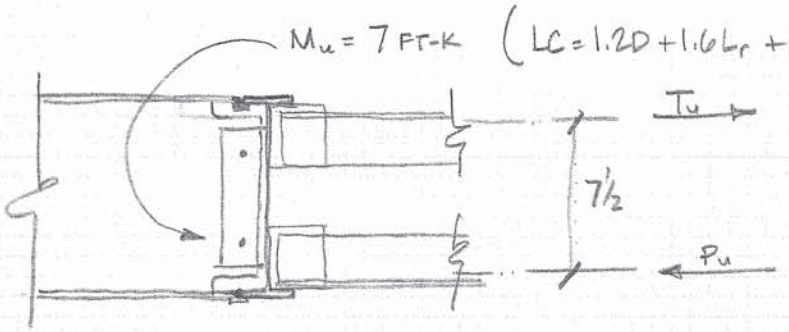
CAPACITY OF ANCHOR = 2.5^{K}

$\frac{0.62\ KLF}{2.5\ K/ANCHOR} = 0.25$ ANCHORS/FT $\times$ 50 FT $\approx$ 12 ANCHORS

$\therefore$ TIE-DOWN ANCHORS @ 4'-0" O.C. EA. SIDE

UTSOA SOLAR D

SIZE ANGLE STRUTS TO BACK UP W10 OUTRIGGERS



$$T_u = P_u = \frac{(7\ \text{FT-K})}{(7\frac{1}{2}\ \text{IN})}\left(\frac{12\ \text{IN}}{\text{FT}}\right) = 11.2^{K}$$

$K = 1$

$L = 8.67\ \text{FT} = 104\ \text{IN}.$

$$\frac{kL}{r} \le 200 \therefore r \ge \frac{(1)(104\ \text{IN})}{200} = 0.52\ \text{IN}$$

TRY L3x3x1/4 $\quad \frac{kl}{r} = \frac{1(104\ \text{IN})}{0.592} = 175.7$

$b = 3\ \text{IN}$, $t = 0.25\ \text{IN}$ $\Big\}$ $\frac{b}{t} = \frac{3}{0.25} = 12\ \text{IN}$

$$0.446\sqrt{\frac{E}{F_y}} = 0.446\sqrt{\frac{29000}{36}} = 12.66$$

$$\frac{b}{t} < 0.446\sqrt{\frac{E}{F_y}} \therefore Q = 1.0$$

$$\lambda_c = \frac{kl}{r\pi}\sqrt{\frac{F_y}{E}} = \frac{175.7}{\pi}\sqrt{\frac{36}{29000}} = 1.97$$

$$\lambda_c\sqrt{Q} = 1.97\sqrt{1.0} = 1.97 \ge 1.5$$

$$\therefore F_{cr} = \left[\frac{0.877}{\lambda_c^2}\right]F_y$$

$$F_{cr} = \left[\frac{0.877}{1.97^2}\right]36\ \text{KSI}$$

$$F_{cr} = 8.1^{K}$$

$$\phi P_n = \phi_c A_g F_{cr}, \quad \phi_c = 0.9$$

$$\phi P_n = 0.9(1.14\ \text{IN}^2)(8.1\ \text{KSI})$$

$$\phi P_n = 10.5^{K}\ \text{N.G.}$$

TRY L3x3x5/16, $\frac{kl}{r} = \frac{1(104)}{0.589} = 176.6$

$$\lambda_c = \frac{176.6}{\pi}\sqrt{\frac{36}{29000}} = 1.98$$

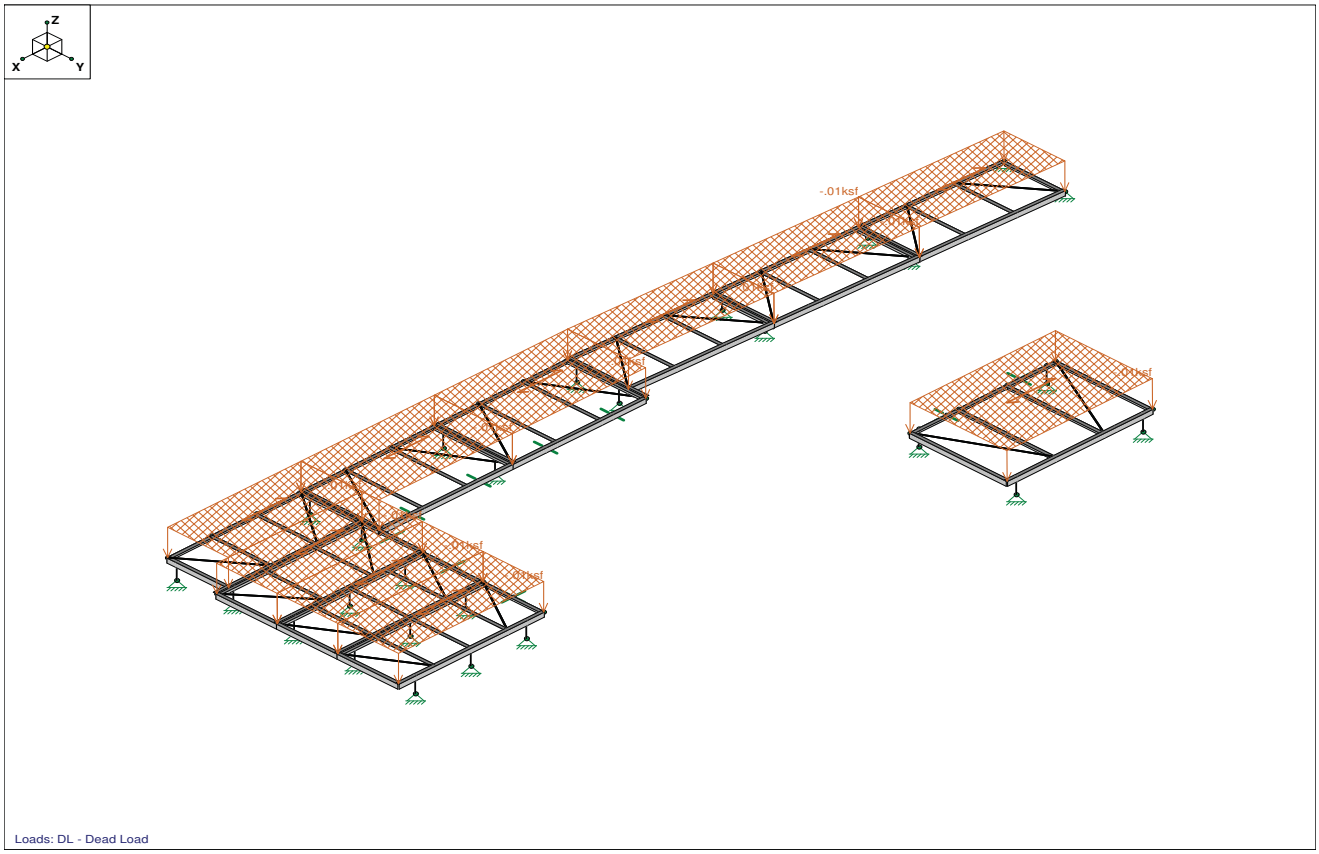
L3x3x5/16, CONTINUED.

$\frac{b}{t} = \frac{3}{5/16} = 9.6 \quad Q = 1.0$

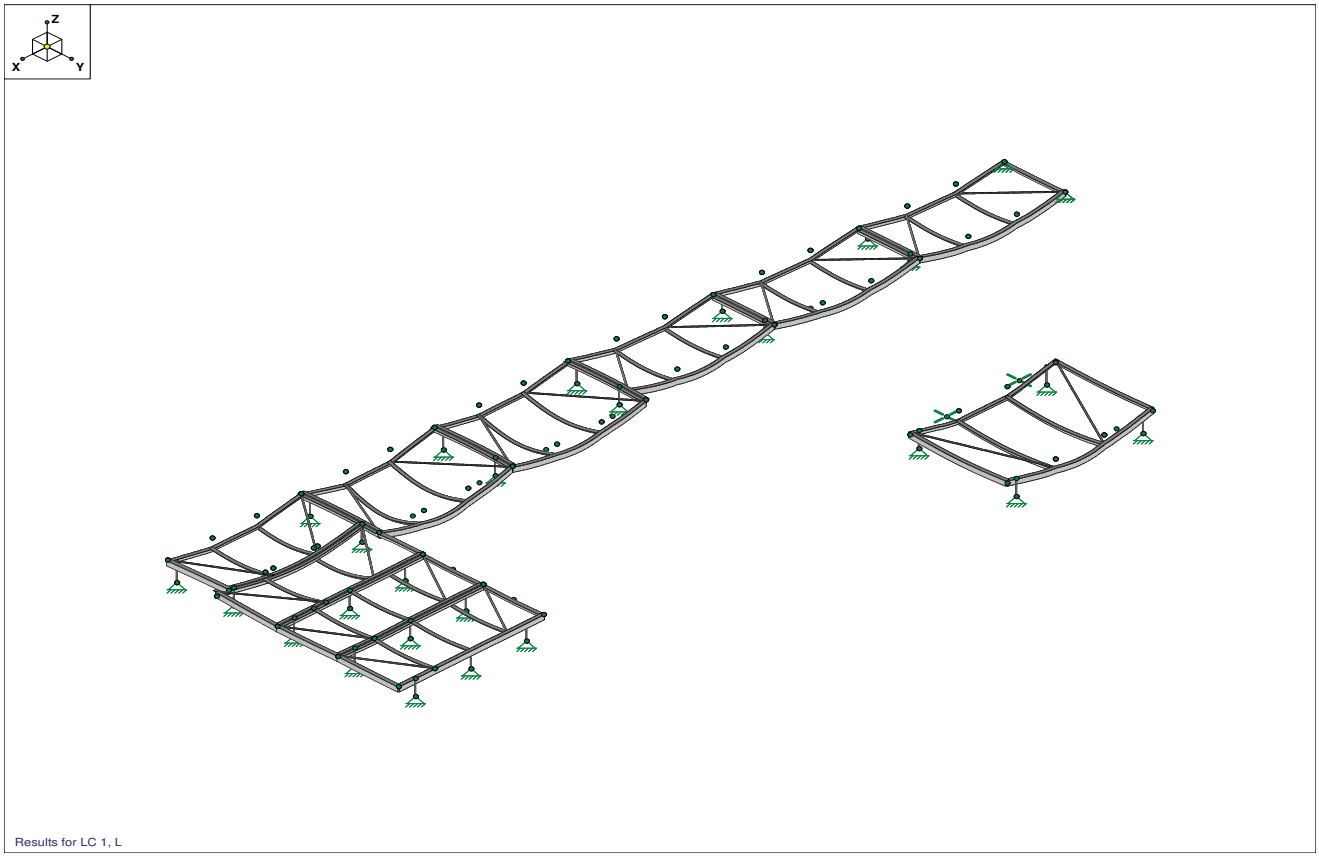
$F_{cr} = \left[\frac{0.877}{1.982}\right](36)$

$F_{cr} = 8.05$ ksi

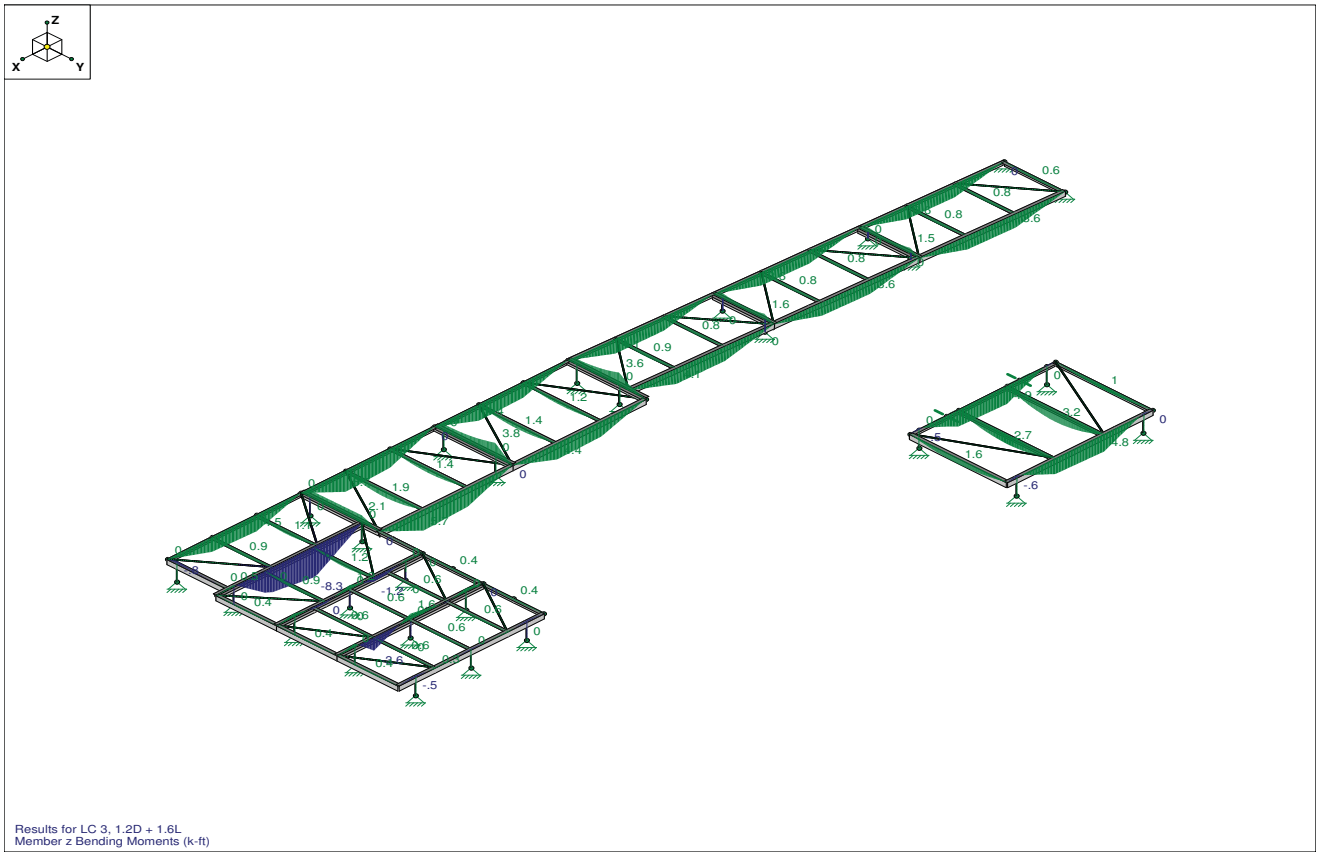
$\phi P_n = \phi_c A_g F_{cr} = 0.9($



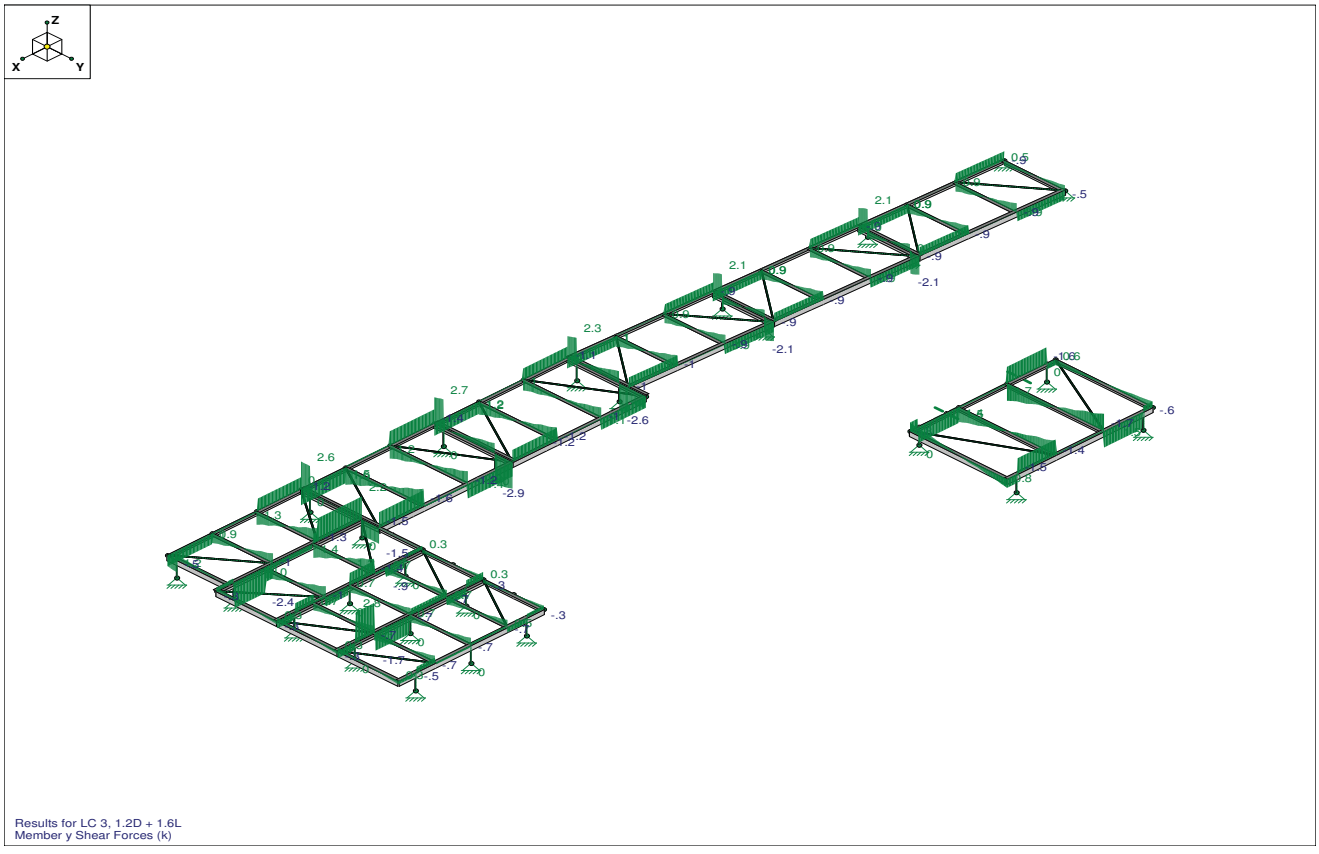
Loads: DL - Dead Load



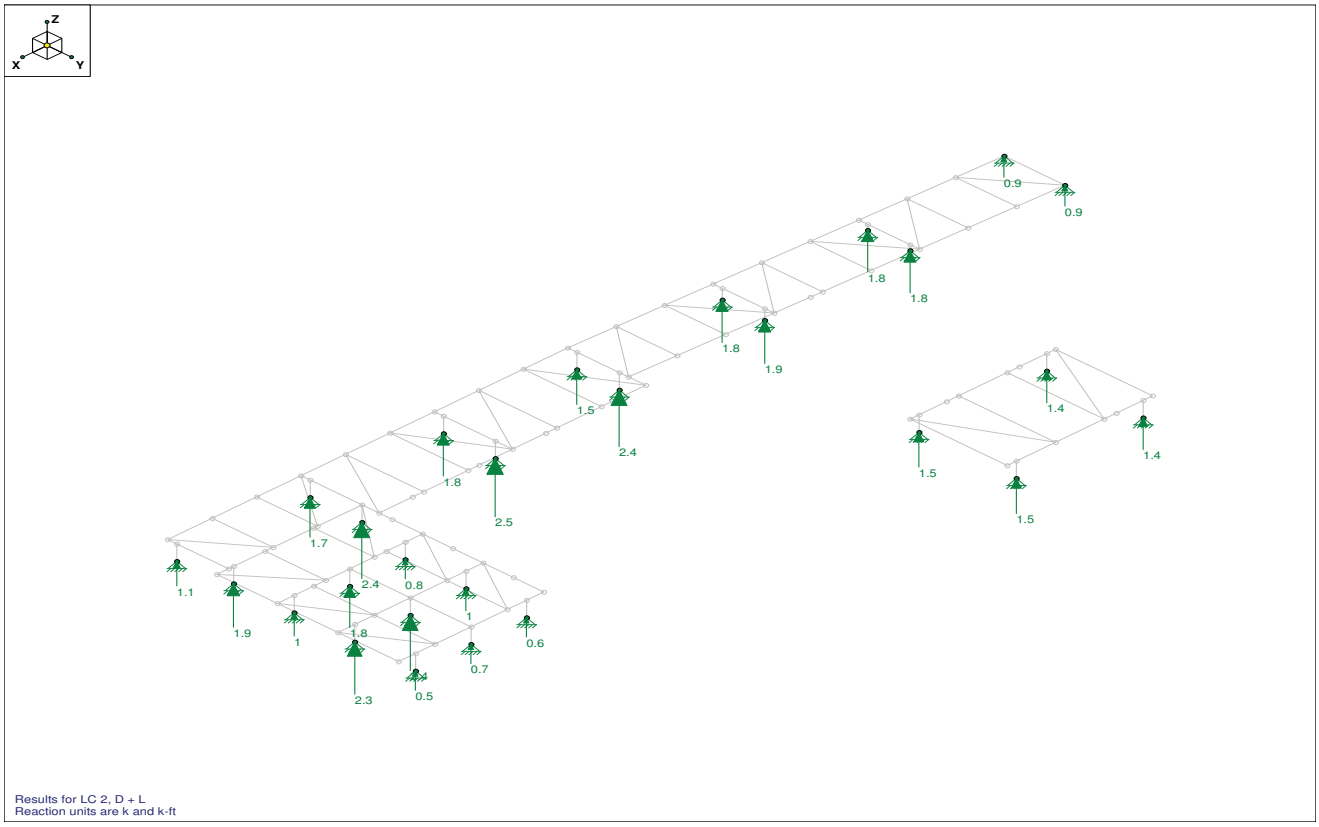
Results for LC 1, L



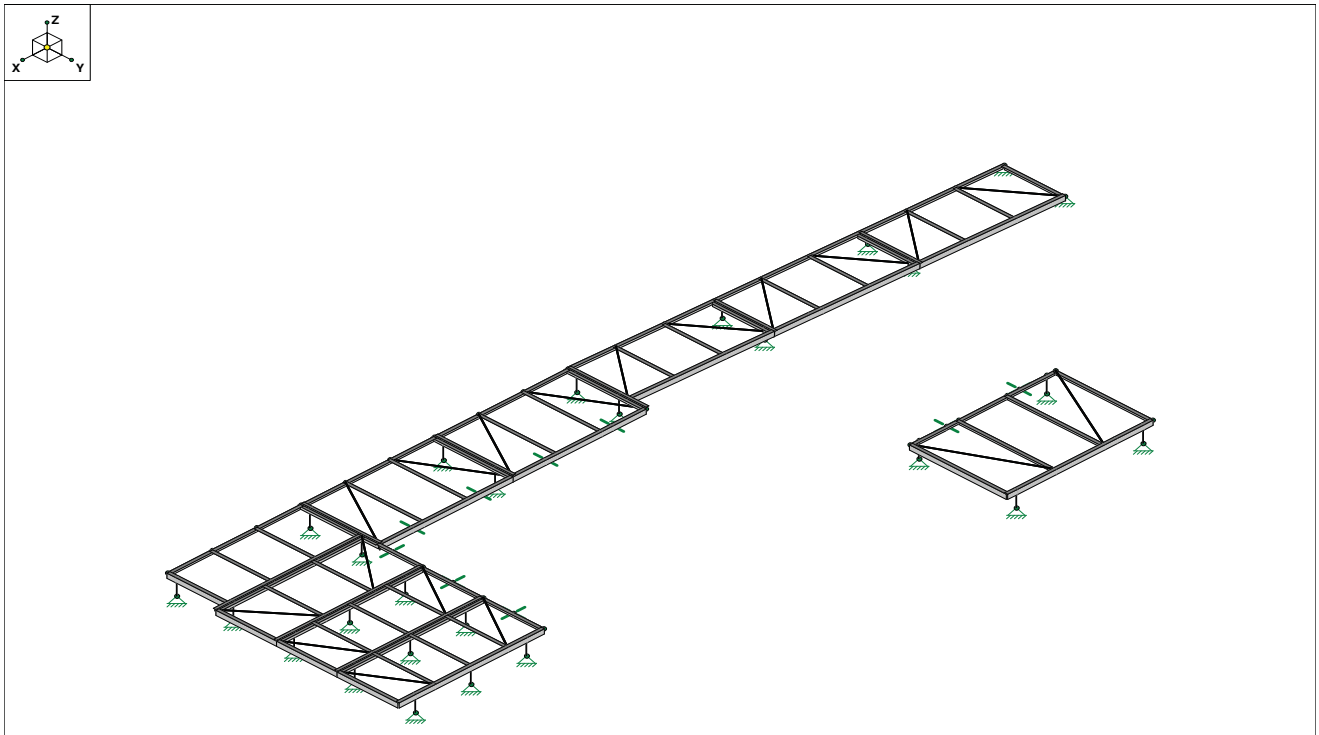
Results for LC 3, 1.2D + 1.6L
Member z Bending Moments (k-ft)



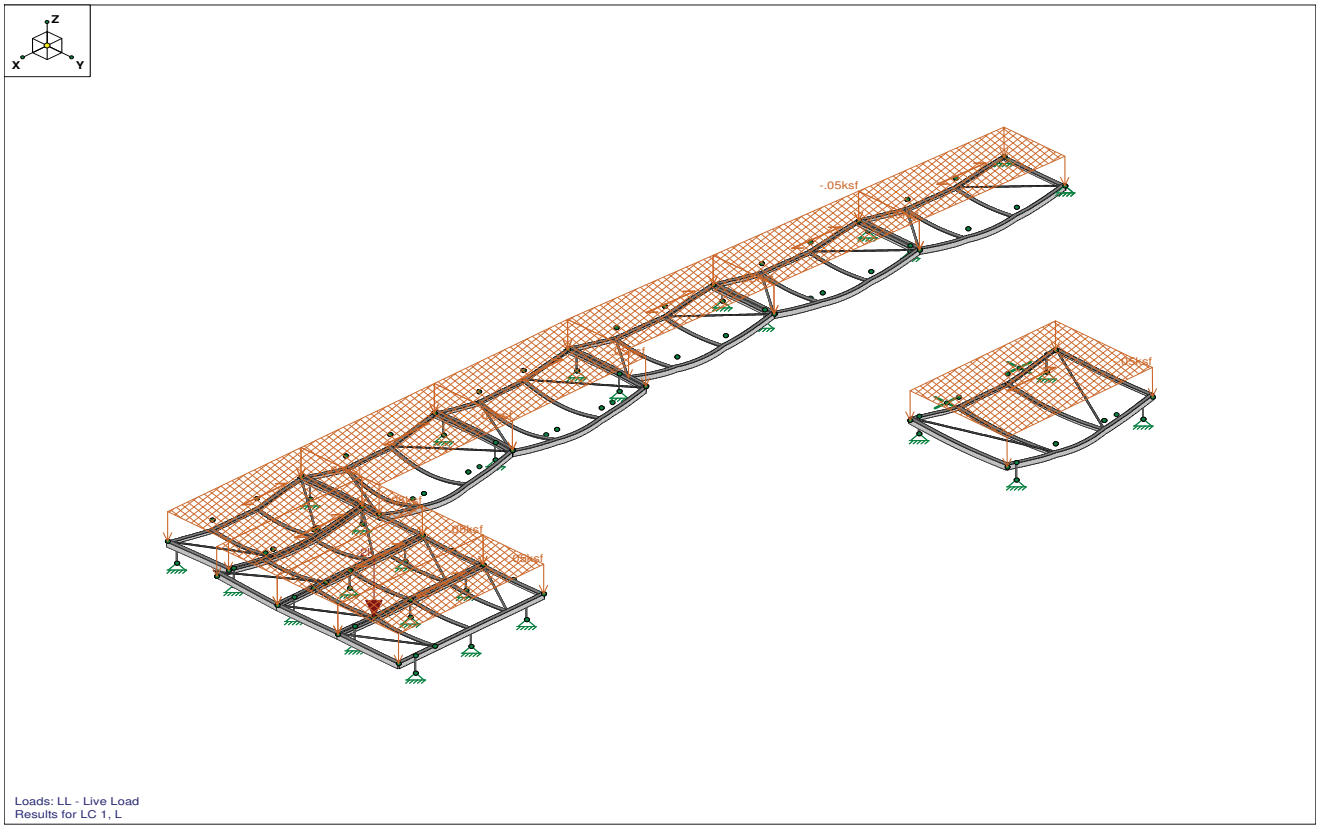
Results for LC 3, 1.2D + 1.6L
Member y Shear Forces (k)



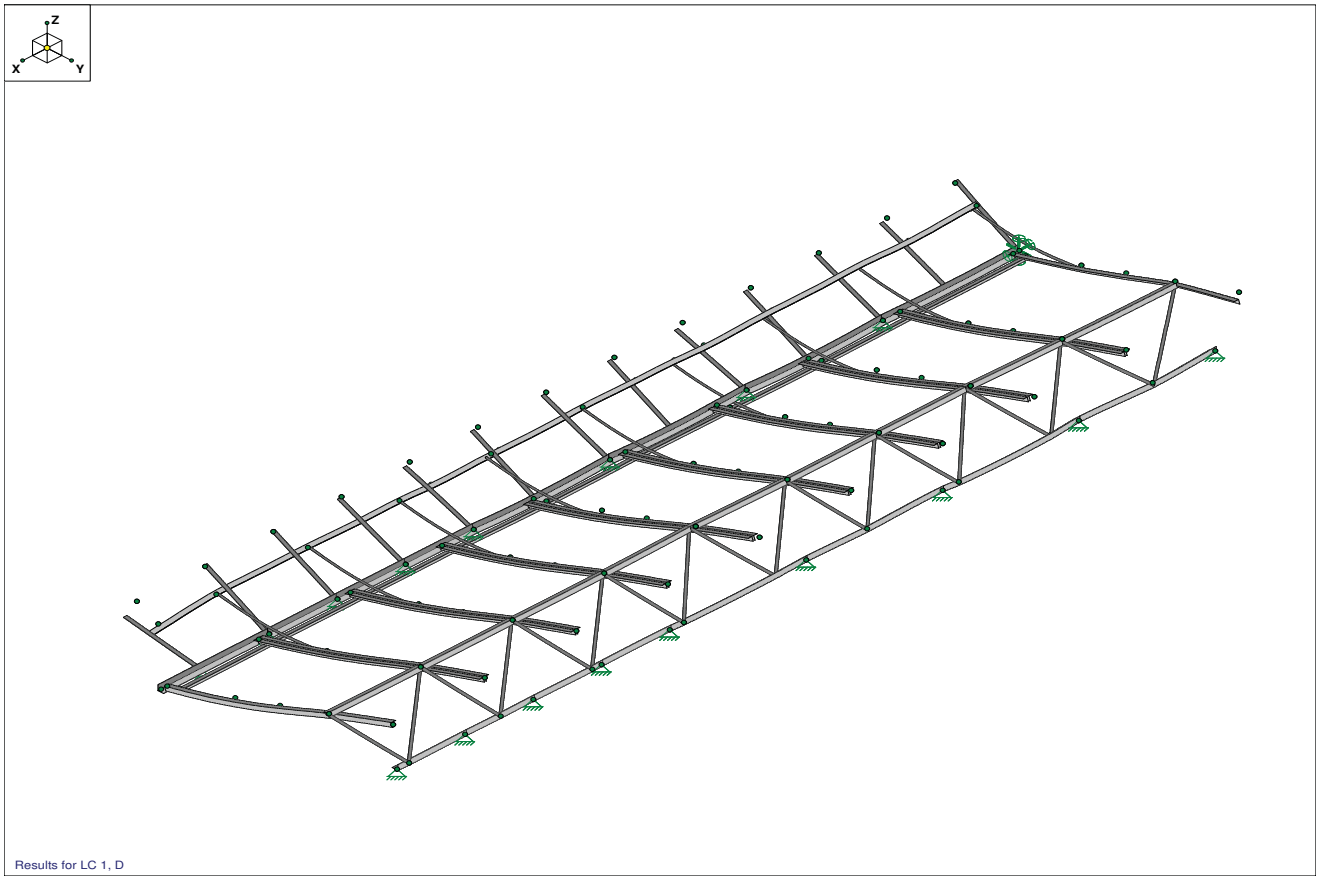
Results for LC 2, D + L
Reaction units are k and k-ft



Results for LC 1, L



Loads: LL - Live Load
Results for LC 1, L



Results for LC 1, D

CSI Masterformat Division 1: General Requirements

SECTION 01 11 00– SUMMARY OF WORK

PART 1 – General
1.1 SUMMARY OF WORK
A. Project: BLOOMhouse, 2007 Solar Decahtlon.
B. Owner: The University of Texas at Austin, School of Architecture.
C. Architect: UT SolarD Team
D. Contractor: Ted Bach, and UT SolarD Team
E. Mission: to provide leadership in the renewable energy revolution for a more livable, sustainable future through innovations in energy-efficient building design and environmental stewardship, and to be competitive in the biennial Solar Decathlons sponsored by the Department of Energy.

END OF SECTION 01 11 00

SECTION 01 14 00– WORK RESTRICTIONS

PART 1 – Access to Site

1.1 MUELLER AIRPORT HANGAR

A. Requirements: Only authorized construction personnel contractors, and Mueller Airport employees are allowed on site during construction unless otherwise authorized by the UT SolarD Team.

B. Unauthorized Access: Any persons attempting to access the site without authorization are to be asked to leave in a polite manner. Failure to leave will result in their expulsion (see Criminal Entry).

C. Criminal Entry: If unauthorized personnel refuse to leave, or if there are visible signs of theft and/or criminal entry, notify the police immediately.

PART 2 – Coordination with Occupants

2.1 MUELLER AIRPORT

A. Requirements: UT SolarD Team members and construction personnel are to comply with any requests made by Mueller Airport employees. The job site remains the property of Mueller Aiport at all times during construction and is to be treated as such.

2.2 BLUE SANTA

A. Requirements: UT SolarD Team members and construction personnel are to work only in those areas of the hangar not occupied by Blue Santa until such time as the organization has left the hangar.

PART 3 – Use of Site

3.1 MUELLER AIRPORT HANGAR

A. Requirements: The hangar and construction are to be used only for construction of the BLOOMhouse and storage of related materials unless otherwise authorized. Construction personnel may not sleep overnight in, dwell within, or otherwise occupy the job site without authorization.

B. Cooking: Use of the kitchen facilities on site is permitted, but all personnel must maintain the kitchen area and keep the site clean in order to prevent pest infestation or contamination of food. Improper care of the kitchen facilities will result in a shutdown of the kitchen facilities.

C. Special Events: The site will be used several times during construction to house special events which showcase the BLOOMhouse project. Construction may be halted during these events. Notification will be given by project management as to the date of such events and their impact on construction.

END OF SECTION 01 14 00

SECTION 01 52 00– VEHICULAR ACCESS AND PARKING

PART 1 – Parking Areas
1.1 DEFINITIONS
A. Front (of Hangar): That side of the hangar painted with a large Texas flag.
B. Rear (of Hangar): That side of the hangar opposite the front doors.
1.1 MEULLER AIRPORT HANGAR PARKING
A. Requirements: All construction personnel and project visitors should park in available spaces near the front doors. Personnel should avoid parking in those spots along the side of the hangar, as this route will be used for delivery trucks and material receiving.
B. Long Term Parking: The construction site is not meant for long term parking. Mueller Airport, UTSolarD, The School of Architecture, UT Austin, and any contractors on site are not responsible for damage to vehicles left on site overnight or after construction has ceased for the day.
PART 2 – Traffic Control
2.1 MOVING VEHICLES
A. Requirements: All personnel are required to move their vehicles at the request of the contractor, procurement officers, or any other personnel attempting to navigate delivery trucks into the site.
B. Unauthorized Vehicles: Vehicles not belonging to Mueller Airport employees, Blue Santa workers, or authorized construction personnel may be towed.
C. Suspicious Vehicles: Construction personnel should notify the police immediately if any suspicious looking vehicles arrive on or are left at the job site. Personnel should not attempt to approach suspicious vehicles on their own.
2.1 ACCESS GATES
A. Codes: All personnel will be issued a gate code to enter the construction site. This code is not to be given to anyone not authorized to be on the site.
PART 3 – Staging Areas
3.1 MUELLER AIRPORT HANGAR
A. Facilities: Staging facilities will be created at the rear end of the hangar. All deliveries and trucks are to be directed to the staging area for unloading.
B. Demarcation: The staging facilities will be separated into different sections based upon materials, construction phase, or schedule needs. Personnel are instructed not to move materials from one sections to another without speaking with project management or procurement officers first.

END OF SECTION 01 52 00

SECTION 01 55 00– CONSTRUCTION FACILITIES

PART 1 – Field Offices and Sheds

1.1 MUELLER AIRPORT HANGAR

A. Available Offices and Storage: The Mueller Aiport site has air conditioned office spaces which will be utilized by the construction management and procurement groups. A large, securable storage room is located on site within the hangar as well a smaller plywood tool shed.

B. Securing Offices and Sheds: Offices and storages sheds are to be securely locked at the end of each construction day. The last personnel to leave the site are responsible for securing all doors and locks before leaving.

C. Storage Room Windows: Several windows are located within the storage room and must be boarded over before storage of construction materials may begin.

PART 2 – First Aid Facilities

2.1 MUELLER AIRPORT HANGAR

A. Requirements: General first aid kits will be made available on site at all times. Personnel are responsible for checking on the condition and quantity of materials in the first aid kits at the beginning of each week during construction.

PART 3 – Sanitary Facilties

3.1 MUELLER AIRPORT HANGAR

A. Facilties: There are two restrooms on site, one for males and one for females. The facilities are not conditioned spaces. Construction personnel are responsible for keeping the facilities clean and properly stocked with sanitary products and soap.

END OF SECTION 01 52 00

CSI Masterformat Division 3: Concrete

KNOW-A-WATT:

The embodied energy of concrete has been estimated at 3 kWh/lb and 90% of this is attributable to the production of Portland cement.

SECTION 03 30 53 SITE CAST CONCRETE

PART 1 – General
1.1 SECTION REQUIREMENTS
A. Structural concrete to be used for foundation base for exterior sliding screen.
B. Structural Performance: Provide structural concrete units capable of withstanding design loadings to be determined by structural engineer.
C. Provide units with fire resistance indicated, calculated according to ASTM E 119 and PCI's "Design for Fire Resistance of Precast Prestressed Concrete."

1.2 SUBMITTALS: Not Applicable.
PART 2 – PRODUCTS
2.1 MATERIALS

A. 5000 psi ready-mix concrete.

2.2 CONCRETE MIX

A. Proportion normal-weight concrete mixes to provide the following properties:

1. Compressive Strength: 5000 psi at 28 days.
2. Water-Cementitious Materials Ratio: 0.40 maximum.
3. Air Content: 5.5 to 7.5 % for concrete exposed to freezing and thawing, 2.5 to 4.5 % elsewhere.

B. Concrete Mixing: Comply with ASTM C 94.
C. Finishes: Standard for formed surfaces.
D. Replace cast concrete units deficient in strength, manufacturing tolerances, and finishes.
PART 3 – EXECUTION
3.1 INSTALLATION
A. Protect units and bearing pads from damage during welding.
B. Install units level, plumb, square, and true, within the recommended erection tolerances of PCI's "Recommended Practice for Erection of Precast Concrete."
C. Shore and brace cast concrete units to maintain location, stability, and alignment until permanent connections are installed.
D. Clean exposed surfaces of cast concrete units after erection.

END OF SECTION 03 30 53

CSI Masterformat Division 5: Metals

KNOW-A-WATT:

Metals have a very high embodied energy. Though steel accounts for only 23% of the tonnage of building materials used nationally, it accounts for 48% of the energy consumed to make those products.

SECTION 05 12 00 STRUCTURAL STEEL

PART 1 – General

1.1 SECTION REQUIREMENTS:

A. Structural steel to be used in conjunction with structural concrete to compose foundation system.

B. Comply with AISC's "Specification for Structural Steel Buildings—Allowable Stress Design and Plastic Design" and AWS D1.1, "Structural Welding Code—Steel."

1.2 DRAWINGS

A. Provide all shop drawings for all custom metal fabrications.

B. See structural notes and drawings for sizes, requirements, and locations of structural steel.

1.3 QUALITY ASSURANCE: (IF APPLICABLE)

1.4 SUBMITTALS: Not Applicable.

PART 2 – PRODUCTS

2.1 STRUCTURAL STEEL AND ACCESSORIES

A. Structural-Steel Shapes, Plates, and Bars: ASTM A 50, carbon steel.

B. Cold-Formed Structural-Steel Tubing: ASTM A 500, Grade B.

C. Anchor Rods, Bolts, Nuts: ASTM A 50 and A 563.

D. Bolts, Nuts, and Washers: ASTM A 307, Type 1, high-strength heavy hex steel structural bolts, heavy hex carbon-steel nuts, and hardened carbon-steel washers, uncoated.

E. Primer: Fast-curing, lead- and chromate-free, universal modified-alkyd, rust-inhibiting primer.

2.2 FABRICATION

A. Fabricate structural steel according to AISC specifications and tolerance limits of AISC's "Code of Standard Practice for Steel Buildings and Bridges" for structural steel.

PART 3 – EXECUTION

3.1 ERECTION

A. Erect structural steel according to AISC specifications and within erection tolerances of AISC's "Code of Standard Practice for Steel Buildings and Bridges."

B. Bolted Connections: Install and tighten high-strength bolts.

C. Weld Connections: Comply with AWS D1.1.

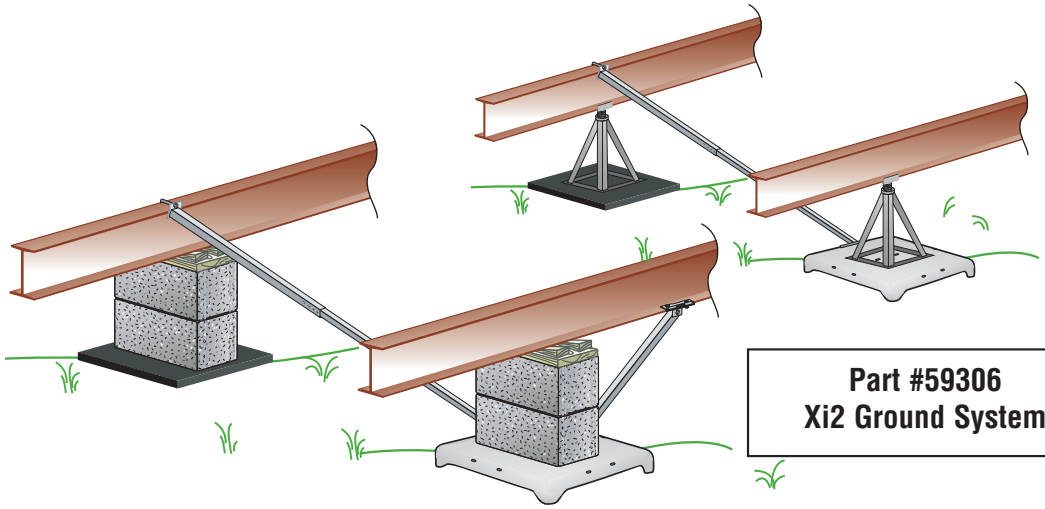
END OF SECTION 05 12 OO

Foundation System

Installation Instructions for Wind Zone I
By Tie Down Engineering

Updated: 12/21/05

- Easy installation
- Stabilizer plates and diagonal frame ties are not required in most set-ups
- Longitudinal stabilization is easily added with Tie Down's LSD strut kit.
- Heavy galvanized coating* on bracket and struts.



Part #59306
Xi2 Ground System

REQUIREMENTS

- Install in any type of soil, 4B(175-275 lbs.) or better.
- Maximum vertical projection at sidewall is 9'. Higher walls may be used when the design loads are adjusted accordingly.
- Main rail spacing must be 75.5" - 99.5"
- Additional vertical anchor ties that are unique to a home's design may be required by the home manufacturer. These locations may include shear walls, marriage line ridge beam support posts, and rim plates. The longitudinal component of the Xi2 system replaces end frame ties. Check manufacturers set-up requirements.
- Maximum pier height is 48".
- Systems must be placed as evenly as possible, no more than 10' from end of home.
- Additional systems may be needed for roof slopes greater than 20 degrees, (4.37" in 12" Pitch) See Page 4.
- Two systems designed to work in conjunction with each other.

* Xi2 components exceed HUD code 3280.307g "Anchoring equipment exposed to weathering shall have a resistance to weather deterioration at least equivalent to that provided by a coating of zinc on steel of not less than 0.30 ounces per square foot of surface coating...."

TIE DOWN ENGINEERING • 5901 Wheaton Drive • Atlanta GA, 30336
www.tiedown.com • (404) 344-0000 • FAX (404) 349-0401

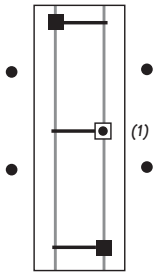
122105.D162

Xi2 Lateral Stabilization Pier Placement

30" Anchor w/vertical strap or frame tie w/stabilizer plate, within 10' of end of home

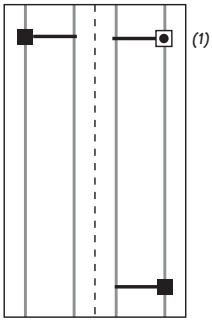
3rd System for homes over 80'

Xi2 Pier Placement



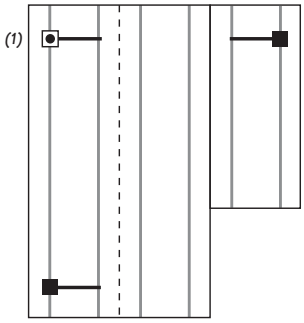
Single Section Home

0 -80' (76' Box) 2 Xi2 Systems
(1) Over 80' (76' Box)3 Xi2 Systems



Double Section Home

0 -80' (76' Box) 2 Xi2 Systems
(1) Over - 80' (76' Box)3 Xi2 Systems



Triple Section Home

0 -80' (76' Box) 2 Xi2 Systems
(1) Over - 80' (76' Box)3 Xi2 Systems

NOTE: Diagram represents single section up to 16' width, double section up to 32' width, and triple section homes up to 48' width. Single section homes have an "overturning moment" in high winds, requiring two anchors per side.

Installation of Lateral System

1. Identify the number of systems to be used on the home using the chart above.
2. Identify the location where the lateral systems will be installed.
3. Clear all organic matter and debris from the pad site.
4. Place pad centered under beam with the lateral strut bracket towards the inside of the home.
5. Press or drive pan into ground until level and flush with prepared surface.
6. Build pier according to State, Local or Home Manufacturers guidelines.*(Figure 1)*
7. Attach the end of the smaller tube to the inside of pan using Ubolt & nuts provided
8. Attach the flag end of the larger tube to the opposite I-beam using the "J" bolt over the top of the I-beam with the nut & washer provided. *(Figure 2)*
9. Install a minimum of four (#12 x 1" tek screws) self-tapping screws into the holes provided in the lateral strut so that the two tubes are connected together. *(Figure 1)*

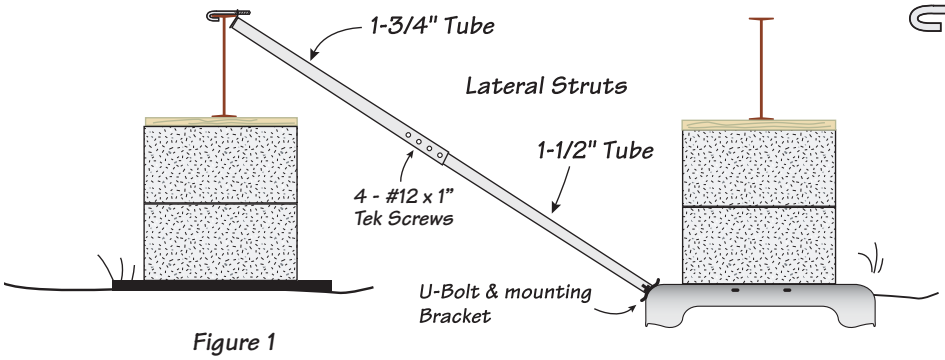


Figure 1

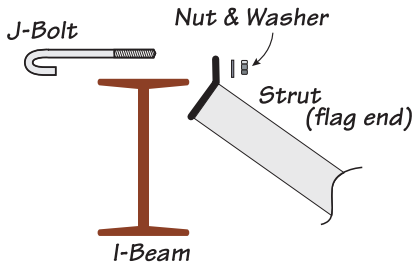
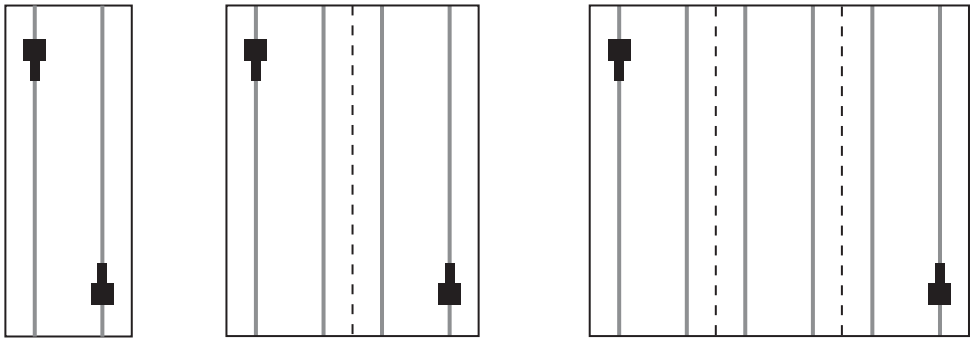


Figure 2

Longitudinal Installation for Xi2 System in Wind Zone I

When the home manufacturer and/or local requirements include longitudinal stabilization, the installer can use the LSD system alone, or combine the LSD strut system with the Tie Down's Xi2 lateral system.

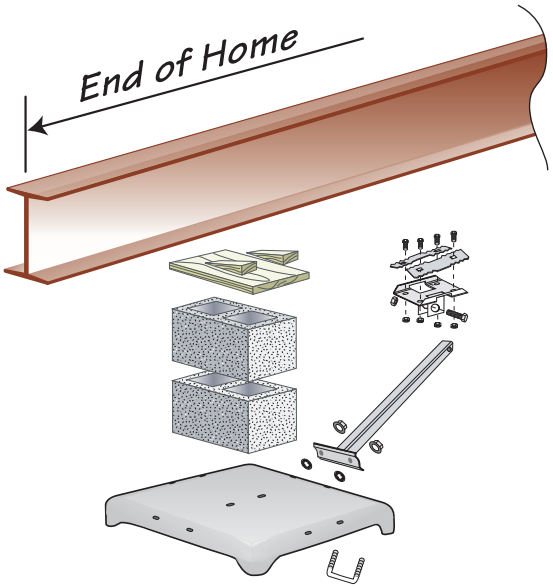


Single Section
Up to 16' Nominal

Double Section
Up to 32' Nominal

Triple Section
up to 48' Nominal

When pier with LSD struts is used only as longitudinal stabilization, systems must be as evenly spaced as possible, no more than 10' from the end of the home.



Installation of Longitudinal Struts

1. Identify the number of systems to be used on the home using the chart above.
2. Clear all organic matter and debris from the pad site.
3. Place u-bolt though holes provided. Attach lock washers on u-bolt, on the top side of pan
4. Press or drive pan into ground until level and flush with prepared surface.
5. Build pier according to State, local or Home Manufacturers guidelines.
6. Install frame bracket clamps to I-beam on in side of block/pier. Do not tighten nuts at this time.
7. Insert u-bolt through mount bracket, attach with nut and bolt. Do not tighten at this time.
8. Insert strut in the frame bracket clamp, attach with nut and bolt. Do not tighten at this time.
9. Pull the frame bracket clamp with the fastened strut outward to remove any slack.
10. Tighten all nuts and bolts on the struts and beam clamps.

Note: Longitudinal stabilization can be combined economically with the Xi2 Lateral System. Combining LSD struts with the pad for the lateral system saves time and material costs. When combining the lateral and longitudinal systems, use the placement directions for the lateral system.

