Appendix A: Typical Floor Plans

Framing Plan of the 2nd Floor, Courtesy of Highland Associates
2nd Story frame, west wing, Courtesy of Highland Associates
2nd Story frame, east wing (south), Courtesy of Highland Associates
2\textsuperscript{nd} Story frame, east wing (north), Courtesy of Highland Associates

2\textsuperscript{nd} Story frame, Link, Courtesy of Highland Associates
3rd Story frame, west wing. Courtesy of Highland Associates
3rd Story frame, east wing (south), Courtesy of Highland Associates
3rd Story frame, east wing (north), Courtesy of Highland Associates

3rd Story frame, Link, Courtesy of Highland Associates
4th Story frame, west wing, Courtesy of Highland Associates
4th Story frame, east wing (south), Courtesy of Highland Associates
4th Story frame, east wing (north), Courtesy of Highland Associates
Main Roof Story frame, west wing, Courtesy of Highland Associates
Main Roof Story frame, east wing (south), Courtesy of Highland Associates
Main Roof Story frame, east wing (north), Courtesy of Highland Associates
Penthouse Roof Story frame, west wing, Courtesy of Highland Associates
Appendix B: Miami, FL, Wind Load Calculations

From design, $V_{3s} = 150$ MPH, Miami, Florida

- $I_{15} = 1.15$ - Buildings with a capacity > 500 for college
- Exposure Category = B - Urban surroundings
- $K_d = 0.85$ - for building's main wind force resisting system
- $K_{2d} = 1.0$
- $K_w$ varies depending on which story

$G_{ap} = \pm 0.18$ - Enclosed building, fully
\[ q_2 = 0.00256 \cdot K_{w2} \cdot K_d \cdot V^2 \cdot I_{w2} \]
\[ = 0.00256 \cdot (0.8) \cdot (0.5) \cdot (150)^2 \cdot (1.15) \]
\[ q_2 = 55.8 \text{ psf for roof} \]
\[ = 0.00256 \cdot (0.8) \cdot (1.0) \cdot (150)^2 \cdot (1.15) \]
\[ q_2 = 46.8 \text{ psf for 4th story floor} \]
\[ = 0.00256 \cdot (0.8) \cdot (1.0) \cdot (150)^2 \cdot (1.15) \]
\[ q_2 = 24.7 \text{ psf for 1st story floor} \]
\[ = 0.00256 \cdot (0.8) \cdot (1.0) \cdot (150)^2 \cdot (1.15) \]
\[ q_2 = 39.5 \text{ psf for 2nd story floor} \]
\[ = 0.00256 \cdot (0.8) \cdot (1.0) \cdot (150)^2 \cdot (1.15) \]
\[ q_{2g} = 39.5 \text{ psf for ground story floor} \]

Finding Gust Effect Factor

\[ n_a = \frac{22.2}{h_a} = \frac{22.2}{43} = 0.51 < 1 \text{ Hz so calculate in the event that building is flexible} \]

\[ G_R = 0.925 \left( 1 + 1.172 \left( \frac{s^2}{a^2} q^2 + 9.2 \frac{R^2}{a^2} \right) \right) \]

\[ G_a = 0.925 \]

\[ n_a = \frac{100}{a_3} = 1.07 \text{ average value} \]

\[ n_1 = \frac{75}{a_3} = 0.41 \text{ lower bound value} \]

\[ R = 2 \left( 2 \ln \left( \frac{3,600}{107} \right) + 2 \ln \left( \frac{3,600}{107} \right) \right) = 4.32 \]

\[ I_z = c \left( \frac{33}{2} \right) \]

\[ I_z = 1.3c \left( \frac{27 + 1/4}{31} \right) = 1.75 \text{ c = 0.30} \]
$Q = \sqrt{\frac{1}{1 + 0.63 \left( \frac{B + H}{L} \right)^{0.63} \left( \frac{L}{z} \right)^{-1}}}\\
R^2 = \frac{1}{\beta} \frac{R_0 R_n}{R_0 (0.5 \beta + 0.47 R_n)}$  
$\beta$ assumed to be

$R_n = \frac{2.47 N_i}{(1 + 0.3 N_i)^{0.5}}\\
N_i = \frac{N_i L_z}{V_z}$  
Constants are from table 26.9-1 (ASCE 7-10)