Xi2 System Requirements for Roof Pitches Higher than 20 degrees

Length of Building	Roof Pitch/Degree of Slope 5:12 23.6°	6:12 26.6°	7:12 30.3°	9:12 36.9°
34'	2	2	2	2
36'	2	2	2	2
38'	2	2	2	3
40'	2	2	2	3
42'	2	2	3	3
44'	2	2	3	3
46'	2	3	3	3
48'	2	3	3	3
50'	3	3	3	3
52'	3	3	3	3
54'	3	3	3	3
56'	3	3	3	3

Length of Building	Roof Pitch/Degree of Slope 5:12 23.6°	6:12 26.6°	7:12 30.3°	9:12 36.9°
58'	3	3	3	3
60'	3	3	3	3
62'	3	3	3	3
64'	3	3	4	4
66'	3	3	4	4
68'	3	4	4	4
70'	3	4	4	4
72'	3	4	4	4
74'	4	4	4	5
76'	4	4	4	5
78'	4	4	4	5
80'	4	4	4	5

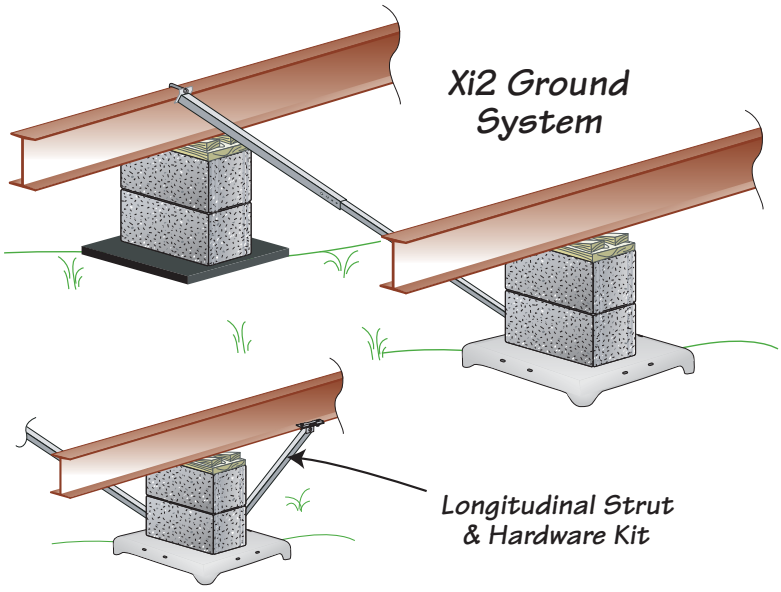
Xi2 Ground Parts Detail

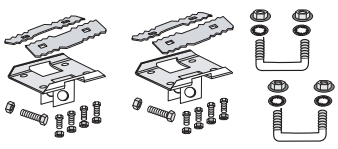
Xi2 Ground System
Includes: 5' Strut, pad & hardware.
Part Number 59306

LSD Hardware Kit
Includes: 2 I-beam brackets &
2 U-bolts with all nuts and bolts.
Part Number 59331

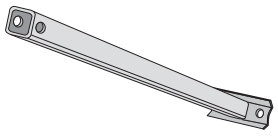
Struts for Longitudinal Systems

Part No.	Strut Length	Pier Height Up To:
59330-30	30"	2 Blocks or 18"
59330-39	39"	3 Blocks or 24"
59330-44	44"	4 Blocks or 32"
59330-53	53"	5 Blocks or 40"
59330-65	65"	6 Blocks or 48"





Ground Longitudinal Hardware Kit



Ground Longitudinal Strut

SECTION 05 52 00 – RAILINGS

PART 1 – General
1.1 SECTION REQUIREMENTS

A. Structural Performance: Provide railings capable of withstanding structural loads required by ASCE 7.

1.2 DRAWINGS
A. See shop drawing/notes.

1.3 SUBMITTALS: Not Applicable.
PART 2 – PRODUCTS
2.1 METALS

A. Steel, Extruded Angles and Tubing, sizes indicated in drawings.
B. Steel Cables.
C. Bolts, nuts, and washers.

2.2 OTHER MATERIALS

A. Transparent plexiglas installed on frame holding evacuated tubes.
PART 3 – EXECUTION
3.1 FABRICATION AND INSTALLATION

A. Assemble railing modules on site.
B. Cut and drill module components, per drawing specification, when needed; verify dimensions in field.
C. Weld railing components in specified locations.
D. Connect cables to modules with bolts; tighten into place.
E. Bolt railing modules in place, to each other, the rails and the deck structure; secure handrail.

3.2 FINISHES

A. Steel Railings: Clean and apply a clear acrylic seal to all raw metal.
END OF SECTION 05 52 00

CSI Subdivision: 05 59 00 Metal Specialities

SECTION 05 59 00 METAL SPECIALITIES

PART 1 – General
1.1 Summary
A. This Section includes the following:
1. Metal Scupper (zinc)
2. Aluminum Exterior Sheathing Rod
3. Aluminum Shutter Frame
4. Aluminum Exterior Cladding and Trim
5. Aluminum Interior Trim

1.2 DRAWINGS
A. See shop drawings/ structural notes and drawings for exact dimensions and locations.

1.3 SUBMITTALS: Manufacturer Safety Data Sheet.
PART 2 – PRODUCTS
2.1 METALS
A. Aluminum Sheets
B. Aluminum Angles
2.2 FABRICATION
A. General: Shear and punch metals cleanly and accurately. Remove burrs and ease exposed edges. Form bent-metal corners to smallest radius possible without impairing work.

B. Welding: Weld corners and seams continuously. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals. At exposed connections, finish welds and surfaces smooth with contour of welded surface matching those adjacent.
PART 3 – EXECUTION
3.1 INSTALLATION

A. Perform cutting, drilling, and fitting required for installing miscellaneous metal fabrications. Set metal fabrication accurately in location, alignment, and elevation; with edges and surfaces level, plumb, true, and free of rack.

C. Fit exposed connections accurately together to form hairline joints.

END OF SECTION 05 59 00

CSI Masterformat Division 6: Woods, Plastics and Composites

KNOW-A-WATT:

The common building material with least embodied energy is wood, with about 640 kilowatt-hours per ton (most of it consumed by the industrial drying process, and some in the manufacture of and impregnation with preservatives). Hence the greenest building material is wood from sustainably managed forests. Brick is the material with the next lowest amount of embodied energy, 4 times (X) that of wood, then concrete (5 X), plastic (6X), glass (14X), steel (24X) and aluminum (126X)

SECTION 06 10 00 – ROUGH CARPENTRY

PART 1 – GENERAL
1.1 Summary
A. Section Requirements
B. Submittals: Manufacturer Safety Data Sheets.
1.2 DRAWINGS
A. See structural notes and drawings
PART 2 – Products
2.1 Wood Products
A. Lumber: Provide dressed lumber, S4S, 15 percent maximum moisture content for 2-inch nominal thickness or less, marked with grade stamp of inspection agency.
B. Engineered Wood Products: Acceptable to authorities having jurisdiction and for which current model code research or evaluation reports exist that show compliance with building code in effect for Project.
C. Wood Structural Panels: DOC PS 2. Provide plywood complying with DOC PS 1, where plywood is indicated.
1. Comply with “Code Plus” provisions in APA Form No. E30K.
2.2 FABRICATION
A. TREATED MATERIALS
1. Preservative-Treated Materials: AWPA ACQ lumber, labeled by an inspection agency approved by ALSC’s Board of Review. After treatment, kiln-dry lumber and plywood to 19 and 15 percent moisture content, respectively. Treat indicated items and the following:
a. Wood framing members less than 18 inches above grade.
2. Fire-Retardant-Treated Materials: Comply with performance requirements in AWPA C20 lumber and AWPA C27 plywood, labeled by a testing and inspecting agency acceptable to authorities having jurisdiction.
a. Use treatment for which chemical manufacturer publishes physical properties of treated wood after exposure to elevated temperatures, when tested by a qualified independent testing agency according toASTM D 5664 for lumber and ASTM D 5516 for plywood.
b. Use Interior Type A High Temperature (HT), unless otherwise indicated.

B. LUMBER

1. Concealed Boards: 19 percent maximum moisture content, Mixed southern pine, No. 2 per SPIB rules.

2. Miscellaneous Lumber: Construction, Stud, or No. 3 grade of any species for nailers, blocking, and similar members.

C. ENGINEERED WOOD PRODUCTS
1. Engineered wood products with allowable design stresses, as published by manufacturer, that meet or exceed those indicated. Manufacturer's published values shall be demonstrated by comprehensive testing.
2. Laminated Veneer Lumber: Manufactured with exterior-type adhesive complying with ASTM D 2559. Allowable design values determined according to ASTM D 5456.
a. Extreme Fiber Stress in Bending, Edgewise: 2850 psi for 6- inch nominal depth members.
b. Modulus of Elasticity, Edgewise: 2,000,000 psi.
D. PANEL PRODUCTS
1. Subflooring: Plywood: DOC PS 1, Exposure 1, Structural I.
2. Underlayment: Storm Guard Peel and Stick Underlayment
E. MISCELLANEOUS PRODUCTS
1. Fasteners: Size and type indicated. Where rough carpentry is exposed to weather, in ground contact, or in area of high relative humidity, provide fasteners with hot-dip zinc coating complying with ASTM A 153/A 153M.
a. Power-Driven Fasteners: CABO NER-272.
b. Bolts: Steel bolts complying with ASTM A 307, Grade A; with ASTM A 563 hex nuts and, where indicated, flat washers. (*NEEDS TO BE SIZED BY RICK).
2. Metal Framing Anchors: Hot-dip galvanized steel of structural capacity, type, and size indicated.
3. Sill-Sealer: Expanding foam spray insulation
4. Adhesives for Field Gluing Panels to Framing: Liquid Nails.
PART 3 – EXECUTION
3.1 INSTALLATION/ APPLICATIONS/ INSPECTIONS/ CLEANING]
A. Set rough carpentry to required levels and lines, with members plumb, true to line, cut, and fitted. Locate nailers, blocking, and similar supports to comply with requirements for attaching other construction.

B. Securely attach rough carpentry to substrates, complying with the following:

1. CABO NER-272 for power-driven fasteners.
2. Published requirements of metal framing anchor manufacturer.

C. Fastening Methods: Comply with recommendations and "Code Plus" provisions in APA Form No. E30K and the following:

1. Subflooring: Glue and screw to framing.
2. Underlayment: Storm Guard Peel and Stick.

END OF SECTION 06 10 00

SECTION 06 12 00 – STRUCTURAL INSULATED PANELS (SIPs)

PART 1 – GENERAL

1.1 Summary

A. This Section includes fabrication and/or installation of the following:

1. Structural Insulated Panel (SIP) Roofing.
2. Structural Insulated Panel (SIP) Ceiling.
3. Structural Insulated Panel (SIP) Walls.
4. Structural Insulated Panel (SIP) Floors.
5. Adhesives.
6. Fasteners such as screws with or without metal stress plates/washers.
7. Opening let-ins (window, door, skylight, etc) for factory or field installed wood bucks, nailers, and blocking.
8. Site applied expanding foam for joint or void sealing.
9. Seam weather sealant (“Wet Stick”) for roof and foundation panels.
10. Headers - lumber or SIP.
11. Accessory or miscellaneous materials.
12. On-site services.

B. The general Provisions of the contract and Division 1, General Supplementary and Special Conditions apply to the work specified in this section.

1.2 DESCRIPTION OF WORK

A. Provide all materials, labor, and equipment to install the Snap-N-Lock Structural Insulated Panels.

A. Snap-N-Lock Structural Insulated Panels consist of facings of polyester coated sheet metal, roll formed to produce a patented locking system.

C. Provide evidence of the maintenance of in-plant quality control and a Third Party Inspection Service in compliance with national codes.

B. Provide evidence of third party inspection for the manufacture of each component use in the manufacture of Snap-N-lock panels – metal, EPS, adhesive.

1.3 DRAWINGS

A. Refer to all drawings for configurations and snapping details, for added steel headers.

1.4 SUBMITTALS

A. Manufacturer shall certify that panels have been tested in accordance with ASTM D 1929-96 (Ignition Properties of Plastics), ASTM E-119-95a (1 Hour Fire Resistance Test Non-Bearing) and ASTM E-84 (Surface Burning Characteristics).

B. Each Snap-N-Lock Structural Insulated Panel type shall be accompanied with manufacturers load tables and/or verified structural calculations signed and/or sealed by a registered design professional qualified to perform such work.

1.5 DELIVERY, STORAGE AND HANDLING

A. Each panel shall be wrapped in plastic with protective end caps, and a protective foam insert in female lock.

B. All panels shall be stored in a protected area and supported to prevent contact with ground.

C. Prior to installation, panels shall be protected from exposure to sunlight or excessive moisture.

PART 2 – PRODUCTS

2.1 STRUCTURAL INSULATED PANELS

A. Structall Snap-N-Lock Structural Insulated Panel – A pressure laminated composite panel consisting of the following:

1. Expanded polystyrene core - Minimum density 0.90 pcf. (Type 1) complying with ASTM C 578-87a. having an average R-value (thermal resistance) of 4 per inch of thickness.
2. 26 gauge G90 galvanized grade D steel alloy ASTM A527 facing – roll formed to create the patented Snap-N-Lock male and female locking system with concealed sealant reservoir. Or 0.024 or 0.032 inch aluminum alloy 3105-H-194 facing – roll formed to create the patented Snap-N-Lock male and female locking system with concealed sealant reservoir.
3. Adhesive – Mor-Ad M-640 & Mor–Ad-642 polymetric MDI and MDI product. locking system with concealed sealant reservoir.
4. Adhesive – Mor-Ad M-640 & Mor–Ad-642 polymetric MDI and MDI product.

B. Sizes – Snap-N-Lock panels are nominal 4 feet and 2 feet wide and can be supplied in lengths from 1 to 32 feet. Nominal standard thicknesses are 2, 3, 4, 6 and 8 inch. Available in custom thickness.

C. Dimensional tolerances – shall comply with values listed in the manufacturer's quality control manual.

2.2 ACCESSORIES

A. Aluminum Extrusions: angle, channel and gutter shall be painted white to match panel. Channels shall be available in thermally broken and non-thermally broken type. All channels and other panel edge fitting extrusions shall fit tight to panel thickness.

B. Break-metal: ridge flashing, valley flashing and hip flashing shall be a minimum of 26ga. Galvanized steel sheet. Bearing plates, wall top caps and headers shall be a minimum of 18ga. Galvanized steel sheet.

C. Fasteners: all screws shall be Zinc plated, Zinc plated and painted or stainless steel and follow panel manufacturers spacing requirements.

D. Sealant: apply a sealant compatible with all components of the panel and adjacent materials as supplied by the panel manufacturer and per manufacturer's details.

2.3 PERFORMANCE CHARACTERISTICS

A. Structural Testing – Each panel type shown on the drawings shall meet or exceed the following performance standards when tested in accordance with the following test methods:

1. Axial Load Test - test method ASTM E72-95 Section 7
2. Transverse Load - test method ASTM E72-95 Section 11
3. Racking Load - test method ASTM E72-95 Section 14
4. Concentrated Static Load - ASTM E661-88
5. Core Density - ASTM C271-94
6. Flexure-Creep - ASTM C480-62

B. Fire Testing – data for Snap-N-Lock panels shall be available for the following tests:

1. Surface Burning Characteristics - ASTM E84-91a
2. 1 Hour Fire Resistance Test Non-Bearing - ASTM E119-95a
3. Ignition Properties of Plastics - ASTM D 1929-96
4. Surface Burning Characteristics - ASTM E84-95
5. Test of Interior Finish Material – UL 1715

C. Snap-N-Lock Panels meet the following code interior finish criteria:

1. SBC Class A
2. UBC Class I
3. FBC Class A

D. Live loads and Dead loads acting on the panels shall be calculated by a certified design professional per applicable codes and be within manufacturer published load tables.

E. Fastener spacing shall be calculated by a certified design professional and/or be per manufacturer recommended details.

2.4 MANUFACTURER

A. All components called for in this section to be supplied by the panel manufacturer shall be obtained from the manufacturer or its approved dealer.

B. Subject to full compliance with all requirements in this section manufacturers approved to supply panels and materials are:

1. Structall Building Systems, Inc.
   Oldsmar Service Center
   350 Burbank Road
   Oldsmar, FL 34677
   1-800-969-3706

C. All manufacturers seeking to qualify under this section shall submit all supporting documentation 30 days prior to the bid date.

PART 3 – EXECUTION

3.1 GENERAL

A. The Contractor shall inspect conditions of substrate, grade, squareness of slab and other conditions affecting the proper installation of panels. Any adverse conditions are to be reported in writing to the construction manager.

B. Do not proceed with the installation until adverse conditions are corrected. Proceeding with installation indicates responsibility for performance of entire installed system complying with all requirements.

3.2 PREPARATION

A. Field Measurements: Field verify all dimensions prior to installation.

B. Anchorage: Install all required anchors, clips, bracket, supports, bracing, etc. prior to installation of panels.

3.3 INSTALLATION

A. Manufacturer's instructions: Installation shall be in strict accordance with manufacturer's published instructions, details and the drawings that are part of the contract documents for this project. Any conflicts between these documents shall be resolved in writing. All plans shall be reviewed by a qualified Architect/Engineer and shall be signed and/or sealed. Deviations from standard details and load design values shall be calculated and signed and/or sealed by a qualified Architect/Engineer.

B. Bracing: The Contractor shall be responsible for the temporary bracing of all installed panels. Any panels damaged by unbraced construction shall be replaced at no cost to the Owner.

CSI Subdivision: 06 12 00 SIPSs

3.4 WARRANTY

A. Execute manufacturer's standard warranty form with Architect/Engineer.

END OF SECTION 06 12 00

CSI Subdivision: 06 16 00 Radiant Floor Heating

SECTION 06 16 00– WARMBOARD RADIANT-FLOOR HEATING PANEL

PART 1 – GENERAL
1.1 Summary
A. This Section includes fabrication and/or installation of the following:
1. WARMBOARD RADIANT-FLOOR HEATING PANEL
2. Span rating
3. Diaphragm construction

1.2 CODE PERFORMANCE REQUIREMENTS
A. Architect or engineer to indicate on construction documents the applicable model building code and structural design loads that the Warmboard is to be fabricated to withstand without exceeding allowable tested or calculated design working stress of the materials involved and in order to meet or exceed applicable building code requirements and ASCE 7.

1. Compliance with the following codes:
a. 2003 international Building Codee (IBC)
b 2003 International Residential Codee (IRC)
c. I 1997 Uniform Building CodeTU (UBC).
B. USES
1. Sub-floor sheathing to accommodate radiant floor tubing.
C. DESCRIPTION
1. Warmboard radiant-floor heating panels are used as sub-floor sheathing, and have grooves to accomodate radiant-floor tubing. Warmboard panels are manufactured from APA-rated Sturd-I-Floor plywood. The panels have a nominal thickness of 1 3/32 inches (27.78 mm) and an actual thickness of 1.075 inches (27.3 mm). The panels are 4 feet by 8 feet (1219 mm by 2438 mm) and have tongue-and-groove edges. One face of each panel has channel grooves muted into the face surface, to accommodate radiant-floor tubing. Grooves are approximately 0.68 inch (17.3 mm) deep and 0.68 inch (17.3 mm) wide, and are spaced 12 inches (305mm) on center, parallel to the length of the panel. Nine inches (229 mm) from the Panel edge. the grooves bend at 90 degrees and 180 degrees to permit the radiant-floor tubing to return to the field of the panel. Panels have an overlayof 0.025-inch thick (.64mm) aluminum bonded to the grooved surface.

1.3 SUBMITTALS
A. Submittals:
1. Product Data.
2. ES Report listing for the Warmboard product line.

PART 2 – PRODUCTS

2.1 PRODUCT DATA

A. Allowable Spans and Loads

1. Warmboard is a wood structural panel meeting the requirements of IBC Section 2303.1.4, IRC Section R503.2 and the UBC Standard 23-3, DOC PS-2, and Section 2312 of the UBC. The panel single-floor span rating is 24 inches (610mm) on center. The span rating applies to panels at least 24 inches (610 mm) wide. The allowable total and live loads at the maximum 24inch (610 mm) span are 110 psf (5.3 kN/m²), and 100 psf (4.2 kN/m²), respectively. The span rating and allowable loads are based on panels installed with the grooves perpendicular to the joists. Panels shall be installed with grooves perpendicular to the joists.

B. Allowable Diaphragm Values:

1. Warmboard panels used in horizontal diaphragms may be used to resist horizontal forces not exceeding those set forth in Table 1 of this report. The general requirements for horizontal diaphragm is specified in IBC Sections 2306 and 2307, and UBC Section 2315.1, are applicable to Warmboard panels.

2.2 FABRICATION

A. See manufacturer's approved tubing types/brands for use with Warmboard panels.

B. A note about PEX Aluminum PEX:

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

2.3 ACCEPTABLE MANUFACTURERS

C. Subject to compliance with requirements, provide panels and related materials or products by:

WARMBOARD, INC.
8035 SOQUEL DRIVE
APTOS, CALIFORNIA 95003
(831) 685-9276
www.warmboard.com
alsbem@warmboard.com

B. Substitutions: manufacturers' or other materials different than herein specified in this section shall not be permitted.

CSI Subdivision: 06 16 00 Radiant Floor Heating

PART 3 – EXECUTION

3.1 INSPECTION/TESTING

A. Contractor shall verify superstructure layout, spans and resulting loads for consistency with the manufacturer's evaluated capacities, and report any inconsistencies to the owner's agent prior to installation.

3.2 INSTALLATION

A. The dimension of the framing member to which the Warmboard panel is attached shall be at least 2 inches (nominal). Panel edges shall be butted together and centered over the framing members. Nails shall be placed not less than 18 inch (9.5 mm) in from the panel edge: shall be spaced not more than 6 inches (152 mm) on center along panel edge bearings; and shall be firmly driven into the framing member. A floor finish material recommended by Warmboard, Inc., shall be installed over the Warmboard panel.

B. Materials and tools on site Warmboard Installation Kit containing:

1. 3 ea - Custom routing templates/guides (wood)
2. 1 ea - Installation DVD
3. 1 ea - 5/8" router bit (Must be used with a minimum 1-1/2 hp plunge router and an ID 3/4" OD 59/64" or 1" template guide)
4. 2 ea - Alignment pins (metal)
5. ID 3/4" OD 59/64" or 1" template guide (to attach to router)
6. Guide lock nut (to fasten template guide to router)

C. Other materials and tools needed on site:

1. Warmboard panels sorted into left turn, right turn, straight and double turn stacks.
2. One tube of silicone caulk for every 3 Warmboard panels to be used.
3. Caulk gun.
4. Tubing un-coiler
5. Heavy roller (typically a linoleum roller)
6. Sufficient Warmboard approved PEX tubing. (refer to Approved Tubing List included)
7. Leaf blower, shop vacuum or broom.
8. Drill motor with 11/16" drill.
9. PEX Tubing cutter.
10. Felt tip marking pen.
11. Warmboard Panel and Tubing Plans.
12. Electrician nailing plates.
13. 4" grinder.
14. 1 1/2 HP plunge router

D. Fastening Warmboard to the joists:

1. Customary subfloor installation practice is generally followed:
2. Fasten with panel adhesive and screws or screw nails.

As sheets are placed, alignment pins are tapped into place on the two outer most channels, across the seam between the adjacent panels, to ensure proper channel alignment. Pay close attention to the panel layout plan as the work proceeds.

3. As turn panels are being placed, check to see that any supplemental joists required at the cross channel are in place. Per APA (American Panel Association) guidelines all subfloor panels, including Warmboard, should be gapped 1/8” on the 4’ side.

E. Panel preparation prior to installing the tubing:

1. Using a felt tip marker, and as per the tubing plan, mark the bury points where each loop starts and stops, the location of any manifolds, and the paths of any supply/return leaders from a given loop to a manifold or the boiler panel.
2. Mark locations of any custom channels, which may be required due to unusual architectural features or where plumbing interferes with the regular Warmboard tube patterns.
3. At each bury point drill a shallow angle 11/16” hole in the channel in the appropriate direction so that the leader can pass from the channel to the under floor area, in the correct direction to lead to the appropriate manifold location or the boiler panel.
4. Sometimes leaders are not directed through the underfloor area. For example, leaders can be run in surface channels (which may or may not be custom routed) or through walls. In such cases, follow plan notes that describe such alternative routing means. Rout all custom channels. Please see instructions for custom routing.

F. For custom routing and tube installation, refer to manufacturer’s instructions.

3.3 CONDITIONS OF USE

A. The Warmboard radiant-floor heating panel described in this report complies with, or is a suitable alternative to what is specified in, those codes listed in Section 1.0 of this report, subject to the following conditons:

1. The Warmboard’ panels are limited to use as structural subflooring or as combined subfloor underlayment.
2. The panels are installed in accordance with this report
3. Allowable spans, loads and diaphragm capacities comply with this report.
4. The panels are manufactured for Warmboard in Willits, California, under a quality control program with inspections by APA-The Engineered Wood Association (AA-649).

B. Allowable Diaphragm Values:

1. Warmboard panels used in horizontal diaphragms may be used to resist horizontal forces not exceeding those set forth in Table 1 of this report. The general requirements for horizontal diaphragm is specified in IBC Sections 2306 and 2307, and UBC Section 2315.1, are applicable to Warmboard panels.

3.4 EVIDENCE SUBMITTED

A. Each panel shall bear a stamp identifying the evaluation report holder (Warmboard, inc.), product name, span rating, nominal panel thickness, Exposure 1 rating, evaluation report number (ESR-1421), and inspection agency (APA- The Engineered Wood Association).

3.5 CLEANING

A. Cleanliness of channels:

1. Inspect the channels at the joints between panels for any excess of panel adhesive, which may have squeezed up between sheets at the channels.

2. Use the 4” grinder to remove any excess. Using a leaf blower, shop vac or broom (leaf blowers are the quickest and easiest way to clean the channels) clean off any debris or dust from the subfloor surface and the channels.

3. Cleanliness is important for easy tubing installation, so take care with this step.

3.6 WARRANTY

A. Execute manufacturer’s standard warranty form with Architect/Engineer.

END OF SECTION 06 16 00

SECTION 06 20 00- FINISH CARPENTRY

PART 1 – GENERAL
1.1 Summary
A. SECTION REQUIREMENTS
1. Submittals: Product Data and Flame Spread
1,2 DRAWINGS
A. See all drawings for locations and configurations
PART 2 – PRODUCTS

2.1 GENERAL MATERIALS
A. Lumber: DOC PS 20 and grading rules of inspection agencies certified by American Lumber Standards Committee Board of Review.

B. Softwood Plywood: DOC PS 1.
C. Hardwood Plywood: HPVA HP-1.
D. Reclaimed Mesquite, random alternating Tongue and Groove Flooring at 1” - 3”, stain grade.

2.2 EXTERIOR FINISH CARPENTRY

A. Exterior Lumber Trim: Kiln-dried Cedar window trim, paint grade.

2.3 INTERIOR STANDING AND RUNNING TRIM

A. Interior Softwood Lumber Trim: Clear, kiln-dried, cedar.

2.4 INTERIOR FINISH MATERIAL-PANELING

A. MDF paneling for interior walls, 3/8 thickness, no added formaldehyde, horizontal planks @ 4” with 1/16” reveal. No average value of a single panel in a multi- panel sampling shall be more than ten percent out of compliance with the requirement shown in ANSI A208.2-1994, product class MD. Stock panel sizes are 49” x 97” in thicknesses of 3/8”, 1/2”, and 3/4”. Custom sizes (up to 5’ x 18’), thicknesses (from 3/8” to 1 1/4”) and/or cut-to-size are also available through SierraPine sales.

2.5 INTERIOR FINISH FLOOR

A. Interior finish floor composed of reclaimed mesquite, random Tongue and Groove Flooring, @ 2” - 5”, tongue oil varnish.

2.6 DECKS, RAMPS, STAIRS

A. Exterior Decks and Ramps: Composite material of reclaimed wood fibers and pure plastic resins in the TimberTech 5/4 planks.
B. Exterior Treads and Risers: Composite material of reclaimed wood fibers and pure plastic resins in 5/4 planks.

2.7 MISCELLANEOUS MATERIALS

A. Fasteners for Exterior Finish Carpentry: Stainless-steel hot-dip galvanized steel or aluminum nails.

PART 3 – EXECUTION

3.1 INSTALLATION
A. Condition finish carpentry in installation areas for 24 hours before installing.

B. Prime and backprime lumber for painted finish exposed on the exterior.

C. Install finish carpentry level, plumb, true, and aligned with adjacent materials. Scribe and cut to fit adjoining work. Refinish and seal cuts.

D. Install standing and running trim with minimum number of joints practical, using full-length pieces from maximum lengths of lumber available. Stagger joints in adjacent and related trim. Cope at returns and miter at corners.

E. Nail siding at each stud. Do not allow nails to penetrate more than one thickness of siding, unless otherwise recommended by siding manufacturer. Seal joints at inside and outside corners and at trim locations.

E. Select and arrange paneling for best match of adjacent units. Install with uniform tight joints.

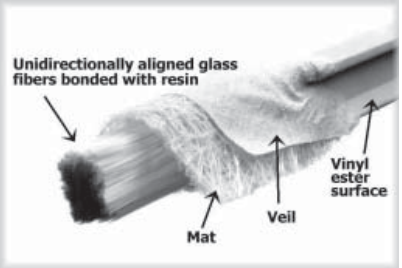
END OF SECTION 06 20 00

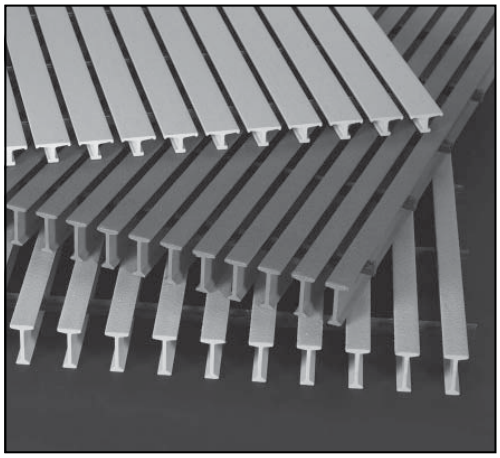
DURADEK®

HIGH STRENGTH FIBERGLASS GRATING

PULTRUDED BAR-TYPE GRATING

Whether you are designing, building or replacing walkways or platforms, make DURADEK® your choice for long lasting dependable service.





DURADEK® high strength fiberglass grating is a pultruded bar type grating that can be designed and used like traditional metal grates. The individual bearing bars are either 1 or 1-1/2 inch "I" or 2 inch "T" shapes. DURADEK® is a flame retardant product utilizing a premium grade vinyl ester resin. The bearing bars use both longitudinal (glass roving) and multidirectional (glass mat) reinforcements as well as a synthetic surfacing veil to provide unequaled corrosion resistance.

Designing with DURADEK®

Complete load tables and properties are available. The bearing bars are assembled into 12 panel sizes for your convenience; 3-, 4-, and 5-foot widths in each of 8-, 10-, 12-, and 20-foot lengths. Standard panels come with cross-rod spacings of 6" or optional 12" on center.

Fabricating with DURADEK®

DURADEK® is lightweight and, therefore, easily handled in installation, and costs less to ship than steel grating.

A patented 3-piece cross-rod system both mechanically locks and chemically bonds the cross rods to the web of each bearing bar. This separates and affixes bearing bars firmly in position and distributes concentrated loads to adjacent bars. The system allows DURADEK® grating to be cut and fabricated like a solid sheet. Standard carpenter's tools with abrasive cutting edges may be used: just coat the cut ends with resin sealer and install. Ask for the detailed DURADEK® *Field Fabrication Guide.*

Features & Benefits

- Corrosion Resistant
- Structurally Strong
- High Impact Strength
- Low Conductivity
- Anti-Skid
- Rigid
- Easy To Fabricate
- Low Maintenance
- Low Thermal Conductivity
- Non-Sparking
- Resistant to Chipping & Cracking
- Aesthetically Pleasing Appearance

Anti-Skid Surface

The top of DURADEK® grating is covered with a permanently bonded grit, anti-skid surface with optional grit material and particle sizes available.

Accessories

A complete line of accessories are available for installing DURADEK® including stair treads and landings, panel hold-downs, panel connectors and curb angle.

Availability

Standard yellow and gray vinyl ester panels can be shipped from the factory within 72 hours. Distributors stock DURADEK® in major cities throughout the USA and Canada.

STRONGWELL

ISO 9001 Certified Manufacturing Plants

BRISTOL DIVISION
400 Commonwealth Ave., Bristol, VA 24201-3820 USA
(276) 645-8000 FAX (276) 645-8003

CHATFIELD DIVISION
1610 Hwy. 52 South, Chatfield, MN 55923-9799 USA
(507) 867-3479 FAX (507) 867-4031

www.strongwell.com

ST1201

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Print

Item Specifications:

Item Number :	BARCD000000000105153
Product Line :	Grating
Product Type :	Pultruded
Weight :	2.61 #/SF
Length (Span for Grating) :	240"
Width :	36"
Minor Material :	SPW
Major Material :	Fiberglass
% Open Area :	18%
Surface :	Fine Grit
Bearing Bar Spacing :	2"
Cross Bar Spacing :	6"
Bearing Bar Color :	White
Bearing Bar Height :	1"
Bearing Bar Shape :	Wide T-Bar
Trade Name :	McNICHOLS
Class :	Wide T-Bar
SKU Type :	Panel
Cross Bar Size :	Standard
Cross Bar Type :	Regular
Bearing Bar Thickness :	N/A
Cross Bar Color :	Gray
Cross Bar Surface :	Smooth
Fire Retardant Rating :	No
Flame Spread Rating :	None
Resin Content :	Comp Glass/Mat/Resin
Grit Application :	Applied
Grit Material :	Silica
Grit Texture :	N/A
Grit Color :	White
Resin Name :	Polyester
Spacing Description :	MS T-1810
Top Flange Width :	1 5/8"
UV Protection :	UV Resistant
Bottom Flange Space :	1 1/2"
Top Flange Space :	3/8"
HS Item Number :	F14FG14332

Accessories:

Angle	Clips, Anchors, Etc	Hardware
Kick Plate	Sealing Kits	

Options:

Angle Cutting	Straight line cutting to produce an angle other than 90 degrees
Circle Cutting	Shearing or sawing material in a circular path to a specified dimension.
Cut to Size	This describes the option of cutting a standard size into pieces of specified size with typically 90 degree corners. Used to describe this process regardless of what tool or machine is used to do the cutting.
Drawings Required	Drawings required to confirm material specifications, sizes or to aid in erection of the finished materials.
Install Toe Plate	The process by which a flat piece of material is attached to the edge of a piece of grating at a 90 degree angle to the surface and extending above the surface of the material, preventing a foot from extending over the edge of the grating
Notching	A type of cutting where material is removed from a portion of the edge of a product to specified dimensions resulting in a "cut-out" or notch in the edge of the material
Random Cutting	The process of cutting when material is cut to size without regard to any finidhed pattern or stub length.
Sealing	The process by which cut parts of fiberglass products are coated with a resin or other coating to protect the cut edge and restore the original properties to the material.
Straight Cutting	Straight line cutting at a 90 degree angle to the edge of the material.

Applications:

Catwalk/Walkway	Material used as flooring on a raised pathway enabling movement from one area to another.
Flooring	Material used as flooring.
Part/Equipment	Products used as parts on equipment or machinery.
Platform/Deck/Mezzanine	Materials used in the construction of a mezzanine or platform up above the existing level.
Railings	Products used to form a physical barrier around an area or platform, typically a handrail.
Ramp	Material used in a gradual incline to get from one elevation to the next.
Trench/Grate/Drain	Material used to cover a long narrow hole, typically used for drainage

CSI Subdivision: 06 64 00 Plastic Fabrications

BUNKER PLASTICS, INC.
Manufacturer of Quality Mirror Products

Product Specification: HMR Extruded Acrylic

Material Grade: Optical Grade Hard Mar Resistant Acrylic sheet with Improved Optical Quality. This product is avalable as one or two sides coated. This product will meet the tough glazing requirements of *ANSI Z 97.1 & Z 26.1*

Material Color: Clear and Bronze

Scope: Specification for Hardcoated Extruded Acrylic. Parameters and manufacturing tolerances are outlined in this specification sheet. Although Acrylic sheets cannot be made completely without flaws, the use of this document will insure only those sheets meeting this specification will be used for Optical Grade Hard Mar Resistant Extruded Acrylic.

Property	Requirement	Test
1.0 Dimension		
1.1 Gauge Tolerance Nominal Gauge Range Available .060" – 1"	See ASTM D 4802-94, 4.1.3 *category* B-1	TM 2000
1.2 Width Tolerance	+ 1.5" - 0"	TM 4000
1.3 Length	+ 2.0" - 0"	TM 5000
2.0 Appearance		
2.1 Warpage	.500" (Max.)	TM 1800
2.2 Squarness	.500" (Max.)	TM 2400

Property	Requirement	Test
3.0 Sheet Defects	Per ASTM D- 4802-94 Sec. 5.6.3.3	TM 3200
Substrate Defects 100% Visual Inspection Performed Vertically @ 36" to 40"		
3.6 Inclusions, Bubbles, White Specks	Max. Defect Per Sq. Ft.	TM 3210
Defect Size .066" - .187" .040" - .065" .030" - .039" .010" - .029"	 1 Per 4 SF 3 Per 1 SF 4 Per 1 SF Not counted	
3.7 Pits, Voids, Dimples,	Max. Defect Per Sq. Ft.	TM 3600
Defect Size .066" - .187" .050" - .065" .030" - .049"	 1 Per 4 SF 2 Per 1 SF 8 Per 1 SF	
4.0 COATING		
4.1 Abrasion Taber, Haze (100 cycles)	4 % (Max.)	TM 2046
4.2 Coating Adhesion (Scribe)	No coating removed by adhesive tape	TM 2047
4.3 Visual Defects (surface)		
A. Lint / Fibers Width < .030" Length > .500" Length < .500"	Max. Defects Per Sq. Ft. 0 1	TM 1059

Property	Requirement	Test

SECTION 06 64 00 – PLASTIC FABRICATIONS

PART 1 – General
1.1 Summary
A. This Section includes fabrication and/or installation of the following:
1. POLGAL POLYCARBONATE SHEETS
1.2 CODE PERFORMANCE REQUIREMENTS

A. Architect or engineer to indicate on construction documents the applicable model building code and structural design loads that the Polygal is to be fabricated to withstand without exceeding allowable tested or calculated design working stress of the materials involved and in order to meet or exceed applicable building code requirements.

1. Compliance with the following codes:

1.3 USES

A. Polygal used for the exterior sheathing of the building.

1.4 SUBMITTALS – GENERAL

A. Submittals:

1. Product Data.
2. Installation, Handling, Storage, Hazards, Safety requirements

1.5 DESCRIPTION

A. Composition/Information on Ingredients:

1. Polycarbonate based on Bisphenol A

1.6 DRAWINGS
A. See shop drawing/notes for sizes, requirements, and locations.
PART 2 – PRODUCTS
2.1 PRODUCT INFO

A. POLYGAL POLYCARBONATE SHEETS
1. Use for exterior sheathing of building.

B. Physical and Chemical Properties:

Form: Hollow Plastic Sheet
Color:
Colorless or pigmented:
Clear, Opal Ice, Bronze, Blue,
Green, Grey and other Odor: Odorless Softening Point: 150-160°C (300-320°F)
Density: Material: 1200 kg/m? at 20°C
Sheet: 125-250 kg/m3 Vapor Pressure: Not Applicable
Viscosity: Not Applicable
Solubility in Water: Insoluble
pH Value: Not Applicable
Flash Ignition Temperature: > 450°C (842°F)
Self Ignition Temperature: > 450°C (842°F)
Explosive Limit: Not Applicable

C. Stability and Reactivity:

1. Thermal decomposition: Decomposition begins at 380°C (716°F).
2. Hazardous decomposition products: in cases of smoldering and incomplete combustion, toxic fumes mainly consisting of CO and CO2 may develop as well as traces of Aliphatic and Aromatic Hydrocarbons, Aldehydes, Acids, Phenol and Phenol-derivatives.
3. Hazardous reactions: No hazardous reactions observed.

D. Toxicological Information:

EYE: Product not considered as a primary eye irritant.
SKIN: Product not considered as a primary skin irritant.
Dermal LD50 (rabbit) >2g/kg estimated.
ACUTE ORAL: Oral LD50 (rat) >5g/kg estimated

E. Ecological Information

1. WATER: Water pollution class (WGK): 0 - not generally hazardous to water.

F. GENERAL: Not expected to present any significant ecological problems.

1. Regulatory Information
2. No labeling is required in accordance with the EEC directives.
3. In connection with dusts formed in consequence of mechanical treatment, e.g. grinding, the appropriate regulation/maximal values for fine dusts must be observed:

a. MAX Value (fine dust): 6 mg/m3

CSI Subdivision: 06 64 00 Plastic Fabrications

2.3 MANUFACTURER
A. Subject to compliance with requirements, provide panels and related materials or products by:

1. Hollow Profile Sheet made of Polycarbonate
Cas # :
Polygal Plastics Industries Ltd.
Ramat Hashofet 19238 ISRAEL
Phone: 972-4-959-6222, Fax: 972-4-959-6296,
Email: sales@polygal.co.il
Website: www.polygal.com
PART 3 – EXECUTION
3.1 SUPPORT/HANDLING/INSTALLATION

A. Handling Instructions

1. Polygal products are generally delivered in 20’ and 40’ box containers, protected on both sides by polyethylene sheets against scratching, and secured to prevent damage from movement within the container. The sheet ends are sealed with masking tape to prevent dust and insects from entering into the fluting of the sheets.

2. The maximum sheet length is 5.8 meters for a 20’ container and 11.8 meters for a 40’ container. Shipping of sheets of different lengths should be coordinated in advance with the regional sales manager. It is recommended to unload the containers by hand using a slanted roller conveyor with adjustable height. Sheets must be stored away from exposure to sunlight and according to the company’s storage guidelines. Polygal’s Technical Support Department is available to answer any questions regarding unloading, storage and use of Polygal sheets.

B. Storage Before Installation

1. Store in dry, dark & well ventilated area, with NO EXPOSURE to sunlight, wind, dirt or hard objects to prevent damage.

2. Store on a flat clean raised surface, and placed on a soft material (cardboard) to prevent damage.

3. Supported, sloped stacking is recommended. If stacked flat, stack to a maximum height of 3 feet.

4. Outdoors, sheets should be covered with an opaque material (cardboard, wood, EPDM sheet etc.) that provides protection from the sun.

5. Outdoors, DO NOT store sheets under flexible PVC coverings.

6. Outdoors, storage of sheets exposed to sun light will cause the protective polyethylene film to bake onto the sheet, and it WILL NOT BE ABLE TO BE REMOVED.

C. Cutting/Drilling

1. Polygal Sheets can be cut and drilled using standard wood working tools.

2. Cutting – standard circular, jig, or table saw with a blade having 8-12 teeth per inch. Thinner gauges can be cut with a box knife.

3. Drilling – standard wood drill bits.

4. Trimming – standard box cutting knife

D. CLEANING

1. Polygal Sheets – standard and specialized – will give longer and better service life with simple cleaning.

2. Rinse sheet with water

3. Use warm soapy (mild liquid dish soap) water to clean sheets. If any dirt remains, gently wipe off with a soft cloth.

4. Apply final rinse and dry with soft cloth, if possible, to prevent water spotting.

5. DO NOT use sponges, squeegees, brushes or sharp instruments as they may damage the UV protective coating.

END OF SECTION 06 64 00

Polygal Panels

Creating an atmosphere is an art form. Choosing the right product for the atmosphere is professionalism! If you are looking for a product that creates the ultimate atmosphere, gives a sense of openness and maximizes advantages of nature while protecting from its elements… Polygal! Polygal produces a line of panels that provide you with a broad range of excellent solutions for uses such as skylights roofing and covering buildings, swimming pools and glazing.

- Excellent Insulation
- Controlled Daylight Transmission
- Virtually Unbreakable
- Flame Retardant
- Flexible and Easy to Install
- Lightweight
- UV Blocking Layer
- Environmentally Friendly

Polygal Standard Sheets double and triple layered, manufactured in various colors and degrees of transparency, are designed for use in most conventional roofing and glazing applications.

Polygal Titan Sky's internal cross-brace structure gives these panels twice the strength and rigidity of equivalent standard polycarbonate panels. Polygal Titan Sky provides a quality solution that is both intelligent and advanced for use where withstanding heavy loads is required.

Polygal Thermogal unique inner X-brace structure provides extra-strength, rigidity and outstanding insulation. Available in different thicknesses, widths and colors. Ideal for low-pitched roofs and for glazing in closed structures with large-span openings.

Polygal Selectogal (RFX) An exclusive Polygal patent that enables the controlled penetration of heat and the transmission of pleasant daylight into buildings, while reducing heating and lighting costs. Selectogal's sophisticated prismatic structure enables it to reflect most of the sun's heat in the summer, yet allows increased penetration of solar heat in the winter.

SPECIAL COATINGS

Polygal PolyShade designed for warm climates. PolyShade effectively reflects sunlight and prevents excess heat build-up, combines effective solar heating control with a highly attractive, metallic look.

Polygal Primalite - Novel sheet selectively reflects a large portion of the Near Infra-Red solar radiation, while transmitting more of the visible light radiation.

Polygal Silhouette with it's sophisticated and lustrous exterior surface, radiates elegance and good taste, available in a variety of formats, the Silhouette sheet features outstanding reflective qualities, making it an excellent choice and suitable for all daylight coverings.

Polygal Primavert (Polycoolite) sheet is specifically designed to supply plants natural solar light needs for photosynthesis. It blocks the UV, supplies high blue and red, and reflects heat from the unused green. It reflects undesirable excess heat from the infrared range.

Anti-Fog coating - factory applied inner coating combines long lasting anti-fogging properties with excellent adhesion and stability in environmental chemicals. Very good rub-off and wash off resistance.

Mechanical and Thermal Properties

Full Technical Information at: www.polygal.com

Product	Structure	Thickness (mm)	Weight (lb/ft²)	Standard width	Minimum radius for cold bending arches	U-Factor ASTM C177 1960 Btu / (h · ft² · F°)
Polygal Standard Sheets		4	0.16	48"	2'3"	0.69
		6	0.27		3'5"	0.63
		8	0.31	72"	4'7"	0.58
		10	0.35		5'9"	0.53
		16	0.55		9'2"	0.41
Triple-Clear		8	0.34	72"	-	0.50
		10	0.36		-	0.46
Titan Sky		16	0.51	48"	9'2"	0.36
Selectogal		16	0.62	47.25"	9'2"	0.41
Thermogal		25	0.72	47.25"	14'4"	0.30
		32	0.78		18'4"	0.25
		35	0.82		20'	0.24
Thermogal Sky		32	0.78	47.25"	18'4"	0.21
		40	0.86		-	0.19
Triple Clip		16	0.55	24"	13'	0.405

Available standard colors: Clear, Ice, Bronze, Nonglare, Blue, Green, Turquoise, Grey. Standard panel length: 24', 36'. Maximum length: in accordance with handling restrictions.
Thermal expansion: 2.5 mm/m for Clear and Ice panel, 4.5 mm/m for dark colors like Bronze, Blue, Green, Grey etc. panel .
Service temperature range: -40 to +248 °F.

Optical Properties

Product	Thickness (mm)	Light Transmission ASTM D1003 (%)			
		clear	NGL	ice	bronze
Polygal Standard Sheets	4	82	-	32	42
	6	80			
	8	80	25		
	10	79			
	16	72	35		
Polygal Triple-Clear	8	77	-	-	-
	10	76			
Polygal Titan	10	62	25	32	42
	16				
Polygal Selectogal	16	34	32		42
Polygal Thermogal	25	55	20		
	32	50	15	51*	16*
	35			47*	14*
	40	71	-	-	-

*By ASTM D1494

Special Coatings Optical Properties

Product	Structure	Thickness (mm)	Light Transmission (%)		Shading Coefficient
			ASTM D1003	ASTM D1494	
PolyShade	Standard	8-10	18	-	0.33
		16			0.26
Primalite	Standard	8-10	45	-	0.45
		16	32		0.31
	Titan	16	18		0.27
	Thermogal	25			0.34
		32	15		0.28
Silhouette Pearl	Standard	8	40	-	0.58
	Titan	16	18	-	0.35
	Thermogal	32	10	45	0.39
Silhouette Gold	Standard	8-10	35	61	0.42
	Titan	16	18	47	0.29
	Thermogal	32	10	43	0.31
Polycoolite	Standard	8	50	63	0.65
Spring	Standard	8	70	-	0.61
	Thermogal	32	44	47	0.42
Rainbow	Standard	8	15	-	0.60

Polygal is the leading manufacturer of structured Polycarbonate panels, and is known throughout the world for the outstanding quality of its products.
Polygal was the first manufacturer in the world to create structured Polycarbonate panels, and over the last 30 years, has developed and produced a broad spectrum of these products, which are successfully covering a full array of structures worldwide.

Always look for the original sign

CSI Subdivision: 06 64 00 Plastic Fabrications

SECTION 06 64 00 – PLASTIC FABRICATIONS

PART 1 – General
1.1 Summary
A. This Section includes fabrication and/or installation of the following:
1. Ecoresin 3form® Varia™ panel system for louvered shutter panels.
1.2 DESCRIPTION

A. Composition/Information on Ingredients:

1. Produced from Spectar* copolyester PETG—a non-toxic, polyester resin that stems from and is compatible with the PET family of materials.

2. ecoresin™ is made from spectar* PETG co-polyester resin with 40% post-industrial recycled content, and is also a non-toxic, non-offgassing material used in architectural and designer applications. ecoresin is used as the building block to produce our flagship Varia™ product line and results in architectural panels that have superior optical, mechanical and fire properties and that promote clean air quality.

1.3 PANEL SIZES AND TOLERANCES

A. 3form varia panels are offered in 4’ x 8’ (1.2m x 2.4m) and 4’ x 10’ (1.2m x 3m). All dimensions and squareness (standard with custom) are subject to a 1/8” (3 mm) tolerance. Varia is available in gauges from 1/16 inch to 1 inch.

1.4 SUBMITTALS – GENERAL

A. Submittals:

1. Product Data, Cleaning instructions

1.9 DRAWINGS
A. See all shop drawings for exact locations and sizes for shutter panel.
PART 2 – PRODUCTS

2.1 FABRICATION
A. Flammability & Smoke Tests– Building Code Approvals
1. Varia panels, produced from ecoresin (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®.

CSI Subdivision: 06 64 00 Plastic Fabrications

B. EXPANSION/CONTRACTION ALLOWANCES

1. Like all resin products, 3form varia 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)

E. SOUND TRANSMISSION CLASS (STC) VALUES

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

2. 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.

2.3 MANUFACTURER

A. All components called for in this section to be supplied by the panel manufacturer shall be obtained from the manufacturer or its approved dealer.

B. Subject to full compliance with all requirements in this section manufacturers approved to supply panels and materials are:

1. 3-FORM
2300 South 2300 West, Suite B
Salt Lake City, Utah 84119
801.649.2500
info@3-form.com

PART 3 – EXECUTION

3.1 SUPPORT/HANDLING/INSTALLATION

A. See manufacturer's guidelines for handling/installation instructions.

3.2 Cleaning Instructions

A. 3form varia, 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 varia with a soft cloth or sponge and a solu¬tion 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.

B, 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 varia. Also avoid scouring compounds, gasoline, benzene, acetone, carbon tetrachloride, certain deicing fluids, gasoline, lacquer thinner or other strong solvents.

C. Don't: Use a squeegee, strong solvents, highly alkaline or abrasive cleaning agents. Clean in hot sun or elevated temperatures Rub with a dry cloth

END OF SECTION 06 64 00

3form® ecoresin

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

3form® ecoresin

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 *eco*resin 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.

*Eco*resin 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.

3form® ecoresin

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)

CSI Masterformat Division 7: Thermal and Moisture Protection

KNOW-A-WATT:

The embodied energy of the EPS foam in a SIP panel is 48,000 BTU/ lb.

SECTION 07 62 00 – SHEET METAL FLASHING AND TRIM

PART 1 – General

1.1 SECTION REQUIREMENTS

A. Flashing, drip flashing, and accessories.

B. Sealants

C. Fastening devices

1.2 CODES

A. Make sure all installation procedures follow IRC codes.

B. Follow applicable ASTM codes.

C. Follow applicable manufacturer handling and installation procedures.

D. 1/16” Zinc.

E. Distributor VM Zinc.

1.3 QUALITY ASSURANCE (IF APPLICABLE)

A. Check for manufacturer guarantee.

1.4 Warranty should be by manufacturer. Be sure to note any handling of product that would make the warranty void and follow instructions.