$L_z = \lambda \left( \frac{V_z}{35} \right)^{2/3}$  
$\lambda = \frac{1}{3}$  
$V_z = \frac{1}{b} \left( \frac{\bar{V}}{35} \right) \left( \frac{88}{60} \right)^2$  
$b = 0.45\\
\bar{V} = 0.45 \left( \frac{\bar{V}}{35} \right) \left( \frac{88}{60} \right)$  
$\bar{V} = 64.0$  

$N_i = \frac{L_z (38 \lambda)}{64} = 6.37$$R_n = \frac{7.47 \left( \frac{6.37}{64} \right)^{2/3}}{1 + 10.3 (6.37)^{2/3}} = 0.044$
Wind Design

West Wing

N-S Direction

\[ h = 93.6 \text{ ft} \]
\[ L = 150 \text{ ft} \]
\[ B = 194 \text{ ft} \]

\[ \eta_x = 4.6 \frac{h}{V_2} = 4.6 \left( \frac{93.6}{150} \right) = 7.15 \]
\[ \eta_y = 1.96 \text{ recommended by ASCE 7-05} \]

E-W Direction

\[ h = 194 \text{ ft} \]
\[ L = 194 \text{ ft} \]
\[ B = 194 \text{ ft} \]

\[ \eta_x = 4.6 \frac{h}{V_2} = 4.6 \left( \frac{194}{194} \right) = 14.9 \]
\[ \eta_y = 4.6 \left( \frac{194}{194} \right) = 14.9 \]

\[ \frac{n_x}{V_2} = 15.4 \left( \frac{194}{194} \right) = 39.6 \]
\[ \frac{n_y}{V_2} = 15.4 \left( \frac{194}{194} \right) = 49.9 \]

\[ R_x = \frac{1}{2} \frac{1}{7.15} \left( 1 - e^{-2n} \right) \quad \text{for} \quad n > 0 \]
\[ R_y = \frac{1}{2} \frac{1}{7.15} \left( 1 - e^{-2n} \right) \]
\[ R_x = \frac{1}{2} \frac{1}{11.9} \left( 1 - e^{-2(11.9)} \right) = 0.064 \]
\[ R_y = \frac{1}{2} \frac{1}{11.9} \left( 1 - e^{-2(11.9)} \right) = 0.026 \]

\[ R = \sqrt{\frac{1}{(0.04x + 0.6)(0.04y + 0.6)}} \left( 0.04x + 0.6 \right) \left( 0.04y + 0.6 \right) = 0.14 \]

\[ Q = \sqrt{\frac{1}{1 + 0.62 \left( \frac{194 + 93.6}{381.2} \right)}} = 0.22 \]

\[ G_x = 0.925 \left( 1 + 0.7 \left( \frac{0.04x + 0.6}{381.2} \right) \right) \]

\[ G_y = 0.925 \left( 1 + 0.7 \left( \frac{0.04y + 0.6}{381.2} \right) \right) \]

\[ G_\text{ratio} = 0.828 \]

\[ G_x = 0.925 \]
Wind Design

West Wing Pressures

\[ p = \alpha C_p \left( C_R - \frac{q_H}{\rho} \right) \]

Wall

Undrained \( C_R = 0.9 \)

Sidelong \( C_R = -0.7 \)

Leeuward \( C_R = \frac{h}{L} = 0.5 \), \( \alpha = 0.8 \)

\( C_R = -0.5 \)

E-W

\( \alpha = 0.5 \)

\( C_R = -0.7 \)

\( C_R = \frac{h}{L} = 0.5 \), \( \frac{\alpha}{\rho} = 0.8 \)

\( C_R = -0.5 \) by interpolation

Roof

\( \theta = 0 \)

\( \frac{h}{L} = \frac{93}{1250} = 0.075 \)

\( C_R = -0.5 \) for \( 0 \) to \( 1 \)

\( C_R = -0.3 \) for \( > 1 \)

\( P = 55.8 \left( 0.8^{2/5} \right) = 55.8 \pm 15 \)

= 37.0 \pm 10.1

= 97.1 or 26.9 psf

at roof height, windward wall

* See Excel for rest of calculations
Wind Design

East Wing

N-S Direction
\[ h = 93 \text{ ft} \]
\[ L = 80 \text{ ft} \]
\[ B = 250 \text{ ft} \]