PART 2 – PRODUCTS

2.1 Sheet Metal

A. 1/16” Rolled zinc flashing panels

A. All hardware required for proper installation

B. [Types of above product]

2.2 FABRICATION

A. [Important fabrication information pertaining to the above products]

2.3 ACCEPTABLE MANUFACTURERS

A. VM Zinc

B. Berridge Manufacturing Company

2.4 SHEET MATERIALS

A. Acceptable flashing material to be used by desired manufacturer.

PART 3 – EXECUTION

3.1 INSPECTIONS

A. All materials should be inspected upon arrival for defects.

B. Materials should be stored in appropriate place to prevent damage.

3.2 DEPLOYMENT

A. All materials should be assembled according to manufacturers suggestions and requirements.

B. All materials should be assembled according to IRC.

END OF SECTION 076200

CSI Subdivision: 07 71 33 Manufactured Scuppers

SECTION 077133 – MANUFACTURED SCUPPERS

PART 1 – General
1.5 SECTION INCLUDES
D. Metal Scupper System
1.6 CODES
F. Installation procedures should follow manufacturer details
G. Installation procedures should follow all applicable ASTM and IRC codes
PART 2 – PRODUCTS
2.1 MANUFACTURED SCUPPERS
C. 1/16” Zinc scuppers
2.2 ACCEPTABLE MANUFACTURERS
C. VM Zinc

PART 3 – EXECUTION
3.1 INSPECTIONS
C. Inspect products upon arrival for deficiencies and correct quantity
3.2 INSTALLATION
A. Follow all installation instructions provided by manufacturer.

END OF SECTION 077133

CSI Masterformat Division 8: Openings

KNOW-A-WATT:

The embodied energy of fiberglass window frames is 12,000 BTU/lb.

SECTION 08 16 13 – OPERATION AND MAINTENANCE OF COMPOSITE DOORS

PART 1 – General
1.3 SECTION REQUIREMENTS
B. Submittals: Product Data.
C. Comply with any applicable ANSI standards.
D. Comply with any applicable IRC codes.
E. Comply with any applicable ADA codes.
F. Make sure doors are meeting applicable fire code requirements.
1.4 DEFINITIONS
a. GBG: Grills between glazing
1.5 WARRANTY
A. Materials and workmanship shall be warranted by Therma-Tru.
PART 2 – PRODUCTS
2.1 Therma-Tru
C. Model number: S8000
D. Out-swing Fiberglass, Low E, No GBG, Handicap Sill
E. Right Hand Swing Quantity: 1
F. Left Hand Swing Quantity: 2
2.2 Therma-Tru
A. Model number: S8000
B. In-Swing Fiberglass, Low E, No GBG, Handicap Sill
C. Right Hand Swing Quantity: 0

D. Left Hand Swing Quantity: 1
E. Double Unit Out swing, Low E, No GBG, Handicap Sill
2.3 Therma-Tru
A. Model number: S8000
2.4 FABRICATION
B. Products come preassembled
2.5 ACCEPTABLE MANUFACTURERS
A. Therma-Tru , 1-800-843-7628
I. Product: Smooth Star Line, thermatru.com/ssdoors.aspx
PART 3 – EXECUTION
3.1 INSPECTION
B. All products should be inspected upon arrival for correct model numbers and defects. Any and all discrepancies, deficiencies and/or damages shall be immediately reported in writing to the supplier.
C. Leave the protective covering in place on the doors and frames until final completion of the project. Prevent prolonged exposure of protective film to direct sunlight.
3.2 INSTALLATION
A. Follow all manufacturer installation procedures.
B. Make sure installation follows procedures of manufacturer’s warranty.
END OF SECTION 081613

SECTION 08 50 00 WOOD [NON-CLAD]: CASEMENT WINDOW UNITS

PART 1 GENERAL
1.01 SUMMARY

A. Work Included: Furnish and install factory-assembled wood exterior casement window units, including glass and glazing, hardware, and accessories; as indicated on Drawings and as specified here in.

B. Related Sections: Other Specification sections that directly relate to the work of this Section include, but are not limited to, the following:

1. Section 06100, Rough Carpentry: Wood framing.
2. Section 07210, Building Insulation: Batt and blanket insulation.
3. Section 07900, Joint Sealers: Perimeter sealants.
4. Section 09900, Painting: Painting and finishing.

1.02 PERFORMANCE REQUIREMENTS

A. General: Perform testing in accordance with AAMA/WDMA 101 I.S.2-97, or CSA-A440-00.

B. Forced Entry: When tested in accordance with ASTM F588, shall be Grade 20/F-2 where applicable

1.03 SUBMITTALS

A. Product Data: Submit manufacturer’s printed product data, test reports and installation instructions.

B. Shop Drawings: Submit shop drawings for approval. Include detailed plans, elevations, details, required rough openings, anchors and accessories. Include relationship with adjacent materials. Provide installation templates for work installed by others.

C. Samples: Submit representative samples of each material that is to be exposed in the completed work. Show full color ranges and finish variations expected.

1.04 QUALITY ASSURANCE:

A. Manufacturer: For each material type required for the work of this section, provide primary materials that are the product of one manufacturer. Provide secondary or accessory materials that are acceptable to the manufacturers of the primary materials.

B. Installer: A firm with a minimum of three years experience in type of work required by this Section.

C. Mock-Up: Prior to commencing the primary work of this section, provide a mock-up of each unit type at locations acceptable to Architect. Obtain Architect's acceptance of visual qualities. Remove and replace units that are not approved. Approved mock-ups built in place may be incorporated into the finished work.

1.05 DELIVERY, STORAGE AND HANDLING

A. Deliver materials and products in factory labeled packages. Store and handle in strict compliance with manufacturer's instructions and recommendations. Protect from damage from weather, excessive temperatures and construction operations.

1.06 WARRANTY

A. Provide manufacturer's standard limited warranty covering the following:
1. Structural members and operating hardware are warranted against defects in material and workmanship for a period of ten years.

2. Insulating glass is warranted against material obstruction of transparency resulting from film formation or dust collection on the interior surfaces for a period of ten years and twenty years on qualifying Heat Smart Systems.

PART 2 PRODUCTS

2.01 ACCEPTABLE MANUFACTURER

A. Provide units manufactured by Loewen (Loewen Inc. in the USA and C.P. Loewen Enterprises Ltd. in Canada and internationally; 77 Highway 52 West, Box 2260, Steinbach, Manitoba R5G 1B2; 204-326-6446; 800-563-9367; www.loewen.com.

2.02 WOOD [NON-CLAD]: CASEMENT WINDOW UNITS

A. Wood casement window units: Preglazed with insulating glass meeting classifications for AAMA/WDMA 101 I.S.2-97, and CSA-A440-00. Tested for Air Leakage PASS/A-3, Water Leakage DP100/B-7, Wind Resistance/Load DP60/C-4 and as follows:

1. Glass and Glazing Type:
a. Double-glazed [and Heat Smart PLUS System 1].
b. Triple-glazed [and Heat Smart PLUS System [2][3].
c. Special Glass Designs: _____

2. Hardware: Roto gear operator with concealed heavy-duty hinges; sash locks; handle.
a. [T-handle] [Fold-away handle]
b. Concealed multi-point concealed locking mechanism.
c. Finish: painted [Bronze] [White][Sandstone] [Black], plated [Antique Brass][Bright Brass][Brushed Chrome][Satin Nickel][Oil Rubbed Bronze],and solid bronze [Rustic Bronze] finishes.

3. Grilles:
a. Style: [Colonial] [Heritage] [Craftsman] [_____].
b. Between Glass Grilles: [White Metal][Square Brass] [Pewter].
c. Simulated Divided Lites: ¾", 1 1/8" or 2" Grille bars permanently applied to the interior and exterior, with or without airspace grilles

4. Insect Screen: Full-size; [bronze tone][white][sandstone] frame color.

5. Double Weatherstripping: Flexible bubble and flexible bubble with semi-rigid fin seal.

2.03 MATERIALS AND COMPONENTS

A. Frame and Door: Coastal Douglas Fir kiln-dried lumber, preservative-treated in accordance with NAFS 1/WDMA 101 I.S.-2/CSA-A440. Interior exposed surfaces are clear fir; exterior surfaces factory primed. Jamb width [4-9/16 in. (116 mm)][6-9/16 in. (166 mm)] [other]

B. Glass and Glazing: Factory sealed units of 3 mm clear glass with 1/2 in. (12 mm) airspace; wood stop at interior face and foam tape gasket at exterior face.

C. Hardware: Steel components with Truth E-Gard coating.

D. Grilles: Manufacturer's standard, unfinished clear wood grilles, interior mounted.

E. Insect Screen: Black anti-glare fiberglass cloth, set in aluminum frame fitted to outside of window, supplied complete with necessary hardware. Screen frame finish shall be baked enamel.

F. Finishes:
1. Exterior Wood Finish: Factory primed. Refer to Section 09900, Painting.
2. Interior Wood Finish: Unfinished, ready for site finishing. Refer to Section 09900, Painting.

PART 3 EXECUTION

3.01 PREPARATION

A. Examine substrates and conditions in which units will be installed. Do not proceed with installation until unsatisfactory conditions are corrected.

3.02 INSTALLATION

A. Strictly comply with manufacturer's instructions and recommendations, except where more restrictive requirements are specified in this section. Coordinate installation with adjacent work to ensure proper sequence of construction, clearances and support.

B. Apply caulking underneath sill, install units plumb, level, complete with drip flashing and in proper relationship with adjacent work. Install without twisting, bowing or springing. Anchor units securely in place.

3.03 ADJUSTING AND CLEANING

A. Adjust hardware and operating parts for proper operation.

B. Clean exposed surfaces using manufacturer recommended materials and methods. Remove labels and visible markings. Remove and replace work that cannot be successfully cleaned.

C. Touch-up damaged coatings and finishes using non-abrasive materials and methods recommended by manufacturer. Eliminate all visible evidence of repair.

END OF SECTION 08 50 00

CSI Masterformat Division 9: Finishes

KNOW-A-WATT:

While ceramic and porcelain tile have high embodied energy, it is potentially a very durable product. Some tile products are now made from recycled products such as fluorescent light bulbs and soy bean waste.

CSI Subdivision: 09 21 16 Gypsum Board Assem-

SECTION 09 21 16– GYPSUM BOARD ASSEMBLIES
PART 1 – General
1.1 SECTION REQUIREMENTS
A. Submittals: Manufacturer Safety Data Sheet.
B. Fire-Resistance-Rated Assemblies: Provide materials and construction identical to those tested in assemblies per ASTM E 119 by independent testing and inspecting agency acceptable to authorities having jurisdiction.
PART 2 – PRODUCTS
2.1 METAL FRAMING AND SUPPORTS
A. Steel Framing Members, General: ASTM C 754
1. Steel Sheet Components: ASTM C 645, with manufacturer's standard corrosion-resistant zinc coating.
B. Partition and Soffit Framing:
1. Studs: 3-5/8 in. in depth and 0.0179 on. Thick, unless otherwise indicated.
2. Rigid Hat-Shaped Furring Channels: 7/8 in. in depth and 0.0179 in. thick.

2.2 PANEL PRODUCTS
A. Provide in maximum lengths available to minimize end-to-end butt joints.
B. Gypsum Wallboard: ASTM C 36, in thickness indicated, with manufacturer's standard edges. Type as required for specific fire-resistance-rated assemblies.
C. Water-Resistant Gypsum Backing Board: ASTM C 630, in thickness indicated. Type X where required for fire-resistance-rated assemblies and where indicated.
D. Cementitious Backer Units: ANSI A118.9
2.3 ACCESSORIES
A. Joint-Treatment Materials: ASTM 475.
1. Joint Tape: Paper, unless otherwise recommended by panel manufacturers.
2. Joint Compounds: Drying-tape, ready-mixed, all-purpose compounds.
3. Cementitious Backer Unit Joint-Treatment Materials: Products recommended by cementitious backer unit manufacturer.
PART 3 – EXECUTION
3.1 INSTALLATION
A. Install steel framing to comply with ASTM C 754 and with ASTM C 840 requirements that apply to framing installation and with United States Gypsum's "Gypsum Construction Handbook."
B. Install and finish gypsum panels to comply with ASTM C 840 and GA-216.
1. Isolate gypsum board assemblies from abutting structural work. Provide edge trim and acoustical sealant.
2. Single-Layer Fastening Methods: Fasten gypsum panels to supports with screws.
3. Multilayer Fastening Methods: Fasten base layers and face layer separately to supports with screws.

C. STC-Rated Assemblies: Comply with ASTM C 919 for location of edge trim and closing off sound-flanking paths around or through gypsum board assemblies.
D. Fire-Resistance-Rated Assemblies: Comply with requirements of listed assemblies.
E. Cementitious Backer Units: Comply with ANSI A108.11.
F. Finishing Gypsum Board Assemblies:
1. Unless otherwise indicated, provide Level 1 finish: All joints and interior angles shall have tape set in joint compound.

END OF SECTION 092116

ECOsurfaces COMMERCIAL FLOORING

ECOnights, Sports Authority, PA

ECOnights®

Bold statements in the dark.

Electric EPDM flecks scattered against a field of black give ECOnights a dramatic blacklight effect. Cosmic colors like Big Bang Blue, Milky Way and Martian Midnight take retail, commercial and institutional spaces to new worlds of design. Go ahead – take a chance. Be bold. Brilliant. Entirely unexpected. ECOnights gives you both the inspiration and the tools.

ECOnights

Various Dimensions

Rolls 48″ x 5/32″ (4mm standard)
48″ x 1/4″ (6mm special)
48″ x 3/8″ (9mm special)
Standard 50′ rolls

Tiles 36″ x 36″
18″ x 18″
Available in 4mm standard; 6mm & 9mm special

ECOnights for Sport, Kern Center - Milwaukee School of Engineering, WI
Architects: Uihlein Wilson Architects and RDG Planning & Design
Innovative Architecture & Design Award Winner, *Recreation Management*

ECOnights for Sport

Imagine the same electric color combinations as ECOnights designed in a special 9mm thickness ideal for sports applications. Slip-, blade- and spike-resistant, ECOnights for Sport is at home around ice rinks, fitness centers, weight rooms and other high-impact environments.

ECOnights for Sport

Various Dimensions

Rolls 48″ x 3/8″ (9mm standard)
Standard 25′ rolls

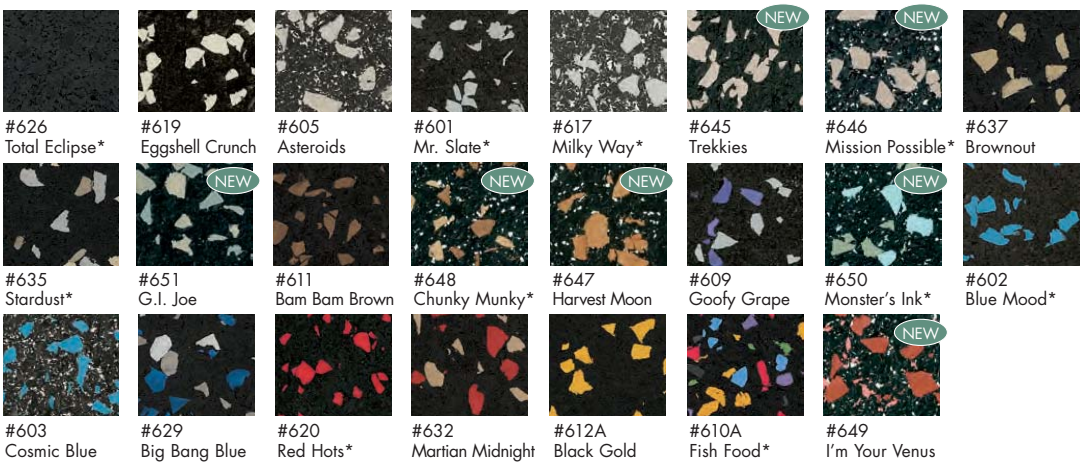
Interlocking Tiles 47″ x 47″
Available in 9mm standard; 6mm special
24″ x 24″
Available in 9mm special; 6mm special

www.ecosurfaces.com or call 1-877-326-7873

ECOsurfaces COMMERCIAL FLOORING

www.ecosurfaces.com or call 1-877-326-7873

ECOnights Color Line



#626 Total Eclipse* | #619 Eggshell Crunch | #605 Asteroids | #601 Mr. Slate* | #617 Milky Way* | #645 Trekkies | #646 Mission Possible* | #637 Brownout

#635 Stardust* | #651 G.I. Joe | #611 Bam Bam Brown | #648 Chunky Munky* | #647 Harvest Moon | #609 Goofy Grape | #650 Monster's Ink* | #602 Blue Mood*

#603 Cosmic Blue | #629 Big Bang Blue | #620 Red Hots* | #632 Martian Midnight | #612A Black Gold | #610A Fish Food* | #649 I'm Your Venus

***ECOnights for Sport AVAILABLE IN THESE COLORS.** Colors may vary. Please specify from actual samples obtained from your local sales representative or Gerbert, Ltd.

ECOnights/Sport Physical Data

Test	ASTM	Result
Tensile Strength	D412	200 lb/in² min
Flexibility	F137	Pass 1/4 inch mandrel
Coefficient of Friction	D2047	>0.9
Thermal Conductivity	C518	0.406 Btu-in/hr-ft²-°F
Static Load Limit	F970, 400 lbs	<0.005 in
Chemical Resistance	F925	no change
Impact Insulation Class	E492	49
Sound Transmission Coefficient	E413	51
Noise Reduction Coefficient	C423	0.10 sabine/ft²
Sustainability	E2129-01	data collected
VOC Washington State IAQ Test	D5116	pass

Brief Architectural Specifications

ECOsurfaces Commercial Recycled Rubber Flooring:
The single-ply, rubber surface furnished under this specification shall be Dodge-Regupol, Inc.'s _____ (specify one of the ECOsurfaces products listed below).

ECOnights & ECOnights for Sport are a non-laminated, single-ply surface from recycled high-quality SBR (Styrene-Butadiene Rubber) tire rubber, with bright reprocessed EPDM color flecks that create a glowing effect. The color shall be (specify: color number and name).

ECOsurfaces rolled products shall be 4' wide. The rolled rubber surface will have an overall thickness of _____ (specify: 5/32" [4mm] standard, 1/4" [6mm] special order, or 3/8" [9mm] special order).

ECOsurfaces tile products shall be _____ (specify: 18" x 18" or 36" x 36" and thickness of 5/32" [4mm] standard, 1/4" [6mm] special order or 3/8" [9mm] special order).

ECOsurfaces interlocking tile products shall be _____ (specify: 47" x 47" and thickness of 3/8" [9mm] standard or 1/4" [6mm] special order or 24" x 24" and thickness of 3/8" [9mm] special order or 1/4" [6mm] special order).

ECOsurfaces shall meet standards specified under the LEED® (Leadership in Energy and Environmental Design) criteria developed by the U.S. Green Building Council (USGBC).

For the Dodge-Regupol warranty to apply, only use recommended adhesive and follow all Dodge-Regupol approved installation and maintenance procedures. The rubber flooring shall comply with the Americans with Disabilities Act (ADA) regulations.

Technical Data: For complete guide specifications, log on to www.ecosurfaces.com or call 1-877-326-7873.

Installation

Basic installation procedures and tools are the same as other standard commercial resilient flooring. ECOsurfaces should be installed by experienced floor covering mechanics. Instructions in the ECOsurfaces installation manual should be followed and are available at www.ecosurfaces.com or through your ECOsurfaces representative.

Cleaning and Maintenance

All ECOsurfaces flooring systems must be maintained as recommended. The type and frequency of maintenance will vary according to maintenance equipment and desired appearance of product. Detailed maintenance instructions are available at www.ecosurfaces.com or through your ECOsurfaces representative.

Warranty

ECOsurfaces is guaranteed by Dodge-Regupol, Inc.® to be free of manufacturing defects in both material and workmanship. If such a defect is discovered, the customer must notify Dodge-Regupol, Inc. directly or through the contracting installer or distributor. If found to be defective within five years, the sole remedy against the seller will be either the replacement or repair of the defective goods, or at the seller's option, credit may be issued not exceeding the selling price of the defective goods.

The ECOsurfaces warranty shall not cover dissatisfaction due to improper maintenance or installation, damage from improper maintenance or usage or general misuse, including, without limitation, burns, cuts, tears, scratches, scuffs, indentation damage from high heels, rolling loads, damage or discoloration from floor care products not recommended by either Gerbert Ltd. or Dodge-Regupol, extended exposure to direct sunlight or differences in color between samples or photographs and actual flooring.

Manufactured by Dodge-Regupol, Inc. • Distributed by Gerbert Ltd.

EC1007-206

CSI Subdivision: 09 64 29 Wood Flooring

SECTION 096429 – WOOD STRIP AND PLANK FLOORING
PART 1 – General
1.7 SECTION REQUIREMENTS
F. Wood Flooring
G. Proper assembly required to ensure high finished quality of final product.
H. All manufacturer instructions of assembly must be adhered to strictly.
I. Hardwood Flooring: Comply with NOFMA grading rules for species, grade, and cut.
1.8 CODES
C. Any applicable IRC codes must be followed.
D. Installation must adhere to manufacturer warranty.
1.9 QUALITY ASSURANCE
A. Final product will be of high quality and performance. Craftsmanship must be thorough.
PART 2 – PRODUCTS
2.1 RECLAIMED MESQUITE
H. Random T+G Flooring @ 2” - 5”, tongue oil varnish
I. All materials specified by manufacturer for proper installation will be properly used.
2.2 FINISHING MATERIALS
I. All finishing should be done in compliance with manufacturer details.
2.3 ACCEPTABLE MANUFACTURERS
D. HMH Designs - 512-756-0702
PART 3 – EXECUTION
3.1 INSPECTION
A. All materials must be inspected upon arrival for defects and/or discrepancies. Any found will be submitted in writing to the manufacturer.
B. All products will be stored in a safe and proper manner to avoid damage on site.
C. Any protective wrapping shall stay on product until installation and/or finished.
D. After installation is complete, protective covering shall be put on to protect the wood from further damage due to further construction on the house. Protective covering should be durable.
3.2 INSTALLATION
A. Proper installation of products shall comply with manufacturers instructions and warranty information.

END OF SECTION 096429

arreis™

When the earth demands affordable excellence

innovation
creativity
market expertise
manufacturing excellence

SDF
Sustainable Design Fiberboard

Arreis™, a medium density fiberboard (MDF) panel manufactured from 100 percent recycled wood waste, meets the most stringent formaldehyde emission standards in the world. SierraPine's patent pending manufacturing process utilizes a formaldehyde-free adhesive system to produce Arreis™, the ideal SDF for all commercial applications.

Features/Benefits

- Panels available in 4' or 5' widths and lengths up to 18'
- Accepts all painted, laminated or printed decorative surfaces
- Excellent machinability allows moulding producers to create even the most intricate profiles
- Fastening: Readily accepts and holds staples, screws and other wood fastening hardware
- Customized performance available

LEED™ Credits Supported

Indoor Environmental Quality - 4.4
Material and Resources - 4.1, 4.2, 5.1, 5.2

Collaborative for High Performance Schools (CHPS)

Meets Materials Specifications for VOC emissions section 01350

Technical Data (Typical data when 3/4" panel is tested to ASTM D 1037-96a Part A)

Property		Units
Imperial Units		
Density	48	lb/ft³
Internal Bond	115	lb/in²
Modulus of Rupture	5,200	lb/in²
Modulus of Elasticity	520,000	lb/in²
Modulus of Hardness	1,150	lbs, Janka ball
Screw Holding, Face	325	lbs req'd to pull 1" #10 sheet metal screw
Screw Holding, Edge	250	lbs req'd to pull 1" #10 sheet metal screw
Metric Units		millimeters
Density	769	kg/m³
Internal Bond	.79	N/mm²
Modulus of Rupture	35.8	N/mm²
Modulus of Elasticity	3583	N/mm²
Modulus of Hardness	522	kg, Janka ball
Screw Holding, Face	148	kgs req'd to pull 1" #10 sheet metal screw
Screw Holding, Edge	114	kgs req'd to pull 1" #10 sheet metal screw
Other Data		
Water Absorption	8	24-hour soak, Avg %
Thickness Swell	5	24-hour soak, Avg %
Linear Expansion	.30	% dimensional change in length & width due to humidity change
Moisture Content	4 - 6	Avg. % oven-dry basis
Thickness Tolerance	± .005" or ± .005"	Avg. from nominal or Deviation from avg.
Flame Spread Rating	U/L, Class C	

Applications

- LEED™ Projects
- Environmentally Preferred Specifications
- Cabinetry
- Furniture
- Moulding
- Millwork
- Casework
- Wall Panels
- Shelving
- Retail Fixtures
- Museum Displays

Commitment to Green

For nearly two decades, SierraPine has been providing products to those in search of sustainable and environmentally preferable building products. Arreis™ is a testament to our expertise in pushing the technology envelope for low emitting composite panels. It also underscores our commitment to environmental stewardship, whether it be in producing no-added formaldehyde SDF, maximizing energy efficiency in our plants, increased use of recycled post consumer wood waste or providing a safe place for our employees to work. Join the leader, call SierraPine today.

SierraPine
COMPOSITE SOLUTIONS
3010 Lava Ridge Ct., Suite 220
Roseville, CA 95661
(800) 676-3339
www.sierrapine.com

Certificate of Achievement

Scientific Certification Systems (SCS) does hereby certify that an independent evaluation has been conducted on behalf of:

SierraPine Limited

Medford, OR

for the following product(s):

Medium Density Fiberboard products: Medite® II, Medex™, and Arreis™

This product(s) meets all of the necessary qualifications to be certified for the following claim(s):

Made with No Added Formaldehyde (made without formaldehyde-containing additives.)

Lab tested to less than 0.05 ppm

SCS

Signed Edward Wynat

10/1/2005 to 9/30/2006

Certification Period

Registration Number: SCS-RRC-01329

CSI Masterformat Division 10: Specialties

SECTION 104416– FIRE EXTINGUISHERS

PART 1 – General
1.1 SECTION REQUIREMENTS
A. Submittals: Product Data, MSDS
B. Fire Extinguishers: NFPA 10, listed and labeled for the type, rating, and classification of extinguisher.
PART 2 – PRODUCTS
2.1 FIRE EXTINGUISHERS
A. Interior Fire Extinguishers: Kidde, Living Area #21005770
B. Exterior Fire Extinguisher: Kidde, Pro 110 #21005776
PART 3 – EXECUTION
3.1 INSPECTIONS
A. Keep all fire extinguishers up do date and filled to appropriate capacity.
B. Check date and capacity on regular basis.

END OF SECTION 104416

CSI Masterformat Division 11: Equipment

KNOW-A-WATT:

In 1991, office equipment directly consumed 26 billion kilowatt hours or 3% of total commercial building energy consumption; this translates into approx. $2.1 billion in electricity costs. If we reduced this by 50%, it would be equivalent to removing 6 million cars from U.S. roads.

SECTION 11 28 00 – OFFICE EQUIPMENT

PART 1 – General
1.1 SECTION REQUIREMENTS
A. Submittals: Product Data
PART 2 – PRODUCTS
2.1 OFFICE EQUIPMENT
A. Monitor
1. DELL 2007WFP Wide-Screen Black Flat Panel Monitor, LCD with Height Adjustable Stand
2. Diagonal Size Viewable Size 20.1”, Depth 7”, Weight 11 lbs (monitor only)
3. Max Resolution 1680x1050 Pixels
4. Port(s) Total (Free) / Connector Type USB/15-pin D-Sub/DVI-D/S-Video/Composite Connectors
5. Power Consumption Operational 75 W (maximum), 55 W (typical)

B. Computer
1. DELL OptiPlex 745 Ultra Small Form Factor Desktop
2. Dimensions H: 10.3” W: 3.5” D: 9.95”H: 26.3cm W: 8.9cm D: 25.2cm

PART 3 – EXECUTION
3.1 INSTALLATION
A. Built-in Equipment: Securely anchor to supporting cabinetry or t countertops with concealed fasteners. Verify that clearances are adequate for proper functioning and rough openings are completely concealed.
B. Freestanding Equipment: Place in final locations after finishes have been completed in each area. Verify that clearances are adequate to properly operate equipment.
C. Test each residential item to verify proper operation. Make necessary adjustments.
D. Verify that accessories required have been furnished and installed.

END OF SECTION 11 28 00

SECTION 11 31 00 – RESIDENTIAL APPLIANCES
PART 1 – General
1.1 SECTION REQUIREMENTS
A. Submittals: Product Data
B. Regulatory: Requirements: Comply with provisions of the following product certifications.
1. NFPA: Provide electrical appliances listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
2. UL and NEMA: Provide electrical components required as part of residential appliances that are listed and labeled by UL and that comply with applicable NEMA standards.
3. NAECA: Provide residential appliances that comply with NAECA standards.

C. Accessibility: Where residential appliances are indicated to comply with accessibility requirements, comply with the U.S. Architectural & Transportation Barriers Compliance Board's "Americans with Disabilities Act (ADA), Accessibility Guidelines for Buildings and Facilities (ADAAG)." ANSI A117.1..
D. Energy Ratings: Provide appliances that qualify for the EPA/DOE ENERGY STAR product labeling program or similar foreign product certification.

PART 2 – PRODUCTS
2.1 RESIDENTIAL KITCHEN APPLIANCES 11 31 12
A. Electric Induction Cooktop: Four Zone: 589cm width
1. Product: Kuppersbusch EKI 607
2. Color: Black
B. Electric Wall Oven, 24"
1. Product: Kuppersbusch EEB 6500.0
2. Color/Finish: stainless steel and glass
C. Refrigerator/Freezer: Built In, frost-free, one-door refrigerator with bottom-mounted freezer, door hinges right
1. Product: Liebherr; CI 1601
2. Color: custom Alno panel
3. Approximate Volume: 15.5 cu. ft.
4. Fresh Food Compartment Volume: 11.3 cu. ft.
5. Freezer Compartment Volume: 4.1 cu. ft.
C. Refrigerator/Freezer: Built In, frost-free, one-door refrigerator with bottom-mounted freezer, door hinges right
1. Product: Liebherr; CI 1601
2. Color: custom Alno panel
3. Approximate Volume: 15.5 cu. ft.
4. Fresh Food Compartment Volume: 11.3 cu. ft.
5. Freezer Compartment Volume: 4.1 cu. ft.

CSI Subdivision: 11 31 13 Residential Appliances

D. Dishwasher: Fully Integrated, custom front panel, 10 place settings, 23 5/8” width
1. Product: Kuppersbusch IGVS 669.1
2. Color/Finish: custom Alno panel
E. Hood Vent, circulating with charcoal filter (non-venting)
1. Product: Sirius; SIU 404 w/ replacement charcoal filters code AF3
2. Color/Finish: 430 stainless steel, #4 brushed finish
3. Capacity: 600 cfm

30" BUILT-IN BOTTOM MOUNT REFRIGERATOR / FREEZER | C 1650 / C 1651 / C 1601

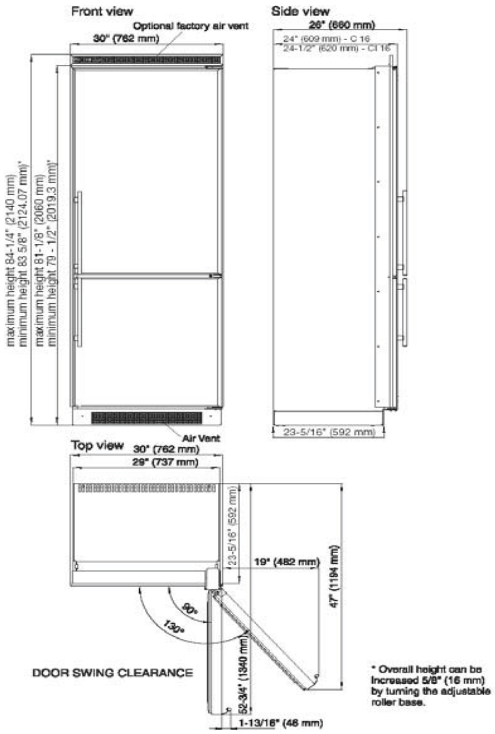
Premium NoFrost

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.

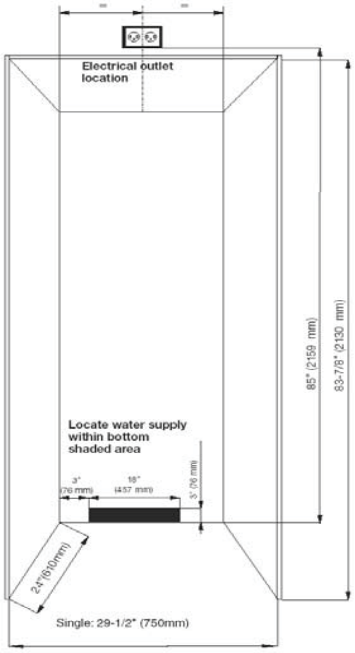
LIEBHERR

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:

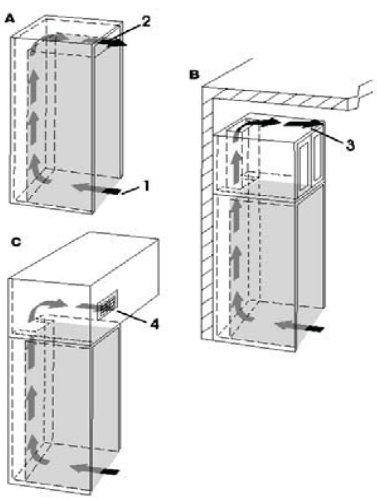
There must be a ventilation space at least 31 in.² (200 cm²) at the airflow inlet (1) and at the airflow outlet (2). The 30" and 60" models are equipped with a rolling base, which is already providing you with the bottom airflow inlet requirements.

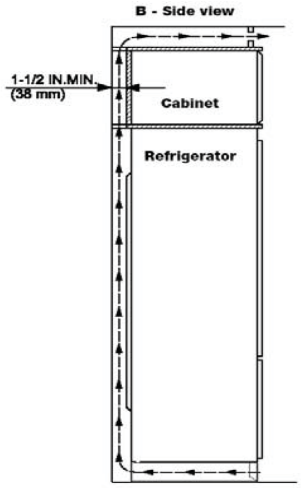
The top ventilation space can be directed in one of the following ways:

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).

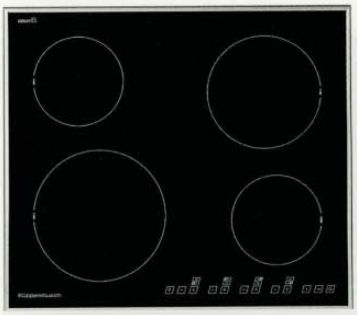




The refrigerator is designed to allow proper air flow when the appliance is installed up against the wall.
A minimum space of 1 1/2" is required when a cabinet is built above.

THE CERAMIC INDUCTION COOKTOPS.

Features: 9-level power controls > Central switch-off controls > Automatic safety cut-off (limiting operation time)



EKI 607.0

Extra features:
- Sensor touch controls
- Pan detection
- Child safety lock
- 1 cooking zone ∅ 21cm (8-1/4")
- 1 cooking zone ∅ 18cm (7")
- 2 cooking zones ∅ 14.5cm (5-3/4")

Available in 2 design options:
- **EKI 607.0 M**
  Metallic frame (stainless steel-look).
- **EKIF 607.0**
  Flush fitting

EKI 307.0

Extra features:
- Sensor touch controls
- Pan detection
- Child safety lock
- 1 cooking zone ∅ 21cm (8-1/4")
- 1 cooking zone ∅ 14.5cm (5-3/4")

Available in 1 design option:
- **EKI 307.0 M**
  Metallic frame (stainless steel-look).

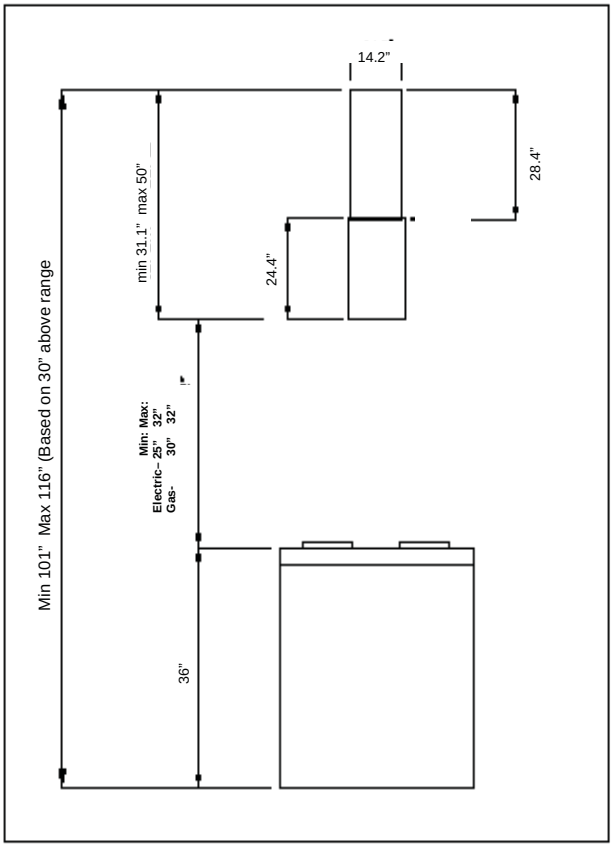
THE TECHNICAL INFORMATION FOR ELECTRIC COOKTOPS.

			Electric Cooktops and Griddle									
Design / material			EKI 807	EKI 607	EKI 307	EKE 854.2	EKE 804.2	EKE 604.2	EKS 804.2	EKS 604.2	EKS 304.1	EGS 304.0
Frame			•	•	•	•	•	•	•	•	•	•
Flush-fitting			•	•		•	•	•				
Glass ceramic			•	•	•	•	•	•	•	•	•	•
Stainless steel												
Cooking zone features												
Front (left)	∅	cm	21	21		21-12	21-12	18-12	21-12	21-12		
	∅	inches	8 1/4	8 1/4		8 1/4-4 3/4	8 1/4-4 3/4	8 1/4-4 3/4	8 1/4-4 3/4	8 1/4-4 3/4		
	Power	kW	2.2-3.0	2.2-3.0		2.2/0.8	2.2/0.8	1.7-0.7	2.2/0.8	2.2/0.8		
Back (left)	∅	cm	14.5	14.5		18	14.5	18	14.5	14.5		
	∅	inches	5 3/4	5 3/4		7	5 3/4	7	5 3/4	5 3/4		
	Power	kW	1.4	1.4		1.8	1.2	1.8		1.2		
Back (middle)	∅	cm			14.5	18					14.5	
	∅	inches			5 3/4	7					5 3/4	
	Power	kW			1.4	1.8					1.2	
Back (right)	∅	cm	18	18		14.5	24x14-14	24x14-14	24x14-14	24x14-14		
	∅	inches	7	7		5 3/4	9 1/2x5 1/2-5 1/2	9 1/2x5 1/2-5 1/2	9 1/2x5 1/2-5 1/2	9 1/2x5 1/2-5 1/2		
	Power	kW	1.8-2.3	1.8-2.3		1.2	2.0-1.1	2.0-1.1	2.0-1.1	2.0-1.1		
Front (right)	∅	cm	14.5	14.5		14.5	18	14.5	18	18		
	∅	inches	5 3/4	5 3/4		5 3/4	7	5 3/4	7	7		
	Power	kW	1.4	1.4		1.2	1.8	1.2	1.8	1.8		
Front (middle)	∅	cm			21			14.5			18-12	
	∅	inches			8 1/4			5 3/4			8 1/4-4 3/4	
	Power	kW			2.2-30			1.2			1.7-0.7	
Griddle												•
Features												
Central switch off controls			•	•	•	•	•	•				
Child safety lock			•	•	•	•	•	•				
Automatic safty cut-off (limits operating time)			•	•	•	•	•	•				
Pan detection			•	•	•	•						
Pan size detection			•	•	•	•						
Residual heat indicators			•	•	•	•	•	•	•	•	•	•
Sensor touch controls			•	•	•	•	•	•				
Knob controls									•	•	•	•
Automatic, preheat-booster phase			•	•	•	•	•	•				
Technical data												
Electrical connection (in kW)			6.8	6.8	3.6	8.2	7.2	6.7	8.4	7.2	2.9	1.5
Voltage (in V)			240	240	240	240	240	240	240	240	240	240
Fuse current (in Amp)			35	35	15	40	30	30	40	30	15	15
Cut-out dimensions (in mm)												
Installation height			42	42	42	103	83	103	113	113	85	62
Width			750	560	265	750	750	560	750	560	265	265
Depth			490	490	490	490	490	490	490	490	490	490
Appliance dimensions (in mm)												
Width			779	589	294	780	780	590	780	590	295	295
Depth			519	519	519	520	520	520	520	520	520	520
Cut-out dimensions (in inches)												
Installation height			1 5/8	1 5/8	1 5/8	4 1/16	3 3/4	4 1/16	4 1/2	4 1/2	3 3/8	2 1/2
Width			29 1/2	22 7/16	10 9/16	29 1/2	29 1/2	22 1/8	29 1/2	22 1/8	10 1/2	10 1/2
Depth			20 7/16	20 7/16	20 7/16	19 5/16	19 5/16	19 5/16	19 5/16	19 5/16	19 5/16	19 5/16
Appliance dimensions (in inches)												
Width			30 11/16	23 3/16	11 9/16	30 3/4	30 3/4	23 1/4	30 3/4	23 1/4	11 5/8	11 5/8
Depth			20 7/16	20 7/16	20 7/16	20 1/2	20 1/2	20 1/2	20 1/2	20 1/2	20 1/2	20 1/2

Specification Sheet
Model SIU 404
Island Range Hood

Sirius Range Hoods

Dimensions and installation measurements



Product Features

- Stainless steel island style range hood
- 430 stainless steel #4 brushed finish
- For use over domestic cooking equipment
- 6" round vertical ducting - not supplied
- 600cfm die cast aluminum squirrel cage blower
- Very quiet operation at 61Dba/3.9 sones maximum
- Wireless remote operation - with emergency off switch
- 4 speed wireless remote, 10 minute timer
- Dishwasher safe aluminum grease filters
- Grease filters are high density with quick release latches
- 1 50W halogen light
- Heat sensor overload protection
- Separate re-circulating kit available

Optional Items:

- Replacement grease filters (pair) - code AF3
- Replacement carbon filters (pair) - code KF3
- Replacement halogen bulbs and lenses
- Chimney flue extensions - see price sheet

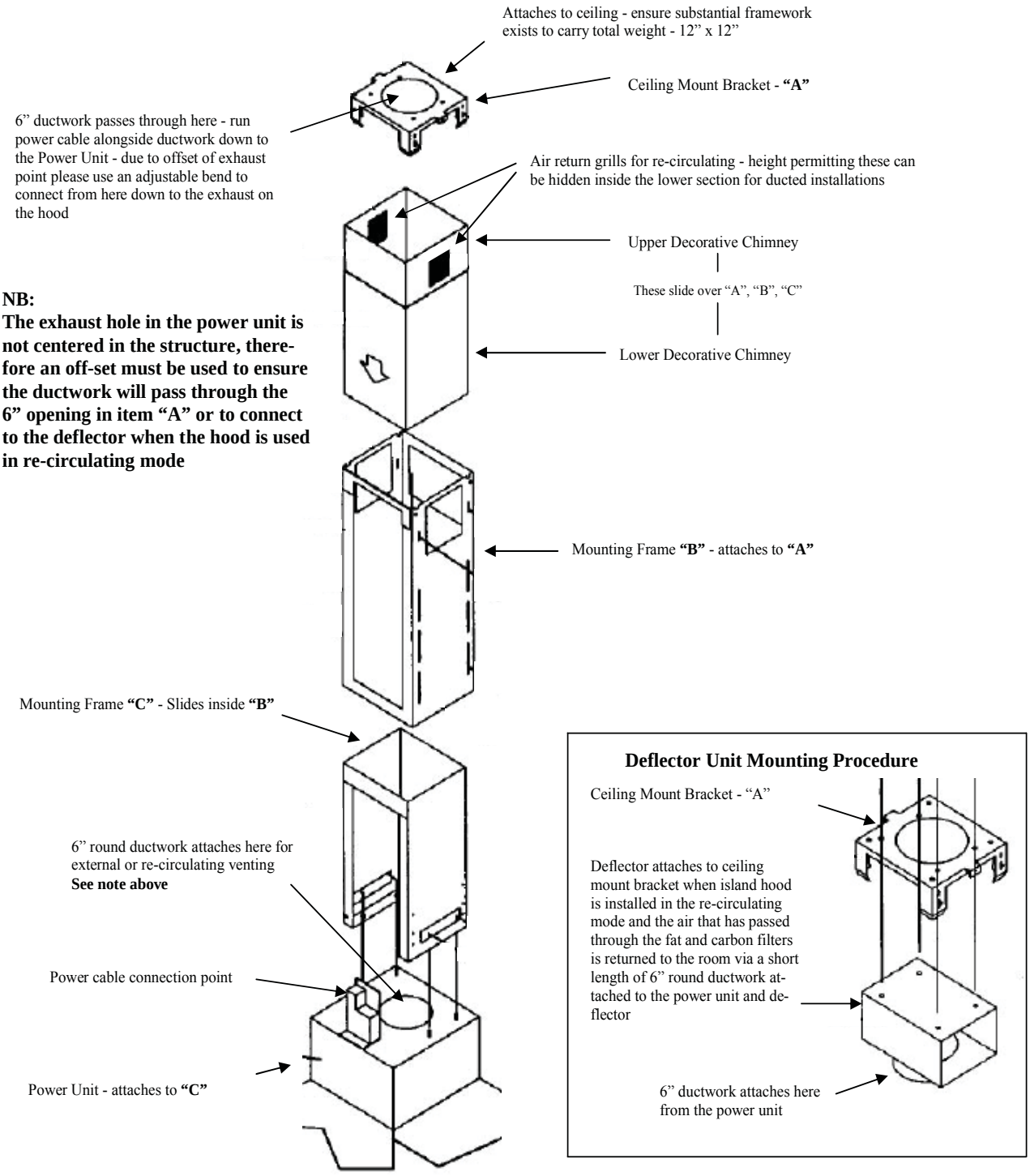
Notes and comments:

C US

Sirius Range Hoods - USA and Canada
Tel: +866 528-4987 Fax: +866 365-9204 email: info@siriushoods.com

Modular Island Range Hood Components SIU 404

Sirius Range Hoods



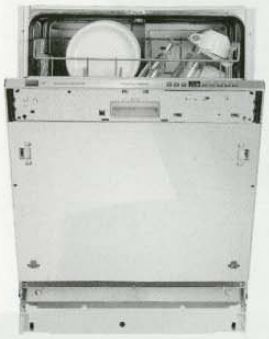
NB:
The exhaust hole in the power unit is not centered in the structure, therefore an off-set must be used to ensure the ductwork will pass through the 6" opening in item "A" or to connect to the deflector when the hood is used in re-circulating mode

Deflector Unit Mounting Procedure

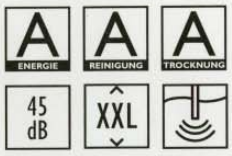
Sirius Range Hoods - USA and Canada
Tel: +866 528-4987 Fax: +866 365-9204 email: info@siriushoods.com

THE FULLY INTEGRATED DISHWASHER.

Features: Capacity for 12 international place settings > Electronic refill display for rinse aid > Integrated water heater > Stainless Steel Tall Tub > Two-Pump Motor System > Suspension Motor > Filtration System > Flow-Through Water Heater > Four-Level Wash > Condensation Drying > Electronic Controls > Energy Star Complaint.



IGVS 669.1



Extra features:

- 2 x 6 programs
  - Pots & Pans
  - Intensive
  - Normal
  - Crystal
  - Quick Wash
  - Rinse & Hold
- Extra functions: Eco/Saver and top basket only
- Aqua Sensor
- Self-cleaning filter
- Pre-programable (up to 19h)
- Digital, remaining time indicator
- Acoustic signal at end of program
- Silverware tray in top basket
- Sprayer for baking trays
- Rear feet adjustable from front
- 120 Volt, 12 Amp

- **IGVS 669.1**

EEB 6500.0

A ENERGIE | MULTI THERM PLUS | ÖKO THERM | ÖKO ENAMEL

Extra features:

- 9 heating functions
- Programmable, sensor touch clock
  (Duration and end of cooking time, minute minder)

Available in 1 design options:

- **EEB 6500.0 MX**
  Design metallic (stainless steel).

11

THE TECHNICAL INFORMATION FOR THE BUILT-IN, ELECTRIC OVENS.

	Built-In, Electric Ovens				
Design / materials	**EEB 9800.0**	**EEB 9600.0**	**EEB 6800.0**	**EEB 6600.0**	**EEB 6500.0**
Metallic (stainless steel)	•	•	•	•	•
Aluminum-look		•		•	
Features					
Oven capacity in liters	69	69	47	47	47
Oven cavity width (in mm)	635	635	455	455	455
Oven cavity height (in mm)	310	310	310	310	310
Oven cavity depth (in mm)	394	394	390	390	390
Max temperature - convection (in °C)	290	290	290	290	290
Max temperature - top / bottom heat (in °C)	290	290	290	290	290
Oven cavity width (in inches)	25	25	18	18	18
Oven cavity height (in inches)	12 1/4	12 1/4	12 1/4	12 1/4	12 1/4
Oven cavity depth (in inches)	15 1/2	15 1/2	15 3/8	15 3/8	15 3/8
Max temperature - convection (in °F)	554	554	554	554	554
Max temperature - top / bottom heat (in °F)	554	554	554	554	554
Baking and roasting programs	13		13		
Heating programs	10		10		
Oven functions		9		9	9
multitherm plus®		•		•	•
Fully electronic	•		•		
Programmable, sensor touch clock	•	•	•	•	•
Roasting thermometer	•	•	•	•	
Electronic child-safety lock	•		•		
Drop-down, large surface broiler	•	•	•	•	•
ökotherm® catalytic convection	•	•	•	•	•
Tangential cooling fan	•	•	•	•	•
Full glass inner door on stainless steel frame			•	•	•
Pop-out control knobs	•	•	•	•	•
Halogen oven lighting	•	•	•	•	•
Standard accessories					
Enameled baking tray	2	2	1	1	1
Roasting grid	1	1	1	1	1
Drip tray	1	1	1	1	1
Broiler pan with handle			1	1	1
backmobil® mobile backing rack (7 levels)			•	•	•
Telescopic glide-out rack (3 levels)	•	•	•	•	•
telemobil®			•	•	•
Technical data					
Electrical connection (in kW)	3.5	3.5	3.5	3.5	3.5
Voltage (in V)	240	240	240	240	240
Fuse current (in Amp)	15	15	15	15	15
Niche dimensions (in mm)					
Width	860	860	560	560	560
Height	475	475	590	590	590
Depth	550	550	550	550	550
Niche dimensions (in inches)					
Width	33 7/8	33 7/8	22 1/16	22 1/16	22 1/16
Height	18 11/16	18 11/16	23 1/4	23 1/4	23 1/4
Depth	21 5/8	21 5/8	21 5/8	21 5/8	21 5/8

2.2 RESIDENTIAL LAUNDRY APPLIANCES 11 31 23
A. Clothes washer/dryer combination unit: WM3431

PART 3 – EXECUTION
3.1 INSTALLATION
A. Built-in Appliances: Securely anchor to supporting cabinetry or t countertops with concealed fasteners. Verify that clearances are adequate for proper functioning and rough openings are completely concealed.
B. Freestanding Appliances: Place in final locations after finishes have been completed in each area. Verify that clearances are adequate to properly operate equipment.
C. Test each residential item to verify proper operation. Make necessary adjustments.
D. Verify that accessories required have been furnished and installed.

END OF SECTION 11 31 00

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%.

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	•
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
No. of Water Levels	Automatically adjusts to size of load
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

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

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

Based on standard U.S. Government tests

ENERGYGUIDE

Clothes Washer
Capacity: Standard

LG Electronics Inc.
Model WM3431H*

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

This Model Uses
197 kWh/year

ENERGY STAR

ENERGY STAR® A symbol of energy efficiency

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

Uses Least Energy	Uses Most Energy
113	680

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

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

$17	$11
when used with an electric water heater	when used with a natural gas water heater

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

Important: Removal of this label before consumer purchase violates the Federal Trade Commission's Appliance Labeling Rule (16 C.F.R. Part 305).

P/No. : 3850EA3083N

SECTION 11 52 00 – AUDIO-VISUAL EQUIPMENT

PART 1 – GENERAL
1.1 SECTION REQUIREMENTS
A. Submittals: Product Data
PART 2 – PRODUCTS
2.1 AUDIO-VISUAL EQUIPMENT
A. Telivision, Flat screen, LCD, 19” minimum

1. DELL W2306C 23” LCD TV
2. Dimensions 20” x 11.25” viewing area (225 sq. in)

B. DVD Player
1. Products
PART 3 – EXECUTION
3.1 INSTALLATION
A. Built-in Equipment: Securely anchor to supporting cabinetry or t countertops with concealed fasteners. Verify that clearances are adequate for proper functioning and rough openings are completely concealed.
B. Freestanding Equipment: Place in final locations after finishes have been completed in each area. Verify that clearances are adequate to properly operate equipment.
C. Test each residential item to verify proper operation. Make necessary adjustments.
D. Verify that accessories required have been furnished and installed.

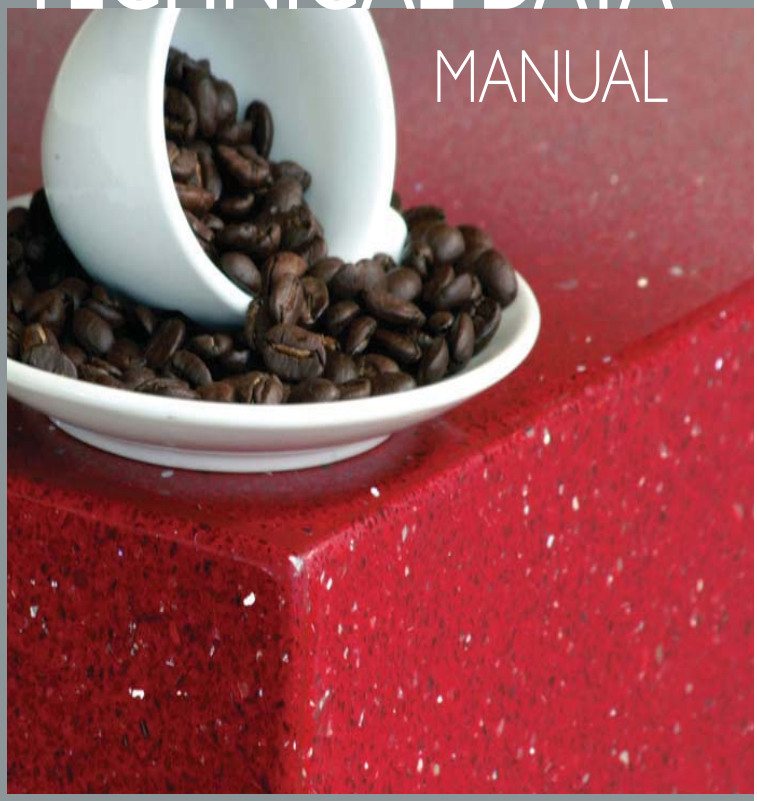
END OF SECTION 11 28 00

CSI Masterformat Division 12: Furnishings

KNOW-A-WATT:

The embodied energy of MDF furniture is 5200 BTU/lb, while wood furniture has an embodied energy of approximately 1100 BTU/lb.

TECHNICAL DATA MANUAL



Ruby Reflections 7450

CaesarStone®
QUARTZ SURFACES

TECHNICAL DATA

PHYSICAL PROPERTIES

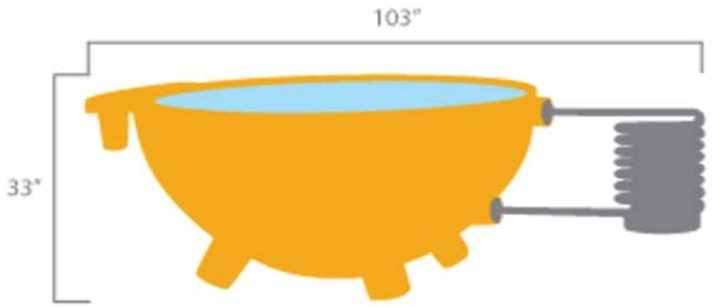
TEST PERFORMED	TEST PROCEDURE	RESULTS	REMARKS
Absorption (%)	ASTM C-97	0.002	
Density (lb/ft^3)	ASTM C-97	2000 series: 145.4 3000 series: 149.1 7000 series: 149.1 9000 series: 152.9	
Mohs Hardness	Scratch Test	7.5	Scale of 1 to 10 where 10 is diamond. A reading of 7.5 means that the surface was scratched by #8 (topaz) but not by #7 (quartz)
Taber Abrasion	ASTM C-501	2000 series: 126 3000 series: 147 7000 series: 196 9000 series: 251	Note: This is the abrasion index at 1,000 cycles. A higher index represents less wear.
Radiant Heat Resistance	NEMA 3-3.10	No Damage	
UL Fire Resistance	Smoke gen	Pass (No Burn)	
Thermal Expansion (x0.000001 in/in/deg c)	ASTM E 228	2000 series: 9.6 3000 series: 7.9 7000 series: 7.9 9000 series: 7.8	
Stain Resistance	ASTM Z 124.6	2000 series: 59 3000 series: 64 7000 series: 54 9000 series: 54	Note: Max rating 64.
Ball Impact Resistance (Height)	NEMA LD 3.33	2000 series: 34" 3000 series: 35" 7000 series: 34" 9000 series: 36"	
Boiling Water Resistance	NEMA LD 3.38	No Effect	
High Temperature Resistance	NEMA LA 3.36	No Effect	
Flexural Strength (Psi)	ASTM C880	2000 series: 7058 3000 series: 5878 7000 series: 3819 9000 series: 4377	Flexural strength minimum requirements: Marble 1000Psi Granite 1200Psi
Static Coefficient of Friction	ASTM C1028 James Machine	Polished Finish: 0.68 Honed Finish: 0.69	
	ASTM D2047 Dynamometer Pull Method	Dry: 0.87, Wet: 0.54 Dry: 0.73, Wet: 0.68	Polished Finish Honed Finish

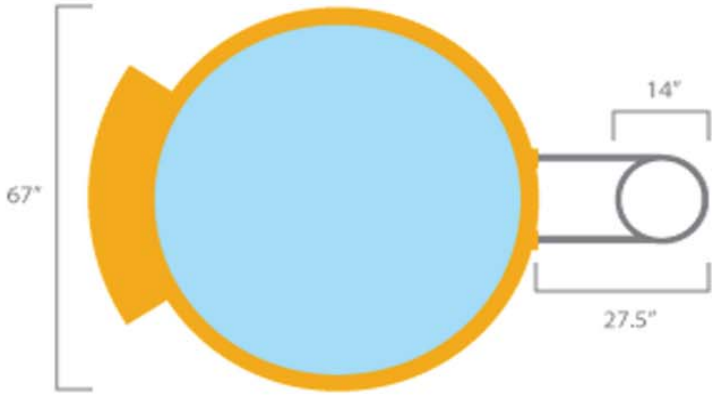
Tests preformed by: ATC and SGS

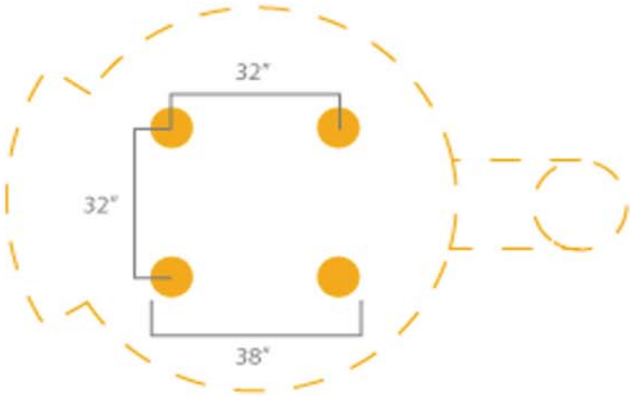
CSI Masterformat Division 13: Special Construction

dutchtub _specifications

Height:	33"
Width:	67"
Length:	102"
Weight:	165 Pounds
Capacity:	200 Gallons
Distance Between Legs:	32" on center
Standard Colors:	Tub Orange (RAL2000) Pigeon Blue (RAL5014) Light Blue (RAL5024) Ocean Green(RAL5021) Dark Grey (RAL7015) Reed Green (RAL6013)
Materials:	Poly Fiber 316 Stainless Steel
Fuel:	Wood







Contact:

Todd Smith
Dutchtub US
PO Box 925
Saranac Lake, NY
12983

518.524.2151

todd@dutchtub.us

CSI Masterformat Division 22: Plumbing

KNOW-A-WATT:

The embodied energy of PVC used in plumbing pipes in 9.5 kWh/lb.
(Check for accuracy of this)

Vanguard

PLUMBING

TECHData

MATERIAL SPECIFICATION SHEET

MANABLOC® Manifold Control Unit

SCOPE:

This specification designates requirements for the Vanguard MANABLOC Manifold Plumbing Control Unit. The MANABLOC water distribution system supplies water to individual plumbing fixtures through dedicated ports and distribution lines. Each port (outlet) is equipped with a built-in on/off valve to provide control for each fixture. The MANABLOC has separate hot and cold water inlets and ports to manage the entire plumbing system. Each port comes complete with necessary fitting hardware to connect Vanguard Vanex PEX directly to the port. This hardware features the patented Lock-In retaining device which secures the tubing in the port and, when assembled properly, reduces the risk of a connection blow-off. Supply connections and fixture transition fittings are not included with the unit but are available separately.

MATERIAL:

The modular MANABLOC sections are molded from polysulfone (PLS) plastic. This material is used extensively in the medical industry and is highly resistant to hot water, chlorine and other chemicals typically found in potable water systems. The seal between the manifold sections is accomplished with high-grade O-rings. The sections are then contained by six (6) metal tie rods which have been adjusted at the factory for optimum tension. The other plastic components are made from engineering plastics chosen specifically for each purpose. The stiffener used in the port compression fittings is 304 stainless steel.

MARKING AND CERTIFICATION:

MANABLOC units are marked with the product name, unit part number, material designation, production date and marks of third party certifications by NSF International (NSF-pw) to ASTM F877 and ANSI/NSF standards 14 and 61, Wernock Hersey and is listed with IAPMO as meeting the requirements of the Universal Plumbing Code™.

RECOMMENDED USES:

The MANABLOC is recommended for use in hot and cold potable water distribution systems in single and multifamily dwellings, as well as multiple unit structures (apartments, condos, hotels, motels etc.). Maximum pressure/temperature rating is 100 psi @ 180˚F. The MANABLOC is not to be used directly inline with domestic recirculation loops.

HANDLING AND INSTALLATION:

The MANABLOC shall be installed in accordance with Vanguard installation instructions and in compliance with local plumbing and building codes.

CAPACITIES AND K-FACTORS:

Specifications	English Units	SI
Main Waterway (each side)	1 1/4"	31.8mm
Main Inlet/Outlet Connection	1" Special Thread	–
Fixture Ports	3/8" CTS and 1/2" CTS (1/2" OD and 5/8"OD)	9.5mm and 12.7mm (12.7mm OD and 15.9mm OD)
Fixture Port Rating (each) (@ 8 FPS tubing velocity)	3/8" - 2.5 GPM 1/2 - 4 GPM	3/8" - 9.5 LPM 1/2" - 15.1 LPM
Fixture Port Pressure Drop (@ Rated Flow)	3/8" - 2 PSI 1/2 - 3.4 PSI	3/8" - .14 BAR 1/2" - .23 BAR
Fixture Port K-Factor	3/8" - .35 1/2" - .21 ($PSI=KxGPM^2$)	3/8" - 1.66×10^{-3} 1/2" - 9.997×10^{-4} ($BAR=KxLPM^2$)
Main Bore Flow Capacity (each side)	31 GPM	117.3 LPM
Main Bore Through Feed K Factor (36 Ports with "Y" Block)	0.012 ($PSI=KxGPM^2$)	56.98×10^{-6} ($BAR=KxLPM^2$)
WSFU Capacity (each side) (1995 IPC, table E102)	60	–

TECHData

PLUMBING

MANABLOC® Quality Control

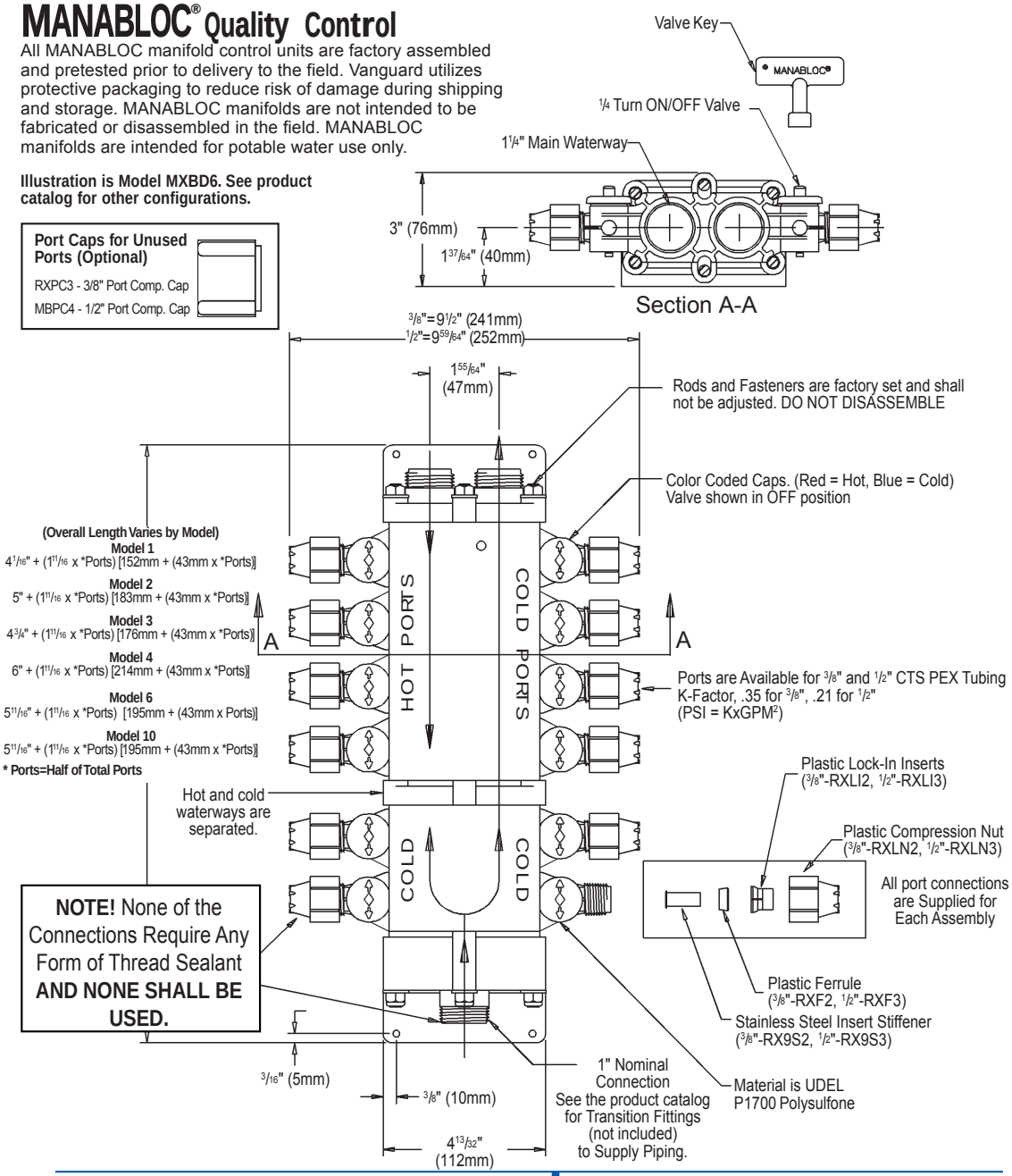
All MANABLOC manifold control units are factory assembled and pretested prior to delivery to the field. Vanguard utilizes protective packaging to reduce risk of damage during shipping and storage. MANABLOC manifolds are not intended to be fabricated or disassembled in the field. MANABLOC manifolds are intended for potable water use only.

Illustration is Model MXBD6. See product catalog for other configurations.

Port Caps for Unused Ports (Optional)

RXPC3 - 3/8" Port Comp. Cap

MBPC4 - 1/2" Port Comp. Cap



Vanguard Piping Systems, Inc.

Vanguard Piping Systems, Inc.
901 N. Vanguard St. • McPherson, KS 67460
Call: 800-775-5039
Fax: 800-775-4068

Vanguard TECHData

PLUMBING

MATERIAL SPECIFICATION

Vanex® Cross-linked Polyethylene (PEX)

SCOPE:

This material specification designates the requirements for Vanguard Vanex PEX hot and cold water distribution tubing. All Vanex tubing is copper tube size dimension (CTS), SDR9 wall thickness and meets the respective requirements of ASTM F 876 and F 877.

MATERIAL:

All Vanex tubing is manufactured from a cross-linkable high density polyethylene produced by grafting organo-silanes onto a polyethylene base. A catalyst (accelerator) added to the cross-linkable polyethylene during extrusion initiates the cross-linking process. Cross-linking is completed with hot water or steam. Vanex tubing is available in white or pigmented red or blue for easy identification of hot and cold lines.

MARKING AND CERTIFICATION:

All Vanex tubing is marked with the name Vanguard as the manufacturer, nominal size, design pressure and temperature ratings, relevant ASTM standards numbers, manufacturing date and production code, as well as both the NSF-pw and the NSF CL-R/CL-TD stamps indicating third-party certification by NSF International for meeting and exceeding performance and toxicological standards, as well as achieving the highest chlorine resistance rating in the PEX industry. NSF conducts random on-site inspections of Vanguard manufacturing facilities and independently tests Vanex tubing for compliance with physical and toxicological standards. Vanex PEX is also listed with IAPMO, Warnock Hersey, the ICBO Evaluation Service and HUD (Housing and Urban Development).

RECOMMENDED USES:

Vanex tubing is intended and recommended for use in hot and cold potable water distribution systems and hydronic radiant heating systems. Design temperature and pressure ratings for Vanex PEX is 160 psi @ 73˚F and 100 psi @ 180˚F. Vanex tubing can also be used in "continuously-recirculating" plumbing systems at temperatures of up to 140° F while still maintaining excellent chlorine resistance. For information on the suitability for other hot and cold water applications not listed here, consult with your Vanguard Piping Systems representative.

HANDLING AND INSTALLATION:

Vanex cross-linked polyethylene tubing is tough yet flexible. However, it is softer than metals and may be damaged by abrasion or by objects with a cutting edge. Use of these materials in hot and cold water distribution systems must be in accordance with good plumbing practices, applicable code requirements, and current installation practices available from Vanguard. Vanex is manufactured to meet written national standards. Contact a Vanguard representative or the applicable code enforcement bureau for information about approvals for specific applications.

Property	ASTM Test Method	Typical Values English Units	Typical Values SI Units
Density	D 792	--	0.946 g/cc
Melt Index[1] (190° C/2.16 kg)	D 1238	--	0.7g/10min
Flexural Modulus[2]	D 790	120,000 psi	830 MPa
Tensile Strength @ Yield (2 in/min)	D 638	2,900 psi	20 MPa
Coefficient of Linear Thermal Expansion @ 68° F	D 696	8 x 10 $^{-5}$/°F	15 x 10 $^{-5}$/°C
Hydrostatic Design Basis @ 73°F (23°C)	D 2837	1250 PSI	8.6 MPa
@ 180°F (82°C)	D 2837	800 PSI	5.5 MPa
Vicat Softening Point	D 1525	255°F	124 °C
Thermal Conductivity	C 177	2.4 BTU/ (hr)(ft^2)(°F/in)	3.5 x 10^{-3} Watts/ (cm^2)(°C/cm)

1. Before Crosslinking 2. 73˚ F

TECHData

PLUMBING

Vanex® PEX

Quality Assurance: When the product is marked with the ASTM F 876/F 877 designation, it affirms that the product was manufactured, inspected, sampled and tested in accordance with these specifications and has been found to meet the specified requirements.

Listings:

NSF-pw - tested for health effects to ANSI/NSF standard 61 and performance to ANSI/NSF standard 14.

NSF CL-R/CL-TD - Testing and conformance to NSF Protocol P171, Chlorine Resistance of Plastic Piping Materials. Meets and exceeds pass/fail criteria for both Traditional Domestic and Domestic Continuous Re-circulation ratings.

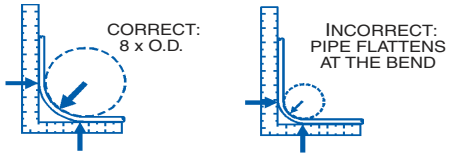
IAPMO - approved for UPC, listed to ASTM F 876/F 877

ICBO ER #5287 - listed for plumbing and hydronic heating applications.

Intertek Testing Services (Warnock Hersey) - certification to CSA B137.5 (Canadian Standards Association)

HUD (Housing and Urban Development) - MR 1276

Minimum Bend Radius:



Changes in direction may be made by bending PEX tubing. The minimum bend radius is 8 times the outside diameter. When bending against the coil direction, the minimum bend radius is 24 times the O.D. No special tools are necessary.

Minimum Burst Pressure (PSI):

Per ASTM F 876/F 877

Size	73˚F (23˚C)	180˚F (82˚C)
1/4"	870	390
3/8"	620	275
1/2"	480	215
5/8"	475	210
3/4"	475	210
1"	475	210
1 1/4"	475	210
1 1/2"	475	210
2	475	210

SDR9 PEX Tubing

ASTM F 876/F 877/CTS-OD SDR9

Part Number	Tubing Size	O.D.	Wall Thickness	Nom. I.D.	Weight Per Foot	Volume (Gal.) Per 100 Foot
PX1	1/4"	0.375±.002	0.065±.002	0.250	.0261	.25
PX2	3/8"	0.500±.002	0.075±.002	0.350	.0413	.50
PX3	1/2"	0.625±.002	0.075±.002	0.475	.0535	.92
PX58	5/8"	0.750±.002	0.088±.002	0.574	.0752	1.34
PX4	3/4"	0.875±.002	0.102±.002	0.671	.1023	1.82
PX5	1"	1.125±.003	0.132±.002	0.863	.1689	3.04
PX6	1 1/4"	1.375±.003	0.161±.003	1.053	.2523	4.52
PX7	1 1/2"	1.625±.004	0.191±.004	1.243	.3536	6.30
PX8	2"	2.125±.004	0.248±.004	1.629	.6010	10.83

NOTE: Dimensions are in English units. Tolerances shown are ASTM requirements. For Red or Blue part numbers, place and "R" after the "X" in the part number for the Red tubing and a "B" for the Blue tubing.

Pressure Drop Table

Expressed as PSI/ft. Pressure Drop

GPM	SIZE 3/8"	1/2"	5/8"	3/4"	1"	GPM	SIZE 1 1/4"	1 1/2"	2"
1	.070	.016				10	.023		
1.5	.149	.034				11	.028		
2	.254	.058	.023			12	.033		
2.5	*.381	.087	.035			13	.038		
3	.539	.122	.048	.023		14	.044		
3.5	.717	.162	.065	.030		16	.056	.025	
4		*.207	.083	.039		18	.069	.031	
5		.314	.125	.059		20	.084	.038	
6		.440	.175	.082	.024	22	.101	.045	
7		.586	*.233	.109	.032	24	*.118	.053	
8			.298	.140	.041	26	.137	.061	
9			.371	*.173	.051	28	.157	.070	
10			.451	.211	.062	30	.179	*.080	.021
11				.252	.074	32	.202	.090	.024
12				.296	.087	34		.101	.027
13				.343	.101	36		.112	.030
14					.116	38		.124	.033
16					*.148	40		.136	.036
18					.184	45			.045
20					.224	50			.055
22					.267	55			*.066
24						60			.077
26						65			.089
28						70			.103
30						75			.116

EXAMPLE: To calculate the pressure drop of a 1/2" line, 40 ft. long, with a 3 gpm flow rate, calculate .122 psi x 40 ft. = 4.9 psi pressure drop. Most plumbing codes require 8 psi residual pressure at the fixture. Refer to your local code requirements.

* Indicates 8 fps maximum velocity required by some plumbing codes.
NOTE: Maximum flow for each size based on 12 FPS velocity.
PSI x 2.307 = head loss.

Vanguard Piping Systems, Inc.

Vanguard Piping Systems, Inc.
901 N. Vanguard St. • McPherson, KS 67460
Call: 800-775-5039
Fax: 800-775-4068

QLTP27VS 4.04

CSI Subdivision: 22 11 23 Domestic Water Pumps Grundfos MQ 3-35

GRUNDFOS **INSTRUCTIONS**

MQ

(US) **Installation and operating instructions**
(F) **Notice d'installation et d'entretien**
(E) **Instrucciones de instalación y funcionamiento**

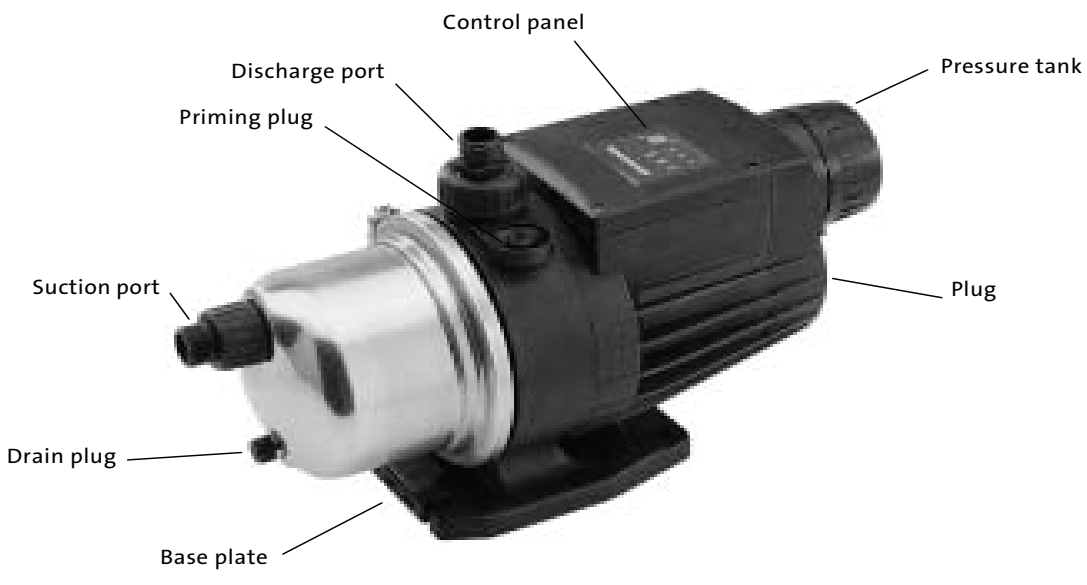
c UL US LISTED

BE > THINK > INNOVATE >

GRUNDFOS

1.3 MQ pump

Fig. 1



2. Pumped liquids

Thin, clean, non-aggressive liquids, not containing solid particles or fibres.

3. Technical data

3.1 Operating conditions

	MQ 3-35	MQ 3-45
Maximum flow rate [gpm]	22	
Maximum pressure [psi]	51	65
Maximum system pressure [psi]	108	
Maximum suction lift [ft], see page 35	25	
Minimum ambient temperature [°F]	32	
Maximum ambient temperature [°F]	113	
Minimum liquid temperature [°F]	32	
Maximum liquid temperature [°F]	95	
Net weight [lbs]	29	
Sound pressure level [dB(A)]	< 70	
Tank volume [oz]	5	
Air pressure in tank [psi]	22 to 25	
Connections	1" NPT	

3.2 Electrical data

		MQ 3-35	MQ 3-45
Enclosure class		IP 54	
Insulation class		B	
Supply cable		6.56 ft H07RN-F with/without plug	
Voltage, power consumption, P_1 [W]	1 x 110-120 V –10/+6%, 60 Hz	800/7.2 A	1000/9.2 A
	1 x 220-240 V –10/+6%, 60 Hz	850/3.7 A	1050/4.5 A

3.3 Dimensions

See dimensions at the end of these instructions.

3.4 Approvals

Materials in contact with the pumped liquid have been approved by the British Water Regulations Advisory Scheme (WRAS) according to BS 6920 for use in drinking water.

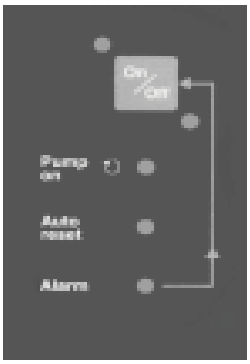
Other approvals: See pump nameplate.

4. Functions

4.1 Control panel

The MQ pump is operated entirely by means of the control panel, see fig. 2. The control panel offers the possibility of starting/stopping the pump. The pump settings and operating condition are indicated by indicator lights.

Fig. 2



TM01 9684 2600

Heating & Air conditioning

Series UP Circulators - closed systems

Industries highest quality and quietest operating heating circulators

< -- Rotate -- > **Play animation**

click left or right arrow to rotate each frame

HIGHLIGHTS

SuperBrute - a new standard

- **Unmatched flexibility** - 3 speed m technology for easy adaptability.
- **Highest reliability** - patented ED u unmatched starting torque.
- **Top performance** - removable, integrated check valve doesn't inhibi water flow.

> Where to purchase

FEATURES

- Built-in motor protection for long life
- Stainless steel construction for corrosion resistance
- Multiple accessories for a variety of applications
- Whisper-quiet operation for sound sensitive installations

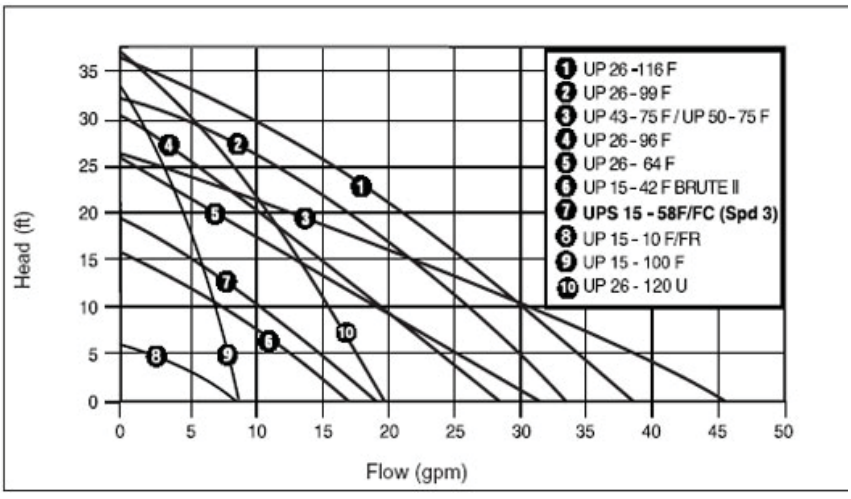
APPLICATIONS

- **Hydronic heating**
- **Fan coil heating**
- **Solar heating**
- **Radiant heating systems**

PERFORMANCE

Performance chart is shown for reference only.
Download the submittal data sheet for exact performance.

CLOSED SYSTEMS 60HZ



QUICK FACT SHEET
Small Circulating Pumps

Series UP15's • Open & Closed Systems

AVAILABLE MODELS (Closed Systems):
- UPS15-42F (3 Speed)
- BRUTE II

CONNECTIONS: Flange, cast iron, (2) 1/2" diameter bolt holes

AVAILABLE MODELS (Open Systems):
- UM15-10B5
- UM15-10B7
- UP15-18B5
- UP15-18B7
- UP15-18SU & SF
- UP15-42SU & SF
- UP15-42B5
- UP15-42B7

CONNECTIONS: B5 - Sweat fittings, Bronze, 1/2" SU - Union, stainless steel, 1-1/4" NPSM
B7 - Sweat fittings, Bronze, 3/4" SF - Flange, stainless steel, (2) 1/2" diameter bolt holes

FLOW RANGE: 0 to 20 gpm
HEAD RANGE: 0 to 16.5 feet
MOTOR: 2&4 pole, single phase

MAXIMUM FLUID TEMPERATURE
(Open Systems): 140°F (60°C)
(Closed Systems): 230°F (110°C)

MINIMUM FLUID TEMPERATURE:
50°F (10°C)
PRESSURE:
145 psi maximum (working)

UP25's & 26's • Open & Closed Systems

AVAILABLE MODELS (Closed Systems):
- UP26-64F
- UP26-96F
- UP26-99F
- UP43-75F

CONNECTIONS: Flange, cast iron, (2) 1/2" diameter bolt holes

AVAILABLE MODELS (Open Systems):
- UP25-64SU & SF
- UP26-96BF
- UP26-99BF
- UP43-75BF

CONNECTIONS: SU - Union, stainless steel, 1-1/4" NPSM BF - Flange, bronze, (2) 1/2" diameter bolt holes
SF - Flange, stainless steel, (2) 1/2" diameter bolt holes

FLOW RANGE: 0 to 46 gpm
HEAD RANGE: 0 to 32.5 feet
MOTOR: 2&4 pole, single phase

MAXIMUM FLUID TEMPERATURE
(Open Systems): 140°F (60°C)
(Closed Systems): 230°F (110°C)

MINIMUM FLUID TEMPERATURE:
50°F (10°C)
PRESSURE:
145 psi maximum (working)

Series UP • BUC5 & BUC7

AVAILABLE MODELS:
- UP15-18BUC5, 60 Hz
- UP15-42BUC5, 60 Hz
- UP15-18BUC7, 60 Hz
- UP15-42BUC7, 60 Hz

CONNECTIONS:
- BUC5 = 1/2" copper pipe, female sweat fittings
- BUC7 = 3/4" copper pipe, female sweat fittings

FLOW RANGE: 0 to 16 gpm
HEAD RANGE: 0 to 15 feet
MOTOR: 2 pole, single phase
MAXIMUM FLUID TEMPERATURE:
140°F (60°C)
MINIMUM FLUID TEMPERATURE:
50°F (10°C)
PRESSURE: 145 psi max. (working)

Grundfos Circulators

Series UP • 50-75F

FLANGE: 2" slotted, 4-bolt

FLOW RANGE: 0 to 45 gpm

HEAD RANGE: 0 to 26 feet

MODEL: UP50-75F, 60 Hz

MOTOR: 2 pole, single phase

MAXIMUM FLUID TEMPERATURE:
230°F (110°C)

MINIMUM FLUID TEMPERATURE:
50°F (10°C)

PRESSURE:
145 psi maximum (working)

Series UP • CPVC Pump

APPLICATIONS:

- Spa heating and circulation
- Spa ozonization
- For indoor or protected outdoor uses
- Circulate chlorinated or brominated (clean/clear) water with neutral pH
- Chlorine concentration (maximum): 5 ppm continuous, 10 ppm intermittent
- Bromine concentration (maximum): 3 ppm continuous, 5 ppm intermittent
- Ozone production and injection systems

AVAILABLE MODELS:

- UP15-15
- UP15-20

CONNECTION: I.D. 1/2" PVC

FLOW RANGE: 0 to 11 gpm

HEAD RANGE: 0 to 10 feet

MOTOR: 2 pole, single phase

MAXIMUM FLUID TEMPERATURE:
140°F (60°C)

MINIMUM FLUID TEMPERATURE:
50°F (10°C)

PRESSURE: 145 psi max. (working)

MATERIALS OF CONSTRUCTION: *Closed Systems & Open Systems*

DESCRIPTION (Closed)	MATERIAL
Inlet Cone, Bearing Plate, Bearing Retainers, Rotor Can, Rotor Cladding, Shaft Retainer, & Impeller (UP26 , 43 & 50)	Stainless Steel
Stator Housing	Aluminum
Shaft, Upper & Lower Radial Bearings	Aluminum Oxide Ceramic
Thrust Bearing	Metal Impregnated Carbon
Pump Housing (Volute)	Cast Iron
O-ring & Gaskets	EP (Ethylene Propylene Rubber)
Impeller (UP15)	PES Composite (30% Glass Filled)
Teminal Box	Noryl®

DESCRIPTION (Open)	MATERIAL
Inlet Cone, Bearing Plate, Bearing Retainers, Rotor Can, Rotor Cladding, Shaft Retainer, Impeller (UP25, 26 & 43), Check Valve Spring on (UP BUC5 & BUC7) & Pump Housing (Volute) on UP15-18SU/SF, UP15-42SU/SF, UP25-64SU/SF Models	Stainless Steel
Shaft, Upper & Lower Radial Bearings	Aluminum Oxide Ceramic
Thrust Bearing	Metal Impregnated Carbon
Pump Housing on CPVC Pump	CPVC
Volute Retainer (SU & SF Models) & Stator Housing	Aluminum

DESCRIPTION (Open) *cont.*	MATERIAL
Pump Housing (Volute) for UM15-10B5 & B7, UP15-18B5 & B7, UP15-42B5 & B7, UP26-96BF, UP26-99BF, UP43-75BF and BUC5 & BUC7	Bronze
O-ring & Gaskets	EP (Ethyl. Propyl. Rubber)
Union Gasket on BUC5 & BUC7	Non Asbestos Fiber
Tail Piece & Union Nut on BUC5 & BUC7	Brass (UNS C36000)
Impeller (UM10 & UP15), (BUC5 & BUC7)	PES Composite (30% Glass Filled)
Teminal Box	Noryl®
Check Valve Housing, Valve and Torpedo	POM (polyoxymethylene)

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130 Gallon Rectangular Poly Tank 60x30x18

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- Open Top Tanks & Lids
- Light Duty Tanks

Accessories
- Tank Fittings, Caps & Lids

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Enter your email

130 Gallon Rectangular Poly Tank 60x30x18

SPECIFICATIONS
Color: White
Capacity: 130 gallons
Height: 18 inches
Length: 60 inches
Width: 30 inches
Weight: 75 pounds
View Product Drawing

Retail Price ~~$825.00~~
Your Price $577.50 Call to Order
Product #: 0260-722

1 Year Manufacturers Warranty

Other products in this category:

Product #	Description	Your Price
0260-002	3 Gallon Rectangular Poly Tank 17x7x7	$91.87
0260-004	3 Gallon Rectangular Poly Tank 17x7x7	$91.87
0260-006	3 Gallon Rectangular Poly Tank 16x9x5	$91.87
0260-008	3 Gallon Rectangular Poly Tank 16x9x5	$91.87
0260-010	4 Gallon Rectangular Poly Tank 18x8x8	$91.87
0260-012	4 Gallon Rectangular Poly Tank 18x8x8	$91.87
0260-014	5 Gallon Rectangular Poly Tank 12x12x8	$91.87
0260-016	5 Gallon Rectangular Poly Tank 12x12x8	$91.87
0260-018	5 Gallon Rectangular Poly Tank 21x8x8	$105.00
0260-020	5 Gallon Rectangular Poly Tank 21x8x8	$105.00
0260-022	5 Gallon Rectangular Poly Tank 18x10x7	$105.00
0260-024	5 Gallon Rectangular Poly Tank 18x10x7	$105.00
0260-026	5 Gallon Rectangular Poly Tank 20x12x6	$105.00
0260-028	5 Gallon Rectangular Poly Tank 20x12x6	$105.00
0260-030	6 Gallon Rectangular Poly Tank 16x12x8	$118.12
0260-032	6 Gallon Rectangular Poly Tank 16x12x8	$118.12
0260-034	6 Gallon Rectangular Poly Tank 22x14x5	$118.12
0260-036	6 Gallon Rectangular Poly Tank 22x14x5	$118.12
0260-038	6 Gallon Rectangular Poly Tank 20x12x7	$118.12
0260-040	6 Gallon Rectangular Poly Tank 20x12x7	$118.12
0260-042	7 Gallon Rectangular Poly Tank 19x13x7	$118.12
0260-044	7 Gallon Rectangular Poly Tank 19x13x7	$118.12
0260-046	7 Gallon Rectangular Poly Tank 24x12x5	$118.12

TANKLESS WATER HEATERS
Models & Prices

Tankless Water Heater Product Guide
Description / Specification

Tankless Water Heater Applications
Residential / Commercial

Tankless Water Heater Electrical Guide
Service Calculations

Tankless Water Heater Installation
Plumbing / Electrical

Tankless Water Heater Cost Comparisons
Reports / Listings

Tankless Water Heaters Service Guide
Remove / Repair

Product Specifications Table

Standard 240 Volt (AC) Operation, 240 VAC Rating
SEISCO® Electric Fluid Heating System

BACK TO Tankless Water Heater Product Guide

[Four Chamber Models]

MODEL	RA-28	RA-22	RA-18
kW	28	22	18
Elements	7000 watts ´ 4	5500 watts ´ 4	4500 watts ´ 4
Btu/hr	95560	75080	61430
kg-cal/ min	400	315	258
TEMPERATURE RISE			
	95 °F @ 2.0 GPM 76 °F @ 2.5 GPM 64 °F @ 3.0 GPM 48 °F @ 4.0 GPM	75 °F @ 2.0 GPM 60 °F @ 2.5 GPM 50 °F @ 3.0 GPM 37 °F @ 4.0 GPM	61 °F @ 2.0 GPM 49 °F @ 2.5 GPM 40 °F @ 3.0 GPM 30 °F @ 4.0 GPM
	50 °C @ 8 L/min 40 °C @ 10 L/ min 33 °C @ 12 L/ min 25 °C @ 16 L/ min	39 °C @ 8 L/min 31 °C @ 10 L/ min 26 °C @ 12 L/ min 20 °C @ 16 L/ min	32 °C @ 8 L/min 26 °C @ 10 L/min 21 °C @ 12 L/min 16 °C @ 16 L/min

Tankless-Water-Heater

MECHANICAL			
Size HxWxD	15x 15x 6 in / 40x 40x 16 cm	15x 15x 6 in / 40x 40x 16 cm	15x 15x 6 in / 40x 40x 16 cm
Plumbing fittings	3/4-in NPT nipple x 2	3/4-in NPT nipple x 2	3/4-in NPT nipple x 2
Shipping weight	23 lbs / 10.5 kg	23 lbs / 10.5 kg	23 lbs / 10.5 kg
ELECTRICAL			
V	240	240	240
A (max)	116	91	75
Hz	50 / 60	50 / 60	50 / 60
Circuits	30A x 4	50A x 2	40A x 2
APPLICATIONS			

Home || Tankless Company Introduction || Tankless Patent Information || Tankless Distribution || Contact Us & LINKS || Tankless Product Information || Tankless Application || Tankless Tankless Water Heater Installation || Trouble Shooting || Buy On Line

THE POWER OF THE SUN

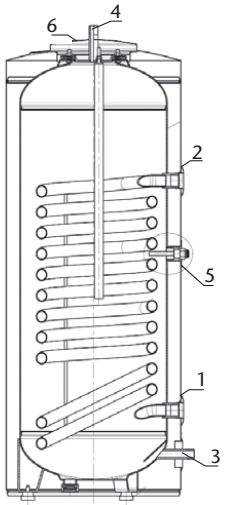
Storage Tanks for Solar Applications

Single Heat Exchanger Models

Technical Data

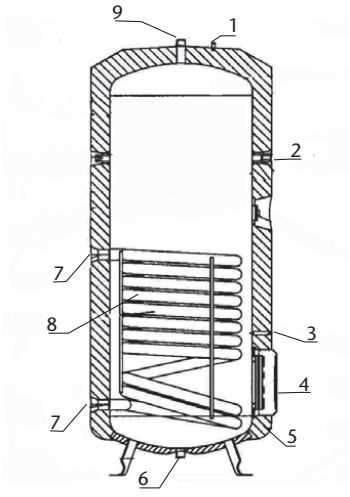
Type		SB 150 S	SB 200 S	SBB 300 S	SBB 400 S
Contents					
Storage capacity	Gal / ltr	39.0 / 147.63	52 / 196.84	80.6 / 305	108.6 / 411
Volume of heat exchanger, top	Gal / ltr	NA	NA	NA	NA
Volume of heat exchanger, bottom	Gal / ltr	1.9 / 7.2	2.7 / 9.1	2.7 / 10.1	2.9 / 11.3
Pressure					
Working pressure	PSI / bar	150 / 10	150 / 10	150 / 10	150 / 10
Tested to pressure	PSI / bar	217 / 15	217 / 15	217 / 15	217 / 15
Max. pressure of boiler loop	PSI / bar	150 / 10	150 / 10	150 / 10	150 / 10
Temperature					
Max. temperature solar loop	°F / °C	203 / 95	203 / 95	203 / 95	203 / 95
Max. temperature of boiler loop	°F / °C	203 / 95	203 / 95	203 / 95	203 / 95
Heat exchanger					
Surface area heat exchanger top	sq. inch / m^2	NA	NA	NA	NA
Surface area heat exchanger bottom	sq. inch / m^2	1742	2059	2325 / 1.5	2635 / 1.7
Weights					
Tank weight empty	lb. / kg	190 / 86.18	226 / 102.5	292 / 133	371 / 169
Tank weight full	lb. / kg	523 / 237.2	658 / 298.4	988 / 448	1304 / 591
Other					
Standby losses in 24 hours	BTU / kWh	6500 / 1.9	4434 / 1.3	6500 / 1.9	7500 / 2.2
Cold/hot water connection		3/4" Male NPT		for 1" copper pipe with adapters, provided with unit	
Dimensions					
Height with insulation	in. / mm	50.5 /	62.75 /	66.1 / 1679	72.7 / 1848
Width with insulation	in. / mm	20.5 /	20.5 /	27.55 / 700	29.52 / 750

SB 150 S & SB 200 S models



1 Heat exchanger out
2 Heat exchanger in
3 Cold water inlet
4 Hot water outlet
5 Well for thermostat
6 T & P valve

SBB 300 S & SBB 400 S models



1 Sacrificial anode indicator
2 Thermometer
3 Well for temperature sensor (solar)
4 Clean-out port
5 Foam insulation
6 Cold water inlet
7 Heat exchanger ports (solar)
8 Exchanger coil (solar)
9 Hot water outlet

Note: heat exchangers are steel with porcelain enamel coating.

CB14-77

Brazed Plate Heat Exchanger

Working principles

The heating surface consists of thin corrugated metal plates stacked on top of each other. Channels are formed between the plates and corner ports are arranged so that the two media flow through alternate channels, always in counter-current flow. The media are kept in the unit by a brazed seal around the edge of the plates. The contact points of the plates are also brazed to withstand the pressure of the media handled.

Standard design

The plate pack is covered by cover plates. Connections are located in the front or rear cover plate. The channel plates are corrugated to improve heat transfer efficiency and to make them rigid.

Standard materials

Cover plates
Stainless steel AISI 316

Connections
Stainless steel AISI 316

Plates
Stainless steel AISI 316

Brazing material
Copper

Particulars required for quotation

To enable Alfa Laval's representative to make a specific quotation, enquiries should be accompanied by the following particulars:

- flow rates or heat load required
- temperature program

Advantages of brazed plate heat exchangers in Industry and HVACaR

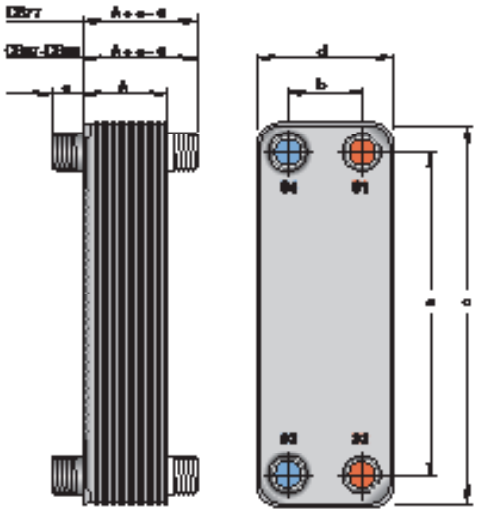
The Alfa Laval Brazed plate heat exchangers (BHE) have several advantages over traditional heat exchangers in industrial and HVACaR applications.

- The high heat transfer efficiency of the BHE makes it extremely compact and also easy to install in place where space is limited.
- The unit has no gaskets and is therefore suitable in applications where temperature and/or pressure is e.g. in district heating.
- The Alfa Laval supply system assesses that, no matt

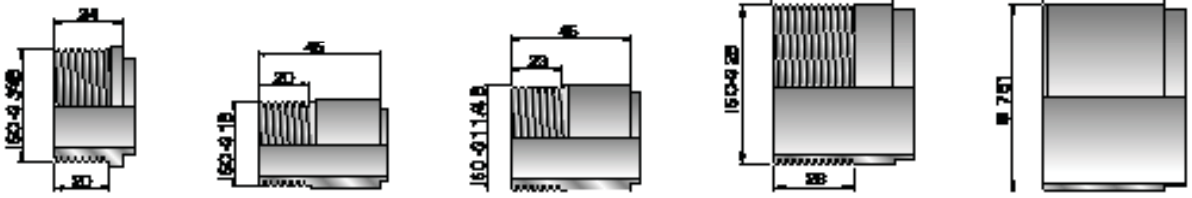
	CB14	CB26	CB27	CB61	CB62	CB76	CB77
Min. working temperature *)	−160°C	−160°C	−160°C	−160°C	−160°C	−160°C	−160°C
Max. working temperature *)	175°C	175°C	175°C	175°C	175°C	175°C	175°C
Min. working pressure *)	Vacuum	Vacuum	Vacuum	Vacuum	Vacuum	Vacuum	Vacuum
Max. working pressure, S3S4/S1S2 *)	32 bar	32 bar	32 bar	32 bar	32 bar	A,E,H: 32 bar L,M: 26 bar	25/16 bar
Volume pr. channel, litres	0.02	0.05	0.05	0.035	0.035	A: 0.18/0.25 E: 0.18/0.18 C,M,H: 0.25/0.25	0.25
Max. flowrate, S3S4/S1S2 *)	3.5 m³/h	8.1 m³/h	8.1/12.7 m³/h	8.1 m³/h	8.1/12.7 m³/h	30 m³/h	30/63 m³/h
Standard number of plates H,M,L	14,20;	10,16,24,	10,16,24,	10,20;	10-100	20-150	20-150
	30,40	34,60;	34,60;70	30,40;	(10,20,...)	(20,30,...)	(20,30,...)
		70,100	100,120	50,80			

*) Velocity 6 m/s (connection velocity) **) According to Swedish pressure vessel code

Standard dimensions



Type	a	b	c	d	e	A	Weight kg
CB14	172	42	208	78	24	8 + n x 2.36	0.7 + n x 0.08
CB26	260	60	310	112	46	9 + n x 2.40	1.2 + n x 0.12
CB27	260	60	310	112	46	9 + n x 2.40	1.2 + n x 0.12
CB61	488	60	626	112	46	10 + n x 2.40	1.9 + n x 0.23
CB62	488	60	626	112	46	10 + n x 2.40	1.9 + n x 0.23
CB76	619	92	818	191	49	A: 10 + 2.6 x n E: 10 + 2.2 x n H,L,M: 10 + 2.65 x n	7.0 + n x 0.44
CB77	619	92	818	191	49	10 + n x 2.65	7.0 + n x 0.44



CB14 (S1-S4)

CB26,CB61 (S1-S4)
CB27,CB62 (S2,S4)

CB27,CB62 (S1,S2)

CB76 (S1-S4)
CB77 (S3,S4)

CB77 (S1,S2)

How to contact Alfa Laval
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CSI Masterformat Division 23: HVAC

ESPINOZA ENERGY
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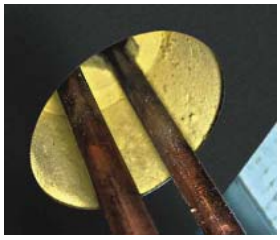
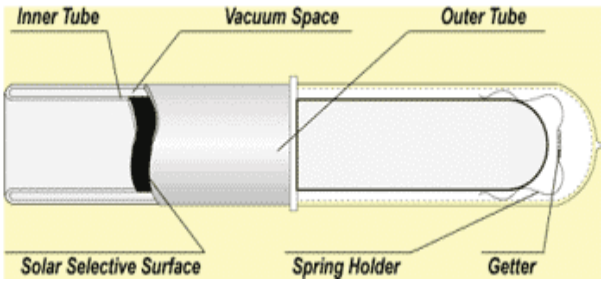
THE TRH SERIES

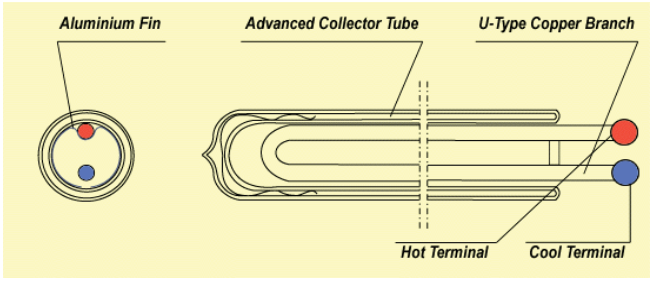
evacuated

TUBE SOLAR COLLECTOR

MODEL SC-01







TRH CASC ISE Institut Solare Energiesysteme ISFH

REDUCING GREENHOUSE EMMSIONS

ESPINOZA ENERGY SOLAR HEATING.COOLING

*EVACUATED TUBE SOLAR COLLECTOR SPECIFICATIONS***

Espinoza Energy Model #	Tube Dimensions inches	Width inches	Length inches	Depth inches	Light Collection Surface sq. ft.	Heat Collection Surface sq. ft.	Dry Weight lbs.	Fluid Content gal.	Tested Pressure psi	Operating System Pressure psi
SC-01	Φ2.28x70.9	39.4	78.3	6.69	20.5	33.9	104	0.832	174	87

Thermal Performance Ratings*

	2 layer Cu-N/Al by TRX
Area of solar heat collector	5 m^2
Heat loss coefficient K	k_1=1.08W/m^2 K
	k_2=0.0031W/m^2K
Heat collection per unit area per year	635 KW-hr/m^2
Test done on	Oct 9th 2001

*Collector rating test performed by ISE Hameln / Emmerthal Test Lab.