E-W Direction
\[ h = 93 \text{ ft} \]
\[ L = 250 \text{ ft} \]
\[ B = 80 \text{ ft} \]

\[ \beta = 1\% \text{ recommended by ASCE 7-05} \]
\[ \beta = 7.15 \]

\[ \eta_h = \frac{4.0 \times (0.07)(125)}{64} = 0.16 \]
\[ \eta_L = \frac{4.0 \times (0.07)(80)}{64} = 0.16 \]
\[ \eta_B = \frac{15.4 \times (0.07)(80)}{64} = 0.20 \]

\[ R_h = 1.3 \]
\[ R_L = 1.3 \]
\[ R_B = 1.3 \]

\[ R = \frac{1}{0.01} = 100 \]

\[ Q = \frac{1}{1 + 0.153(250 + 50) \times 1.3} = 0.793 \]

\[ G_6 = 0.92 \left( \frac{1 + 1.7(2.21)}{1 + 1.7(2.21)} \right) \times \frac{0.44}{1 + 1.7(2.21)} = 0.92 \]

\[ G_6 = 0.963 \]
Wind Design

East Wind Pressures

\[ p = q G C_p = q G (\frac{3}{2} C_p) \]

<table>
<thead>
<tr>
<th>Wall</th>
<th>( C_p )</th>
</tr>
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<tbody>
<tr>
<td>Front</td>
<td>0.18</td>
</tr>
<tr>
<td>Side Wall</td>
<td>-0.7</td>
</tr>
<tr>
<td>Leeward</td>
<td>( \frac{4}{5} ) = 0.8  ( C_p = -0.5 )</td>
</tr>
</tbody>
</table>

\[ E - W \]

\[ C_p = 0.8 \]
\[ C_p = -0.7 \]
\[ C_p = -0.25 \] by interpolation

\[ W = \frac{431}{800} = 1.142 \]
\[ \frac{h}{2} = \frac{3.5}{2} = 1.85 \]
\[ 2h = 1.86 \]

Roof area \( > 1000 \) sf, R.F. = 1.8

\[ C_p = -1.3 \] for \( 0 \) to \( h/2 \)
\[ C_p = -0.7 \] for \( > h/2 \)

\[ \rho = 55.8 (\frac{3}{2})(0.8) = 55.8 (1.18) = 64.91 \]
\[ = 38.6 \pm 10.1 \]
\[ = 46.6 \text{ or } 24.4 \text{ psf} \]

at roof height, windward wall

* See Excel for rest of calculations

Wind Forces breakdown

<table>
<thead>
<tr>
<th>93</th>
</tr>
</thead>
<tbody>
<tr>
<td>72</td>
</tr>
<tr>
<td>52</td>
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<td>36</td>
</tr>
<tr>
<td>20</td>
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<tr>
<td>10</td>
</tr>
</tbody>
</table>
Appendix C: Miami, FL, Seismic Load Calculations

For Miami, Florida, Site Class D

\[ S_x = 0.050g \quad S_y = 0.080g \quad S_z = 0.053g \]
\[ S_x' = 0.019g \quad S_y' = 0.047g \quad S_z' = 0.031g \]

From Table 12.2-1:

- For ordinary steel moment frames:
  \[ R = 3.5 \]
  \[ S_2 = 3 \]
  \[ C_d = 3 \]

- For ordinary steel concentrically braced frames:
  \[ R = 3.25 \]
  \[ S_2 = 2 \]
  \[ C_d = 3.25 \]

From Table 11.6-1, ASCE 7-05:

- \[ S_{ps} < 0.16 \] Occupying Category III \( \Rightarrow \) Seismic Category A.

Section 11.7 of code:

\[ V = 0.01(W) \]
\[ W = 23,000 \text{ kips} \]
\[ V = 0.01(23,000) = 130 \text{ kips} \]
\[ F_x = 0.01Wx = 130 \text{ kips at 1st for west wall} \]

See rest on excel:

\[ F_x = 0.01(12,600) = 126 \text{ kips at 1st for East Wall} \]

See rest on excel.
Appendix D: Moment Frame Design

1.2D+1.6L on Frame A
1.2D+1.6W+0.5L on Frame A
0.9D+1.6W on Frame A
Frame A will be used for this preliminary design.