INSTALLATION ANGLE

Angle of inclination is about the same as the local latitude +/- 10 degrees facing south (northern hemisphere) or facing north (southern hemisphere)

e.g.: The best inclined angle
=local latitude –10 if it is not used in winter
or
=local latitude +10 if it is used in winter.

Flow Rate

Volumetric flow rate should be controlled to 0.159 to 0.317 gpm

Linear flow rate should be adjusted to below 6.56 ft/s

- High strength evacuated tube array utilizes the proven TRX selective coating technology to convert maximum solar radiation energy from the sun.
- 12 evacuated tubes are assembled in a panel.
- U tubes are inserted in each tube from the header manifold and are connected in parallel.
- Each U tube is coiled with aluminum foil to effectively remove the trapped heat from the tube.
- The end of each evacuated tube is well insulated with CFC FREE polyurethane foam to ensure no heat loss in the header manifold.
- A pair of inlet/outlet hex connectors are located in each end of the header ends, which allows easy installation in small and large arrays.
- G22, 3/4" Hex connector with flexible stainless steel conduit for external pipe joining.
- Virtually no wind load, unlike flat bed collectors.
- TRX Solar Collector can be used in all weather, all seasons.
- Our pollution free PVD process was utilized to assemble this high efficiency solar collector.

**Continuous product improvement, specifications are subject to change

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www.espinozaenergy.com

AVALIABLE FROM:

SECTION 23 72 19– Fixed-Plate Air-to-Air Energy-Recovery Equipment
PART 1 – GENERAL
1.1 SECTION REQUIREMENTS
A. Submittals: Product Data
1.2 PRODUCTS
B. Venmar Constructo 1.0 HRV #41500
1.3 PRODUCT SPECIFICATION
C. Shall be a packaged plate enthalpic-energy recovery ventilator as manufactured by Venmar
1.4 QUALITY ASSURANCE
A. The energy recovery ventilator shall be certified by the Home Ventilating Institute (HVI) under CAS 439. Both a heating and an air conditioning test must be run to determine year-round energy recovery.
D. The energy recovery cores used in these products shall be certified by ARI under its Standard 1060 for Energy Recovery Ventilators. ARI published certifications shall confirm manufacturer's published performance for airflow, static pressure, temperature and total effectiveness, purge air (OACF) and exhaust air leakage (EATR). Products that are not currently ARI Certified will not be accepted.
E. Manufacturer shall be able to provide evidence of independent testing of the core by Underwriters Laboratory (UL), verifying a maximum flame spread index (FSI) of 25 and a maximum smoke developed index (SDI) of 50, thereby meeting NFPA 90A and NFPA 90B requirements for materials in a compartment handling air intended for circulation through a duct system. The method of test shall be UL Standard 723.
F. Unit shall be listed under UL 1812 Standard for Ducted Air to Air Heat Exchangers.
G. The Venmar core shall be warranted to be free of manufacturing defects and to retain its functional characteristics, under circumstances of normal use, for a period of ten years from the date of purchase. Balance of Unit shall be warranted to be free of manufacturing defects and to retain its functional characteristics, under circumstances of normal use, for a period of two years from the date of purchase.
PART 2 – PERFORMANCE
2.1 ENERGY TRANSFER
A. Shall be capable of transferring both sensible and latent energy between air streams. Latent energy transfer shall be accomplished by direct water vapor transfer from one airstream to the other, without exposing transfer media in succeeding cycles directly to the exhaust air and then to the fresh air.
2.2 PASSIVE FROST CONTROL
A. Energy-transfer element shall perform without condensing or frosting under normal operating conditions (defined as outside temperatures above -10° F and inside relative humidity below 40%). Occasional extreme conditions shall not affect the usual function or performance of the element. No condensate drains will be allowed. Optional frost protection accessory shall be available for severe applications and climate zones.

2.3 CONTINUOUS VENTILATION
A. Unit shall have the capacity to operate continuously without the need for bypass, re-circulation, preheaters, or defrost cycles under normal operating conditions.
2.4 POSITIVE AIRSTREAM SEPARATION
A. Water vapor transfer shall be through molecular transport by hydroscopic resin and shall not be accomplished by “porous plate” mechanisms. Exhaust and fresh airstreams shall at all times travel in separate passages, and airstreams shall not mix.
2.5 LAMINAR FLOW
A. Airflow through the energy exchange element shall be laminar, avoiding deposition of particulates on the interior of the energy exchange plate material.
PART 3 – PRODUCT
3.1 CONSTRUCTION
A. Fixed-plate energy-exchange element. Energy-exchange module shall be of fixed-plate cross-flow construction, with no moving parts.
B. No condensate drain pans or drains shall be allowed and unit shall be capable of operating in winter and summer conditions without generating condensate.
C. Unit shall be compatible for use with 24 V, or line voltage controls. Unit shall be supplied with 24 V transformer and relay.
D. Unit shall have line cord for easy plug-in operation.
E. No Speed Control Allowed. External blower speed controls shall not be used.
F. Insulating double collars shall be provided suitable for connection of flexible or rigid ductwork.
G. Latched and hinged access door shall provide easy access to blowers, energy transfer element, and filters.
H. Case walls and doors shall be insulated with 1 in. FSK high-density board insulation, with additional 1/4 in. foam insulation on access panel for thermal and sound insulation.
I. Energy-exchange element shall be protected by washable polyester air filters in exhaust and fresh air streams.
J. Blower motor shall be thermally protected with automatic reset.

END OF SECTION 23 72 19

INSTALLATION GUIDE FOR VENMAR AVS UNITS CONSTRUCTO 1.0 HRV AND CONSTRUCTO 1.0 ERV

Model no.: 41502
(HRV with ports on top)

VB0069

Model no.: 41500
(HRV with ports on sides)

VB0070

Model no.: 41506
(ERV with ports on top)

VB0071

Model no.: 41504
(ERV with ports on sides)

VB0074

RESIDENTIAL USE ONLY

READ AND SAVE THESE INSTRUCTIONS

7 72371 08634 0

06010A rev. B

ABOUT THIS MANUAL

Because of the large amount of models covered by this publication, the illustrations are typical ones. Some details of your unit may be slightly different than the ones shown.

Please take note that this manual uses the following symbols to emphasize particular information:

⚠ WARNING
Identifies an instruction which, if not followed, might cause serious personal injuries including possibility of death.

CAUTION
Denotes an instruction which, if not followed, may severely damage the unit and/or its components.

NOTE: Indicates supplementary information needed to fully complete an instruction.

We welcome any suggestions you may have concerning this manual and/or the unit, and we would appreciate hearing your comments on ways to better serve you. Please contact us by phone at 1 800 567-3855.

ABOUT THESE UNITS

LIMITATION

For residential (domestic) installation only. This unit must be installed in accordance with all national and local regulations, building codes and safety codes.

⚠ WARNING

TO REDUCE THE RISK OF FIRE, ELECTRIC SHOCK, OR INJURY TO PERSON(S) OBSERVE THE FOLLOWING:

1. Use this unit only in the manner intended by the manufacturer. If you have questions, contact the manufacturer at the address or telephone number listed in the warranty.
2. Before servicing or cleaning the unit, disconnect power cord from electrical outlet.
3. This unit is not designed to provide combustion and/or dilution air for fuel-burning appliances.
4. When cutting or drilling into wall or ceiling, do not damage electrical wiring and other hidden utilities.
5. Do not use this unit with any solid-state speed control device other than following main wall controls: Lite-Touch Constructo, Simple-Touch Constructo or Constructo, and no other optional wall controls than 60-minute crank timer and/or 20-minute lighted push button and/or Dehumidistat.
6. This unit must be grounded. The power supply cord has a 3-prong grounding plug for your personal safety. It must be plugged into a mating 3-prong grounding receptacle, grounded in accordance with the national electrical code and local codes and ordinances. Do not remove the ground prong. Do not use an extension cord.
7. Do not install in a cooking area or connect directly to any appliances.
8. Do not use to exhaust hazardous or explosive materials and vapors.

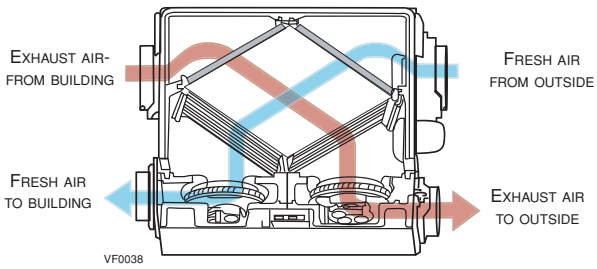
CAUTION

1. To avoid prematurate clogged filters, turn OFF the unit during construction or renovation.
2. Please read specification label on product for further information and requirements.
3. Be sure to duct air outside – Do not intake / exhaust air into spaces within walls or ceiling or into attics, crawl spaces, or garage.
4. Intended for residential installation only in accordance with the requirements of NFPA 90B (for a unit installed in USA) or Part 9 of the National Building Code of Canada (for a unit installed in Canada).
5. Do not run any air ducts directly above or closer than 2 ft (0.61 m) to any furnace or its supply plenum, boiler, or other heat producing appliance. If a duct has to be connected to the furnace return plenum, it must be connected not closer than 9’10” (3 m) from this plenum connection to the furnace.
6. The ductwork is intended to be installed in compliance with all local and national codes that are applicable.

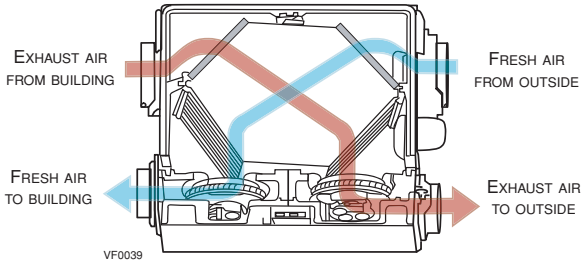
1. TECHNICAL DATA

1.1 Air Distribution (Normal Operation)

HRV

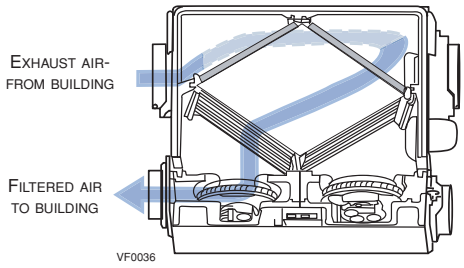


ERV



1.2 Air Distribution (Recirculation or Defrost Mode)

HRV



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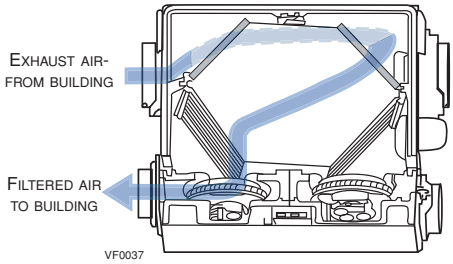


Outside Temperature		HRV and ERV Defrost Cycles	
Celcius (˚C)	Fahrenheit (˚F)	Defrosting (min.)	Operation time (min.) between each defrost cycle
-5 to -27 -27 and less	23 to -17 -17 and less	7 10	25 22

1.3 Specifications

Model	HRV	ERV
Weight	41 lbs (18.6 kg)	45 lbs (20.4 kg)
Oval Ports	Fit 5” (127 mm) ducts	Fit 5” (127 mm) ducts
Drain Diameter	1/2” (12 mm)	N/A
Installation	Chains, springs and hooks (provided with the unit).	
Motor Speeds	High and low speed	
Electrical supply	120 V, 60 Hz	120 V, 60 Hz
Power Consumption	150 watts	160 watts

1. TECHNICAL DATA (CONT'D)

1.4 PERFORMANCE CHARTS

1.4.1 HRV UNITS

Ventilation Performance

EXT STATIC PRESSURE		NET SUPPLY AIR FLOW			GROSS AIR FLOW SUPPLY			EXHAUST		
Pa	in.w.g.	l/s	cfm	m³/h	l/s	cfm	m³/h	l/s	cfm	m³/h
25	.1	52	110	187	52	110	187	57	122	205
50	.2	50	106	180	50	106	180	55	116	198
75	.3	48	101	173	48	102	173	53	113	191
100	.4	45	96	162	46	97	166	50	107	180
125	.5	43	92	155	43	92	155	48	103	173
150	.6	41	87	148	41	87	148	45	96	162
175	.7	38	81	137	38	81	137	43	91	155
200	.8	35	75	126	36	76	130	40	85	144

NOTE: ALL SPECIFICATIONS ARE SUBJECT TO CHANGE WITHOUT NOTICE.

Energy Performance

SUPPLY TEMPERATURE C°	SUPPLY TEMPERATURE F°	NET AIR FLOW l/s	NET AIR FLOW cfm	NET AIR FLOW m³/h	POWER CONSUMED WATTS	SENSIBLE RECOVERY EFFICIENCY	APPARENT SENSIBLE EFFECTIVENESS	LATENT RECOVERY/ MOISTURE TRANSFER
HEATING								
0	+32	23	48	82	68	66	78	0.07
0	+32	30	63	108	82	65	76	0.04
0	+32	44	93	157	116	59	68	0.04
-25	-13	30	63	108	110	55	81	0.08
COOLING						TOTAL RECOVERY EFFICIENCY		
+35	+95	-	-	-	-	Not tested		
		-	-	-				

1.4.2 ERV UNITS

Ventilation Performance

EXT STATIC PRESSURE		NET SUPPLY AIR FLOW			GROSS AIR FLOW SUPPLY			EXHAUST		
Pa	in.w.g.	l/s	cfm	m³/h	l/s	cfm	m³/h	l/s	cfm	m³/h
25	.1	53	112	191	55	117	198	56	118	202
50	.2	51	107	184	53	112	191	54	115	194
75	.3	49	103	176	51	108	184	53	111	191
100	.4	47	99	169	49	104	176	50	106	180
125	.5	44	94	158	46	98	166	48	102	173
150	.6	42	89	151	44	93	158	46	97	166
175	.7	40	84	144	42	88	151	43	91	155
200	.8	36	76	130	38	80	137	41	87	148

NOTE: ALL SPECIFICATIONS ARE SUBJECT TO CHANGE WITHOUT NOTICE.

Energy Performance

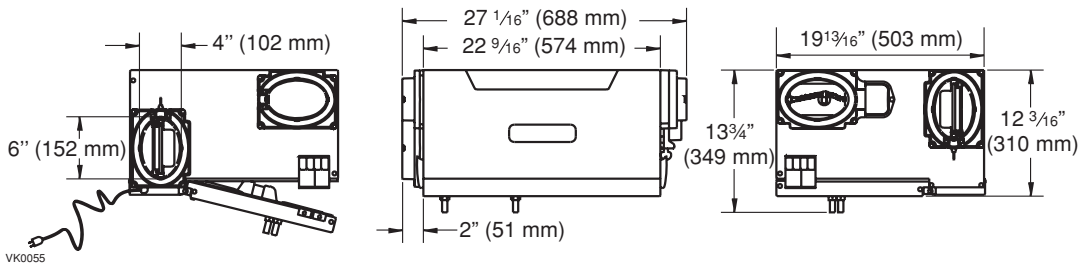
SUPPLY TEMPERATURE C°	SUPPLY TEMPERATURE F°	NET AIR FLOW l/s	NET AIR FLOW cfm	NET AIR FLOW m³/h	POWER CONSUMED WATTS	SENSIBLE RECOVERY EFFICIENCY	APPARENT SENSIBLE EFFECTIVENESS	LATENT RECOVERY/ MOISTURE TRANSFER
HEATING								
0	+32	22	46	79	70	67	82	0.60
0	+32	30	64	108	85	65	77	0.54
0	+32	45	91	155	127	61	73	0.49
-25	-13	30	64	108	102	56	78	0.50
COOLING						TOTAL RECOVERY EFFICIENCY		
+35	+95	23	46	166	68	51		
		-	-	-				

1. TECHNICAL DATA (CONT'D)

1.5 Dimensions

1.5.1 Dimensions for Ports on Sides Units

HRV



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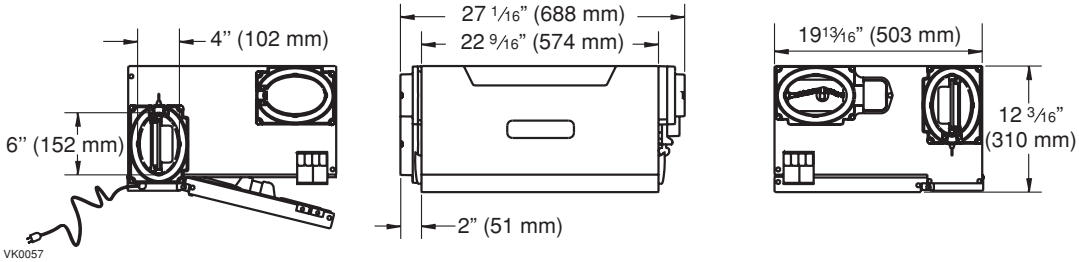
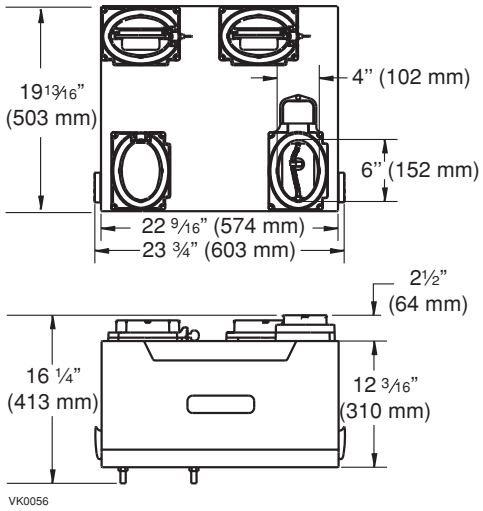


1.5.2 Dimensions for Ports on Top Units

HRV



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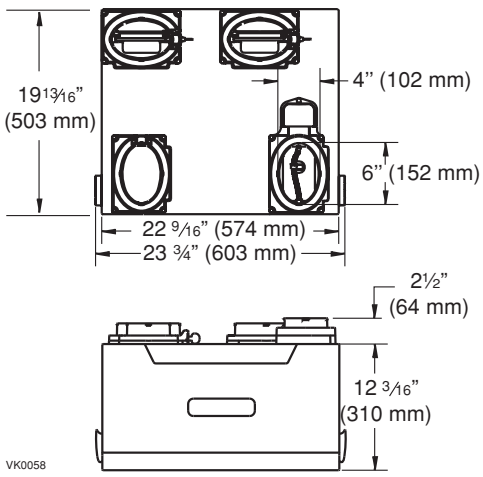


1.6 Controls and Linkage Possibility

Main Controls
- Lite-Touch Constructo (part # 40370)
- Simple-Touch Constructo (part # 40390)
- Constructo (part # 40350)

Auxiliary Controls
- 20-minute Push Button Timer (part # 12030)
- 60-minute Crank Timer (part # 00910)
- Dehumidistat (part # 11297)

Linkage Possibility
- Air Handler Interlock (used with forced air system)

SECTION 23 81 26– Split-System Air Conditioner

PART 1 – GENERAL

1.1 SECTION REQUIREMENTS

A. Submittals: Product Data

B. System Description: The heat pump air conditioning system shall be a Mitsubishi Electric MXZ-2A20NA split system series. The system shall consist of two slim-silhouette, compact evaporator sections with wireless controller. System model numbers will be MXZ-2A20NA: MSZ-A09NA and MSZ-A12NA. This system model number includes the MXZ series horizontal discharge, inverter driven single phase outdoor unit.

1.2 QUALITY ASSURANCE

A. The units shall be listed by Electrical Laboratories (ETL) and bear the ETL label.

B. All wiring shall be in accordance with the National Electrical Code (N.E.C.).

C. The units shall be rated in accordance with ARI Standard 210 and bear the ARI label.

D. The units shall be manufactured in a facility registered to ISO 9001 and ISO14001, which is a set of standards applying to environmental protection set by the International Standard Organization (ISO).

E. A full charge of R-22 for 197 feet of refrigerant tubing shall be provided in the condensing unit.

F. A dry air holding charge shall be provided in the evaporator.

G. System efficiency shall meet or exceed 11.0 SEER.

1.3 DELIVERY, STORAGE AND HANDLING

A. Unit shall be stored and handled according to the manufacturer's recommendation.

B. The wireless controller shall be shipped inside the carton with the indoor unit and able to withstand 105° F storage temperatures and 95% relative humidity.

PART 2 – PRODUCTS

2.1 MECHANICAL HVAC

A. Products:

1. Mitsubishi Model # MXZ Heat pump series

a. Mitsubishi Electric MXZ-2A20NA split system series

b. Mitsubishi Electric MSZ-A09NA wall mounted heat pump system

c. Mitsubishi Electric MSZ-A12NA wall mounted heat pump system

2.2 WARRANTY

A. The units shall have a manufacturer's warranty for a period of one year from date of installation. The compressor shall have a warranty of six years from date to installation. If, during this period, any part should fail to function properly due to defects in workmanship or material, it shall be replaced or repaired at the discretion of the manufacturer. This warranty does not include labor.

2.3 PERFORMANCE
A. Each system shall perform in accordance to the ratings shown in the table below.
B. Performance shall be based on 67° FWB, 80° FDB for the indoor unit and 95° FDB, 75° FWB for the outdoor unit.
C. MXZ-2A20NA Cooling Performance.
2.4 INDOOR UNIT

A. General: The indoor unit shall be factory assembled, wired and run tested. Contained within the unit shall be all factory wiring, piping, control circuit board and fan motor. The unit shall have a self-diagnostic function, 3-minute time delay mechanism, an auto restart function, an emergency operation function and a test run switch. Indoor unit and refrigerant pipes will be charged with dry air instead of R22 before shipment from the factory.

B. Indoor unit combinations:

Indoor units	Models
2	MSZ-A09NA + MSZ-A12NA

C. Unit Cabinet:
1. The casing shall have a white finish.
2. Multi directional drain and refrigerant piping offering four directions for refrigerant piping and two directions for draining shall be standard.
3. There shall be a separate back plate which secures the unit firmly to the wall.
D. Fan:
1. The evaporator fan shall be an assembly with a line-flow fan direct driven by a single motor.
2. The fan shall be statically and dynamically balanced and run on a motor with permanently lubricated bearings.
3. A manual adjustable guide vane shall be provided with the ability to change the airflow from side to side (left to right).
4. A motorized air sweep flow louver shall provide an automatic change in airflow by directing the air up and down to provide for uniform air distribution.
5. The indoor fan shall consist of three speeds, High, Medium and Low.

E. Filter:
1. Return air shall be filtered by means of an easily removable washable filter.

F. Coil:
1. The evaporator coil shall be of nonferrous construction with smooth plate fins on copper tubing.
2. The tubing shall have inner grooves for high efficiency heat exchange.
3. All tube joints shall be brazed with phoscopper or silver alloy.
4. The coils shall be pressure tested at the factory.
5. A condensate pan and drain shall be provided under the coil.
6. Refrigerant piping shall have a maximum length of 82 feet per indoor unit providing that the total length for the system does not exceed 197 feet.

G. Electrical:
1. The unit electrical power shall be 115 volts, 1 phase, 60 hertz.
2. The system shall be capable of satisfactory operation within voltage limits of 103 volts to 127 volts.
3. The indoor unit shall not have any supplemental electrical heat elements.

H. Control:
1. Each indoor unit shall have a wireless controller independent of the other units.
2. The wireless controller to perform input functions necessary to operate the system.
3. The controller shall consist of an Power On-Off switch, Mode Selector, Temperature Setting, Timer Control, Fan Speed Select and Auto Vane selector.
4. The indoor units shall have Self-diagnostic Function, Test Run switching and Check Mode switching.
5. Temperature changes shall be by 2° F increments with a range of 65 - 87° F.
6. The microprocessor located in the indoor unit shall have the capability of sensing return air temperature and indoor coil temperature, receiving and processing commands from the wireless controller, providing emergency operation and controlling the outdoor unit.
7. The control voltage between the indoor unit and the outdoor unit shall be 12 volts, DC.
8. The system shall be capable of automatic restart when power is restored after power interruption.
9. Control system shall control the continued operation of the air sweep louvers, as well as provide on/off and system/mode function switching.

2.5 OUTDOOR UNIT GENERAL

A. The outdoor unit is designed specifically for use with MSH series indoor units. These units are equipped with a circuit board that interfaces to the MSH indoor unit and perform all functions necessary for operation. The unit must have a powder coated finish. The outdoor unit shall be completely factory assembled, piped and wired. Each unit must be run tested at the factory. Total system performance shall be determined by the specified combination of indoor unit sections connected to the outdoor unit. While at least two indoor unit sections shall be specified, three shall be the maximum allowed.

B. Unit Cabinet:
1. The casing shall be fabricated of galvanized steel, bonderized and finished with a powder coated baked enamel.

C. Fan:
1. The unit shall be furnished with a direct drive propeller type fan.
2. The motor shall have inherent protection and have permanently lubricated bearings.
3. The fan motor shall be mounted for quiet operation.
4. The fan shall be provided with a raised guard to prevent contact with moving parts.
5. The outdoor unit shall have a horizontal discharge airflow.

D. Coil:
1. The condenser coil shall be of nonferrous construction with lanced or corrugated plate fins on copper tubing.
2. The coil shall be protected with an integral metal guard.
3. Refrigerant flow from the condenser shall be controlled by means of an electronic linear expansion valve.

E. Compressor:
1. The compressor shall be a high performance AC inverter twin rotary employing a Variable Frequency Drive that will constantly speed up or slow down its speed.
2. The outdoor unit shall have only one compressor.
3. Refrigerant flow from the outdoor unit shall be controlled by means of electronic linear expansion valves.
4. The outdoor unit shall have an accumulator.
5. The compressor will be equipped with an internal thermal overload.
6. The outdoor unit shall have a high pressure safety switch.
7. The outdoor unit must have the ability to operate with a maximum height difference of 33 feet and a maximum refrigerant tubing length of 197 feet between indoor and outdoor units without the need for line size changes, traps or additional oil.
8. The compressor shall be mounted to avoid the transmission of vibration.

F. Electrical:
1. The unit electrical power shall be 208/230 volts, 1 phase, 60 hertz.
2. The unit shall be capable of satisfactory operation within voltage limits of 198 volts to 253 volts.
3. The outdoor unit shall be controlled by the microprocessor located in the indoor unit and outdoor unit.
4. The control voltage between the indoor unit and the outdoor unit shall be 12 volts, DC.

END OF SECTION 23 81 26

MITSUBISHI ELECTRIC
HVAC Advanced Products Division

Mr.SLIM
Split-ductless A/C and Heat Pumps

SUBMITTAL DATA: MXZ-2A20NA

MULTI-INDOOR UNIT INVERTER HEAT-PUMP SYSTEM

Job Name: Location: Date:

Purchaser: Engineer:

Submitted to: For ☐ Reference ☐ Approval ☐ Construction

Unit Designation: Schedule No.:

GENERAL FEATURES

- Limited warranty: one year on parts and defects and six years on compressor
- Compact side discharge outdoor unit
- Zone control
- Wireless remote controller
- Automatic fan speed control
- Quiet operation – both indoor and outdoor units
- Auto restart following a power outage
- Self check function – onboard diagnostics
- Advanced microprocessor control

Cooling

Rated capacity . . . . . 20,000/(7,800 ~ 20,000) Btu/h
SEER . . . . . 15.0 Btu/h/W
Power consumption . . . . . 2,150/(630 ~ 2,150) W
Power supply . . . . . 208 / 230V, 1 Phase, 60 Hz

Heating

Rated capacity . . . . . 22,000/(8,500 ~ 22,000) Btu/h
Power consumption . . . . . 1,780/(520 ~ 1,780) W
HSPF (IV/V) 9.0
COP 12.4
Weight (lbs/Kg) . . . . . 130 / 59
Field drain pipe size I.D. (inches/mm) . . . . . 1/2 / 12.7
Compressor . . . . . DC inverter/twin rotary
MCA 15
Fan motor . . . . . 0.96 F.L.A.
Sound level . . . . . 51 dB(A)

DIMENSIONS		INCHES	MM
inches	W	33-1/16	840
	D	13-19/32	330
	H	27-15/16	710

Weight (lbs/Kg) . . . . . 128 / 58
Refrigerant type R410A
Refrigerant pipe size O.D. (inches/mm)
gas side . . . . . 3/8 / 9.5
liquid side . . . . . 1/4 / 6.35
Max. refrigerant pipe length (ft/m) . . . . . 164 / 50
Max. refrigerant pipe height difference (ft/m) . . . . . 33 / 10
Connection method . . . . . flared


Remote Controller

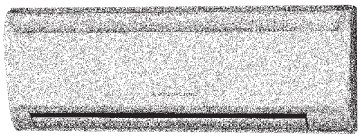

Outdoor Unit: MXZ-2A20NA

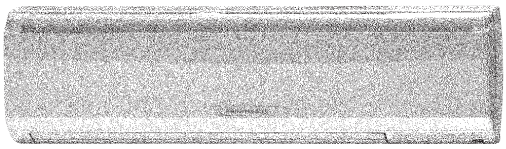
INDOOR MODELS

MSZ-A09NA
9,000 Btu/h Cooling
10,900 Btu/h Heating

MSZ-A12NA
12,000 Btu/h Cooling
13,600 Btu/h Heating

MSZ-A15NA
15,000 Btu/h Cooling
18,000 Btu/h Heating





NOTES :
*1. Rating conditions (cooling)-indoor : D.B. 80°F, W.B. 67°F
outdoor : D.B. 95°F, W.B. 75°F.
*2.Rating conditions (heating)-indoor : D.B. 70°F, W.B. 60°F outdoor : D.B. 17°F, W.B. 15°F.

Operating range

		Indoor intake air temp.	Outdoor intake air temp.
Cooling	Maximum	D.B. 95°F, W.B. 71°F	D.B. 115°F
	Minimum	D.B. 67°F, W.B. 57°F	D.B. 14°F *
Heating	Maximum	D.B. 80°F, W.B. 67°F	D.B. 70°F, W.B. 59°F
	Minimum	D.B. 70°F, W.B. 60°F	D.B. 12°F, W.B. 10°F

*

R410A INVERTER

Notes:

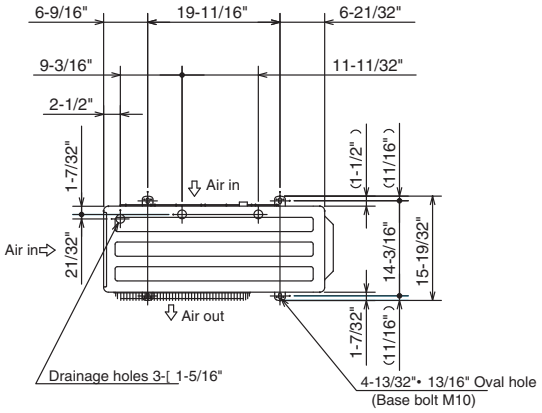
COOLING: MXZ-2A20NA

Indoor units combination	**Cooling capacity** (Btu/h)			Power consumption (W)	Current (A)		Power factor (%)
	Unit A	Unit B	Total		208V	230V	
09	9,000		9,000 (5,400 ~ 9,000)	730 (490 ~ 730)	3.69	3.34	95
12	12,000		12,000 (5,400 ~ 12,000)	990 (490 ~ 990)	5.01	4.53	95
15	15,000		15,000 (5,400 ~ 15,000)	1,540 (490 ~ 1,540)	7.79	7.05	95
09+09	9,000	9,000	18,000 (7,800 ~ 18,000)	1,740 (630 ~ 1,740)	8.62	7.80	97
09+12	8,500	11,500	20,000 (7,800 ~ 20,000)	2,150 (630 ~ 2,150)	10.66	9.64	97
09+15	7,500	12,500	20,000 (7,800 ~ 20,000)	2,150 (630 ~ 2,150)	10.66	9.64	97
12+12	10,000	10,000	20,000 (7,800 ~ 20,000)	2,150 (630 ~ 2,150)	10.66	9.64	97

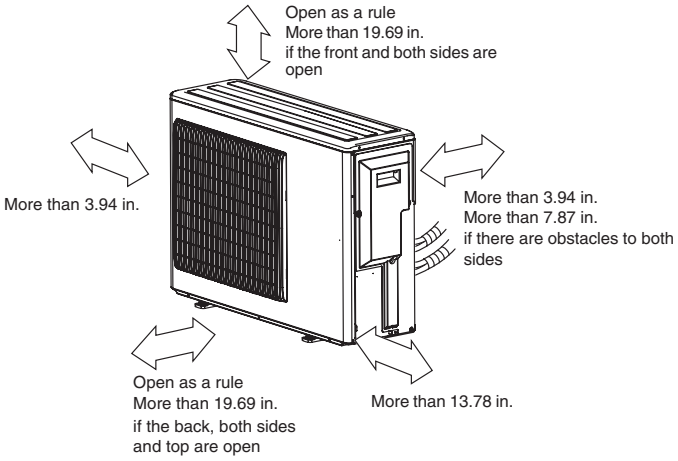
HEATING: MXZ-2A20NA

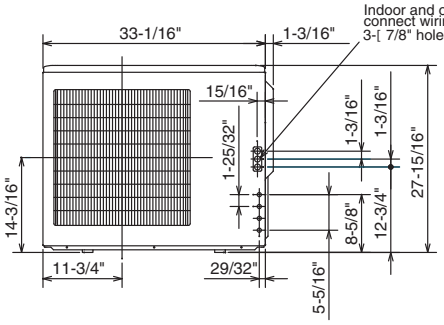
Indoor units combination	**Heating capacity** (Btu/h)			Power consumption (W)	Current (A)		Power factor (%)
	Unit A	Unit B	Total		208V	230V	
09	10,900		10,900 (5,200 ~ 15,400)	940 (480 ~ 1,430)	4.76	4.30	95
12	13,600		13,600 (5,200 ~ 16,400)	1,180 (480 ~1,460)	5.97	5.40	95
15	18,000		18,000 (5,200 ~ 21,100)	1,720 (480 ~ 2,100)	8.70	7.87	95
09+09	10,900	10,900	21,800 (8,500 ~ 21,800)	1,820 (520 ~ 1,820)	9.02	8.16	97
09+12	9,500	12,500	22,000 (8,500 ~ 22,000)	1,780 (520 ~ 1,780)	8.82	7.98	97
09+15	8,250	13,750	22,000 (8,500 ~ 22,000)	1,780 (520 ~ 1,780)	8.82	7.98	97
12+12	11,000	11,000	22,000 (8,500 ~ 22,000)	1,780 (520 ~ 1,780)	8.82	7.98	97

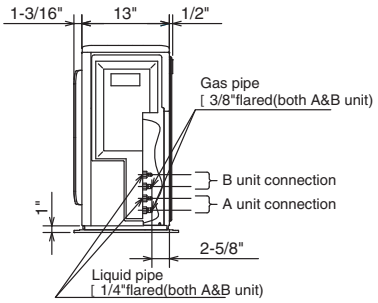
DIMENSIONS: MXZ-2A20NA

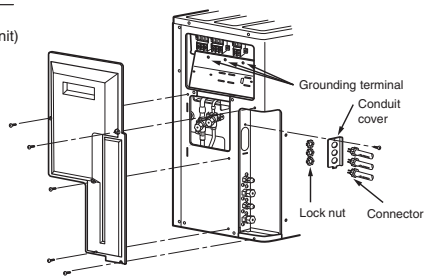


REQUIRED SPACE









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Mr.SLIM
Split-ductless A/C and Heat Pumps

SUBMITTAL DATA: MSZ-A09NA & MUZ-A09NA

9,000 Btu/h WALL-MOUNTED HEAT PUMP SYSTEM

Job Name: Location: Date:

Purchaser: Engineer:

Submitted to: For ☐ Reference ☐ Approval ☐ Construction

Unit Designation: Schedule No.:

GENERAL FEATURES

- Limited warranty: one year on parts and defects and six years on compressor
- Compact side-discharge outdoor unit
- Zone control
- Wireless remote controller
- Automatic fan speed control
- Quiet operation – both indoor and outdoor units
- Auto restart following a power outage
- Self check function – onboard diagnostics
- Advanced microprocessor control
- Auto changeover for cooling and heat

Cooling

Rated capacity . . . . . 9,000 Btu/h
Minimum capacity . . . . . 5,500 Btu/h
SEER . . . . . 16.0 Btu/h/W
Total input . . . . . 690 W
Power supply . . . . . 208 / 230V, 1 Phase, 60 Hz
Breaker size . . . . . 15 A

Heating

Rated capacity 47°F . . . . . 10,000 Btu/h
Minimum capacity . . . . . 5,200 Btu/h
Total input . . . . . 860 W
HSPF (IV/V) (Btu/h/W) . . . . . 8.2 / 6.7
COP . . . . . 3.71 Btu/h/W

Voltage

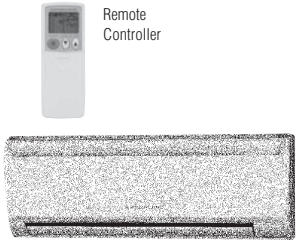
Indoor - Outdoor S1-S2 . . . . . 208 / 230V, 1 Phase, 60 Hz
Indoor - Outdoor S2-S3 . . . . . 12-24 VDC
Indoor - Remote Controller . . . . . wireless

Indoor unit

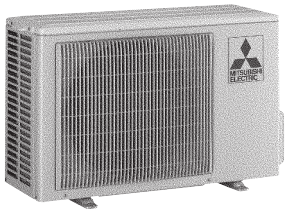
MCA . . . . . 1.0 A
Fan motor . . . . . 0.76 F.L.A.
Airflow (Low-Medium-High) . . . . . 159-222-307 Dry CFM
134-205-275 Wet CFM
Sound level (Lo-M1-M2-Hi) . . . . . 22-33-38 dB(A)

DIMENSIONS		INCHES	MM
	W	30-11/16	780
	D	8-1/4	210
	H	11-3/4	299

Weight (lbs/Kg) . . . . . 23 / 10
Field drain pipe size I.D. (inches/mm) . . . . . 1/2 / 12.7



Indoor Unit: MSZ-A09NA



Outdoor Unit: MUZ-A09NA

Outdoor Unit

Compressor . . . . . DC inverter/rotary
MCA 12
Fan motor . . . . . 0.52 F.L.A.
Sound level . . . . . 47 dB(A)

DIMENSIONS		INCHES	MM
	W	31-1/2	800
	D	11-1/4	286
	H	21-5/8	550

Weight (lbs/Kg) . . . . . 82 / 37
Refrigerant type R410A
Refrigerant pipe size O.D. (inches/mm)
liquid side . . . . . 1/4 / 6.35
gas side . . . . . 3/8 / 9.5
Max. refrigerant pipe length (ft/m) . . . . . 65 / 20
Max. refrigerant pipe height difference (ft/m) . . . . . 40 / 12
Connection method . . . . . flared

NOTES :
*1. Rating conditions (cooling)-indoor : D.B. 80°F, W.B. 67°F outdoor : D.B. 95°F, W.B. 75°F.
*2.Rating conditions (heating)-indoor : D.B. 70°F, W.B. 60°F outdoor : D.B. 17°F, W.B. 15°F.

Operating range

		Indoor intake air temp.	Outdoor intake air temp.
Cooling	Maximum	D.B. 95°F, W.B. 71°F	D.B. 115°F
	Minimum	D.B. 67°F, W.B. 57°F	D.B. 14°F *
Heating	Maximum	D.B. 80°F, W.B. 67°F	D.B. 70°F, W.B. 59°F
	Minimum	D.B. 70°F, W.B. 60°F	D.B. 12°F, W.B. 10°F

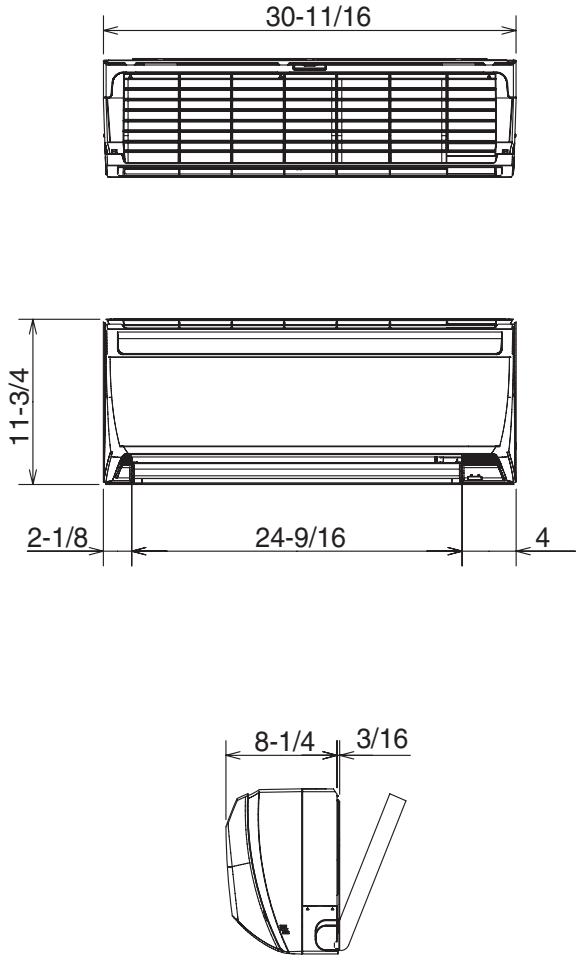
* Unit locks out at 10° FDB.

R410A

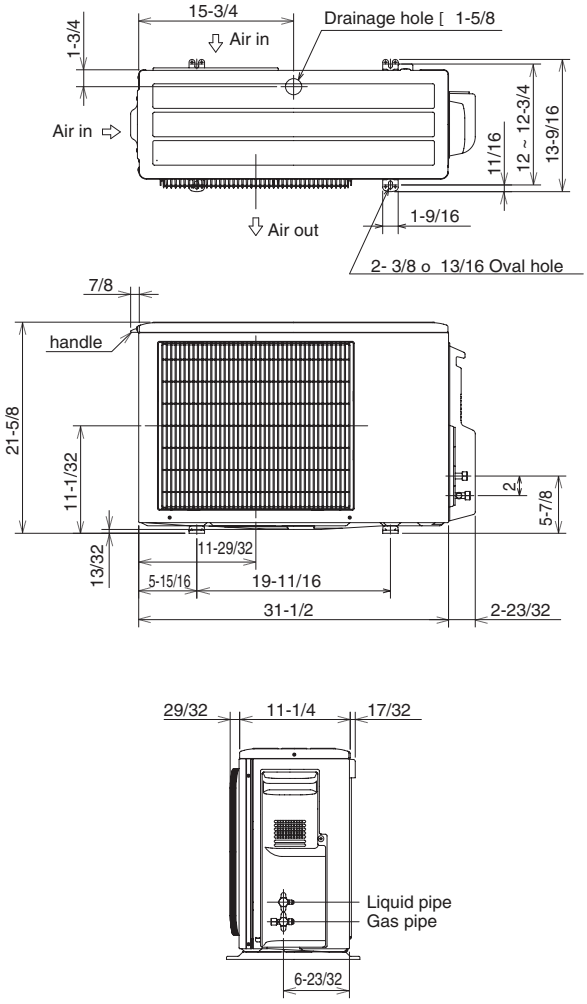
Notes:

DIMENSIONS: MSZ-A09NA & MUZ-A09NA

MSZ-A09NA



MUZ-A09NA



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Mr. SLIM®
Split-ductless A/C and Heat Pumps

SUBMITTAL DATA: MSZ-A12NA & MUZ-A12NA

12,000 Btu/h WALL-MOUNTED HEAT PUMP SYSTEM

Job Name: Location: Date:

Purchaser: Engineer:

Submitted to: For ☐ Reference ☐ Approval ☐ Construction

Unit Designation: Schedule No.:

GENERAL FEATURES

- Limited warranty: one year on parts and defects and six years on compressor
- Compact side-discharge outdoor unit
- Zone control
- Wireless remote controller
- Automatic fan speed control
- Quiet operation – both indoor and outdoor units
- Auto restart following a power outage
- Self check function – onboard diagnostics
- Advanced microprocessor control
- Auto changeover for cooling and heat

Cooling

Rated capacity . . . . . 12,000 Btu/h
Minimum capacity . . . . . 5,700 Btu/h
SEER . . . . . 16.0 Btu/h/W
Total input . . . . . 1170 W
Power supply . . . . . 208 / 230V, 1 Phase, 60 Hz
Breaker size . . . . . 15 A

Heating

Rated capacity . . . . . 13,600 Btu/h
Minimum capacity . . . . . 5,200 Btu/h
Total input . . . . . 1160 W
HSPF (IV/V) (Btu/h/W) . . . . . 8.2 / 6.7
COP . . . . . 3.44 Btu/h/W

Voltage

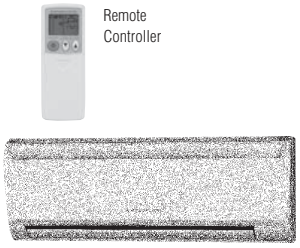
Indoor - Outdoor S1-S2 . . . . . 208 / 230V, 1 Phase, 60 Hz
Indoor - Outdoor S2-S3 . . . . . 12-24 VDC
Indoor - Remote Controller . . . . . wireless

Indoor unit

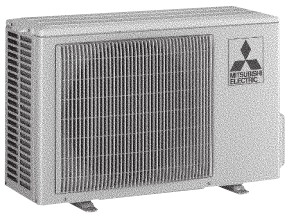
MCA . . . . . 1.2 A
Fan motor . . . . . 0.95 F.L.A.
Airflow (Low-Medium-High) . . . . . 152-240-353 Dry CFM
134-215-318 Wet CFM
Sound level (Lo-M1-M2-Hi) . . . . . 33-34-42 dB(A)

DIMENSIONS		INCHES	MM
	W	30-11/16	780
	D	8-1/4	210
	H	11-3/4	299

Weight (lbs/Kg) . . . . . 23 / 10
Field drain pipe size I.D. (inches/mm) . . . . . 1/2 / 12.7



Indoor Unit: MSZ-A12NA



Outdoor Unit: MUZ-A12NA

Outdoor Unit

Compressor . . . . . DC inverter/rotary
MCA 12
Fan motor . . . . . F.L.A. 0.52
Sound level . . . . . 48 dB(A)

DIMENSIONS		INCHES	MM
	W	31-1/2	800
	D	11-1/4	286
	H	21-5/8	550

Weight (lbs/Kg) . . . . . 82 / 37
Refrigerant type R410A
Refrigerant pipe size O.D. (inches/mm)
liquid side . . . . . 1/4 / 6.35
gas side . . . . . 3/8 / 9.5
Max. refrigerant pipe length (ft/m) . . . . . 65 / 20
Max. refrigerant pipe height difference (ft/m) . . . . . 40 / 12
Connection method . . . . . flared

NOTES :
*1. Rating conditions (cooling)-indoor : D.B. 80°F, W.B. 67°F
outdoor : D.B. 95°F, W.B. 75°F.
*2.Rating conditions (heating)-indoor : D.B. 70°F, W.B. 60°F outdoor : D.B. 17°F, W.B. 15°F.

Operating range

		Indoor intake air temp.	Outdoor intake air temp.
Cooling	Maximum	D.B. 95°F, W.B. 71°F	D.B. 115°F
	Minimum	D.B. 67°F, W.B. 57°F	D.B. 14 °F *
Heating	Maximum	D.B. 80°F, W.B. 67°F	D.B. 70°F, W.B. 59°F
	Minimum	D.B. 70°F, W.B. 60°F	D.B. 12°F, W.B. 10°F

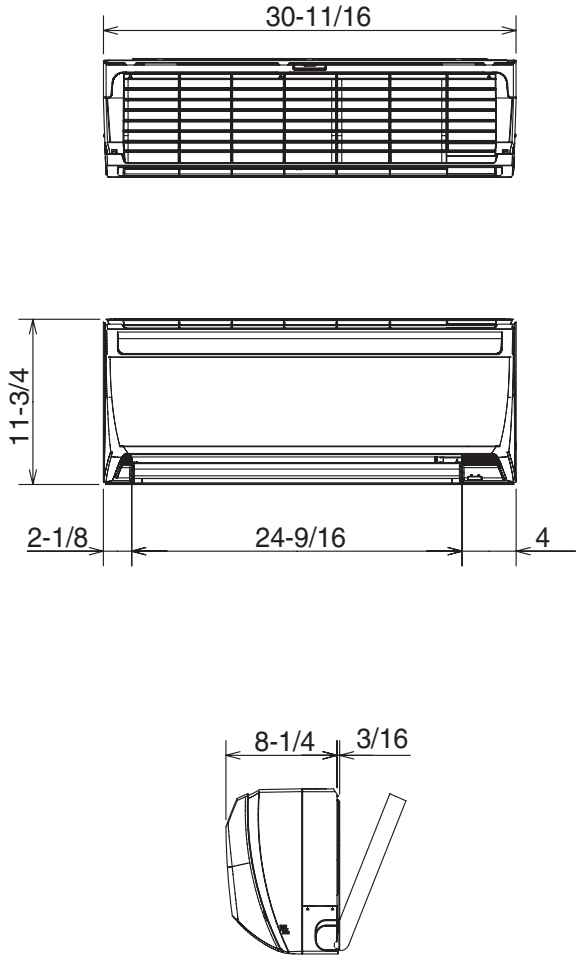
* Unit locks out at 10° FDB.

R410A

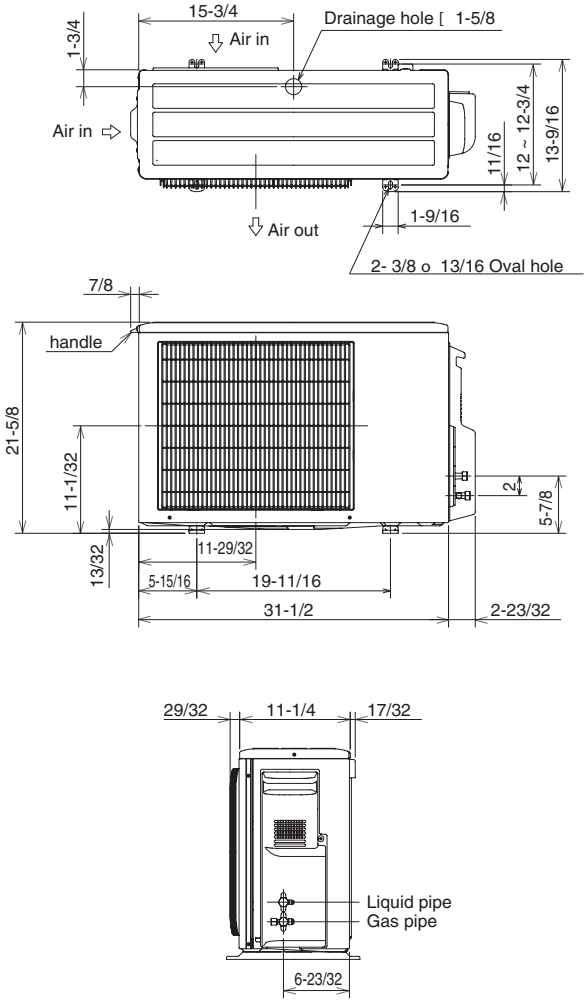
Notes:

DIMENSIONS: MSZ-A12NA & MUZ-A12NA

MSZ-A12NA



MUZ-A12NA



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SECTION 23 83 16– Radiant-Heating Hydronic Piping

PART 1 – GENERAL
1.1 SECTION REQUIREMENTS
A. Submittals: Product Data
B. System Description: The hydronic floor heating system shall consist of Warmboard radiant subflooring with approved ½" ID PEX Aluminum PEX tubing.
PART 2 – PRODUCTS
2.1 PIPES, TUBES, AND FITTINGS
A. Pipes supplying heated water:
1. Pipes supplying heated water must be of a construction approved for use with Warmboard radiant subflooring. These include all ½" ID PEX Aluminum PEX piping.
B. Subflooring Panels:
1. Radiant subflooring panels will be Warmboard brand radiant subflooring. No other radiant subflooring systems shall be mixed with the warmboard for ease of construction.
PART 3 – EXECUTION
3.1 INSTALLATION
A. Fastening Warmboard to Floor:
1. Customary subfloor installation practice is generally followed.
Fasten with panel adhesive and screws or screw nails.
As sheets are placed, alignment pins are tapped into place on the two outer most channels, across the seam between the adjacent panels, to ensure proper channel alignment. Pay close attention to the panel layout plan as the work proceeds. As turn panels are being placed, check to see that any supplemental joists required at the cross channel are in place. Per APA (American Panel Association) guidelines all subfloor panels, including Warmboard, should be gapped 1/8" on the 4' side.
B. Panel Preparation Prior to Installing Tubing:
1. Using a felt tip marker, and as per the tubing plan, mark the bury points where each loop starts and stops, the location of any manifolds, and the paths of any supply/return leaders from a given loop to a manifold or the boiler panel. Mark locations of any custom channels, which may be required due to unusual architectural features or where plumbing interferes with the regular Warmboard tube patterns. At each bury point drill a shallow angle 11/16" hole in the channel in the appropriate direction so that the leader can pass from the channel to the under floor area, in the correct direction to lead to the appropriate manifold location or the boiler panel. Sometimes leaders are not directed through the underfloor area. For example, leaders can be run in surface channels (which may or may not be custom routed) or through walls. In such cases, follow plan notes that describe such alternative routing means. Rout all custom channels

C. Cleanliness of Channels

1. Inspect the channels at the joints between panels for any excess of panel adhesive, which may have squeezed up between sheets at the channels. Use the 4” grinder to remove any excess. Using a leaf blower, shop vac or broom (leaf blowers are the quickest and easiest way to clean the channels) clean off any debris or dust from the subfloor surface and the channels. Cleanliness is important for easy tubing installation, so take care with this step.