Check for dead + live loads.

\[ G_{12} = W14 	imes 25.7 \]

Frame D

Topping area = 26' \times 25' = 650 \text{ ft}^2

Load = 3 \text{ floors} + 1 \text{ roof}

\[ L_{\text{load}} = 0.25 + \frac{15}{4.3(650)} = 0.42 \]

\[ P_1 = 100(1.42)(650) = 27,300 \quad 27,300(3) = 81,900 \]

\[ P_2 = 93(650) = 60,450 \quad 60,450(3) = 181,350 \]

\[ P_{\text{fl}} = 20(650) = 13,000 \]

\[ P_{\text{dr}} = 20(150) = 13,000 \]

\[ R_3 = 30(650) = 19,500 \]

\[ P_{\text{br}} = 1/2(81,900 + 13,000) + 1.6(81,900 + 13,000) + 1.6(19,500) \]

= 394.9 \text{ kips}

The following loadings give the largest moments on beams.

\[ -0.131 \text{ kips}^2 = \text{largest negative moment} \]

\[ +0.09 \text{ kips} = \text{largest positive moment} \]
Moment Frame Design

Columns: Continue

\[ w_e = 1.2(33)(25) + 1.6(100)(25)(20) = 679 \text{ kN} \]

\[ U_{ed} = 0.25 + \frac{1}{3} \cdot \frac{1}{2} \cdot \frac{1}{2} = 0.67 \]

Dead load unbalanced moment \( \neq 0 \)

Live load unbalanced moment

\[ L_{aw} = 1.6(100)(25)(20) = 268 \text{ kN} \]

\[ FEM_u = \frac{2.68(26)^2}{12} = 151 \text{ kN.m} \]

\[ \frac{1}{2} FEM = 75.5 \text{ kN.m} \]

\[ \begin{aligned} 
\text{At } M_{aw} = 0, \\
\text{FEM} & = 151 \text{ kN.m} \\
\end{aligned} \]

Use Column W11 x 90, \( P_{Pa} = 877 \text{ kN} \) @ 20 ft

Beam: Continue

\[ w_b = 1.25(100)(25) = 1.625 \text{ kN} \]

\[ w_a = 93(25) = 2.325 \text{ kN} \]

\[ w_k = 1.2(2.325) + 1.6(16.25) = 539 \text{ kN} \]

\[ \frac{w_h^2}{2} = \frac{5.39(26)^2}{12} = 40425 \text{ kN.m} \]

\[ W18 x 97 \text{ with } S_{MP} = 195 \text{ kN.m} \@ 30' \text{ unbraced} \]
Portal Method Analysis

Frame A

1.6 W load

Story 4

182.24

\[ \begin{align*}
\text{Story 4} & : 182.24 \\
& \rightarrow 13.9k & \rightarrow 27.8k & \rightarrow 27.8k & \rightarrow 13.9k \\
& \rightarrow 26k & \rightarrow 26k & \rightarrow 26k & \rightarrow 26k \\
& \rightarrow 12.4k & \rightarrow 12.4k & \rightarrow 12.4k & \rightarrow 12.4k \\
& \rightarrow 10.2k & \rightarrow 10.2k & \rightarrow 10.2k & \rightarrow 10.2k \\
& \rightarrow F_{ax} & \rightarrow F_{ax} & \rightarrow F_{ax} & \rightarrow F_{ax} \\
& \rightarrow F_{ay} & \rightarrow F_{ay} & \rightarrow F_{ay} & \rightarrow F_{ay} \\
\end{align*} \]

Use load from STAAD model.

Determining Sizes

For $C_1 \Rightarrow P_x = 864 \text{ kip}$

\[ M_x = 923 \text{ k-ft} \]

\[ P_x \frac{M_x}{E} = 923 \frac{923}{1270} = 0.73 \]

\[ 0.23 + \frac{0.23(0.73)}{0.25} = 0.88 \text{ works} \]

For $W_14 \times 142 \Rightarrow P_x = 2380$

\[ M_x = 1270 \]

\[ P_x \frac{M_x}{E} = 2380 \frac{2380}{1270} = 0.73 \]

\[ 0.23 + \frac{0.23(0.73)}{0.25} = 0.88 \text{ works} \]

For $W_14 \times 311 \Rightarrow P_x = 3390$

\[ M_x = 1140 \]

\[ P_x \frac{M_x}{E} = 3390 \frac{3390}{1140} = 0.81 \]

\[ 0.23 + \frac{0.23(0.81)}{0.25} = 0.97 \text{ works} \]

For $B_i \Rightarrow M_i = 1189 \text{ k-ft}$

Most economical = $W_27 \times 146$ Table 3-10 Steel Manual.
Appendix E: Chevron Braced Frame Design

1.2D+1.6L on Frame A
1.2D + 1.6W + 0.5L on Frame A
0.9D+1.6W on Frame A
Preliminary Calculations for Braced Frame G in the West Wing

Frame A West Wing

- Columns
  - We have selected from STD.
  - Set of loads on columns, columns will be the same size.
  - So column size $C_1 = C_2 = C_3$
  - Set of loads $C_{1b}$
    - $P_{a} = 417 \text{kN}$ $M_{u} = 12 \text{kN}\cdot\text{m}$ $x$ unit until
    - $P_{u} = 146 \text{kN}$ $M_{d} = 73 \text{kN}\cdot\text{m}$ $\rightarrow$ try
    - $C_{2b}$
    - $P_{a} = 542 \text{kN}$ $M_{u} = 0 \rightarrow$ try
    - $P_{u} = 354 \text{kN}$ $M_{d} = 51 \text{kN}\cdot\text{m}$ $x$ uniformly control
    - $C_{3b}$
    - $P_{a} = 508 \text{kN}$ $M_{u} = 57 \text{kN}\cdot\text{m}$ $\rightarrow$ try
  - $14\times107$ is more than sufficient, based on inspection.
    - $B_{Pn} = 1138 \text{kN}$ $M_{Pn} = 310 \text{kN}\cdot\text{m}$
      - Can try smaller, depending on drift.

- Beams
  - $8_i$ $P_{a} = 250 \text{kN}$ $M_{u} = 47 \text{kN}\cdot\text{m}$
    - $P_{u} = 68 \text{kN}$ $M_{d} = 190 \text{kN}\cdot\text{m}$
    - $P_{n} = 230 \text{kN}$ $M_{u} = 132 \text{kN}\cdot\text{m}$
  - $8_o$ $P_{a} = 137 \text{kN}$ $M_{u} = 125 \text{kN}\cdot\text{m}$
    - $12\times107$ is more than sufficient
Bearings

\[ P_1 = 324 \text{ k} \text{ on 1st Floor} \]
\[ P_2 = 240 \text{ k} \text{ on 2nd Floor} \]
\[ P_3 = 181 \text{ k} \text{ on 3rd Floor} \]
\[ P_4 = 113 \text{ k} \text{ on 4th Floor} \]

Check for buckling.

\[ F = \frac{\pi^2 EI}{(KL)^2} \]

\[ 324 = \frac{\pi^2 (20,000)(I_{req})}{(24+12)^2} \rightarrow I_{req} = 86.3 \text{ in}^4 \]

\[ 240 = \frac{\pi^2 (20,000)(I_{req})}{(24+12)^2} \rightarrow I_{req} = 53.3 \text{ in}^4 \]

\[ 181 = \frac{\pi^2 (20,000)(I_{req})}{(24+12)^2} \rightarrow I_{req} = 40.2 \text{ in}^4 \]

\[ 113 = \frac{\pi^2 (20,000)(I_{req})}{(24+12)^2} \rightarrow I_{req} = 25.1 \text{ in}^4 \]

Buckling isn’t much of a problem.

1st Floor \[ W/14 \times 68 = \frac{0}{Pn} = 33\text{ k} \] @ 24' unbraced length \[ I = 722 \text{ in}^4 \]

2nd Floor \[ W/14 \times 61 = \frac{0}{Pn} = 34.5\text{ k} \] @ 22' unbraced length \[ I = 640 \text{ in}^4 \]

3rd Floor \[ W/14 \times 53 = \frac{0}{Pn} = 156\text{ k} \] @ 22' unbraced length \[ I = 541 \text{ in}^4 \]

4th Floor \[ W/14 \times 43 = \frac{0}{Pn} = 146\text{ k} \] @ 22' unbraced length \[ I = 428 \text{ in}^4 \]
Preliminary sizes chosen for brace frame.

Final sizes will be chosen on ETA0 design
Must be at least this size.
Appendix F: Foundation Design

Designing a typical Mat Foundation

Simplified with assumptions due to lack of geotechnical report.

For west wing:

- Trim Df = 10 ft
- Assume soil has improvements to make cu = 2,500 lbf/ft^2
- Total dead + live load = 180,000 k

- We need to check for bearing and uplift in foundation design.
- On D+W load combo controls foundation design because it causes an uplift on one side of the foundation.
- We use load combo with control for bearing.