D. Custom Routing

1. Review all tubing layout plans. Using felt tip marker and wood templates (included in installation kit) mark all areas on Warmboard that will require custom routing.
2. Prepare router with router bit, template guide and template guide lock nut.
3. Place the appropriate Warmboard custom routing template over the area to be routed. Fasten with 2 screws to securely hold the wooden template in position. Proceed with router (ensure that router bit and metal template guide are properly installed). When rout is complete, remove wooden template guide and use 4” grinder to remove aluminum burrs (ensure that entire area is smooth in preparation for tubing installation).

E. Tubing Installation

1. Tubing should be installed as soon as possible after the subfloor is fastened in place. Mount a coil of Warmboard approved PEX tubing on the tubing un-coiler. Begin the first loop by measuring the length of leader necessary to reach from the bury point to the manifold plus a few extra feet for margin of error. Mark the bury point on this leader. Mark its loop number and whether it is the supply or return. Tape the end of the tube to keep debris out of it. Insert the leader into the hole at the bury point up to the mark you previously made. Guide the tube into the channels following the course indicated on the tubing plan. Roll the tubing into the channel with the weighted roller pressing it firmly into the channel, flush with the top surface.
2. As you roll the tubing in, check from time to time to ensure that the tubing is flush with the top surface. If it is flush you will barely be able to notice it as you walk on it. If it is not flush, you will notice it easily. If it is not flush there are usually two causes.
   i. Excess panel adhesive squeezed up and remains at a seam between panels.
   ii. Debris in the channel. Both of these possibilities are unlikely if you have followed the steps above regarding channel preparation and cleanliness.
3. When you come to the end of the loop, measure out a similar amount of tubing for the other leader back to the manifold or boiler panel. Tape the end of the tube and mark it as a supply or return leader with its loop number. Insert this leader into the bury hole. You may find that at the bury points there is a slight bump above flush as the supply and return leaders tend to spring up at those points. Use the electrician cover plates to temporarily hold the leader flush. These plates can typically be removed the next day. You can then proceed, loop after loop following the routine of the first loop.

4. PEX tubing is especially tough once embedded in its channel. Normal construction activity will not damage it. Of course, care must be taken to avoid nailing a tube or using a sharp cutting tool directly on top of a tube. All tradespeople working on a Warmboard site must take note of the easily visible tubes and must exercise reasonable care to avoid puncturing a tube. Weather is always a factor in construction. PEX tubing becomes quite stiff and difficult to work with below 50°F. Below 40°F the coil will need to be kept warm immediately prior to installation.

3.2 VALVE INSTALLATIONS

A. Shutoff Duty: Use gate or ball valves.

B. Throttling Duty: Use globe or ball valves.

C. Install shutoff-duty valves at each branch connection to supply mains, at supply connection to each piece of equipment, and elsewhere as indicated.

D. Install throttling-duty valves at each branch connection to return mains, at return connections to each piece of equipment, and elsewhere as indicated.

E. Install calibrated plug valves on the outlet of each heating or cooling element and elsewhere as required to facilitate system balancing.

F. Install drain valves at low points in mains, risers, branch lines, and elsewhere as required for system drainage, consisting of a tee fitting, NPS 3/4 ball valve, and short NPS 3/4 threaded nipple and cap.

G. Install check valves on each pump discharge and elsewhere as required to control flow direction.

H. Install safety relief valves on hot-water generators and elsewhere as required by authorities having jurisdiction. Pipe discharge to floor drain without valves.

I. Install manual air vents at high points in the system, at heat-transfer coils, and elsewhere as required for system air venting.

J. Install valves with stem up. Allow clearance above stem for check mechanism removal.

3.3 TESTING, ADJUSTING, AND BALANCING

A. Clean and flush hydronic piping systems. Remove, clean, and replace strainer screens.

B. Hydrostatically test completed piping at a pressure one and one-half times operating pressure. Isolate equipment before testing piping. Repair leaks and retest piping until there are no leaks.

END OF SECTION 23 83 16

CSI Subdivision: 23 83 16 Radiant Heating Hyronic Vangaurd PEX

INSTALLATION INSTRUCTIONS

HYDRONIC RADIANT HEATING SYSTEMS

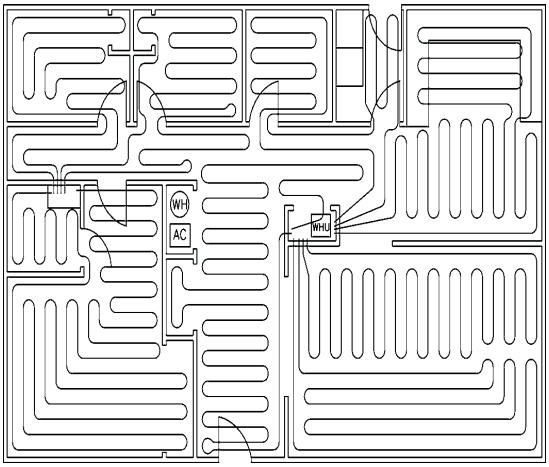
Vanguard
Piping Systems, Inc.

January 2004

DDSpecBook -175

SYSTEM BASICS

A hydronic radiant floor heating system is really quite simple. Heated water is circulated through Vanex PEX tubing installed in or under the floor of the building. As the heated water warms the floor, it becomes a huge radiant-heat radiator. Since radiant heat energy passes through air readily and radiates in all directions, it warms the human body and objects in the building without relying on the conduction of heat by air as with forced air systems. The warmth that is felt from the sun easily describes the radiant heat of a floor heating system. Even though the sun is millions of miles away, the radiant (also referred to as infrared) heat waves pass through those millions of miles of space and are readily absorbed by the skin. Radiant heating systems offer increased comfort levels while generally allowing for lower building air temperatures.



A RADIANT FLOOR HEATING SYSTEM USES THE HEATED FLOOR PANEL TO RADIATE HEAT INTO THE HOME OR BUILDING

To provide the necessary heat output from a radiant floor system, there must be a sufficient amount of tubing installed in or under the floor and the temperature of the heated water must be within a range that will supply the needed output without overheating the floor. A floor that's too warm will be as much a detriment to system comfort as one that is too cool. A properly designed system will maintain a comfortable floor temperature while supplying the required heat output.

A minimum hydronic radiant floor heating system includes:

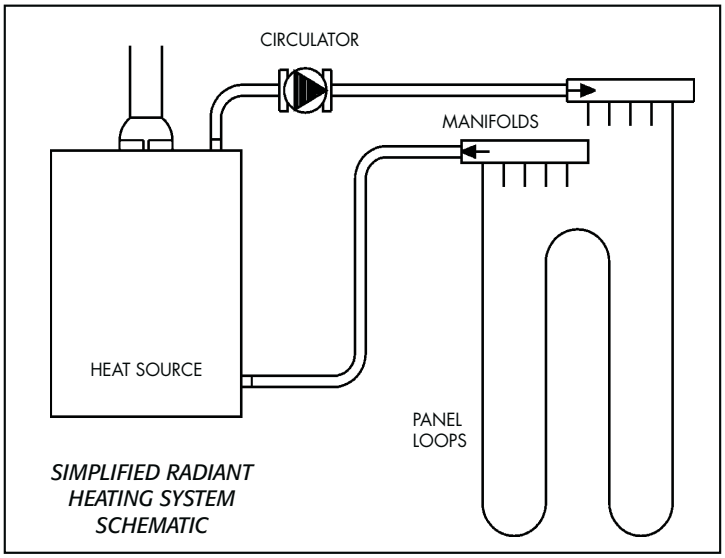
1. Water heating unit of sufficient size to meet the heat-load of the building or space to be heated

2. Circulation pump or pumps

3. Manifold or manifolds to distribute the heated water to Vanex PEX tubing loops and return the cooled water from those loops

4. Vanex PEX tubing loops installed in or under the floor

5. Vanex PEX supply and return tubing from the hot-water source to the manifold(s).



SIMPLIFIED RADIANT HEATING SYSTEM SCHEMATIC

6. Thermostatic control to turn water circulation on and off as required.

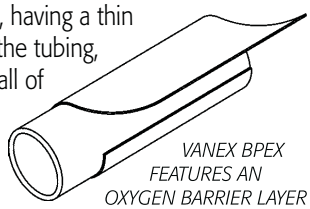
Generally, additional components are also needed to assure safe and efficient operation of the system and will be covered in detail throughout this manual.

SYSTEM COMPONENTS

VANEX PEX TUBING

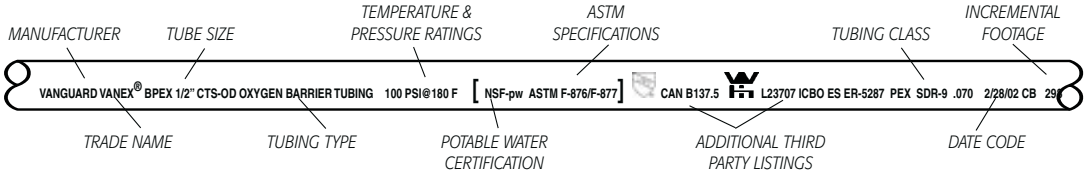
The key to the Vanguard Radiant Heating System is Vanex PEX tubing. The flexibility and durability of Vanex PEX offers ease of installation and extremely long service lifetime expectancy when properly installed and operated.

Vanex PEX is also available with an oxygen barrier layer. Oxygen barrier PEX (BPEX) is made available since it has been demonstrated that hydronic heating systems that contain ferrous iron components (steel and cast iron) may be adversely affected by the presence of too much oxygen in the water. Vanex BPEX, having a thin layer of oxygen permeation resistant material permanently applied to the exterior of the tubing, limits the amount of oxygen that can enter the system by permeation through the wall of PEX tubing, substantially reducing the overall aggressiveness of the water towards ferrous iron components. For a more detailed explanation of oxygen ingress into radiant heating systems and its affects, see the Plastics Pipe Institute technical paper TR-40. (PPI phone 888-314-6774 or go to www.plasticpipe.org.)



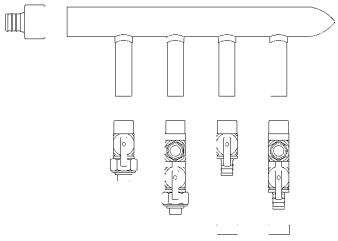
VANEX BPEX FEATURES AN OXYGEN BARRIER LAYER

All Vanex PEX and BPEX is manufactured, tested and third-party listed to meet or exceed the requirements of ASTM (American Standards for Testing and Materials) F 876 and F 877, and CSA (Canadian Standards Association) B137.5. Additionally, both Vanex PEX and BPEX are certified for potable water use and BPEX meets the requirements of German DIN Standard 4726 for oxygen permeation resistance.



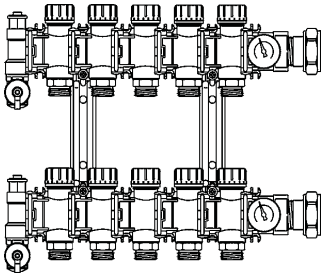
VANEX HYDRONIC HEATING MANIFOLDS

Vanguard offers three separate lines of supply/return manifolds for hydronic heating systems. System size, control features and economics represent the primary differences between the separate offerings. See the Vanguard Piping Systems Product Catalog for a complete listing of the different manifolds and features.

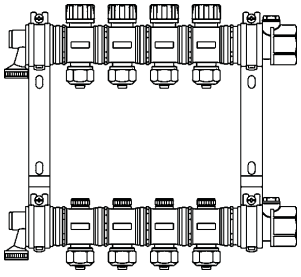


Copper Manifolds

The size of the system and the desired amount of control for separate zones and/or individual loops will govern the type of manifold and available manifold control options. Very small systems having only one to a few loops may not require a manifold.



Comap Manifolds

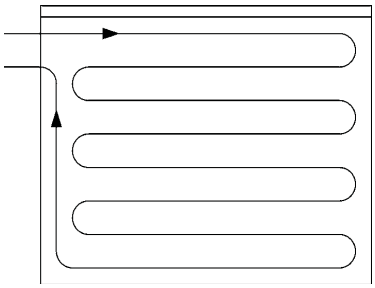


Simplex Manifolds

PEX TUBING LOOPS

LAYOUT BASICS

Each radiant floor panel will contain one or more loops of Vanex PEX tubing through which the heated water is circulated. To ensure proper heat output from the panel the loops must be laid out in a specific pattern and attached at specific intervals. Also, the length of individual loops must not be too long. The system design will specify the number, length and spacing of loops. Loops that are too long will experience higher than necessary head-loss and temperature drop and will lead to poor system performance.



A RADIANT PANEL WILL CONTAIN ONE OR MORE LOOPS OF VANEX PEX TUBING. SPACING AND LENGTH OF LOOPS MUST FOLLOW THE SYSTEM DESIGN

For panels with more than one loop, the length of individual loops within the panel should be within 10% to prevent inconsistent heat output. Even though individual loops connected to the same manifold can be adjusted at the manifold with built-in balancing valves, it is better to have consistent loop lengths as balancing individual loops can be a tedious trial and error task unless individual flow meters are used on each loop increasing system cost.

Maximum loop lengths for the different sizes of PEX tubing are shown in the chart on the right, however, the panel design should dictate the actual lengths used for any particular radiant panel.

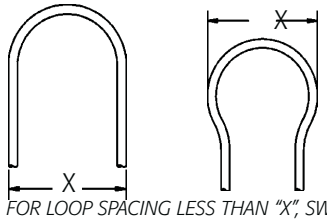
RECOMMENDED AND MAXIMUM TUBE LENGTHS IN FEET

	Rec.	Max.
3/8" Vanex	200	250
1/2" Vanex	250	350
5/8" Vanex	400	500
3/4" Vanex	500	600

Typical loop spacing is 4" to 15" and is dependent on the location of the loops within the room and the required heat output of the radiant panel. Loops spaced too far apart will lead to cold spots between the loops and can also require higher supply water temperatures and will lower panel output.

LOOPS SPACED TOO FAR APART LEAD TO HOT AND COLD SPOTS AND POOR PERFORMANCE. THE SPACING DICTATED BY THE SYSTEM DESIGN MUST BE FOLLOWED.

Each size of Vanex PEX used in radiant floor loops has a minimum bend radius dimension. When the loops are spaced closer together than the minimum bend radius X 2, then 180° turns in the tubing need to be swept out to the minimum dimension as shown below.



FOR LOOP SPACING LESS THAN "X", SWEEP THE TUBING AS SHOWN

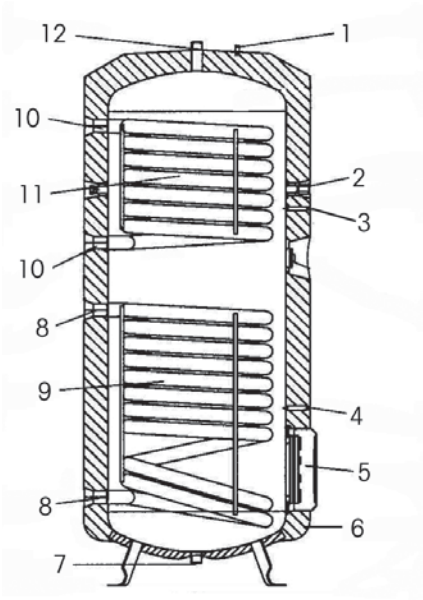
Tubing Size	Dimension X With the Coil
3/8"	8"
1/2"	10"
5/8"	12"
3/4"	14"
1"	18"

Technical Data

Type		SBB 300 Plus	SBB 400 Plus	SBB 600 Plus
Contents				
Storage capacity	Gal / ltr	80.6 / 305	108.6 / 411	162.9 / 617
Volume of heat exchanger, top	Gal / ltr	1.9 / 7.3	2.2 / 8.2	2.5 / 9.6
Volume of heat exchanger, bottom	Gal / ltr	2.7 / 10.1	2.9 / 11.3	3.5 / 13.2
Pressure				
Working pressure	PSI / bar	150 / 10	150 / 10	150 / 10
Tested to pressure	PSI / bar	217 / 15	217 / 15	217 / 15
Max. pressure of boiler loop	PSI / bar	150 / 10	150 / 10	150 / 10
Temperature				
Max. temperature solar loop	°F / °C	203 / 95	203 / 95	203 / 95
Max. temperature of boiler loop	°F / °C	203 / 95	203 / 95	203 / 95
Heat exchanger				
Surface area heat exchanger top	sq. inch / m^2	1705 / 1.1	2015 / 1.3	2945 / 1.9
Surface area heat exchanger bottom	sq. inch / m^2	2325 / 1.5	2635 / 1.7	3875 / 2.5
Weights				
Tank weight empty	lb. / kg	339 / 154	412 / 187	544 / 247
Tank weight full	lb. / kg	1,051 / 477	1,362 / 618	1,955 / 887
Other				
Standby losses in 24 hours	BTU / kWh	6,500 / 1.9	7,500 / 2.2	10,000 / 2.9
Cold/hot water connection		for 1″ copper pipe with adapters, adapters provided with unit		
Dimensions				
Height with insulation	in. / mm	66.1 / 1679	72.7 / 1848	68.3 / 1735
Width with insulation	in. / mm	27.55 / 700	29.52 / 750	36.22 / 920 *

* Insulation is partially removeable to reduce width to 31.5″ for clearance purposes

SBB 300 Plus, SBB 400 Plus and SBB 600 Plus models



1 Sacrificial anode indicator
2 Thermometer
3 Well for temperature sensor (boiler)
4 Well for temperature sensor (solar)
5 Clean-out port
6 Foam insulation
7 Cold water inlet
8 Heat exchanger ports (solar)
9 Exchanger coil (solar)
10 Heat exchanger ports (boiler)
11 Exchanger coil (boiler)
12 Hot water outlet

Note: heat exchangers are steel with porcelain enamel coating.

	LD40E	LD50EL	LD65EL
Pints	40	50	65
Electronic Controls	•	•	•
Energy Factor	1.5	1.75	1.60
Energy Star	•	•	•
CAPACITY			
Dehumidification (pts/day)	40	50	65
Power Rating	115V/60Hz	115V/60Hz	115V/60Hz
Watts	525	565	800
Amps	5.0	5.4	7.6
Circuit Size (Amps)	15	15	15
Compressor Type	Rotary	Rotary	Rotary
Refrigerant Weight (oz)	6.0	9.17	9.17
Refrigerant Weight (g)	170	260	260
dB Noise Level (High/Low) @ Front (High/Low) @ Back	49/48 52/51	52/50 54/52	52/50 54/52
FEATURES			
LED Display (Set Humidity)	•	•	•
Touch Pad Button	•	•	•
Energy Timer	•	•	•
Auto Restart	•	•	•
Automatic Humidistat Control	•	•	•
Fan Speed Selection Switch	Touch Pad Button	Touch Pad Button	Touch Pad Button
Fan Speeds	2	2	2
Air Flow CFM (High/Low)	110/100	131/120	131/120
CMM	3.1/2.8	3.7/3.4	3.7/3.4
Fan Type	Turbo	Turbo	Turbo
Removable Bucket	•	•	•
Bucket Loading Direction	Front	Front	Front
Bucket Full Indicator Light	•	•	•
Bucket Pints	21	21	21
Automatic Shut-Off System	•	•	•
Automatic Defrost Control	•	•	•
Low Temperature Operation	65	42	42
External Drain Connector	•	•	•
Washable Air Filter	•	•	•
APPEARANCE			
Color	White	White	White
Easy-Roll Casters	•	•	•
DIMENSIONS AND WEIGHTS			
Width (inches)	15 5/32	15 5/32	15 5/32
Height (inches)	21 1/4	21 1/4	21 1/4
Depth (inches)	13 3/8	13 3/8	13 3/8
Net Weight (lbs)	44.5	44.9	49.6
Carton Width (inches)	17 9/16	17 9/16	17 9/16
Carton Height (inches)	22 1/4	22 1/4	22 1/4
Carton Depth (inches)	15 1/8	15 1/8	15 1/8
Shipping Weight (lbs)	48.9	49.4	54
WARRANTY			
	5 Years Carry-in Parts and Labor	5 Years Carry-in Parts and Labor	5 Years Carry-in Parts and Labor
UPC CODE			
LD40E	048231 353373		
LD50EL		048231 353380	
LD65EL			048231 353397

CSI Masterformat Division 25: Integrated Automation

Compact FieldPoint Backplanes

NI cFP-BP-4, NI cFP-BP-8

- 4 and 8-slot backplanes
- Solid metal construction for rugged installations
- Panel, DIN rail, and 19 in. rack mounting
- Local bus for communications and module power
- Secure screw mounting for I/O and control modules
- -25 to 60 °C operating range

NEW

Back Plane	I/O Module Slots	Standard Mounting Hardware
cFP-BP-4	4	cFP-PM-H horizontal panel mounting bracket
cFP-BP-8	8	cFP-PM-H horizontal panel mounting bracket

Overview

National Instruments offers two backplanes for mounting Compact FieldPoint modules – the cFP-BP-4 (4 slots) and the cFP-BP-8 (8 slots). Both backplanes, which are constructed of extruded metal with grounding lugs on the bottom, feature screw-down connections for a controller module, four or eight I/O modules, and 37 pin D-Sub connectors for I/O connections. The backplanes all come with a cFP-PM-H horizontal mounting bracket, which provides mounting holes on either side of the backplane so you can mount it to a panel. For other mounting options, you can purchase a vertical panel mount, a DIN rail mount, or a 19 in. rack mount separately.

Compact FieldPoint and FieldPoint

These backplanes are used with Compact FieldPoint only. Compact FieldPoint is designed for industrial control applications that perform advanced embedded control, data logging, headless operation, and Ethernet connectivity. Compact FieldPoint is our most rugged and reliable platform and is designed for industrial and mobile environments with high shock, vibration, and temperature extremes. FieldPoint is a lower-cost distributed I/O system with a variety of communication options besides Ethernet. It is designed to mount on DIN rails in static applications where the FieldPoint bank is connected to a PC for data collection, analysis, display, and storage.

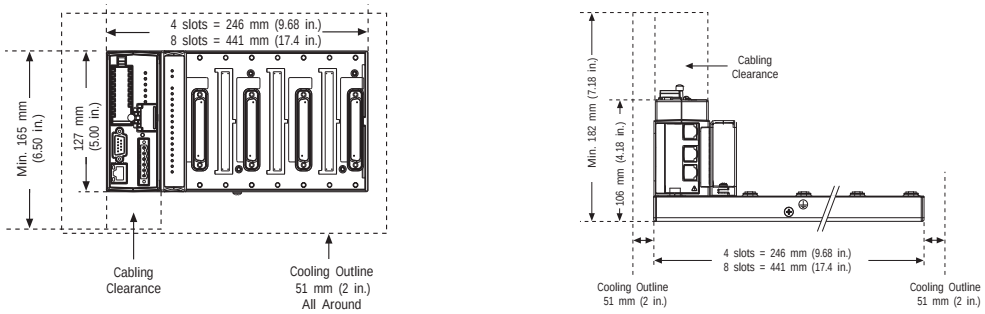


Figure 1. Dimensions of the Compact FieldPoint systems with the cFP-BP-4 and cFP-BP-8 backplanes.

Compact FieldPoint Backplanes

High Shock and Vibration

To withstand high levels of shock and vibration, Compact FieldPoint backplanes are made of extruded metal and provide a rigid mounting surface for the Compact FieldPoint modules. The backplane also provides screw-down connections for the controller module, I/O modules, and connector blocks.

Mounting

NI offers four mounting options for Compact FieldPoint backplanes including panel mounting, DIN-rail mounting, and 19 in. rack mounting.

Mounting Option	Description	Number Needed to Mount cFP-BP-4	Number Needed to Mount cFP-BP-8
cFP-PM-H	Panel mount with bolt holes at the sides of the backplane. (included with all backplane)	1	1
cFP-PM-V	Panel mount with bolt holes at the top and bottom of the backplane	1	1
cFP-RM-8	19 in. rack mount. Features captive screws for easy mounting and cutouts for running grounding cables	1	1
DIN rail mounting clip	DIN rail clip for cFP-BP-4	1	2*

* DIN rail mounting is not recommended for the cFP-BP-8

Compact FieldPoint System Configuration

Compact FieldPoint I/O modules mount on either the cFP-BP-4 or cFP-BP-8 backplane. The backplane also contains a controller module, which runs embedded LabVIEW Real-Time and can connect over Ethernet to a PC, to other FieldPoint banks, to Web browsers, or to other Ethernet devices. The Compact FieldPoint backplane also provides a 37-pin D-Sub connector to connect your field signal wiring for each I/O module. You have three options to connect field wiring to this 37-pin D-Sub connector:

1. Using an integrated connector block such as the cFP-CB-1 or cFP-CB-11;
2. Using a cable to an external connector block mounted on a DIN rail;
3. Making your own custom cable.

For more details on configuring your Compact FieldPoint system, please see 517.

Ordering Information

NI cFP-BP-4 778617-04
NI cFP-BP-8 778617-08

Recommended Compact FieldPoint System Products
NI cFP-2020 777317-2020
NI cFP-CB-1 778618-01
NI PS-5 Power Supply 778805-90
NI Developer Suite Professional Control Edition 777906-03

BUY ONLINE!
Visit *ni.com/info* and enter cfppb4, and/or cfppb8.

Compact FieldPoint I/O Connectivity Accessories

Figure 1. cFP-CB-1 General-Purpose Connector Block

Figure 2. cFP-CB-3 Isothermal Connector Block for Thermocouple Measurement

Figure 3. cFP-CB-11 Low-Profile Connector Block

Flexible I/O Connectivity

The Compact FieldPoint backplane provides standard 37-pin D-Sub connectors for the signals from the I/O modules. This provides you the flexibility to choose the connectivity method that works best for your application. You have three options to connect field wiring to the 37-pin D-Sub connectors:

1. Using an integrated connector block like the cFP-CB-1, cFP-CB-3, or cFP-CB-11
2. Using a cable to an external connector block mounted on a DIN rail
3. Making your own custom cable.

Integrated Connector Blocks

The most secure and compact connectivity option is to use the integrated connector blocks. We offer three connector blocks – the cFP-CB-1, the cFP-CB-3, and the cFP-CB-11.

cFP-CB-1 (See Figure 1)

The cFP-CB-1 is a general-purpose connector block suitable for any I/O module. With 36 terminals, the connector block simplifies wiring by eliminating the need to connect more than one wire to a terminal. The cFP-CB-1 also features both a built-in strain relief bar and a separate wire tie connector, making it easy to create secure wiring setups for high shock and vibration applications. Although both the cFP-CB-1 and the cFP-CB-3 feature a built-in thermistor for cold-junction compensation, we recommend using the cFP-CB-3 when measuring thermocouples.

cFP-CB-3 (See Figure 2)

The cFP-CB-3 connector block is designed for use with the cFP-TC-120 module. The cFP-CB-3 uses isothermal construction to minimize thermal gradients on the I/O terminals. This increases the accuracy of the thermistor that is used for cold-junction compensation. The cFP-CB-3 also features both a built-in strain relief bar and a separate wire tie connector, making it easy to create secure wiring setups for high shock and vibration applications.

cFP-CB-11 (See Figure 3)

The cFP-CB-11 is a low-profile, general-purpose connector block suitable for any I/O module except the thermocouple module. These connector blocks feature a side exit for the wiring, making them a good fit for applications with limited front clearance. Because the connector blocks are smaller, the cFP-CB-11 is best suited for applications that use small-gauge wire or that use only a few channels.

Connector Block	Number of Screw Terminals	Built-in CJC	High Shock andVibration	Voltage Limit	Applications	Part Number
cFP-CB-1	36	•	•	250 V	General purpose	778618-01
cFP-CB-3	18	•	•	250 V	Isothermal for thermocouple	778618-03
cFP-CB-11	37	–	–	24 V	low wiring density and low clearace	778618-11

NATIONAL INSTRUMENTS

NI Home > Products & Services > Distributed I/O > Compact FieldPoint -- Programmable Automation Controller > I/O Modules > Combination Analog Input/Output > 8-Ch Voltage AI/AO, 12-Bit

United States

NI cFP-AIO-610

8-Channel Combination Analog Input/Output Module for Compact FieldPoint

[+] Enlarge Picture

- 4 analog input channels for ±30 V or ±20 mA
- 1.4 kHz update rate
- -40 to 70 °C operating range
- 12-bit resolution
- 100 mA current input protection and short-circuit protection
- 4 analog voltage output channels for 0 to 10 or ±10 V

Part Number	Description	Est Ship	US Dollars
Compact FieldPoint Products			
777318-610	cFP-AIO-610, 12 bit Analog Input/Output Module (V, mA /V)	1 - 2	$ 649.00
777317-2120	cFP-2120, LabVIEW Real-Time/Ethernet Network Module	12 - 20	$ 2,099.00
778617-04	cFP-BP-4, 4 Slot Backplane	5 - 10	$ 389.00
778618-01	cFP-CB-1 Connector Block	1 - 2	$ 150.00
778805-90	PS-5 Power Supply, 24 VDC, 5A, Universal Power Input	1 - 2	$ 250.00

You have selected **United States** as the country where you will use the product(s)

Bac

NATIONAL INSTRUMENTS

NI cFP-DIO-550

16-Channel Digital Input/Output Module for Compact FieldPoint

[+] Enlarge Picture

- 8 sinking/sourcing inputs, 11 to 30 VDC
- 8 sourcing outputs, 10 to 30 VDC, 250 mA per channel
- Output short-circuit protection
- -40 to 70 °C operating range
- 7 mA current-limited input protection

The National Instruments cFP-DIO-550 is an 8-channel digital input/output module. It can measure eight digital in a range of 11 to 30 VDC and source eight outputs from 10 to 30 VDC with 250 mA per channel. The main benefit module is that it offers both digital input and digital output channels, effectively replacing two modules with one (D This module provides 250 V CAT II safety isolation to backplane, and discrete sensor and actuator interfacing. Th module also offers a user-selectable input filter to rejects noise, and has a range of 1 µs to 65 ms. Customers car configure the module so that digital outputs turn on only when the states of digital input channels match specific p

View Pricing and Purchasing Information »

Bac

Compact FieldPoint LabVIEW Real-Time Controllers with Ethernet

NI cFP-21xx *NEW!*

- Rugged LabVIEW Real-Time controller
  - 188 MHz processor and up to 128 MB of SDRAM
  - Up to 128 MB of nonvolatile storage and 512 MB removable CompactFlash
- Ethernet communication for distributed real-time systems
- Dual redundant 11 to 30 VDC power supply inputs, low power
- Up to 4 serial ports (3 RS232 and 1 RS485) for communication
- Industrial certifications, Class I, Div 2, and -40 to 70 °C

Operating Systems
- Windows 2000/NT/XP
- LabVIEW Real-Time

Recommended Software
- LabVIEW
- LabVIEW Real-Time Module
- LabVIEW Datalogging and Supervisory Control Module

Driver Software (included)
- Measurement & Automation Explorer
- OPC server (2.0 compliant)

Controller	SDRAM Memory (MB)	Internal Nonvolatile Storage (MB)	Removable CompactFlash	Ethernet Ports	RS232 Ports	RS485 Ports
cFP-2120	128	128	✓	1	3	1
cFP-2110	128	64	–	1	2	0
cFP-2100	64	64	–	1	1	0

Overview

National Instruments Compact FieldPoint is a programmable automation controller (PAC) designed for industrial control applications performing advanced embedded control, data logging, and network connectivity. It combines the packaging, specifications, and reliability of a PLC with the software, flexibility, connectivity, and functionality of a PC. Compact FieldPoint is a reliable platform designed for rugged industrial environments with shock, vibration, and temperature extremes.

National Instruments cFP-21xx controllers run LabVIEW Real-Time, providing the functionality, connectivity, and flexibility of National Instruments LabVIEW software on a small industrial platform. The modular I/O architecture with built-in signal conditioning and isolation provides direct connectivity to industrial sensors such as analog voltage, 4 to 20 mA current, thermocouples, RTDs, pressure, strain, flow, pulse-width modulation (PWM), and 24 V digital I/O. You can use NI cFP-21xx controllers in intelligent distributed applications requiring industrial-grade reliability – such as process and discrete control systems – to open and close valves, run control loops, log data on a centralized or local level, perform real-time simulation and analysis, and communicate over serial and Ethernet networks.

System Basics

A single cFP-21xx controller manages a bank of up to eight Compact FieldPoint I/O modules. The controller mounts securely on a metal backplane that provides the communication bus as well as a solid surface for the Compact FieldPoint I/O modules and controller. The system is modular; select the I/O modules and connector blocks or cabling options best suited for your application. Compact FieldPoint I/O banks have a number of features for industrial operation, including 2,300 V transient overvoltage protection, a wide temperature range for operation in extreme environments, backup power supply connections to protect against primary power failure, and hot-swappable modules to simplify maintenance and minimize downtime. cFP-21xx controllers feature an industrial 188 MHz x86 processor that reliably and deterministically executes your LabVIEW Real-Time applications.

Choose from thousands of built-in LabVIEW functions to build your multithreaded embedded system for real-time control, analysis, data logging, and communication. cFP-21xx controllers also offer up to 128 MB of 100 MHz SDRAM and 128 MB of internal nonvolatile storage and a removable CompactFlash slot. All cFP-21xx controllers feature a 10/100 Mb/s Ethernet port for communication over the network (including e-mail) and built-in Web (HTTP) and file servers (FTP). Using the LabVIEW Remote Panel feature, you can automatically publish the front panel graphical user interface (GUI) for your embedded application so that multiple clients can monitor or control it remotely using a Web browser.

Compact FieldPoint LabVIEW Real-Time Controllers with Ethernet

Specifications

Network

Network interface	10BaseT and 100BaseTX Ethernet
Compatibility	IEEE802.3
Communication rates	10 Mb/s, 100 Mb/s, autonegotiated
Maximum cabling distance	100 m/segment
Maximum number of banks	Determined by network topology

Memory

cFP-2100	64 MB nonvolatile; 64 MB DRAM
cFP-2110	64 MB nonvolatile; 128 MB DRAM
cFP-2120	128 MB nonvolatile; 128 MB DRAM
Memory lifetime (nonvolatile)	300,000 writes per sector

For information about the memory used by the LabVIEW Real-Time Module and the OS, go to **ni.com/info** *and enter* **rdfpec**.

Serial Ports

cFP-2100	1 RS232
cFP-2110	2 RS232
cFP-2120	3 RS232; 1 RS485

RS232 (DTE) Ports

Baud rate	110 to 115,200 b/s
Data bits	5, 6, 7, 8
Stop bits	1, 1.5, 2
Parity	Odd, even, mark, space
Flow control	RTS/CTS, XON/XOFF, DTR/DSR

RS485 (DTE) Port

Baud rate	110 to 115,200 b/s
Data bits	5, 6, 7, 8
Stop bits	1, 1.5, 2
Parity	Odd, even, mark, space
Flow control	XON/XOFF
Mode	4-wire
Maximum continuous	
Isolation voltage	100 V_{rms}
Dielectric withstand	740 V_{rms}, 1 minute

Power Requirement

Power supply range	11 to 30 VDC
Recommended power supply	
cFP-BP-4 system	15 W
cFP-BP-8 system	20 W
Power consumption	6.1 W + 1.1(I/O module power requirements)
Maximum power to connected I/O modules	9 W

Physical Characteristics

Screw-terminal wiring	16 to 26 AWG copper conductor wire with 7 mm (0.28 in.) of insulation stripped from the end
Torque for screw terminals	0.5 to 0.6 N•m (4.4 to 5.3 lb•in.)
Weight	278 g (9.8 oz)

Thermocouple and RTD Modules for Compact FieldPoint

NI cFP-TC-120, NI cFP-TC-125, NI cFP-RTD-122, NI cFP-RTD-124

- 8 temperature inputs
  - Thermocouple or millivolt
  - 2, 3, or 4-wire RTD
- Built-in signal conditioning between channels
  - 250 V common-mode isolation on TC-125
  - 50 and 60 Hz noise rejection
- 16-bit resolution
- Input ranges configurable in software for each channel
- 2,300 V_{rms} bank isolation for transient overvoltage protection
- Hot-swappable with autoconfiguration
- -40 to 70 °C operating range

Module	Input Channels	Resolution (bits)	Input Type	Input Ranges Software Configurable per Channel	50/60 Hz Noise Filter	All-Channel Update Period	Common-Mode Between Channels	Safety Isolation
cFP-TC-120	8	16	Thermocouple	J,K,R,S,T,N,E, and B ± 25 mV, ±50 mV,	✓	1.13 s (0.88 Hz)	–	2,300 V_{rms} bank isolation
			Millivolt	±100 mV, -20 to 80 mV				
cFP-TC-125	8	16	Thermocouple	J,K,R,S,T,N,E, and B	✓	0.22 s (Filter Off) 0.99 s (Filter On)	250 V_{rms}	2,300 V_{rms} bank isolation
			Millivolt	-20 to 80 mV				
cFP-RTD-122	8	16	2, 3-Wire RTD	Pt 100, Pt 1,000	✓	1.08 s (0.93 Hz)	–	2,300 V_{rms} bank isolation
			Resistance	0 to 400, 0 to 4000 Ω				
cFP-RTD-124	8	16	2, 4-Wire RTD	Pt 100	✓	1.08 s (0.93 Hz)	–	2,300 V_{rms} bank isolation
			Resistance	0 to 400 Ω				

Overview

The National Instruments cFP-TC-12x and cFP-RTD-12x are versatile temperature input modules for Compact FieldPoint, used to measure thermocouples, millivolt-level voltages, thermistors, and 2, 3, and 4-wire RTDs. They are used in applications such as temperature chamber control, device testing, and process control. Thermocouples are low-cost, flexible temperature devices. RTD sensors are used in applications for acquiring temperatures with high accuracy. Two and 3-wire RTDs work well for applications with short signal wires and low noise levels; 4-wire RTDs are well-suited for applications with long signal wires or high noise levels. All of these I/O modules include overranging and onboard diagnostics to ensure trouble-free installation and maintenance. The modules measure and linearize signals on board to return scaled values to your control or monitoring software. NI cFP-TC-12x and cFP-RTD-12x modules have NIST-traceable calibration certificates (available on request), ensuring accurate and reliable analog measurements.

Compact FieldPoint

Compact FieldPoint is designed for industrial control applications that perform advanced embedded control, data logging, headless operation, and Ethernet connectivity. Compact FieldPoint, a rugged, reliable NI platform, is designed for industrial and mobile environments with high shock, vibration, and temperature extremes.

Isolation

The cFP-TC-125 provides 250 V_{rms} common-mode voltage protection between channels, and all cFP-TC-12x and cFP-RTD-12x modules feature optical bank isolation with 2,300 V_{rms} of breakdown isolation. In addition, the cFP-TC-12x and cFP-RTD-12x provide double insulation for up to 250 V_{rms} of operational isolation. You can safely use Compact FieldPoint with the cFP-CB-1 or cFP-CB-3 connector block in applications where hazardous voltages are present.

NATIONAL INSTRUMENTS™

NI Factory Installation Services

PXI System Hardware and Software Components

Module Installation

Software Installation

System Level Integrated Confirmation Test

Utility Installation

Overview

NI Factory Installation Services provides the fastest and easiest way to get your PXI or PXI/SCXI combination systems up and running during application development and deployment. Trained NI technicians install the software and hardware and configure the system to your specifications. We deliver the system to you ready to use, so that you can get started using it right out of the box.

Ready-to-Use Measurement and Automation System

NI Factory Installation Services delivers a ready-to-use PXI or PXI/SCXI combination measurement and automation system to you. Based on your specifications, we will install any PXI modules in your chassis, plus any memory upgrades, NI application software, and any required driver software on your embedded controller. We perform a system-level test to verify that it is configured to your specifications. PXI controllers installed by NI Factory Installation Services include a startup software utility that shows the software and hardware installed in the chassis, version numbers, and links to online documentation. You also get a recovery image that restores your hard drive as shipped from NI. You can add NI Factory Installation Services to any PXI order including an embedded controller or a PXI chassis. Let our trained technicians configure your system, so that you can be more efficient and get your PXI or PXI/SCXI combination system up and running in the least amount of time possible.

Configure Your System Online with NI Online Product Advisors

To use NI Factory Installation Services, simply configure your system online with our product advisors (***ni.com/advisor***). Configure your PXI system with the online PXI Advisor or your PXI/SCXI combination system with the online PXI/SCXI Advisor. Our online product advisors lead you through a series of questions to help you easily and quickly build your complete system with a chassis, controller, modules, accessories, and software. With the advisors, you can graphically insert modules into a virtual chassis of your choice. You immediately see onscreen a graphical image and list of features for your system. When you feel satisfied with your configuration, you can automatically order the entire system through our online store. If you prefer to place your order by fax or phone, refer to the Configuration ID generated by the product advisor. With NI Factory Installation Services as part of your order, you receive your PXI or PXI/SCXI combination system just as you configured it.

Ordering Information

NI Factory Installation Services

PXI System 960596-01
PXI/SCXI Combination System 960596-04

CSI Masterformat Division 26: Electrical

SECTION 26 05 00 – COMMON WORK RESULTS FOR ELECTRICAL
PART 1 - GENERAL
1.1 SECTION REQUIREMENTS
A. Submittals: Not Applicable.
B. Coordinate Arrangement, Mounting, and Support of Electrical Equipment:
1. Allow maximum possible headroom unless specific mounting heights that reduce headroom are indicated.
2. Provide for ease of disconnecting the equipment with minimum interference to other installations.
3. Allow right of way for piping and conduit installed at required slope.
4. Ensure that connecting raceways, cables, wireways, cable trays, and busways are clear of obstructions and of the working and access space of other equipment.
C. Coordinate installation of required supporting devices and set sleeves in structural components as they are constructed.
D. Coordinate location of access panels and doors for electrical items that are behind finished surfaces or otherwise concealed. Access doors and panels are specified in Division 8 Section “Access Doors and Frames.”
PART 2 - PRODUCTS
2.1 RACEWAYS AND CONDUCTORS
A. Raceways:
1. EMT: ANSI C80.3, zinc-coated steel, with set-screw or compression fittings.
2. FMC: Zinc-coated steel.
3. IMC: ANSI C80.6, zinc-coated steel, with threaded fittings.
4. LFMC: Zinc-coated steel with sunlight-resistant and mineral-oil-resistant plastic jacket.
5. RNC: NEMA TC 2, Schedule 40 PVC, with NEMA TC3 fittings.
6. Raceway Fittings: Specifically designed for raceway type used in Project.
7. MC: Metallic Cable pre-wired flex conduit.
B. Conductors:
1. Conductors, No. 10 AWG and Smaller: Solid or stranded copper.
2. Conductors, Larger than No. 10 AWG: Stranded copper.
3. Insulation: Thermoplastic, rated at 75 deg C minimum.
4. Wire Connectors and Splices: Units of size, ampacity rating, material, type, and class suitable for service indicated.
2.2 ELECTRICAL IDENTIFICATION MATERIALS
A. Raceway Identification Materials:
1. Snap-around, color-coding bands; flexible, pre-printed, color-coded acrylic.
2. Self-adhesive, color-coding vinyl tape; flexible, pre-printed, self-adhesive vinyl.
B. Conductor Identification Materials:
1. Color-Coding Conductor Tape: Self-adhesive vinyl tape 1 to 2 inches wide.

C. Tape Markers for Wire: Vinyl, self-adhesive, wraparound type with pre-printed numbers and letters.
D. Warning Labels and Signs: Baked-enamel, pre-printed signs, punched or drilled for fasteners; with colors, legend, and size required for application.
E. Equipment Identification Labels: Engraved, laminated acrylic or melamine label; punched or drilled for screw mounting. White letters on a dark-gray background; red letters for emergency systems.
1. Fasteners: Self-tapping, stainless-steel screws or stainless-steel machine screws with nuts and flat and lock washers.

2.3 SUPPORT AND ANCHORAGE COMPONENTS

A. Steel Slotted Support Systems: MFMA-3, factory-fabricated components for field assembly.
B. Raceway and Cable Supports: As described in NECA 1.
C. Conduit and Cable Support Devices: Steel and malleable-iron hangers, clamps, and fittings.
D. Pipe Sleeves: Schedule 40, galvanized steel, plain ends.
E. Mounting, Anchoring, and Attachment Components:
1. Expansion Anchors: Steel, insert-wedge type, for use in concrete.
2. Clamps for Attachment to Steel Structural Elements: MSS SP-58, type suitable for attached structural element.
3. Through Bolts: Structural type, hex head, high strength; comply with ASTM A 325.
4. Toggle Bolts: All-steel springhead type.
5. Hanger Rods: Threaded steel.
6. PV Mounting System: Aluminum.
7. PV Clamping System: Aluminum.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Sleeve and Sleeve Seals: Use type and number of sealing elements recommended by manufacturer; comply with NECA 1.

3.2 RACEWAY APPLICATION

A. Outdoor Installations:
1. Exposed or Concealed: IMC.
2. Underground, Single Run: RNC.
3. Connection to Vibrating Equipment: LFMC.
4. Boxes and Enclosures: Metallic, NEMA 250, Type 3R or Type 4.
B. Indoor Installations:
1. Exposed or Concealed: MC.
2. Connection to Vibrating Equipment: FMC; in wet or damp locations, use LFMC.
3. Damp or Wet Locations: IMC.
4. Boxes and Enclosures: Metallic, NEMA 250, Type 1, unless otherwise indicated.

3.3 RACEWAY AND CABLE INSTALLATION

A. Conceal raceways and cables, unless otherwise indicated, within finished walls, ceilings, and floors.

B. Install raceways and cables at least 6 inches away from parallel runs of flues and steam or hot-water pipes. Locate horizontal raceway runs above water and steam piping.

C. Install raceways embedded in slabs in middle third of slab thickness where practical, and leave at least 1 inch thick concrete cover.

1. Secure raceways to reinforcing rods to prevent sagging or shifting during concrete placement.

2. Space raceways laterally to prevent voids in concrete.

3. Install conduit larger than 1-inch trade size parallel to or at right angles to main reinforcement. Where conduit is at right angles to reinforcement, place conduit close to slab support.

4. Transition from nonmetallic tubing to Schedule 80 nonmetallic conduit, rigid steel conduit, or IMC before rising above floor.

D. Install pull wires in empty raceways.

E. Install telephone and signal system raceways, 2-inch trade size and smaller, in maximum lengths of 150 feet and with a maximum of two 90-degree bends or equivalent.

F. Connect motors and equipment subject to vibration, noise transmission, or movement with a 72-inch maximum length of flexible conduit. Install LFMC in wet or damp locations.

3.4 WIRING METHODS FOR POWER, LIGHTING, AND CONTROL CIRCUITS

A. Feeders: Type THHN/THWN insulated conductors in raceway.

B. Underground Feeders and Branch Circuits: Type THWN or single-wire, Type UF insulated conductors in raceway.

C. Branch Circuits: Type THHN/THWN insulated conductors in raceway.

D. Branch Circuits: Type THW or THHN/THWN insulated conductors in raceway where exposed. Metal-clad cable where concealed in ceilings and gypsum board partitions.

E. Branch Circuits: Type THW or THHN/THWN insulated conductors in raceway where exposed. Armored or nonmetallic sheathed cable where permitted by authorities having jurisdiction and where concealed in ceilings and gypsum board partitions.

F. Remote-Control Signaling and Power-Limited Circuits: Type THHN/THWN insulated conductors in raceway for Classes 1, 2, and 3, unless otherwise indicated.

3.5 APPLICATION OF IDENTIFICATION MATERIALS

A. Accessible Raceways and Cables of Auxiliary Systems: Identify the following systems with snap-around color-coding bands:

1. Fire Alarm System: Red.

2. Security System: Blue and yellow.

3. Telecommunication System: Green and yellow.

B. Power-Circuit Conductor Identification: For No. 3 AWG conductors and larger, at each location where observable, identify phase using color-coding conductor tape.

C. Locations of Underground Lines: Identify with underground-line warning tape for power, lighting, communication, and control wiring.

D. Warning Labels for Enclosures for Power and Lighting: Comply with 29 CFR 1910.145; identify system voltage with black letters on an orange background. Apply to exterior of door, cover, or other access.
E. Equipment Identification Labels:
1. Labeling Instructions: Provide a single line of text with 1/2-inch- high letters on 1-1/2-inch high label.
2. Equipment to Be Labeled:
a. Panelboards.
b. Electrical switchboards.
c. Transformers.
d. Motor starters.
e. Push-button stations.
f. Contactors.
g. Terminals, racks, and patch panels for voice and data communication and for signal and control functions.

3.6 INSTALLATION OF IDENTIFICATION MATERIALS

A. Verify identity of each item before installing identification products.
B. System Identification Color Banding for Raceways and Cables: At 50-foot maximum intervals in straight runs, and at 25-foot maximum intervals in congested areas.

3.7 INSTALLATION OF SUPPORTS

A. Multiple Raceways or Cables: Install on trapeze-type supports fabricated with steel slotted channel.
B. Install seismic-restraint components using methods approved by the evaluation service providing required submittals for component.
C. Strength of Support Assemblies: Where not indicated, select sizes of components so strength will be adequate to carry present and future static loads within specified loading limits.

3.8 FIRESTOPPING

A. Apply firestopping to electrical penetrations of fire-rated floor and wall assemblies to restore original fire-resistance rating of assembly. Firestopping materials and installation requirements are specified in Division 7 Section “Through-Penetration Firestop Systems.”

END OF SECTION 26 05 00

SECTION 26 24 16 – PANELBOARD SCHEDULE
PART 1 - GENERAL
1.1 SECTION REQUIREMENTS
A. Comply with NEMA PB 1.
B. Comply with NFPA 70.
C. Submittals: Not Applicable.
PART 2 - PRODUCTS
2.1 MANUFACTURED UNITS
A. Surface-mounted, NEMA PB 1, Type 1.
1. Front: Secured to box with concealed trim clamps.
2. Doors: With concealed hinges, flush catches, and tumbler locks, all keyed alike.
3. Bus: Hard-drawn copper, 98 % conductivity for each phase.
4. Extra-Capacity Neutral Bus: Rated 200 % of phase bus, and UL listed as suitable for nonlinear loads.
5. Main and Neutral Lugs: Type suitable for use with conductor material.
6. Extra-Capacity Neutral Lugs: Rated 200 % of phase lugs.
7. Equipment Ground Bus: Bonded to box.
8. Feed-through Lugs: Type suitable for use with conductor material.
B. Fabricate and test panelboards according to IEEE 344 to withstand seismic forces defined in Division 16 Section “Seismic Controls for Electrical Work.”
C. Panelboard Short-Circuit Rating: UL label indicating series-connected rating with integral or remote upstream devices. Include size and type of upstream device allowable, branch devices allowable, and UL series-connected short-circuit rating.
2.2 PANELBOARD
A. Panel: Square D load center
2.3 MAIN DISCONNECT
A. Disconnect: Cutler Hammer 125A Main Lug Loadcenter, CH2L125RP 120/240V Single Phase.
2.4 COMPONENTS
A. Molded-Case Circuit Breaker: NEMA AB 1 thermal-magnetic type; UL 489 with series-connected rating and interrupting capacity to meet available fault currents.
1. Appropriate for application; Type SWD for switching; Type HACR for heating, air-conditioning, and refrigerating equipment loads.
2. GFCI Circuit Breakers: Single- and two-pole type with 30-mA trip sensitivity.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install panelboards and accessory items according to NEMA PB 1.1. Indicate installed circuit loads on a typed circuit directory after balancing panelboard loads.

B. Design each fastener and support to carry load indicated by seismic requirements and according to seismic-restraint details. See Division 16 Section “Basic Electrical Materials and Methods” for seismic-restraint requirements.