Special West Wing

\[ A = 100(60) = 21,000 \text{ ft}^2 \]
\[ I_x = \frac{12}{12} \times 500(100)^3 = 5.12 \times 10^6 \text{ ft}^4 \]
\[ D = \text{Axial load on Columns} = 180,000 \text{ k} \]
\[ I_y = \frac{12}{12} \times 40(100)^3 = 9.6 \times 10^6 \text{ ft}^4 \]
\[ e_x = x' - \frac{A}{I_x} = 0.3 \]
\[ e_y = y' - \frac{1}{2} = 0.2 \]
\[ q = \frac{15,000}{21,000} + \frac{0.3(1800)}{40} + \frac{2(1800)}{51,325} \]

For A = 0.75, 0.89, 0.96 = b = 600 lb/ft^2
For C = 0.75, 0.89, 0.96 = a = 900 lb/ft^2 < 2,500 lb/ft^2
Amount of soil over column A to stop uplift,

Assume compact fill is $8 = 120 \frac{lb}{ft^2}$

$\frac{2}{3}(120)(3)(20) = 374 k$ of soil

keeping column A clear, from uplift.

F.S. = $\frac{80}{374} = 4.4$

So bearing and uplift has been satisfied.

Design foundation size and reinforcing

$Q_{ax} = \frac{900 + 600}{2} = 750 \frac{lb}{ft^2}$

$Q_{ax} = 750(20)(160) = 2.12 \times 10^6$

Thickness of Mat Slab

Critical Section: do diagonal tensile shear at column A.

$b_0 = (0.5 + \frac{d}{2}) + (0.5 + \frac{d}{2}) + (0.5 + d) = 1.5 + 2d$

$U = 2.5 \left( \frac{345}{4} \right) = 230$

$220,000 = (1.5 + 2d)(d) \left[ 0.45 \tanh^{-1}(34 \frac{10^6}{4000} \right]$

$15724 = 1.5d + 2d^2$

$d = 8.7'' \cong 7.3 ft \cong 2.2 m$
<table>
<thead>
<tr>
<th>Mat Foundation</th>
<th>Thesis</th>
<th>Page 3 of 3</th>
</tr>
</thead>
</table>

For Moment west using:

<table>
<thead>
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<th>30'</th>
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<th>30'</th>
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</tr>
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</table>

Bearing is less critical here since it is more spread out. So using a $D_e = 10\text{'}$ or $4\text{'}$ and above MAT is sufficient.

Thickness of MAT

Critical section at Column E with 284 k, Column D = 256 k

$U = \frac{2.5 \times 284}{256} = 2.6$

$162,000 = (1.5 + 2.6) \times (d) \times [0.64 \times (34) \times \text{min}]$

$\delta = 162,000 + 2.6d$

$d = 67.3\text{''} \times 5.6 \text{c} \times \text{use } 6\text{''} \rightarrow D_e = 10\text{'}$

Reinforcing

Same as brace frame.

Summary

Typical Mat Foundation

<table>
<thead>
<tr>
<th>Bored</th>
<th>Poured</th>
<th>Current</th>
</tr>
</thead>
<tbody>
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<td>F.S. for strength = 2.5</td>
<td>2.5</td>
<td>/</td>
</tr>
<tr>
<td>F.S. for uplift = 4/4</td>
<td>not an issue</td>
<td>/</td>
</tr>
<tr>
<td>F.S. for bearing = 2.5</td>
<td>2.5</td>
<td>/</td>
</tr>
<tr>
<td>Depth into Earth = 11' - 6&quot;</td>
<td>10'</td>
<td>8' - 8&quot;</td>
</tr>
<tr>
<td>Thickness of Mat = 7' - 6&quot;</td>
<td>6'</td>
<td>4'</td>
</tr>
</tbody>
</table>
Appendix G: Welded Braced Connection Design

<table>
<thead>
<tr>
<th>A'</th>
<th>W'</th>
<th>N'</th>
</tr>
</thead>
<tbody>
<tr>
<td>304</td>
<td>224</td>
<td>78</td>
</tr>
<tr>
<td>1025</td>
<td>14</td>
<td>10</td>
</tr>
<tr>
<td>A</td>
<td>73.5</td>
<td>4.75</td>
</tr>
<tr>
<td>A'</td>
<td>21.8</td>
<td>4.75</td>
</tr>
</tbody>
</table>

\[
\text{Bolt Failure: } F = 0.9 (50 \times 21.8) = 981 
\]

\[
\text{Tension Rupture: } F = 0.75 (68 \times 21.8) = 922 
\]

\[
\text{Weld Rupture: } F = 0.75 (68 \times 21.8) / \left( \frac{1}{6} \right) = 701 
\]

\[
\text{both ok!} 
\]

\[
\text{Base moment: } F = 0.75 (0.65 \times 28) = 724 
\]

\[
\text{Block Shear: } F = 0.75 (0.65 \times 28) + 1.0 (65 \times 8) = 1740 
\]

\[
\text{Controlly: } 724 > 514 \ 	ext{kips} 
\]
B: Gusset to Beam Connection (look at p. 2 for values)