C. Mount top of trim 74 in. above finished floor, unless otherwise indicated.

D. Stub four empty 3/4 in. conduits from panelboard into accessible or designated ceiling space; stub four empty conduits into space below floor.

E. More Than Three Current-Carrying Conductors in a Raceway or Cable. Where the number of current-carrying conductors in a raceway or cable exceeds three, or where single conductors or multiconductor cables are stacked or bundled longer than 600 mm (24 in.) without maintaining spacing and are not installed in raceways, the allowable ampacity of each conductor shall be reduced as shown in Table 310.15(B)(2)(a). Each current-carrying conductor of a paralleled set of conductors shall be counted as a current-carrying conductor.

Table 310.15(B)(2)(a) Adjustment Factors for More Than Three Current-Carrying Conductors in a Raceway or Cable

Number of Current-Carrying Conductors Percent of Values in Tables 310.16 through 310.19 as Adjusted for Ambient Temperature if Necessary

CSI Subdivision: 26 27 26 Wiring Devices

SECTION 26 27 26- WIRING DEVICES
PART 1 - GENERAL
1.1 SECTION REQUIREMENTS
A. Comply with NFPA 70.
B. Submittals: Not Applicable.
PART 2 - PRODUCTS
2.1 DEVICES
A. General: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
B. Color: White.
C. Receptacles: General-Duty grade, NEMA WD 1, NEMA WD 6, DSCC W-C-596G, and UL 498.
D. Ground-Fault Circuit Interrupter Receptacles: Feed-through type, with integral duplex receptacle complying with UL 498 and UL 943; for installation in a 2-3/4-inch- deep outlet box without an adapter.
E. Snap Switches: General-duty, quiet type, DSCC W-C-8896F and UL 20.
F. Wall Plates: Satin-finish stainless steel, fastened with metal screws having heads matching plate color on kitchen backsplash. All other finished areas: white with white screw heads.
G. Wall Plates, Unfinished Areas: Galvanized steel with metal screws.
H. Wall Plates, Wet Locations: Cast aluminum with spring-loaded lift cover, and listed and labeled for use in wet locations.
I. Floor Service Fittings
1. Modular, flush-type, dual-service units suitable for wiring method used.
2. Service Plate: Rectangular, die-cast aluminum with satin finish.
PART 3 - EXECUTION
3.1 INSTALLATION
A. Install devices and assemblies plumb, level, and square with building lines.
B. Install unshared neutral conductors on line and load side of dimmers.
C. Mount devices flush, with long dimension vertical, and grounding terminal of receptacles on top, unless otherwise indicated. Group adjacent devices under single, multigang wall plates.
END OF SECTION 26 27 26

CSI Subdivision: 26 31 00 PV Collector BP 7190

Solar Cell Specifications

Manufacturer:	BP Solar
Contact:	Sherwin McDonald
	PO Box 68
	Deer Park, TX 77536 USA
	281.542.2778
	www.bpsolar.com
Stock Number:	BP 7190 Moncrystalline
Maximum Power:	190W
Number of Units:	40
Weight:	34 lb
Size:	62.8 in. (L) x 31.1 in. (W) x 1.97 in. (D)
Cost:	$5.50 / watt (free to team)

See Manufacturer's Data Sheet.

bp solar

190 Watt Photovoltaic Module – Saturn Technology

BP 7190

3033E-1 07/06

The BP 7190S forms part of the high efficiency Saturn 7 Series "real power" range of solar modules. Our industry leading warranty is based on nominal power output, meaning more power for a longer period of time. The bypass diodes use the IntegraBus™ technology, which limits the loss of energy in the event of partial shadowing affecting the module. Being one of the largest, most powerful modules manufactured by BP Solar, the BP 7190S is ideal for installations where high power is needed in a limited area.
The BP 7190S has been especially designed for grid connect applications such as large commercial roofs, residential systems and photovoltaic power plants.

Performance

Rated power	190W
Tolerance	-0/+2.5%
Module efficiency	15.1%
Nominal voltage	24V
Warranty	90% power output over 12 years 80% power output over 25 years Free from defects in materials and workmanship for 5 years

Configuration

BP 7190S	Clear Universal Frame, sealed junction box, cables with Multi-Contact connectors.

Qualification Test Parameters

Temperature cycling range	-40ºC to +85ºC for 200 cycles
Damp heat test	85ºC and 85% relative humidity for 1000h
Front & rear load test (eg: wind)	2400Pa
Front load test (eg: snow and wind)	5400Pa
Hailstone impact test	25mm hail at 23m/s from 1m distance

Quality and Safety

- Manufactured in ISO 9001 and ISO 14003 certified factories
- Conforms to European Community Directive 89/33/EEC, 73/23/EEC, 93/68/EEC
- Certified to IEC 61215

Module power measurements calibrated to World Radiometric Reference from ESTI (European Solar Test Installation) at Ispra, Italy.

Framed modules certified by TÜV Rheinland as Safety Class II (IEC 60364) equipment for use in systems up to 1000V.

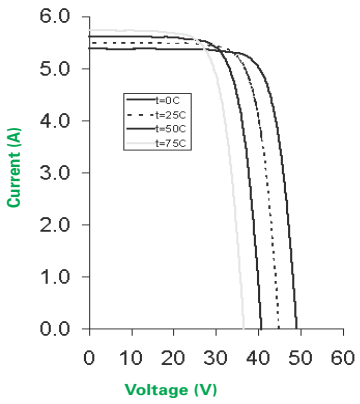
Framed modules listed by Underwriters Laboratories for electrical and fire safety (Class C fire rating).

BP 7190S scale 1:14

Efficiency (%)

9-11	11-12	12-13	13-14	14-15

BP 7190S I-V Curves



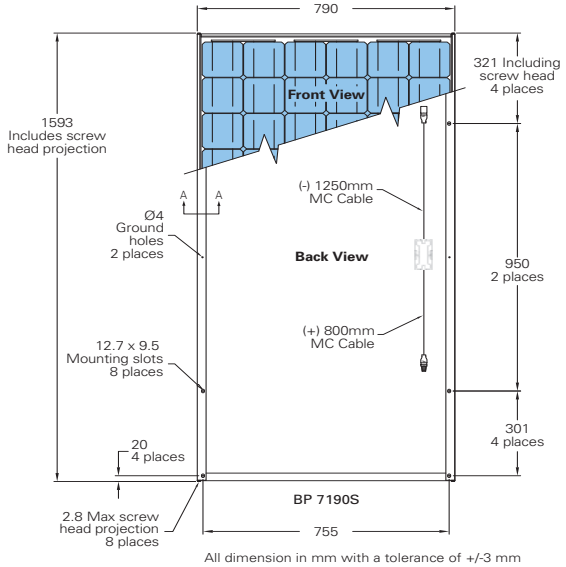
bp solar

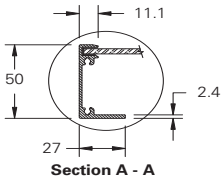
190 Watt Photovoltaic Module

BP 7190

3033E-1 07/06

Module Diagram





All dimension in mm with a tolerance of +/-3 mm

Self-tapping grounding screw, instruction sheet and warranty document included with each module.

Typical Electrical Characteristics	BP 7190
Warranted minimum power*	190W
Voltage at MPP (V_{mpp})	36.6V
Current at MPP (I_{mpp})	5.2A
Short circuit current (I_{sc})	5.5A
Open circuit voltage (V_{oc})	44.8A
Temperature coefficient of I_{sc}	(0.065±0.015)%/K
Temperature coefficient of V_{oc}	-(160±20)mV/K
Temperature coefficient of P	-(0.5±0.05)%/K
NOCT (Air 20°C; Sun 800W/m²; wind 1m/s)	47±2°C
Maximum series fuse rating	15A
Maximum system voltage	1000V (IEC 61215 rating) 1000V (TÜV Rheinland rating)

*As measured by BP Solar test equipment rounded to the nearest watt.

Standard test conditions - irradiance of 1000W/m² at an AM1.5G solar spectrum and a cell temperature of 25°C.

Mechanical Characteristics	BP 7190
Dimensions (mm) (Overall tolerances +/-3mm)	1593 x 790 x 50
Weight (kg)	15.4
Frame	Clear anodised aluminium alloy type 6063T6. Silver Universal frame.
Solar cells	72 cells (125mm x 125mm) configured geometrically in a 6 x 12 matrix connected in series.
Output cables	3.3mm² cable with weatherproof Multi-Contact connectors. Asymmetrical cable lengths - 1250mm (-) and 800mm (+).
Diodes	IntegraBus™ technology includes for every 12 cells a Schottky bypass diode integrated into the printed circuit board bus.
Construction	Front: High transmission 3.2mm tempered glass. Rear: White polyester; encapsulant: EVA.

Your BP Solar Distributor:

www.bpsolar.com

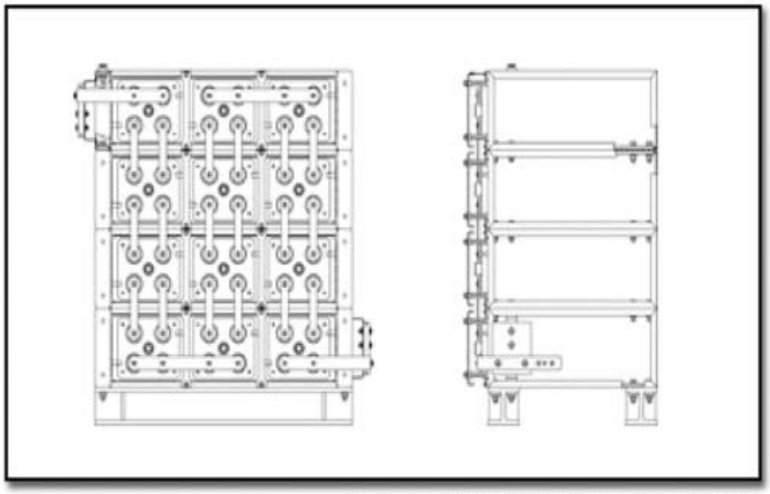
Battery Specifications

Manufacturer:	Interstate Battery
Contact:	Dorsey Self 214-674-3543 www.ibsa.com
Stock Number:	LLP-1440.
Cell Voltage:	2 V.
Number of Cells:	24.
Weight:	195 lb.
Capacity:	1440Ah – 8Hr To 1.75 Vpc @ 25□C
Size:	22.84x12.91x7.19 in.
Cost:	$14,500 total.
System Number:	P1440308024B
System Voltage:	48V
Size:	73.71x43.4x24.82
Weight:	5900 lb.

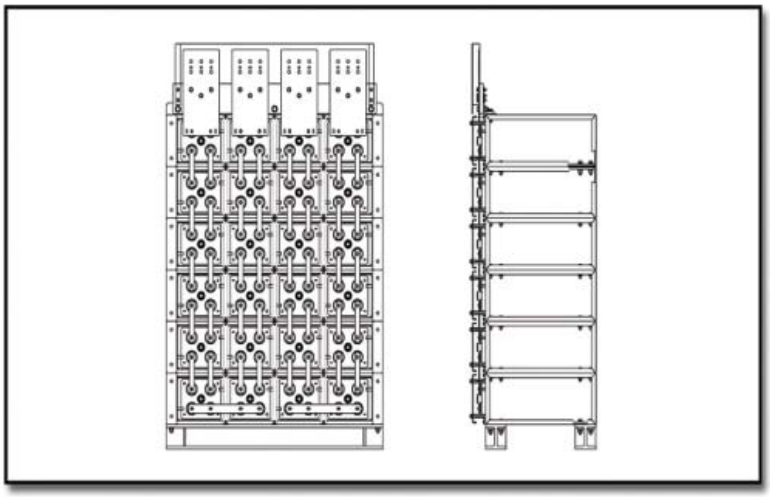
See Manufacturer’s Data Sheet and MSDS.

LLP Batteries

SAMPLE SYSTEM DRAWINGS



Drawing of P10403X424H: 24V 1040AH with H Termination



Drawing of P10404X62X24Z: 2 Parallel Systems of 24V 1040 AH with Z Termination

LLP Batteries
LONG LIFE PROTECTION

Interstate PowerCare
12770 Merit Drive, Suite 1000
Dallas, TX 75251
Customer Service: 1-866-210-6679

interstatepowercare.com

LLP Batteries

Interstate PowerCare
LLP Batteries
LONG LIFE PROTECTION

For Standby Applications
Capacities from 960–1440 Ampere-hours

PERFORMANCE YOU CAN TRUST

Interstate's PowerCare Long Life Protection (LLP) Series brings unsurpassed overall performance and service life in a modular, stackable power system with a truly advanced engineering design. With the longest full-warranty period in the industry, the LLP Series valve-regulated lead-acid (VRLA) batteries provide exceptional standby performance and reliability backed by a name you can trust.

FEATURES AND BENEFITS

Exceptional Warranty

- 7-year full warranty*

Exceptional Service Life

- Field-proven, proprietary cell design and manufacturing process — provides documented long-lasting service life
- Advanced microporous absorbed-glass-mat separators for ultra-low float current — reduces grid corrosion for a long, usable service life
- Highly efficient, proprietary plate processing for high utilization of active material — results in high energy density
- Advanced calcium alloys to minimize positive grid corrosion and growth — produces maximum battery life

Exceptional 24V Reliability

- Double Network Reliability through two-24V parallel systems
- Increased capacity over single-cell strings in a compact footprint
- Amp-Hr ratings from 1920 to 2880

Exceptional Product Quality

- Proprietary, high-strength jar design for reliable cell performance
- Ribbed jar walls for sustained cell compression
- Flame-retardant jar and cover material capable of withstanding high temperature excursions
- Built-in cooling channels to maintain proper cell temperature
- Exceptional manufacturing process for consistent plate quality

Exceptional Qualifications

- Tested to the latest industry standards
- NEBS
- Bellcore SR-4228
- IBC 2000 300% qualified

* Contact your local PowerCare representative for details.

LLP Batteries

SPECIFICATIONS AND CHARACTERISTICS

CELL MODEL	LLP-960	LLP-1040	LLP-1120	LLP-1200	LLP-1360	LLP-1440
Nominal Voltage Rated Capacity (8 hr rate @ 1.75Vpc)	2 Vpc 960 Ahr	2 Vpc 1040 Ahr	2 Vpc 1120 Ahr	2 Vpc 1200 Ahr	2 Vpc 1360 Ahr	2 Vpc 1440 Ahr
DIMENSIONS						
Depth	22.84 in (580 mm)	22.84 in (580 mm)	22.84 in (580 mm)	22.84 in (580 mm)	22.84 in (580 mm)	22.84 in (580 mm)
Width	9.65 in (245 mm)	9.65 in (245 mm)	11.06 in (281 mm)	11.06 in (281 mm)	12.91 in (328 mm)	12.91 in (328 mm)
Height	7.19 in (183 mm)	7.19 in (183 mm)	7.19 in (183 mm)	7.19 in (183 mm)	7.19 in (183 mm)	7.19 in (183 mm)
Weight	136 lb (62 kg)	146 lb (66 kg)	155 lb (71 kg)	166 lb (75 kg)	185 lb (83 kg)	195 lb (88 kg)
Jar Material	FR Polypropylene UL 94 V-0 >28% LOI	FR Polypropylene UL 94 V-0 >28% LOI	FR Polypropylene UL 94 V-0 >28% LOI	FR Polypropylene UL 94 V-0 >28% LOI	FR Polypropylene UL 94 V-0 >28% LOI	FR Polypropylene UL 94 V-0 >28% LOI
Internal Resistance Full charge @ 77F (25C)	0.35 mOhm	0.33 mOhm	0.32 mOhm	0.30 mOhm	0.28 mOhm	0.27 mOhm
Maximum Discharge (1 minute duration)	1920A	2080A	2240A	2400A	2720A	2880A
Termination Type	6 mm Insert	6 mm Insert	6 mm Insert	6 mm Insert	6 mm Insert	6 mm Insert
Connector Torque	75 in-lbs (8.5 N-m)	75 in-lbs (8.5 N-m)	75 in-lbs (8.5 N-m)	75 in-lbs (8.5 N-m)	75 in-lbs (8.5 N-m)	75 in-lbs (8.5 N-m)
Charge Voltage @ 77F (25C)	2.23 ~ 2.25 Vpc	2.23 ~ 2.25 Vpc	2.23 ~ 2.25 Vpc	2.23 ~ 2.25 Vpc	2.23 ~ 2.25 Vpc	2.23 ~ 2.25 Vpc
Maximum Charge Current	384A	416A	456A	480A	544A	576A

STANDARD SYSTEMS (CONTACT INTERSTATE POWERCARE FOR ALTERNATE SYSTEM CONFIGURATIONS NOT SHOWN)

SYSTEM NUMBER	DESCRIPTION	TERMINATION LOCATION†	MODULE LAYOUT (wxh)	HEIGHT		WIDTH		DEPTH		WEIGHT	
				in	mm	in	mm	in	mm	lb	kg
P0960304012H	24V/960AH	H	3X4	38.94	989	33.45*	850*	24.75	629	2070	939
P0960308024A	48V/960AH	A	3X8	73.71*	1872*	33.45	850	24.82	630	4040	1833
P1040304012H	24V/1040AH	H	3X4	38.94	989	33.45*	850*	24.75	629	2240	1016
P1040308024A	48V/1040AH	A	3X8	73.71*	1872*	33.45	850	24.82	630	4375	1984
P1120304012H	24V/1120AH	H	3X4	38.94	989	37.48*	952*	24.75	629	2430	1102
P1120308024A	48V/1120AH	A	3X8	73.71*	1872*	37.48	952	24.82	630	4708	2136
P1200304012H	24V/1200AH	H	3X4	38.94	989	37.48*	952*	24.75	629	2520	1143
P1200308024A	48V/1200AH	A	3X8	73.71*	1872*	37.48	952	24.82	630	4950	2245
P1360304012H	24V/1360AH	H	3X4	38.94	989	43.40*	1102*	24.75	629	2805	1272
P1360308024H	48V/1360AH	H	3X8	73.71	1872	43.40*	1102*	24.75	629	5470	2481
P1440304012H	24V/1440AH	H	3X4	38.94	989	43.40*	1102*	24.75	629	2850	1293
P1440308024B	48V/1440AH	B	3X8	73.71*	1872*	43.40	1102	24.82	630	5900	2676

† Contact your PowerCare representative for additional termination layout options. * Total dimension does not include terminal plates.

INTERSTATE POWERCARE

RATINGS IN AMPERES AT 77F (25C)

CELL MODEL	FINAL VOLTS	1 HR	2 HR	4 HR	6 HR	8 HR	10 HR	20 HR
LLP-960	1.75	486	322	200	150	120	95	48
	1.78	469	316	199	149	119	94	47
	1.80	458	312	198	148	118	93	46
	1.83	428	297	190	143	113	91	45
	1.85	409	288	185	139	109	89	44
	1.88	380	273	178	133	104	87	43
	1.90	360	263	173	130	101	86	42
LLP-1040	1.75	527	349	217	163	130	103	52
	1.78	509	343	215	161	128	102	51
	1.80	496	338	214	160	127	101	50
	1.83	464	322	206	154	122	98	49
	1.85	443	312	201	150	118	97	48
	1.88	411	296	193	144	113	94	47
	1.90	390	285	187	140	109	93	46
LLP-1120	1.75	567	376	233	175	140	111	56
	1.78	548	369	232	174	138	109	55
	1.80	534	364	231	173	137	108	54
	1.83	500	347	222	166	131	106	53
	1.85	477	336	216	162	127	104	52
	1.88	443	319	207	156	122	102	50
	1.90	420	307	202	151	118	100	49
LLP-1200	1.75	608	403	250	188	150	119	60
	1.78	587	395	248	186	148	117	59
	1.80	572	390	247	185	147	116	58
	1.83	535	371	238	178	141	113	57
	1.85	511	360	232	174	137	112	56
	1.88	474	341	222	167	130	109	54
	1.90	450	329	216	162	126	107	53
LLP-1360	1.75	689	457	283	213	170	135	68
	1.78	665	448	281	211	168	133	67
	1.80	648	442	280	210	167	131	66
	1.83	607	421	269	202	160	128	64
	1.85	579	407	262	197	155	126	63
	1.88	538	387	252	189	148	123	61
	1.90	510	373	245	184	143	121	60
LLP-1440	1.75	729	484	300	226	180	143	72
	1.78	704	474	298	224	178	141	71
	1.80	686	468	296	222	176	139	70
	1.83	642	446	285	214	169	136	68
	1.85	613	431	278	208	164	134	67
	1.88	569	410	267	200	156	131	65
	1.90	540	395	259	194	151	128	64

NOTE: All ratings conform to IEEE-485-1997.

Battery Closet Passive Ventilation Calculations

From IMC:
[F] 502.5.2 Ventilation rate in cabinets. Continuous cabinet ventilation shall be provided at a rate of not less than 1 cubic foot per minute per square foot (cfm/ft.2) [0.00508 m3/(s • m2)] of the floor area covered by the cabinet. The room in which the cabinet is installed shall also be ventilated as required by Section 502.4.1 or 502.4.2.

Battery closet area = 37.36 SQ FT = 37.36 CFM for ventilation

Formula for solar induced passive air flow: $Q = KA\sqrt{H \Delta T}$

Where:

Q = rate of air flow (CFH)
K = unitless coefficient depending on ration of outlet to inlet size
A = area of inlet (SQ FT)
H = height difference between mid-point of inlet to mid-let of outlet (FT)
ΔT = temperature change (ºF)

Chose: inlet area = 0.5 SF, outlet area = 1 SF; K = 680

Calculation:
$Q = (680)\ (.5SF)\ \sqrt{}\ (5FT)\ (10ºF)$

Q = 2380.2 CFH
Q(mins) = 2380.2 CFH / 60 MINS

Q(mins) = 39.67 CFM (sufficient for required 37.36 CFM for ventilation)

Yields: (see A4.6 Battery Closet Section and A2.6 Battery Closet Elevations)

Inlet = 9” x 4” vent x 2 = .5 SF
Outlet = 24” x 6” vent = 1.5” x 108” = 1 SF

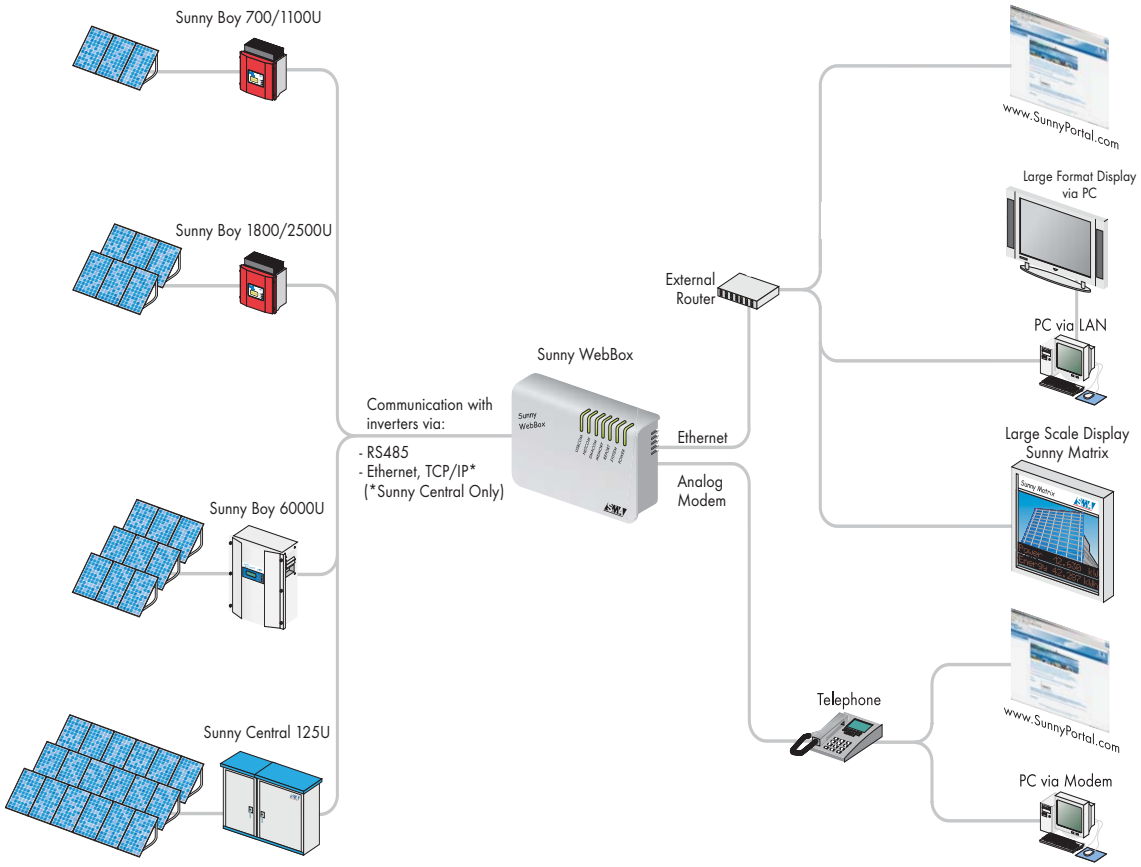
CSI Masterformat Division 27: Communications

Sunny WebBox™

Web enabled data logging and control for alternative energy systems

- System access from any Web browser - anywhere in the world
- Recording of daily, monthly and annual energy yield via Sunny Portal ™
- Remote plant diagnosis
- Remote system configuration
- Automatic data transfer at chosen intervals
- Data storage and display via Ethernet
- Compatible with all SMA utility interactive inverters
- Low power consumption
- Automated communication with Sunny Portal ™

The new Sunny WebBox from SMA is a powerful communications tool that allows the operating data of your solar system to be logged and easily transmitted via modem or Ethernet to the Web or directly to your PC. It can also send the data to SMA's new internet portal (Sunny Portal) which provides free long-term data storage and graphical display of your system data. Collected information is stored in common file formats so that you can use it in various spreadsheets, graphs or your own web site. The Sunny WebBox is extremely versatile; making the storage, transmission, management and display of your system data easier than ever before.



Specifications

Interfaces	
SMACOM	RS485 (up to 50 inverters, max. 4000 ft. cable)
Ethernet	10Mb / 100 Mb auto sensing

External Data Storage	
SD-Card	from 16 MB upwards
USB-Stick	USB 2.0 Host

Dimensions	
Size	8.85 x 2.25 x 5.11 in. (w x d x h)
Weight	1.65 lb.

Power Requirements	
Wall Transformer	Typ. 300 mA @ 12 V
(120 VAC 60Hz)	Max. 1 A @ 12 V
Power Consumption	Max. 12W

Ambient Temperature Rating	
Ambient Temperature Range	0°C to 55°C
Relative Humidity Range	5 % to 95 %, non-condensing

Miscellaneous	
Operating System	Windows CE.NET
Status Display	7 LED´s
Mounting Options	Wall mount, DIN rail mount, desktop

Options
Integrated Analog Modem

CSI Masterformat Division 48: Electrical Power Generation

SB 5000US / SB 6000US / SB 7000US

- > Certified to the new UL 1741/IEEE 1547
- > 10 yr. standard warranty
- > Highest CEC efficiency in its class
- > Integrated load-break rated AC and DC disconnect switch
- > Integrated fused series string combiner
- > Sealed electronics enclosure & Opticool
- > Comprehensive SMA communications and data collection options
- > Ideal for residential or commercial applications
- > Sunny Tower compatible

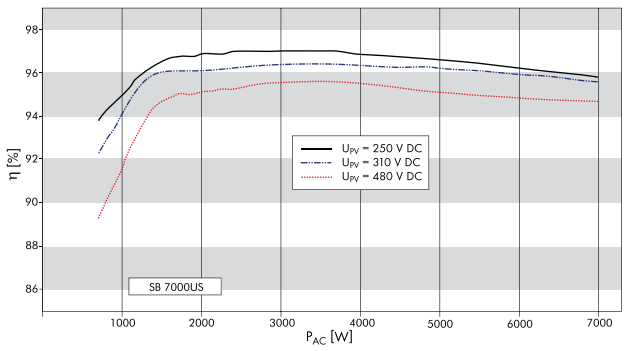
Sunny Boy 5000 / 6000 / 7000

The best in their class

SMA is proud to introduce our new line of inverters updated with our latest technology and designed specifically to meet the new IEEE 1547 requirements. The SB6000U and SB7000U are also compatible with SMA's new Sunny Tower. Increased efficiency means better performance and shorter payback periods. All three models are field-configurable for positive ground systems making them more versatile than ever. With over 500,000 fielded units, Sunny Boy has become the benchmark for PV inverter performance and reliability throughout the world.

	SB 5000US	SB 6000US	SB 7000US
Input Data (DC)			
Max. Recommended Array Input Power (DC @ STC)	6250 W	7500 W	8750 W
Max. DC Voltage	600 V	600 V	600 V
Peak Power Tracking Voltage	250 – 480 V	250 – 480 V	250 – 480 V
DC Max. Input Current	21 A	25 A	30 A
DC Voltage Ripple	< 5%	< 5%	< 5%
Number of Fused String Inputs	4	4	4
PV Start Voltage (adjustable)	300 V	300 V	300 V
Output Data (AC)			
AC Nominal Power	5000 W	6000 W	7000 W
AC Maximum Output Power	5000 W	6000 W	7000 W
AC Maximum Output Current (@ 208, 240, 277 V)	24 A, 20.8 A, 18 A	29 A, 25 A, 21.6 A	34 A, 29 A, 25.3 A
AC Nominal Voltage / Range	183 – 229 V @ 208 V 211 – 264 V @ 240 V 244 – 305 V @ 277 V	183 – 229 V @ 208 V 211 – 264 V @ 240 V 244 – 305 V @ 277 V	183 – 229 V @ 208 V 211 – 264 V @ 240 V 244 – 305 V @ 277 V
AC Frequency / Range	60 Hz / 59.3 Hz – 60.5 Hz	60 Hz / 59.3 Hz – 60.5 Hz	60 Hz / 59.3 Hz – 60.5 Hz
Power Factor	1	1	1
Efficiency			
Peak Inverter Efficiency	96.8 %	97.0 %	97.1 %
CEC weighted Efficiency	95.5 % @ 208 V 95.5 % @ 240 V 95.5 % @ 277 V	95.5 % @ 208 V 95.5 % @ 240 V 96.0 % @ 277 V	95.5 % @ 208 V 96.0 % @ 240 V 96.0 % @ 277 V
Mechanical Data			
Dimensions W x H x D in inches	18.4 x 24.1 x 9.5	18.4 x 24.1 x 9.5	18.4 x 24.1 x 9.5
Weight / Shipping Weight	143 lbs / 154 lbs	143 lbs / 154 lbs	143 lbs / 154 lbs
Ambient temperature range	–13 to +113 °F	–13 to +113 °F	–13 to +113 °F
Power Consumption: standby / nighttime	< 7 W / 0.25 W	< 7 W / 0.25 W	< 7 W / 0.25 W
Topology	PWM, true sinewave, current source	PWM, true sinewave, current source	PWM, true sinewave, current source
Cooling Concept	Convection with regulated fan cooling	Convection with regulated fan cooling	Convection with regulated fan cooling
Mounting Location Indoor / Outdoor (NEMA 3R)	●/●	●/●	●/●
Features			
LCD Display	●	●	●
Lid Color: aluminum / red / blue / yellow	●/❍/❍/❍	●/❍/❍/❍	●/❍/❍/❍
Communication: RS485 / Wireless	❍/❍	❍/❍	❍/❍
Warranty: 10-year	●	●	●
Compliance: IEEE-929, IEEE-1547, UL 1741, UL 1998, FCC Part 15 A & B	●	●	●
Specifications for nominal conditions	● Included ❍ Option – Not available		

Efficiency Curves

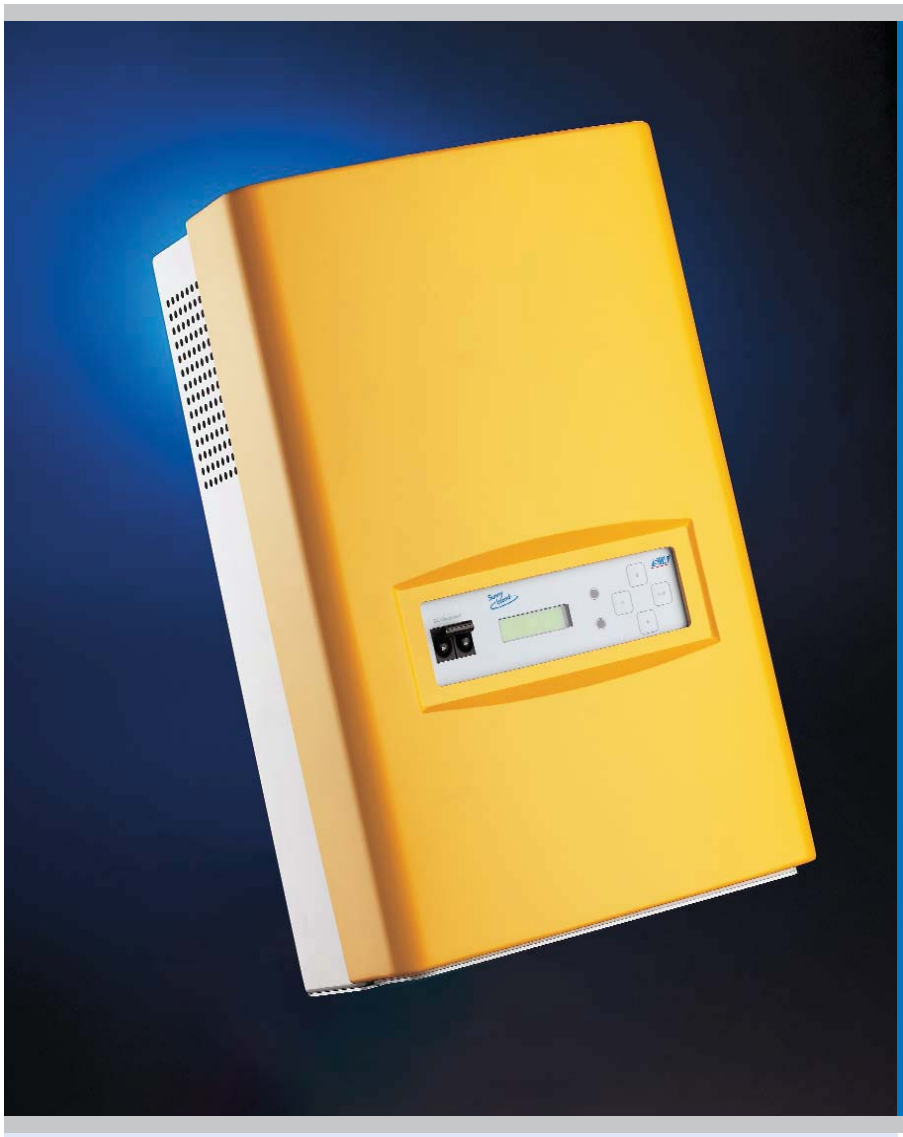


www.sma-america.com
Phone 530-273-4895
Toll Free 888-4SMAUSA

SMA America, Inc.

Sunny Island 4248U

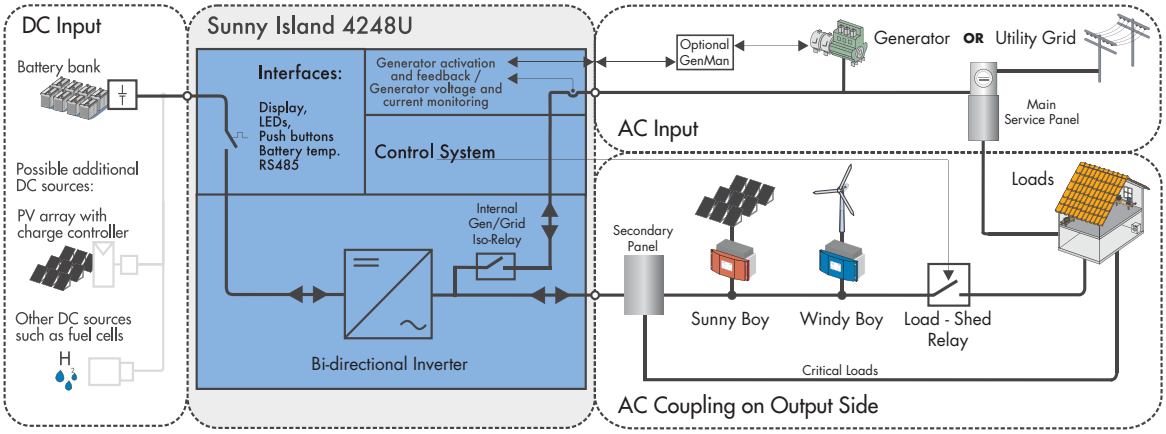
SMA's new off grid inverter - A technological leap into the future



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

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

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



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

The internal battery charger can supply up to 100A to the battery when in charge mode. Transition from charge to invert mode is a lightning fast 20ms, so even your computers will stay on-line. A pass-through relay with a rating of 60A at 120V is also included. Two Sunny Island 4248's may be 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

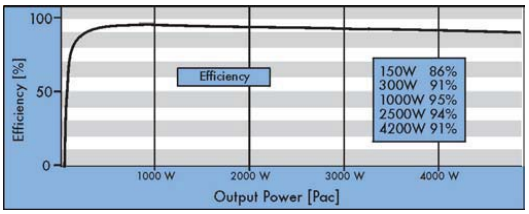
Nom. Battery Voltage:	$V_{DC,nom}$	48 V
Battery Voltage Range:	V_{DC}	41 - 63 V
Nom. AC Voltage:	$V_{AC,nom}$	120 V
AC Voltage Range:	V_{AC}	105 - 132 V
Nom. AC Frequency:	$f_{AC,nom}$	60 Hz
AC Input Charge Current:	$I_{AC,chrg}$	40A @ 25°C 28A @ 45°C
Max. AC pass through current (transfer relay):		60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

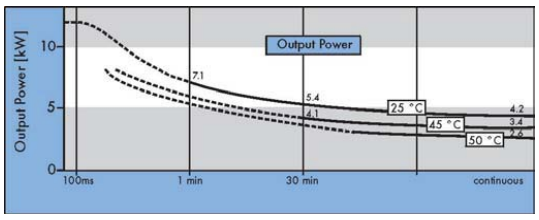
Temperature Range
-20°C to +45°C / -4.0°F to +113.0°F

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)





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Product Detail

HU362RB
SWITCH NOT FUSIBLE HD 600V 60A 3P NEMA3R

Product Characteristics | Digest Information | Docs & Literature | Pricing & Ordering

From the Digest

3-6	Heavy Duty Safety Switches: Not Fusible 600 Volt Class 3110

Documentation & Literature

Disclaimer: Not all of the product information below may apply to this particular part number. Please check the documentation to ensure proper application.

CAD Drawings

Heavy Duty Safety Switches Visible Blade Type 60 Ampere Enclosure - NEMA Type 1 General Purpose Nema Type 3R Rainproof	1897

Literature

H-200-SNC Solid Neutral Assembly	40269-883-03
Electrical Interlock Kit	40267-163-05
Electrical Interlock Kits Class 3110 Type EK1020-1, EK1020-2	40267-552-05
Neutral Assembly Installation and Replacement	40273-483-0303
F Series Safety Switches (Neutral Assembly Replacement)	40271-801-02
F Series Safety Switches (Arc Suppressor or Arc Shield Replacement)	40271-667-02
200 A, F-Series Safety Switches Lug Replacement	40273-712-05
F Series Safety Switches (Lug Replacement)	40271-800-04
Class J Fuse Adaptor Kit (Series E1 and E2 Heavy Duty Safety Switches)	40272-131-02
Heavy Duty Safety Switches	3110CT9601
F Series Safety Switches (Operating Handle Assembly Replacement)	40271-666-02

Pricing and Ordering Information

Category	00009 - Safety Switch, Heavy Duty, 2 & 3 Pole, 30-200 Amp, Outdoor
Discount Schedule	DE1
List Price	$584.00
Article Number	785901505617
Package Qty	1
Weight (lbs.)	15.45
Availability Code	S
Returnability	N

SECTION 16471B
LOADCENTERS TYPE BR
PART 1 GENERAL
1.01 SCOPE
A. The Contractor shall furnish and install deadfront loadcenters incorporating circuit breakers of the number, rating and type as specified herein and as shown on the contract drawings.
1.02 REFERENCES
A. The loadcenter and all components shall be designed, manufactured and tested in accordance with the latest applicable standards of UL, NEMA and NEC including:
1. UL 67 – Standards for Panelboards
2. UL 50 – Standards for Cabinets and Boxes
3. UL 489 – Standards for Molded Case Circuit Breakers
4. UL 869 – Standards for Service Equipment
5. Federal Specification W-C 375B – Circuit Breakers
1.03 SUBMITTALS – FOR REVIEW/APPROVAL
A. The following information shall be submitted to the Engineer:
1. Dimension outline drawing
2. Component list
3. Conduit entry/exit locations
4. Loadcenter ratings including:
a. Voltage
b. Continuous current
c. Short-circuit rating
d. Series combination rating
5. Major component ratings including:
a. Voltage
b. Continuous current
c. Interrupting ratings
6. Cable terminal sizes
7. Product data sheets
1.04 SUBMITTALS – FOR CONSTRUCTION
A. The following information shall be submitted for record purposes:
1. Final as-built drawings and information for items listed in Paragraph 1.04, and shall incorporate all changes made during the manufacturing process
2. Wiring diagrams
3. Certified production test reports
4. Installation information including equipment anchorage provisions
5. Seismic certification as specified
1.05 QUALIFICATIONS
A. The manufacturer of the assembly shall be the manufacturer of the major components within the assembly.
B. For the equipment specified herein, the manufacturer shall be ISO 9001 or 9002 certified.

C. The manufacturer of this equipment shall have produced similar electrical equipment for a minimum period of five (5) years. When requested by the Engineer, an acceptable list of installations with similar equipment shall be provided demonstrating compliance with this requirement.

D. Provide Seismic tested equipment as follows:

1. The equipment and major components shall be suitable for and certified to meet all applicable seismic requirements of the International Building Code (IBC) for zone 4 application. Guidelines for the installation consistent with these requirements shall be provided by the switchgear manufacturer and be based upon testing of representative equipment. The test response spectrum shall be based upon a 5% minimum damping factor, IBC: a peak of 2.45g's (3.2-11 Hz), and a ZPA of 0.98g's applied at the base of the equipment. The tests shall fully envelop this response spectrum for all equipment natural frequencies up to at least 35 Hz.

-- OR –

1. The equipment and major components shall be suitable for and certified to meet all applicable seismic requirements of the California Building Code (CBC) through zone 4 application. Guidelines for the installation consistent with these requirements shall be provided by the switchgear manufacturer and be based upon testing of representative equipment. The test response spectrum shall be based upon a 5% minimum damping factor, CBC: a peak of 2.15g's, and a ZPA of 0.86g's applied at the base of the equipment. The tests shall fully envelop this response spectrum for all equipment natural frequencies up to at least 35 Hz.

-- OR --

1. The manufacturer may certify the equipment based on a detailed computer analysis of the entire assembly structure and its components. Guidelines for the installation consistent with these requirements shall be provided by the switchgear manufacturer and be based upon testing of representative equipment. The equipment manufacturer shall document the requirements necessary for proper seismic mounting of the equipment

2. The following minimum mounting and installation guidelines shall be met, unless specifically modified by the above referenced standards.

a. The Contractor shall provide equipment anchorage details, coordinated with the equipment mounting provision, prepared and stamped by a licensed civil engineer in the state. Mounting recommendations shall be provided by the manufacturer based upon approved shake table tests used to verify the seismic design of the equipment.

b. The equipment manufacturer shall certify that the equipment can withstand, that is, function following the seismic event, including both vertical and lateral required response spectra as specified in above codes.

c. The equipment manufacturer shall document the requirements necessary for proper seismic mounting of the equipment. Seismic qualification shall be considered achieved when the capability of the equipment, meets or exceeds the specified response spectra.

1.06 REGULATORY REQUIREMENTS

A. The regulatory requirements shall conform to the following:

1. The loadcenters shall be UL labeled

1.07 DELIVERY, STORAGE AND HANDLING

A. Equipment shall be handled and stored in accordance with manufacturer's instructions.

1.08 OPERATION AND MAINTENANCE MANUALS

A. Equipment operation and maintenance manuals shall be provided with each assembly shipped, and shall include instruction leaflets and instruction bulletins for the complete assembly and each major component.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Eaton / Cutler-Hammer products

B. ~_____

C. _____

The listing of specific manufacturers above does not imply acceptance of their products that do not meet the specified ratings, features and functions. Manufacturers listed above are not relieved from meeting these specifications in their entirety. Products in compliance with the specification and manufactured by others not named will be considered only if pre-approved by the Engineer ten (10) days prior to bid date.

2.02 RATINGS

A. Loadcenters shall be rated for 240 volts ac and shall have short-circuit ratings as shown on the drawings or as herein scheduled, but not less than 10,000 amperes rms symmetrical.

B. Breakers shall be a minimum of 125-ampere frame. Breakers 15- through 125-ampere trip size shall take up the same pole spacing.

C. Loadcenters shall be labeled with a UL short-circuit rating. When series combination ratings are applied with integral or remote upstream devices, a label shall be provided. Series combination ratings shall cover all trip ratings of installed frames. It shall state the conditions of the UL series ratings including:

1. Size and type of upstream device
2. Branch devices that can be used
3. UL series short-circuit rating

2.03 CONSTRUCTION

A. Loadcenters shall be Cutler-Hammer type BR or approved equal meeting all ratings and features specified herein.

B. All interiors, with the exception of the branch circuit breakers, shall be completely factory assembled with main breakers, main lugs or no main device.

C. Interiors shall be designed so that circuit breakers can be replaced without disturbing adjacent units and without removing the main bus connectors and shall be designed so that circuits may be changed without machining, drilling, or tapping.

D. Physical means shall be provided to prevent the installation of more over-current devices than that number for which the enclosure was designed, rated and approved. Half-size breakers shall have a UL listed rejection tab over the line terminals. Loadcenter interiors must have notched stabs to accept these rejection tab class CTL breakers, if required and

approved.
E. Where shown on the drawings, loadcenters shall meet the following for Riser Panel construction:
1. Riser Panels shall have the interior offset to either side to allow for NEC approved gutter tapping of the riser cable inside the loadcenter. Insulated gutter taps shall be of type and quantity approved by the loadcenter manufacturer
2. Where drawings call for a riser panel configuration other than commercially available, the contractor shall supply a gutter/junction box attached to the side of the loadcenter. The gutter/junction box must be made by the same manufacturer of the loadcenter and incorporate an overlapping trim providing a neat installation with no gaps between the two. A bushing shall be supplied to protect the cables passing between the two enclosures
2.04 BUS
A. Bus bars for the main and cross connectors shall be [tin-plated aluminum] [copper] in accordance with UL standards. Busing shall be braced throughout to conform to industry standard practice governing short-circuit stresses in loadcenters. Bus bars shall be mounted to a rigid metal backpan.
B. Neutral bus shall have a suitable lug for each outgoing feeder requiring a neutral connection that is the same ampacity as the branch circuit.

2.05 WIRING/TERMINATION
A. All wire connectors and terminals shall be of the anti-turn solderless type and shall be suitable for copper or aluminum wire of the sizes indicated. All connectors must meet the “Requirements for Wire Connectors and Soldering Lugs” as stated in UL 486B.
B. All loadcenters where marked shall be suitable for use with 60/75 degrees C rated wire.
C. Where loadcenters are used in a Riser panel construction, adequate space shall be provided to meet NEC wire bending requirements. Additionally, an approved gutter tap lug kit shall be provided. Contractor installation of the riser panel must also comply with NEC 374-8(a).
2.06 CIRCUIT BREAKERS
A. Circuit breakers shall be molded case type. Circuit breakers shall have four-rivet construction. Multi-pole circuit breakers shall be of a stack pole design to provide electrical phase isolation.
B. Each pole of the circuit breaker shall provide inverse time delay overload and instantaneous short-circuit protection by means of both thermal and magnetic sensors.
C. The circuit breaker calibration shall not be affected by environmental changes in relative humidity. The thermal bimetal element shall be welded to the steel frame and calibration shall be set independent of the molded case, by computer-controlled equipment.
D. All circuit breakers shall be operated by a toggle-type handle and multi-pole circuit breakers shall have an internal common trip mechanism. The circuit breakers shall incorporate trip mechanisms that are mechanically trip-free from the handle. The handle position shall provide good visual trip indication.

E. Contacts shall be of non-welding silver alloy.
F. All circuit breakers shall have the breaker's ampacity printed on each handle, and shall be easily readable. Provide unique color-coded cases that indicate the UL listed 10 kA or 22 kA interrupting ratings. Breakers shall be usable as main or branch disconnect devices.
G. All circuit breakers shall be molded case thermal-magnetic quick-make/quick-break, over-toggle-type. Loadcenters shall be suitable for use in systems having a short-circuit capacity of [10,000] [22,000] [25,000] [42,000] amperes rms symmetrical at the loadcenter location as indicated on the drawings.
H. Branch circuit breakers may also be used in the 1/2-inch per pole ratings that include 2-pole one-inch wide modules and 4-pole two-inch wide modules. 2-pole circuit breakers must incorporate a common trip mechanism. The exclusive CTL rejection tab feature shall be provided to limit the number of branch devices for a loadcenter to 42, in compliance with NEC Article 384-15.
I. Circuit breakers shall be completely enclosed in a molded case of thermoset material. No internal aluminum parts shall be used. All internal ferrous parts shall be plated to prevent corrosion.
J. All terminals shall be listed for use with copper or aluminum conductors. Terminals shall be of the box-lug or clamp type design. The terminals shall meet UL 486B requirements and shall be suitable for use with either 60 degrees C or 75 degrees C wire.
K. The calibrated bimetal assembly shall be mechanically isolated from the load terminal using a flexible braided copper shunt wire, such that movement of the terminals due to twisting and overtorquing does not affect breaker calibration.
L. Breakers shall be SWD rated and/or HACR rated as required.
M. Where indicated on the drawings, a branch circuit breaker with shunt trip shall be provided.
N. Where indicated on the drawings, ground fault protection circuit breakers of the following type shall be provided:
1. A type GFCB 1- and 2-pole people protector protects against line-to-ground and grounded neutral faults in the 4 to 6 milliampere range
2. A type GFEP 1- and 2-pole equipment protector protects against line-to-ground faults in the 30 milliampere range
O. Where indicated on the drawings supply arc fault circuit interrupters (AFCI) or arc fault circuit interrupters with ground fault circuit interruption (AFCI w/GFCI). The breaker shall provide parallel arc detection and protection in addition to overload and short-circuit protection. AFCI breakers shall be "Classified for mitigating the effects of arcing faults" or conforming to UL Standard 1699 and as defined by Article 210-12 of Section A of the 1999 NEC.
P. Main Circuit Breakers greater than 125 amperes shall be a molded case design. Main breakers utilizing 4-pole bundled mains are not permitted. Single-phase main breakers 200 amperes and less shall have a side-to-side toggle mechanism allowing for top or bottom mounting.

2.07 ENCLOSURES
A. Loadcenter shall have NEMA 1 general purpose or NEMA 3R rainproof enclosures as indicated on the drawings and shall be combination flush/surface mounted except where noted.
B. Boxes shall be made from cold rolled code gauge galvanized sheet steel having multiple knockouts except where noted. Rainproof boxes shall use galvanized steel or an approved coating system which meets or exceeds standards for outdoor type NEMA 3R enclosures. Boxes shall be of sufficient size to provide at least a minimum code gutter space on all sides.
C. The interior shall have an easy adjustment feature for flush applications.
D. Boxes shall be factory assembled into a single rigid structure.
E. Unless otherwise noted on drawings, hinged doors covering all circuit breaker handles shall be included in all trims. Trim doors shall not uncover any live parts in making the circuit breaker handles accessible. Doors shall have a manually operated spring latch. If key locks are required, all locks shall be keyed alike.
F. Combination trims for flush and surface panels shall be flat and shall overlap the box by at least 5/8 inch all around. Trims shall be mounted by a screwdriver without the need for special tools.
2.08 NAMEPLATES
A. Blank legends, approximately one-inch square, suitable for marking by pen or pencil shall be provided next to each breaker position.
2.09 TRANSIENT VOLTAGE SURGE SUPPRESSION
A. Where indicated on the drawings, provide a 120/240-volts ac [Clipper Home Surge Protector Device] [plug-in surge protection device].
B. The Clipper Home Surge Protector shall be supplied in its own rugged steel enclosure and must be suitable for either surface or flush mounting external of the loadcenter. The device shall provide surge protection for the loadcenter as well as protection for: two (2) incoming telephone lines and one (1) incoming coaxial cable. The surge protector shall be installed in accordance with NEC Article 280 and be listed under UL 1449, (2nd Edition), and UL 497A. The units shall be CSA certified and be tested to meet ANSI/IEEE Category B3 and C3 levels. The surge protector shall incorporate a surge plane design to facilitate a common point of grounding for all connected power, telephone and coaxial incoming conductors. The device shall provide as a minimum, the following protection:
1. Up to 39 kA surge current protection per phase for transients on the incoming ac line
2. Up to 10 kA surge protection per pair for telephone lines
3. Up to 5 kA line to shield (ground) protection for coaxial conductors
-- OR --
B. The surge protection device shall be capable of plugging onto a maximum of two adjacent spaces in single-phase loadcenter. The device shall provide, as a minimum, up to 10 kA surge current protection per phase for transients on the incoming line.
C. Surge protection devices must be equipped with LEDs to indicate proper functioning of the internal electronics.

2.10 FINISH

A. Trims shall be bonderized and finished with a medium light gray ANSI 61 enamel. The finish paint shall be of a type to which field applied paint will adhere.

PART 3 EXECUTION

3.01 FACTORY TESTING

A. The standard factory tests shall be performed on the equipment provided under this section. All tests shall be in accordance with the latest version of UL and NEMA.

3.02 INSTALLATION

A. The equipment shall be installed in accordance with manufacturer's recommendations.

B. The equipment shall conform to all NEC and local codes.

MSDS

MATERIAL SAFETY DATA SHEET

SECTION I: CHEMICAL PRODUCT AND COMPANY IDENTIFICATION

PRODUCT IDENTITY: Sealed, Lead-Acid Battery **CDID:** LLP Valve Regulated Lead Acid Battery Series	**MANUFACTURER NAME: INTERSTATE BATTERIES** **ADDRESS:** 12770 Merit Drive Suite 400 Dallas, TX 75087 **TELEPHONE:** (888) 772-3600

24 HOUR EMERGENCY TELEPHONE: (CHEM TEL) 1-800-255-3924
IN CASE OF MEDICAL EMERGENCY CALL 911 FOR EMERGENCY SERVICE

SECTION II: COMPOSITION / INFORMATION ON INGREDIENTS

NOTE: The Interstate PowerCare LLP Lead Acid batteries are a sealed non-spillable design. Under normal use and handling the customer has no contact with the internal components of the battery or the chemical hazards. Under normal use and handling these batteries do not emit regulated or hazardous substances.

HAZARDOUS COMPONENT	CAS#	OSHA PEL	ACGIH TLV	% BY WEIGHT
^Lead & Lead Components	7439-92-1	0.05mg/m3	0.15mg/m3	72-73%
^Sulfuric Acid	7664-93-9	1.0mg/m3	1.0mg/ m3	7-8%
Tin	7440-31-5	2.0mg/m3	2.0mg/m3	< .01%
Non-Hazardous Contents				18-21%

Percentages of compounds are dependent upon the model of the battery and the state of charge/discharge.

^ SECTION 311, 312 and 313 of the Emergency Planning and Community Right-to-Know Act (EPCRA) (40 CFR 372) LISTED TOXIC CHEMICALS.

SECTION III: HAZARDS IDENTIFICATION

HMIS III Rating	Health: **3*** (* Chronic hazard)	Flammability: **0**	Reactivity: **2**	Icons: **eye, skin, respiratory, water reactive**
NFPA RATING:	Health: **3**	Flammability: **0**	Reactivity: **2**	Other: **W**

TARGET ORGANS: Skin, Eyes, Upper Respiratory Tract	**ROUTES OF ENTRY:** Inhalation **X** Skin **X** Ingestion **X**

HEALTH HAZARDS (ACUTE AND CHRONIC):
ACUTE: ACID /Battery Electrolyte: Tissue destruction on contact with acid. May cause 2nd and 3rd degree burns or blindness with prolonged contact. Ingestion will cause corrosive burns on contact. May be fatal if swallowed.
CHRONIC: Inhalation of acid mists may cause upper respiratory irritation.
SIGNS AND SYMPTOMS: Irritation and burning of exposed tissues.

MEDICAL CONDITIONS AGGRAVATED BY EXPOSURE: Respiratory disorders may be aggravated by prolonged inhalation of acid mists.

California Proposition 65 Warning *– Battery posts, terminals, and related accessories contain lead and lead compounds, chemicals known to the State of California to cause cancer and reproductive harm. Batteries also contain other chemicals known to the State of California to cause cancer. The only possible exposure would be the terminal posts on LLP models 150, 200 and 300. LLP models 500 through 1440 do not have lead terminal posts, but are a tin-plated brass terminal. Wash hands thoroughly after handling batteries and before eating, drinking or smoking.*

SECTION IV: FIRST AID MEASURES

EMERGENCY AND FIRST AID PROCEDURES:

SKIN / EYES	INGESTION	INHALATION
• Flush with water for 15 minutes • Remove contaminated clothing • If irritation continues, seek medical attention	• If conscious, drink large quantities of milk or water • Do not induce vomiting • Give CPR if breathing has stopped • Seek medical attention immediately	• Remove to fresh air • Give oxygen or artificial respiration if needed • Get immediate medical attention

SECTION V: FIREFIGHTING MEASURES

FIRE AND EXPLOSIVE PROPERTIES:

Flash Point: N/A	**Flammable Limits**:	LEL: 4.10%	UEL: 74.20%

UNUSUAL FIRE AND EXPLOSION HAZARDS: Hydrogen and oxygen gases are generated in cells during normal battery operation or when on charge. (Hydrogen is flammable and oxygen supports combustion). These gases enter the air through the vent caps. To avoid risk of fire or explosion, keep sparks and other sources of ignition away from the battery. Do not allow metal objects to simultaneously contact both the positive and negative terminals of batteries. Ventilate area well.

EXTINGUISHING MEDIA: Dry Chemical, foam, Halon, or Carbon Dioxide

SPECIAL FIREFIGHTING PROCEDURES: If batteries are on charge, turn off power. Use positive pressure, self-contained breathing apparatus (SCBA) in fighting fire. Water applied to electrolyte generates heat and causes it to splatter. Ventilate the area well. Acid protective clothing is recommended.

SECTION VI: ACCIDENTAL RELEASE MEASURES

STEPS TO BE TAKEN IF BATTERY IS BROKEN: Neutralize exposed battery parts with soda ash (sodium bicarbonate) until fizzing stops. The pH should be neutral at 6-8. Collect residue in a suitable container. Residue may be hazardous waste. Place the broken battery in a heavy gauge plastic bag or other non-metallic container. Provide adequate ventilation, hydrogen gas may be given off during neutralization.

SECTION VII: HANDLING AND STORAGE

Store in a cool, dry area away from combustibles. DO NOT store or charge in sealed, unventilated areas. Avoid over-heating and overcharging. Do not use organic solvents or other than recommended chemical cleaners on the batteries.

SECTION VIII: EXPOSURE CONTROLS / PERSONAL PROTECTION

ENGINEERING CONTROLS: General room ventilation is sufficient during normal use and handling. DO NOT install these batteries in a sealed, unventilated area. Recommend 2-3 room air changes per hour to prevent hydrogen gas buildup.

PERSONAL PROTECTIVE EQUIPMENT (IN THE EVENT OF BATTERY BREAKAGE):

Eye Protection = chemical goggles or safety glasses with sideshields and a full-face shield.

Protective Gloves = rubber or neoprene

Respiratory Protection = NIOSH approved acid mist respirator, if OSHA PEL is exceeded or respiratory irritation occurs.

Other Protective Equipment = acid resistant boots, apron or clothes.

WORK PRACTICES: DO NOT wear metallic jewelry when working with batteries. Use non-conductive tools only. Discharge static electricity prior to working on a battery by touching a grounded surface in the vicinity of the batteries, but away from cells. Batteries are heavy. Serious injury can result from improper lifting or installation. DO NOT lift, carry, install or remove cells by lifting or pulling the terminal posts for safety reasons and because terminal posts and post seals may be damaged. DO NOT use nylon cloths or wear nylon overalls when working with batteries as these can create static electricity. Maintain an eyewash, fire extinguisher and emergency communication device in the work area. Wash hands thoroughly after handling.

SECTION IX: PHYSICAL AND CHEMICAL PROPERTIES	
ACID: Appearance / Odor: At normal temperatures: colorless, oily fluid / acrid odor when hot.	
Boiling Point: Electrolyte 110º C – 112º C	Vapor Pressure: Electrolyte 11.7 mm Hg. At 20º C
Vapor Density (air = 1): Electrolyte 3.4	Melting Point: N/A
Evaporation Rate (water = 1): N/A	Solubility in water: Lead, Lead Oxide and Lead Sulfate Acid insoluble in water, Sulfuric Acid is 100% soluble in water.
Specific Gravity (contained in battery): Electrolyte 1.300+/-.010	

SECTION X: STABILITY AND REACTIVITY
STABILITY: This battery and contents are stable under normal conditions.
CONDITIONS TO AVOID: Overheating or overcharging may result in acid mist / Hydrogen generation.
INCOMPATIBILITY (MATERIALS TO AVOID): Strong alkaline materials, conductive metals, organic solvents, sparks or open flame.
HAZARDOUS DECOMPOSITION OR BYPRODUCTS: Hydrogen gas may be generated in an overcharged condition, in fire or at very high temperatures. In fire may emit CO, CO2 and Sulfur Oxides.
HAZARDOUS POLYMERIZATION WILL NOT OCCUR.

SECTION XI: TOXICOLOGICAL INFORMATION - SULFURIC ACID		
The "LLP Series" batteries are a sealed, recombinant design. Under normal use and handling the customer has no contact with the internal components of the battery or the chemical hazards. Under normal use and handling these batteries do not emit regulated or hazardous substances**.**		
LD 50: Administration Route: Oral	Dose: **2140mg/kg**	Test Animal: **Rat**
LDLo: Administration Route: **Unreported**	Dose: **135mg/kg**	Test Animal: **Man**
LC50: Administration Route: **Inhalation** Dose: **510mg/m3**		Test Animal: **Rat**
CARCINOGENICITY: The International Agency for Research on Cancer (IARC) has classified "strong inorganic acid mists containing sulfuric acid" as a category 1 carcinogen (inhalation), a substance that is carcinogenic to humans. The National Toxicology Program (NTP) has designated strong inorganic sulfuric mists as a “Known Human Carcinogen.” This classification does not apply to the liquid forms of sulfuric acid contained within the battery. Misuse of the product, such as overcharging, may result in the generation of sulfuric acid mist at high levels.		

SECTION XII: ECOLOGICAL INFORMATION
Lead and its compounds can pose a threat if released to the environment. See waste disposal method in Section XIII.

SECTION XIII: DISPOSAL CONSIDERATIONS
WASTE DISPOSAL METHOD: This battery is recyclable. It is illegal to dispose of lead-acid batteries by any means other than recycling. Interstate PowerCare provides an environmentally responsible lead acid battery collection and recycling program. Contact your local Interstate PowerCare sales representative for more information.
HAZARDOUS WASTE CODES: **D002, D008**

SECTION XIV: TRANSPORTATION INFORMATION		
All DOMESTIC SHIPMENTS: BATTERIES – WET, NON-SPILLABLE, ELECTRIC STORAGE, UN 2800		
FOR WATER EXPORT AND CANADIAN SHIPMENTS:		
FOR AIR: NON-SPILLABLE, NOT REGULATED. UNITS MEET A67 SPECIAL PROVISION OF IATA		
IMO = UNREGULATED	UN OR NA IDENTIFICATION: UN-2800	
PROPER DOT SHIPPING NAME: Batteries, Wet, Non-spillable, Electric Storage		
HAZARD CLASS: 8	PACKING GROUP: III	
LABEL: Corrosive (NOT REQUIRED FOR CANADA)	NO PLACARDS OR LABELS REQUIRED.	

SECTION XV: OTHER INFORMATION
This information has been compiled from sources considered to be dependable and is, to the best of our knowledge, accurate and reliable as of the date compiled. No representation, warranty (expressed or implied) or guarantee is made to the accuracy, completeness or reliability of the information contained herein.

MSDS Preparation / Review Date: 03/05/04 Revision Number: 1 Prepared by: D. Elledge

MATERIAL SAFETY DATA SHEET (U.S.)

Product Name: **CaesarStone® and Concetto®**
MSDS Date: December 7, 2006

1. Product and Company Description

U.S. Quartz Products
CaesarStone USA
11830 Sheldon St.
Sun Valley, CA 91352
Tel: 818.394.6000 or 877.978.2789
Fax: 818.394.6006
info@caesarstoneus.com

For Product Information/Emergency Contact: U.S. Quartz Products: 818.394.6000 or 877.978.2789

Product Use: CaesarStone Quartz Surfacing and Concetto Natural Stone Surfacing

2. Hazards Identification

Emergency Overview:

Appearance/Odor: Multi-colored engineered stone with no odor.

Potential Health Effects:

Acute Eye: Product in finished form does not present a health hazard via this route of entry. Dusts and flying particles generated during cutting, grinding and forming may cause irritation and injury.

Acute Skin: Dusts generated from this product may cause skin irritation.

Acute Inhalation: Dusts from product may cause irritation to respiratory tract, nose, throat and lungs.

Acute ingestion: Not considered a potential health hazard via this route of entry. This product may cause gastrointestinal irritation if dusts are swallowed.

Chronic Exposure: The adverse health effects from crystalline silica exposure - silicosis, cancer, scleroderma, tuberculosis, and nephrotoxicity - are chronic effects.

Aggravation of Pre-existing Conditions: Not Determined.

3. Hazardous Chemical Composition

Component	CAS#	% Composition
Crystalline silica (quartz) and other natural stone	14808-60-7	>90
Resins and trace minerals including Al2O3, Fe203, TiO2, CaO, MgO, Na2O, K2), PtO5	N/A	Balance

4. First Aid Measures

Eye Exposure: Immediately flush eyes with copious amounts of water for a minimum of 15 minutes. Seek immediate medical attention if adverse effect occurs.

Skin Exposure: Wash skin with soap and water. Remove exposed or contaminated clothing, taking care not to contaminate eyes. Seek medical attention if adverse effect occurs.

Inhalation: Remove person to fresh air. If necessary, use artificial respiration.

Ingestion: If the material is swallowed, seek medical attention or advice.

5. Fire Fighting Measures

Autoignition: At temperatures >490°C, this product will auto ignite.

Flash Point: 490°C

Flammability Limits (vol/vol%): **Lower:** ND **Upper:** ND

Extinguishing Media: Use appropriate extinguishing media for surrounding fire.

Special Fire Fighting Procedures: Firefighters should wear full fire-fighting turn-out gear including NIOSH-approved self-contained breathing apparatus with full facepiece operated in the pressure demand or other positive pressure mode.

Unusual Fire and Explosion Hazards: When heated to decomposition, may release various hydrocarbons, carbon dioxide, carbon monoxide and water. Fumes of metal oxides and mica particles could also be released.

6. Accidental Release Measures

Cleanup and Disposal of Spill: Solid slabs can simply be gathered as necessary. If large amounts of dust or wastes are created by cutting process, vacuum or sweep up material avoiding dust generation or dampen spilled material with water to avoid airborne dust. Wear sufficient respiratory protection and protective clothing where necessary. If large quantities of this material enter the waterways contact the Environmental Protection Authority, or local Waste Management Authority. Dispose of waste in accordance with local, state and federal regulations.

7. Handling and Storage

Handling/Storage: Avoid breathing dust. Wash hands before eating, drinking, smoking, or using toilet facilities. Wash thoroughly after work using soap and water. Good industrial hygiene practices should be followed when handling this material. Product is heavy and breakable; handle with care to avoid injury and prevent damage.

8. Exposure Controls / Personal Protection

Exposure Guidelines:

Component	ACGIH	NIOSH	OSHA-PELs
Crystalline silica	0.025 mg/m3 TWA (respirable fraction)	0.05 mg/m3 TWA (respirable dust)	((250)/(%SiO2 + 5) mppcf TWA (respirable)); ((10)/(%SiO2 + 2) mg/m3 TWA (respirable)); ((30)/(%SiO2 + 2) mg/m3 TWA (total dust))

Engineering Controls: Ventilation must be adequate to maintain the ambient workplace atmosphere below the exposure limit(s) outlined in the MSDS.

Respiratory Protection: If respiratory protection is needed, use only protection authorized in the U.S. Federal OSHA Standard (29 CFR 1910.134), applicable U.S. State regulations, or the Canadian CSA Standard Z94.4-93 and applicable standards of Canadian Provinces.

Eye / Face Protection: During cutting, grinding or sanding operations safety glasses with side shields or goggles should be worn.

Skin Protection: During cutting, grinding or sanding operations use body protection appropriate for task including work gloves if handling sharp or rough edges and steel-toed shoes if lifting product.

9. Physical and Chemical Properties

Physical Appearance: Multi-colored engineered stone
Odor: None
pH: NA
Specific Gravity/Density: 2.4
Water Solubility: Insoluble
Melting Point: NA
Freezing Point NA
Boiling Point: NA
Vapor Pressure: NA
Percent Volatiles by Volume: NA
Evaporation Rate: NA
Viscosity: ND
Flash Point: 490°C.
Explosion Limits: Lower: ND Upper: ND
Autoignition Temp: At temperatures >490°C, this product will auto ignite.

10. Stability and Reactivity

Chemical Stability: Stable

Conditions to Avoid: None

Materials / Chemicals to Be Avoided: This product is incompatible with hydrofluoric acid. Silica will dissolve in hydrofluoric acid and produce the corrosive gas silicon tetrafluoride.

Hazardous Decomposition Products: Upon decomposition, various hydrocarbons, carbon dioxide, carbon monoxide fumes, and water may be released.

Hazardous Polymerization: Will not occur.

11. Toxicological Information

Acute Effects

For Crystalline Silica: Inhalation (human) LCLo: 0.3mg/m3/10Y
Inhalation (human) TCLo: 16mppcf/ 8H/17.9Y
Intermittent; focal fibrosis, (pneumoconiosis), cough, dyspnoea.
Inhalation (rat) TCLo: 50mg/m3/6H/71W
Intermittent; liver - tumors

Chronic Effects

Silicosis: The major concern is ***silicosis***, caused by the inhalation and retention of respirable crystalline silica dust. Symptoms include:

Chronic or ordinary silicosis is the most common form of silicosis, and can occur after many years of exposure to relatively low levels of airborne respirable crystalline silica dust. It is further defined as either simple or complicated silicosis.

Simple silicosis is characterized by lung lesions (shown as radiographic opacities) less than 1 centimeter in diameter, primarily in the upper lung zones. Often, simple silicosis is not associated with symptoms, detectable changes in lung function, or disability.

Simple silicosis may be progressive and may develop into complicated silicosis or progressive massive fibrosis (PMF). Complicated silicosis or PMF is characterized by lung lesions (shown as radiographic opacities) greater than 1 centimeter in diameter. Although there may be no symptoms associated with complicated silicosis or PMF, the symptoms, if present, are shortness of breath, wheezing, cough and sputum production. Complicated silicosis or PMF may be associated with decreased lung function and

may be disabling. Advanced complicated silicosis or PMF may lead to death. Advanced complicated silicosis or PMF can result in heart disease secondary to the lung disease (cor pumonale).

Accelerated silicosis can occur with exposure to high concentrations of respirable crystalline silica over a relatively short period; the lung lesions can appear within five (5) years of the initial exposure. The progression can be rapid. Accelerated silicosis is similar to chronic or ordinary silicosis, except that the lung lesions appear earlier and progression is more rapid.

Acute silicosis can occur with exposures to very high concentrations of respirable crystalline silica over a very short time period, sometimes as short as a few months. The symptoms of acute silicosis include progressive shortness of breath, fever, cough and weight loss. Acute silicosis is fatal.

Carcinogenicity: The International Agency for Research on Cancer **(IARC)** concluded that "crystalline silica inhaled in the form of quartz or cristobalite from occupational sources is *carcinogenic to humans* (Group 1)." The National Toxicology Program **(NTP)**, in its *Ninth Annual Report on Carcinogens*, concluded that silica, crystalline (respirable) is "known to be a carcinogen, based on sufficient evidence in experimental animals and in humans." The U.S. Occupational Safety and Health Administration **(OSHA)** does regulate crystalline silica (quartz) as a carcinogen.

The American Thoracic Society position on the issue of silica carcinogenicity was published in *Adverse Effects of Crystalline Silica Exposure*, American Journal of Respiratory and Critical Care Medicine, Vol. 155, pp. 761-765 (1997). The official statement concluded that "The available data support the conclusion that silicosis produces increased risk for bronchogenic carcinoma. The cancer risk may also be increased by smoking and other carcinogens in the workplace."

Scleroderma: There is evidence that exposure to respirable crystalline silica or that the disease silicosis is associated with the increased incidence of scleroderma, an immune system disorder manifested by a fibrosis (scarring) of the lungs, skin and other internal organs.

Tuberculosis: Individuals with silicosis are at increased risk to develop tuberculosis, if exposed to persons with tuberculosis.

Nephrotoxicty: There are several recent studies suggesting that exposure to respirable crystalline silica or that the disease silicosis is associated with the increased incidence of kidney disorders.

Mutagenicity: No Data

Reproductive Effects: No Data

Developmental Effects: No Data

12. Ecological Information

Environmental Fate: Not Determined

Environmental Toxicity: Not Determined

ISO 14001 Certification: CaesarStone is ISO 14001 certified for Environmental Management Systems.

13. Disposal Considerations

Waste Disposal Method: Whatever cannot be saved for recovery or recycling should be managed in an appropriate and approved waste disposal facility. Processing, use or contamination of this product may change the waste management options. State and local disposal regulations may differ from federal disposal regulations. Dispose in accordance with federal, state and local requirements.

14. Transportation Information

US Department of Transportation	**Proper Shipping Name**	Not Regulated
	Hazard Class	Not Regulated
	ID Number	Not Regulated
	Packing Group	Not Regulated

15. Regulatory Information

Federal Regulations:

SARA Title III Hazard Classes:

Fire Hazard: No

Reactive Hazard: No

Release of Pressure: No

Acute Health Hazard: No

Chronic Health Hazard: Yes

TSCA: All components of this product are on the TSCA inventory or are exempt from TSCA Inventory requirements

U.S. State Regulations: California Prop 65 List: Crystalline silica (quartz) is classified as a substance known to the state of California to be a carcinogen.

16. Other Information

National Fire Protection Association NFPA(R) and Hazardous Materials Identification System (HMIS) Hazard Ratings:

Health Hazard:	1
Flammability:	0
Reactivity:	0

Key Legend Information:
N/A – Not Applicable
ND – Not Determined
ACGIH – American Conference of Governmental Industrial Hygienists
OSHA – Occupational Safety and Health Administration
TLV – Threshold Limit Value
IDLH – Immediately Dangerous to Life and Health
PEL – Permissible Exposure Limit
TWA – Time Weighted Average
STEL – Short Term Exposure Limit
NTP – National Toxicology Program
IARC – International Agency for Research on Cancer

The information contained herein is based on the data available to us and is believed to be correct. However CaesarStone and U.S. Quartz Products make no warranties expressed or implied regarding the accuracy of these data or the results to be obtained from the use thereof.

The MSDS format adheres to the standards and regulatory requirements of the United States and may not meet regulatory requirements in other countries.

Material Safety Data Sheet

1,3-PROPANEDIOL ALL IN SYNONYM LIST SOR003

SOR003 Revised 7-AUG-2001

CHEMICAL PRODUCT/COMPANY IDENTIFICATION

Material Identification

CAS Number	: 504-63-2
Formula	: C3H8O2
Molecular Weight	: 76.09
CAS Name	: 1,3-Propanediol

Tradenames and Synonyms

Trimethylene Glycol
TMG
3G
PDO
Refined PDO
Propane-1,3-Diol
1,3-Propylene Glycol
1,3-Dihydroxypropane
2-(Hydroxymethyl) Ethanol

Company Identification

MANUFACTURER/DISTRIBUTOR

DuPont 3GT Business Venture
Barley Mill Plaza 23
P.O. Box 80023
Wilmington, DE 19880-0023

PHONE NUMBERS

Product Information	: 1-800-441-7515
Transport Emergency	: CHEMTREC 1-800-424-9300
Medical Emergency	: 1-800-441-3637

COMPOSITION/INFORMATION ON INGREDIENTS

Components

Material	CAS Number	%
1,3-Propanediol	504-63-2	>99.7

HAZARDS IDENTIFICATION

Potential Health Effects

1,3-PROPANEDIOL

Based on animal data, skin contact with 1,3-Propanediol may cause dermatitis with itching or rash.

Based on animal data, no adverse effects are expected from incidental eye contact with 1,3-Propanediol.

Based on animal data, ingestion of 1,3-Propanediol may cause liver abnormalities.

Carcinogenicity Information

None of the components present in this material at concentrations equal to or greater than 0.1% are listed by IARC, NTP, OSHA or ACGIH as a carcinogen.

FIRST AID MEASURES

First Aid

INHALATION

If inhaled, remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Call a physician.

SKIN CONTACT

Flush skin with water after contact. Wash contaminated clothing before reuse.

EYE CONTACT

In case of contact, immediately flush eyes with plenty of water for at least 15 minutes. Call a physician.

INGESTION

If swallowed, do not induce vomiting. Immediately give 2 glasses of water. Never give anything by mouth to an unconscious person. Call a physician.

Notes to Physicians

No antidote or specific regimens known. Use supportive measures as needed.

FIRE FIGHTING MEASURES

Flammable Properties

Flash Point : 131 C (268 F)
Method : Cleveland Open Cup - COC.

This material will burn. It is not an explosion hazard.

Extinguishing Media

Water, Foam, Dry Chemical, CO2, Water Spray.

Fire Fighting Instructions

Evacuate personnel to a safe area. Keep personnel removed and upwind of fire. Wear self-contained breathing apparatus.

Avoid breathing vapor. Use water spray to knock down vapor.

ACCIDENTAL RELEASE MEASURES

Safeguards (Personnel)

NOTE: Review FIRE FIGHTING MEASURES and HANDLING (PERSONNEL) sections before proceeding with clean-up. Use appropriate PERSONAL PROTECTIVE EQUIPMENT during clean-up.

Initial Containment

Dike spill. Prevent material from entering sewers, waterways, or low areas.

Spill Clean Up

Soak up with sawdust, sand, oil dry or other absorbent material.

Accidental Release Measures

Ventilate area and wash spill site after material pickup is complete.

HANDLING AND STORAGE

Handling (Personnel)

Avoid breathing vapors or mist. Avoid contact with eyes, skin or clothing. Wash thoroughly after handling.

Avoid prolonged or repeated exposure.

(HANDLING AND STORAGE - Continued)

Storage

Keep container tightly closed. Keep away from heat, sparks and flames. Store in a cool, dry place.

EXPOSURE CONTROLS/PERSONAL PROTECTION

Engineering Controls

Keep container tightly closed. Mechanical exhaust required. Keep away from heat and open flame. Store in a cool dry place.

Personal Protective Equipment

EYE/FACE PROTECTION

Wear safety glasses or coverall chemical splash goggles.

RESPIRATOR

Where there is potential for airborne exposure, wear appropriate NIOSH approved respiratory protection.

PROTECTIVE CLOTHING

Where there is potential for skin contact have available, and wear as appropriate, impervious gloves, apron, pants, and jacket.

Exposure Guidelines

Exposure Limits
1,3-PROPANEDIOL ALL IN SYNONYM LIST SOR003
AEL * (DuPont) : 5 mg/m3, 8 & 12 Hr. TWA

* AEL is DuPont's Acceptable Exposure Limit. Where governmentally imposed occupational exposure limits which are lower than the AEL are in effect, such limits shall take precedence.

PHYSICAL AND CHEMICAL PROPERTIES

Physical Data

Boiling Point	: 214 C (417 F)
Melting Point	: -24 C (-11 F)
Vapor Pressure	: 0.08 mm Hg @ 20 C (68 F) 9.8 mm Hg @ 100 C (212 F)
Solubility in Water	: Miscible with water
pH	: 4.5-7 in water.
Color	: Colorless.
Form	: Liquid.
Specific Gravity	: 1.053

(PHYSICAL AND CHEMICAL PROPERTIES - Continued)

Evaporation Rate : <1 (Butyl Acetate=1.0)

STABILITY AND REACTIVITY

Chemical Stability

Stable at normal temperatures and storage conditions.

Incompatibility with Other Materials

None reasonably foreseeable.

Decomposition

Decomposition is not known. Hazardous gases/vapors produced are methanol and acrolein in the vapor.

Polymerization

Polymerization may occur under extreme conditions between minor components but has not been experienced.

TOXICOLOGICAL INFORMATION

Animal Data

1,3-Propanediol

Oral LD50:	15,000 mg/kg in rats
Dermal LD50:	> 20,000 mg/kg in rabbits
Inhalation 4 hour ALC:	> 5.0 mg/L in rats

1,3-Propanediol is not an eye irritant, is a slight skin irritant, and is not a skin sensitizer.

Repeated exposure of rats by oral gavage caused no toxicologically important changes in clinical pathology, pathology (including sperm analyses), or in-life measurements. The NOEL for this study was 1000 mg/kg/day, the highest dose tested. These results suggest that changes to testicular DNA and liver substructure observed in earlier studies are unlikely to cause adverse effects.

Repeated inhalation exposure in rats caused no toxicologically important changes in clinical pathology, pathology, or in-life measurements. The NOEL was 1800 mg/m3.

Animal data show that 1,3-Propanediol is not uniquely toxic to the fetus. Information about reproductive toxicity potential is limited to information from the oral repeated dose study in rats where no adverse effects to sperm and reproductive organs were observed.

(TOXICOLOGICAL INFORMATION - Continued)

1,3-Propanediol is not likely to be a genetic toxin. In vitro, it was not mutagenic in bacterial or mammalian cells. An increase in chromosome aberrations was observed in mammalian cells under certain conditions, but a repeat study with 1,3-propanediol manufactured by DuPont was negative for all test conditions. 1,3-Propanediol was also negative in the in vivo mouse micronucleus assay.

No animal data are available to define the carcinogenic potential of 1,3-Propanediol.

ECOLOGICAL INFORMATION

Ecotoxicological Information

1,3-Propanediol

AQUATIC TOXICITY:

48 hour EC50 - Daphnia magna: ¸7417 mg/L

72 hour NOEC - algae: ¸500 mg/L

DISPOSAL CONSIDERATIONS

Waste Disposal

Treatment, storage, transportation, and disposal must be in accordance with applicable Federal, State/Provincial, and Local regulations.

TRANSPORTATION INFORMATION

Shipping Information

Not Regulated as a hazardous material by DOT, IMO, or IATA.

REGULATORY INFORMATION

U.S. Federal Regulations

TSCA Inventory Status : Listed.

TITLE III HAZARD CLASSIFICATIONS SECTIONS 311, 312

Acute : Yes
Chronic : No
Fire : No
Reactivity : No
Pressure : No

Material Safety Data Sheet

(REGULATORY INFORMATION - Continued)

HAZARDOUS CHEMICAL LISTS

SARA Extremely Hazardous Substance: No
CERCLA Hazardous Substance : No
SARA Toxic Chemical : No

OTHER INFORMATION

NFPA, NPCA-HMIS

NFPA Rating
Health : 1
Flammability : 1
Reactivity : 0

NPCA-HMIS Rating
Health : 1
Flammability : 1
Reactivity : 0

The data in this Material Safety Data Sheet relates only to the specific material designated herein and does not relate to use in combination with any other material or in any process.

Responsibility for MSDS : THOMAS P. PRICE, PH.D.
PACKAGING & INDUSTRIAL POLYMERS
Address : CHESTNUT RUN PLAZA 713
WILMINGTON, DE 19880-0713
Telephone : 302-999-4664

# Indicates updated section.

This information is based upon technical information believed to be reliable. It is subject to revision as additional knowledge and experience is gained.

End of MSDS

Susterra™ 1,3 Propanediol Physical Properties

1,3-Propanediol	
Molecular Formula	C3H8O2
CAS #	504-63-2
Molecular Wt.	76.1
Melting Point, (°C)	-27.7
Boiling Point, (°C)	217.4
Density	1.0538
Weight/gal (US-lbs/20°C)	8.78
Refractive Index (20°C)	1.439
Viscosity, cP (20°C)	52
Vapor Pressure, mmHg (20°C)	0.08
Surface Tension, dyne/cm (20°C)	46.2
Coeff of Expansion, per °C (10° - 40°C)	0.00061
Flash Point, (°C)	131
Autoignition Temp, (°C)	405
Heat of Formation (kJ/mol)	-480.8
Heat of Vaporization (kJ/mol)	57.9
Heat of Fusion (kJ/mol)	7.1
Critical Temp (°C)	445
Critical Pressure (mPa)	6.55

50% PDO + 50% DI Water	
Electrical Resistivity	Essentially non-conductive
Thermal Conductivity (W/m-k)	~ 0.4
Heat Capacity (kJ/kg-K, @ 100 °C)	~ 3.4

Walter Kidde Portable Equipment Inc.
1394 South Third Street
Mebane, NC 27302
(919) 563-5911

MATERIAL SAFETY DATA SHEET
Kidde ABC Fire Extinguisher

SECTION 1 – CHEMICAL PRODUCT AND COMPANY IDENTIFICATION

Trade Name / Label Name:	**ABC Fire Extinguisher**
CAS Number:	N/A
Chemical Name / Family	N/A It is a mixture
Synonyms:	ABC Fire extinguishing powder Multipurpose Fire extinguishing agent
Manufacturer's Name:	Kidde – Residential & Commercial
Address:	1394 South Third Street, Mebane, NC 27302
Business phone / Fax:	919-563-5911 / 1-800-547-2111
24 Hour Emergency Contact:	Chemtrec 1-800-424-9300
Date of Preparation:	October 25, 2001
Revision Date:	February 16, 2005

SECTION 2 – COMPOSITION AND INFORMATION ON INGREDIENTS

CHEMICAL NAME	CAS N°	% w/w	OSHA PEL mg/m^3	ACGIH TLV mg/m^3	TOXICITY DATA
Monoammonium phosphate	7722-76-1	25 - 95	NONE	NONE	NONE
Ammonium sulfate	7783-20-2	0 - 70	NONE	NONE	NONE
Mica	12001-26-2	1 – 4	5	10	NONE
Attapulgus clay	8031-18-3	1 - 4	NONE	NONE	NONE
Amorphous silica	7631-86-9	0.2 – 1.5	6	10	NONE
Methyl Hydrogen Polysiloxane	68037-59-2	0.3 – 1.5	NONE	NONE	NONE

SECTION 3 – PHYSICAL AND CHEMICAL CHARACTERISTICS

Boiling point, °C:	N/A	**Specific gravity (H_20=1)**	ABOUT 1.9	**Viscosity @ 20°C:**	N/A
Vapor pressure, mm Hg:	N/A	**Percent volatile by volume:**	N/A	**Melting point, °C:**	NDA
Vapor density (Air=1):	N/A	**Evaporation rate (Butyl acetate=1)**	N/A	**Solubility in water:**	22.7 g/100g

Reactivity in water:	Unreactive	**Appearance and odor:**	Odorless, pale colored fine powder (variable color)

SECTION 4 – FIRE AND EXPLOSION HAZARD DATA

Flash point:	N/A	**Flammable limits in air, % by volume**	N/A	**Auto-ignition temperature:**	N/A
Extinguishing media:	N/A – The product is a fire extinguishing agent				
Unusual fire and explosion hazards:	NONE				
Special fire fighting procedures:	The material is a fire extinguishing agent and will not burn. However, if other materials are involved, use standard chemical fire fighting procedures and consider the hazards of those materials. In enclosed areas, fire fighters must wear self-contained breathing apparatus and full protective equipment.				

SECTION 5 – REACTIVITY DATA

Stability:	Stable	**Conditions to avoid:**	Extreme heat	**Hazardous polymerization:**	Will not occur
Incompatibility (materials to avoid):	Strong alkalis. Do not mix with BC type dry chemical extinguishing agents.				
Hazardous decomposition products:	Ammonia, phosphorus oxides.				

SECTION 6 – HEALTH HAZARD DATA

Threshold limit value:	ACGIH TLV for particulates not otherwise classified: 10 mg/m^3 OSHA PEL for nuisance dust limit total: 15 mg/m^3
Routes of entry:	**Inhalation:** YES; may be irritant to the respiratory tract. **Eye contact:** YES; mildly irritant for a short period. **Skin contact:** YES; may be mildly irritating. **Ingestion:** NOT an expected route of entry.
Signs and symptoms of overexposure:	**Acute:** Transient cough, shortness of breath, irritation of airways. **Chronic:** This product is not known to cause chronic illness.
Medical conditions generally aggravated by exposure:	Asthma, emphysema, bronchitis or other respiratory illness.
Chemical listed as carcinogen or potential:	NTP program: No IARC monographs: No OSHA: No
Emergency and first aid procedures:	**Eye contact:** Flush with large amounts of water for at least 15 minutes. If irritation persists, seek medical attention. **Skin contact:** Wash with soap and water. If irritation persists, seek medical attention. **Inhalation:** Move victim to fresh air. Seek medical attention if discomfort continues. **Ingestion:** Rinse mouth, drink large amounts of water and induce vomiting. Seek medical help.

SECTION 7 – SPECIAL PRECAUTIONS AND SPILL / LEAK PROCEDURES

Precautions to be taken in handling and storage:	Should be stored in original containers. Store in dry, cool, well-ventilated place away from alkaline compounds. Wash after handling. Do not cut, grind, weld or drill on or near product containers. Treat empty containers as if they were full.
Other precautions:	Do not mix with alkaline materials.
Steps to be taken in case materials is released or spilled:	Sweep up or vacuum. Store in covered containers. Do not reuse. In case of large spills, use rubber gloves, chemically resistant suit and boots, hard hat and air purifying respirator.
Waste disposal method:	Dispose of in compliance with local, state and federal regulations. Components are non hazardous, sanitary landfill disposal may be acceptable

SECTION 8 – SPECIAL PROTECTION INFORMATION

Respiratory protection:	Dust mask where dustiness is prevalent or TLV exceeded. Mechanical filter respirator if exposure is prolonged.
Ventilation:	Use adequate ventilation. Use fan or vent to outside.
Protective gloves:	Wear rubber gloves for routine industrial use.
Eye protection:	Recommended as mechanical barrier for prolonged exposure. Safety glasses or chemical type goggles.
Other protective equipment:	If irritation occurs, long sleeves and impervious gloves should be worn.
Work / Hygienic practices:	Use good personal hygiene and good housekeeping practices. Avoid breathing of dust. Wash with soap and water.

SECTION 9 – REGULATORY INFORMATION

HAZARDOUS MATERIAL IDENTIFICATION SYSTEM RATINGS

HEALTH: 1	**FLAMMABILITY: 0**	**REACTIVITY: 0**

HAZARD INDEX: 0 Minimal hazard; 1 Slight hazard; 2 Moderate hazard; 3 Serious hazard; 4 Severe hazard

SHIPPING INFORMATION

DOT Shipping Name:	**Fire Extinguishers**	**DOT Hazard Class:**	**2.2 (Nonflammable Compressed Gas)**
DOT ID Number:	**UN1044**	**Packing Group:**	**N/A**

GENERAL KEYS:

N/A: Not applicable.
NDA: No data available.

Anti Fog Coating

Improves Light Transmission and Prevents Plant Disease

Polygal Polycarbonate sheets can be Anti-Fog coated upon request. This factory-applied, silicone-based coating combines long lasting anti-fogging properties with excellent adhesion and great stability under exposure to environmental chemicals.

Anti-Fog coated Polycarbonate sheets show improved abrasion resistance, resulting in very good rub-off and wash-off resistance.

When used in greenhouse applications, Anti-Fog treated Polygal Polycarbonate sheets increase light transmission and protect against plant diseases by eliminating condensed water drip.

Polygal PCSS Material Safety Data Sheet

Date of issue: November 27, 2000

1. Identification of the substance, preparation and manufacturer:

Hollow Profile Sheet made of Polycarbonate

Cas # :

Polygal Plastics Industries Ltd.
Ramat Hashofet 19238 ISRAEL
Phone: 972-4-959-6222, Fax: 972-4-959-6296,
Email: sales@polygal.co.il
Website: www.polygal.com

2. Composition/Information on Ingredients:

Polycarbonate based on Bisphenol A

3. Hazard Identifications:

Emergency Overview:

Sheets have almost no odor. Can burn in fire creating dense toxic smoke. If heated to melt-point the molten plastic can cause severe thermal burns. Secondary operations, such as grinding, sanding or sawing can produce dust, which may create a respiratory or explosion hazard.

Potential Health Effects

EYE: Product may cause irritation or injury due to mechanical action.
SKIN: Sheets are not likely to cause skin irritation. If heated to melt-point the molten plastic can cause severe thermal burns.
INGESTION: Not acutely toxic.
INHALATION: Unlikely due to physical form.
CHRONIC/CARCINOGENICITY: Not listed
MEDICAL RESTRICTIONS: There are no known human health effects aggravated by exposure to this product.

4. First-Aid Measures:

EMERGENCY AND FIRST AID INFORMATION:
EYES: Remove contact lenses at once. Immediately flush eyes well with copious quantifies of water or normal saline for at least 20-30 minutes. If irritation persists, seek medical attention.
SKIN: Wash skin thoroughly with soap and water. Seek medical attention if rash or burn occurs.
INGESTION: Not probable. If large amount is swallowed, seek medical attention.
INHALATION: Not likely due to physical form.
BURNS: Burns by molten material must receive medical attention. Do not try to remove melted PC from skin.

5. Fire-Fighting Measures:

Extinguishing materials: water spray is recommended due to its cooling capacity. Other materials such as extinguishing powder, CO2 , Foam, dry powder are also possible.
Firemen must wear self-contained breathing apparatus.
FLASH POINT: Not applicable
AUTO IGNITION TEMPERATURE: 630°C (1166°F) estimated
LOWER EXPOSURE LIMIT(%): Not established
UPPER EXPOSURE LIMIT (%): Not established
HAZARDOUS COMBUSTION BY-PRODUCTS: Hazardous combustion by-products may include intense heat, dense black smoke, carbon monoxide, carbon dioxide and hydrocarbon fragments.

6. Accidental Release Measures:

Sweep or gather up material mechanically.

7. Handling and Storage:

Ensure adequate ventilation or exhaust ventilation in the working area. Dust must be removed by effective exhaust ventilation.
Avoid contact or proximity with PVC plasticizers (phtalates).

Store in a dry place away from moisture, excessive heat and sources of combustion.

8. Exposure Controls / Personal Protection:

No specific exposure related hazards are known.
Wear protective gloves while handling sheets.

9. Physical and Chemical Properties:

Form: Hollow Plastic Sheet
Color:
Colorless or pigmented:
Clear, Opal Ice, Bronze, Blue,
Green, Grey and other Odor: Odorless Softening Point: 150-160°C (300-320°F)
Density: Material: 1200 kg/m? at 20°C
Sheet: 125-250 kg/m3 Vapor Pressure: Not Applicable
Viscosity: Not Applicable
Solubility in Water: Insoluble
pH Value: Not Applicable
Flash Ignition Temperature: > 450°C (842°F)
Self Ignition Temperature: > 450°C (842°F)
Explosive Limit: Not Applicable

10. Stability and Reactivity:

Thermal decomposition: Decomposition begins at 380°C (716°F).
Hazardous decomposition products: in cases of smoldering and incomplete combustion, toxic fumes mainly consisting of CO and CO2 may develop as well as traces of Aliphatic and Aromatic Hydrocarbons, Aldehydes, Acids, Phenol and Phenol-derivatives.
Hazardous reactions: No hazardous reactions observed.

11. Toxicological Information:

EYE: Product not considered as a primary eye irritant.
SKIN: Product not considered as a primary skin irritant.
Dermal LD50 (rabbit) >2g/kg estimated.
ACUTE ORAL: Oral LD50 (rat) >5g/kg estimated

12. Ecological Information

WATER: Water pollution class (WGK): 0 - not generally hazardous to water.
GENERAL: Not expected to present any significant ecological problems.

13. Disposal Considerations:

RECYCLE AND DISCHARGE: The product is suitable for mechanical recycling. After appropriate treatment it can be remelted and processed into new molded articles.

Mechanical recycling is possible if the material has been selectively retrieved and carefully segregated according to type.

May be discharged or incinerated together with household refuse if local official regulations are observed.

STEPS TO BE TAKEN IN CASE MATERIAL IS RELEASED OR SPILLED:

Sweep or gather up material and place in proper container for disposal or recovery.

14. Transport Information

DOT HAZARD CLASS: Not regulated

PROPER SHIPPING NAME: Not regulated

IDENTIFICATION NUMBER: Not listed

OTHER INFORMATION: Not Dangerous Cargo. Keep Dry.

15. Regulatory Information

No labeling is required in accordance with the EEC directives.

In connection with dusts formed in consequence of mechanical treatment, e.g. grinding, the appropriate regulation/maximal values for fine dusts must be observed:

MAX Value (fine dust): 6 mg/m3

This product does not contain reportable quantities of substances subject to supplier notification.

16. Other Information

The safety data sheet is valid for Polycarbonate (bisphenol-A-carbonate).

The trade names of the base resin are Makrolon of Bayer AG Germany and Lexan of General Electric Plastics B.V. Holland.

Pigments and additives used to enhance specific properties are encapsulated in the polymer resin matrix, and/or on the sheet surface.

BUNKER PLASTICS, INC.
Manufacturer of Quality Mirror Products

Date Issued: 7/7/1993
Date Revised: 1/28/2002

EMERGENCY HOTLINE:
(800) 527-7765

Contact Name:
Michael Cleaver

Contact Phone:
(903) 962-7575

MATERIAL SAFETY DATA SHEET

1. PRODUCT IDENTIFICATION

Material: Bunker Plastics Hardcoated Extruded Acrylic Sheet

Chemical Name or Synonyms: Polymethyl methacrylate sheet

2. HAZARD INGREDIENTS / IDENTITY INFORMATION

COMPONENTS	CAS REG. NO.	OSHA PEL	ACGIH TLV	WEIGHT (%)
1. Methyl methacrylate (MMA)	80-62-6	100 ppm	100 ppm	0.5
2. Methyl acrylate	96-33-3	10 ppm	2 ppm	0 - 0.5
3. Ethyl acrylate	140-88-5	25 ppm	5 ppm	0 - 0.5

This product as supplied is non-hazardous under the OSHA Hazard Communication Standard (29 CFR 1910.1200). However, under processing conditions it may become a health hazard to employees because vapors and/or particulates could be released.

3. PHYSICAL / CHEMICAL CHARACTERISTICS

Appearance:	Solid sheet
Odor:	N/A
Viscosity:	N/A
Melting Point:	150° C / 300° F
Boiling Point:	N/A
Vapor Pressure:	N/A
Vapor Density:	N/A (Air =1)
Specific Gravity:	1.2 (Water =1)
pH:	N/A
Solubility in Water:	Negligible
Volatility:	Negligible (Weight %)
Evaporation Rate:	Negligible (Butyl Acetate = 1)

BUNKER PLASTICS, INC.
Manufacturer of Quality Mirror Products

4. FIRE AND EXPLOSION HAZARD DATA

Flash Point:	N/A
Auto Ignition Temperature:	445° C / 833° F
Upper Explosion Limit (%):	N/A
Lower Explosion Limit (%):	N/A
Extinguishing Media:	Carbon dioxide, dry chemical, or water.
Fire Protection Equipment:	Wear self-contained, positive pressure breathing apparatus (MSHA/NIOSH approved, or equivalent) and full protective gear.
Unusual Fire and Explosion Hazard:	Product is combustible thermoplastic material that burns vigorously with intense heat.

5. REACTIVITY DATA

Stability:	Stable
Conditions to Avoid:	Temperatures over 300° C / 570° F.
Hazardous Decomposition Products:	Thermal decomposition or combustion may emit vapors, carbon monoxide, or carbon dioxide.
Incompatible Compounds:	Acids, bases, and strong oxidizing agents.
Hazardous Polymerization:	Will not occur.

6. HEALTH HAZARD DATA

Hazard Scale: 0 = Insignificant, 1 = Slight, 2 = Moderate, 3 = High, 4 = Extreme

NFPA **Health: 0** **Fire: 1** **Reactivity: 0**

Additional Hazards: There are no known acute or chronic health hazards associated with the normal use of acrylic sheets.

Carcinogenicity: N/A

SIGNS AND SYMPTOMS OF EXPOSURE

Inhalation:	Inhalation of vapors from heated product can cause nausea, headache, dizziness as well as irritation of lungs, nose, and throat.
Eye Contact:	Vapors from heated product can irritate the eyes.
Ingestion:	Low hazard associated with normal conditions.
Skin Contact:	Possible skin irritation. Contact with molten material can result in burns.

MEDICAL CONDITION GENERALLY AGGRAVATED BY EXPOSURE

N/A

BUNKER PLASTICS, INC.
Manufacturer of Quality Mirror Products

EMERGENCY AND FIRST AID PROCEDURES

Inhalation:	Move subject to fresh air.
Eye Contact:	Flush eyes with plenty of water for at least 15 minutes. Call a physician.
Ingestion:	This material is not expected to be absorbed within the gastrointestinal tract, so induction of vomiting should not be necessary.
Skin Contact:	If molten material contacts skin, cool rapidly with cold water and obtain medical attention for thermal burn.

7. PRECAUTIONS FOR SAFE HANDLING AND USE

Steps to Be Taken in Case Material is Released or Spilled:	Sweep or scoop up and remove.
Waste Disposal Method:	Landfill or incinerate at a facility that complies with local, state and federal regulations.
Precautions to Be Taken in Handling and Storing:	While material is stored under normal room temperature conditions, it is not hazardous. However, storing at higher than the maximum temperature (99° C / 210° F) can cause it to emit vapors, carbon monoxide or carbon dioxide. Processing of the material under high temperatures will cause hazardous emissions of vapors, carbon monoxide or carbon dioxide. Sawing of this product generates particulates regulated as "inert" or "nuisance" dusts. To minimize dust emissions, engineering controls should be employed.

8. CONTROL MEASURES

Respiratory Protection:	None required under normal conditions. See Section 6 & 7.
Hand Protection:	Leather or cotton gloves.
Eye Protection:	Safety glasses with side shield (ANSI Z87.1 equivalent).
Other Protection:	N/A
Ventilation:	Exhaust ventilation systems should be constructed and installed in accordance with ANSI Z9.2 or ACGIH guidelines to control potential emissions near the source.
Work / Hygienic Practices:	Wash hands and contaminated skin thoroughly after handling.

BUNKER PLASTICS, INC.
Manufacturer of Quality Mirror Products

9. REGULATORY INFORMATION

ENVIRONMENT

Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA):	The listed hazardous components of this product may be subject to reporting requirements pursuant to section 313 of CERCLA (40 CFR 372), Section 12(b) of TSCA, or may be subject to release reporting requirements (40 CFR 307, 40 CFR 311, etc.) See Section 7 for information on waste classification and waste disposal of this product.
Resource Conservation and Recovery Act (RCRA):	When this product becomes a waste, it is identified as solid but not hazardous waste under RCRA criteria (40 CFR Part 261).
Toxic Substances Control Act (TSCA):	The components of this product are on the TSCA inventory list. Any impurities present in this product are exempt from listing.
Superfund Amendment and Reauthorization Act of 1986 (SARA) Title III:	This product may be considered an immediate (acute) health hazard due to potential MMA emissions. However, reporting of thresholds for the material is not required because the concentration of its MMA component is below the de minimis concentration (40 CFR Part 370).

TRANSPORTATION

DOT Hazard Class:	Not regulated.
DOT Shipping Name:	N/A

10. GLOSSARY

ACGIH	American Conference of Governmental Industrial Hygienists
CFR	Code of Federal Regulations
DOT	United States Department of Transportation
mg/m^3	milligrams per cubic meter (concentration)
MMA	Methyl methacrylate
MSHA	Mine Safety and Health Administration
N/A	Not Applicable or Not Available
NIOSH	National Institute for Occupational Safety and Health
OSHA	Occupational Safety and Health Administration (Department of Labor)
PEL	Permissible Exposure Limit (time-weighted average)
PMMA	Polymethyl methacrylate
ppm	parts per million (concentration)
STEL	Short-Term Exposure Limit (15-minute)
TLV	Threshold Limit Value (time-weighted average)

Water Use Calculations

UT SolarD 2007 Water Needs Estimates

Task / Item	Gallons	Multiplier	Total Gallons
Shower	15	10	150
Water Boiling	0.6	3	1.8
Clothes Washing	55	2	110
Dishwashing	15	4	60
Water Trough	50	1	50
Dutch Tub / Plants	200	2	400
Misc.	20	1	20
		TOTAL:	792
		TOTAL + 20%=	950