Tension Yielding: \( \Delta R_n = 0.9(35)(2.07)(2) = 636 \text{k} \)  

Tension Rupture: \( \Delta R_n = 0.75(65)(2.07)(2.07)(2)(2) = 736 \text{k} \)

Weld Rupture: "same" when UT is welded 10x on gusset plate,  
\[ \Delta R_n = 726 \text{k} \]

Base Metal: \( \Delta R_n = 636 \text{k} \) "same thickness"  

Compressive: \( \Delta R_n = 0.1(50)(7.07)(2) = 68.6 \text{k} \)

Corrugation: \( 636 \text{k} > 51 \text{k} \) OK

C: Gusset Plate

Tension Yielding: \( \Delta R_n = 0.9(55)(2.07)(2) = 645 \text{k} \)

Tension Rupture: \( \Delta R_n = 0.75(78)(2.07)(2.07)(2) = 865 \text{k} \)

Weld Rupture: "same" when UT is welded 10x on gusset plate,  
\[ \Delta R_n = 726 \text{k} \]

Base Metal: \( \Delta R_n = 636 \text{k} \) "same thickness"  

Blade Shear: \( \Delta R_n = 1394 \text{k} \)

Compressive: \( \Delta R_n = 0.1(50)(19.2)(2) = 644 \text{k} \)

Corrugation: \( 644 \text{k} > 51 \text{k} \) OK

D: Gusset to Beam Connection (look at p. 2 for values)

Weld Rupture: \( \Delta R_n = 1.352(32)(6)(2)(5) = 751 \text{k} \) > 226 \text{k} = V_b  
\[ \Delta R_n = 1.352(32)(6)(2)(5) = 751 \text{k} \]

Beam web yield:  
\[ \frac{\Delta R_n}{10(5)(18)} + (30)(50)(1,14) = 729.8 \text{k} \]

Beam web crippling:  
\[ \Delta R_n = 0.75(60)(4.74)^2 \left(1 + 3 \left( \frac{4.74}{12} \right)^{0.51} \right) \left( \frac{20.0}{12} \right) \]  
\[ \frac{\Delta R_n}{14} \]

E: Gusset to Column Connection

Weld Rupture: \( \Delta R_n = 1.352(2)(6)(1)(15) = 275 \text{k} \) > 116 \text{k}  
\[ \Delta R_n = 1.352(2)(6)(1)(15) = 275 \text{k} \]

F: Beam to Column Connection (8" x 8" x 1/4" x 1/4"")

Weld Rupture due to eccentricity shear:  
\[ C = 2.5, L = 1.0, \Delta = 7/10 \]

\[ \text{OK: } \Delta = 7/10 \text{ or } 0.7 \]
Beam Web Strength at Weld:

\[ N_a = \frac{0.75 \times 1.5 \times 0.49}{1.89} \times (345 \times 1.0) = 586.1 \text{kN} > 68.8 \text{kN} \]

\[ P_m = 6.35 \times (56) \times (0.5) = 184.4 \text{kN} \]

\[ P_{cr} = 6.35 \times (56) \times (0.5) = 68.8 \text{kN} \]

Column Web Strength:

\[ N_a = \frac{2 \times (16)^2 \times (1.34)}{(11.7^2 + 13.96 \times 0.025)^2} = 252 \text{kN} > 68.8 \text{kN} \]

\[ \varepsilon = \frac{52}{225} = 0.23 \]
Appendix H: Façade Breadth

R VALUE ANALYSIS
The Heat, Air and Moisture Building Science Toolbox - V1B-E/U (11)

WALL SECTION AND TEMPERATURE GRADIENTS

<table>
<thead>
<tr>
<th>Generic Material</th>
<th>Manufacturer</th>
<th>Model No.</th>
<th>Thick (in.)</th>
<th>RVal (R)</th>
<th>W.Temp. (°F)</th>
<th>S.Tem (°F)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 brick, (vented), 4 in.</td>
<td>No Recor...</td>
<td>Generic...</td>
<td>3.50</td>
<td>0.64</td>
<td>46.3</td>
<td>91.0</td>
</tr>
<tr>
<td>2 cavity, 2 in.</td>
<td>No Recor...</td>
<td>Generic...</td>
<td>2.00</td>
<td>0.98</td>
<td>47.4</td>
<td>90.3</td>
</tr>
<tr>
<td>3 rigid ins., expand., 2 in.</td>
<td>No Recor...</td>
<td>Generic...</td>
<td>2.00</td>
<td>7.90</td>
<td>55.6</td>
<td>84.7</td>
</tr>
<tr>
<td>4 poly film, (6mil)</td>
<td>No Recor...</td>
<td>Generic...</td>
<td>0.01</td>
<td>0.12</td>
<td>55.7</td>
<td>84.7</td>
</tr>
<tr>
<td>5 block, 8 in.</td>
<td>No Recor...</td>
<td>Generic...</td>
<td>8.03</td>
<td>1.03</td>
<td>56.8</td>
<td>83.9</td>
</tr>
<tr>
<td>6 batt ins., 4 in.</td>
<td>No Recor...</td>
<td>Generic...</td>
<td>4.00</td>
<td>12.19</td>
<td>69.4</td>
<td>75.4</td>
</tr>
<tr>
<td>7 gypsum bd., 5/8 in., (#1)</td>
<td>No Recor...</td>
<td>Generic...</td>
<td>0.63</td>
<td>0.46</td>
<td>69.9</td>
<td>75.1</td>
</tr>
<tr>
<td>8 paint (#1), (12mil)</td>
<td>No Recor...</td>
<td>Generic...</td>
<td>0.01</td>
<td>0.12</td>
<td>70.0</td>
<td>75.0</td>
</tr>
</tbody>
</table>

Total or (Layer 0) 20.18 23.44 (45.7) (91.4)

CLIMATIC CONDITIONS

<table>
<thead>
<tr>
<th>Winter</th>
<th>Summer</th>
</tr>
</thead>
<tbody>
<tr>
<td>Int.</td>
<td>Ext.</td>
</tr>
<tr>
<td>Temp (°F)</td>
<td>70</td>
</tr>
<tr>
<td>RH (%)</td>
<td>25</td>
</tr>
<tr>
<td>DPT (°F)</td>
<td>33</td>
</tr>
</tbody>
</table>

TCMC Wall Analysis
City: Miami, FL
Date: 3/20/2013
Analysis by: Xiao Ye Zheng
Wall Type: Option

PENNSYLVANIA STATE UNIVERSITY
104 ENGINEERING, UNIT A UNIVERSITY PARK, PA, USA, 1680
** CONDENSATION ANALYSIS **

The Heat, Air and Moisture Building Science Toolbox - V.1B-E/U (11a)

WALL SECTION AND VAPOUR PRESSURE GRADIENTS

<table>
<thead>
<tr>
<th>Name</th>
<th>PROJECT</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number</td>
<td>Miami, FL</td>
</tr>
<tr>
<td>City</td>
<td></td>
</tr>
<tr>
<td>Date</td>
<td></td>
</tr>
<tr>
<td>Analysis by:</td>
<td></td>
</tr>
<tr>
<td>Wall Type</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Option</td>
</tr>
</tbody>
</table>

CLIMATIC CONDITIONS

<table>
<thead>
<tr>
<th>Winter</th>
<th>Summer</th>
</tr>
</thead>
<tbody>
<tr>
<td>Int.</td>
<td>Ext.</td>
</tr>
<tr>
<td>Temp (°F)</td>
<td>75</td>
</tr>
<tr>
<td>RH (%)</td>
<td>50</td>
</tr>
<tr>
<td>DPT (°F)</td>
<td>56</td>
</tr>
</tbody>
</table>

** PENNSYLVANIA STATE UNIVERSITY **

104 ENGINEERING, UNIT A UNIVERSITY PARK, PA, USA, 1680

<table>
<thead>
<tr>
<th>Material</th>
<th>Manufacturer</th>
<th>Model No.</th>
<th>Rvap (1/M)</th>
<th>Temp (°F)</th>
<th>VapSat (in.Hg)</th>
<th>VapCo (in.Hg)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 brick, (vented), 4 in.</td>
<td>No Recor...</td>
<td>Generic...</td>
<td>0.191</td>
<td>90.6</td>
<td>1.449</td>
<td>0.935</td>
</tr>
<tr>
<td>2 cavity, 2 in.</td>
<td>No Recor...</td>
<td>Generic...</td>
<td>0.016</td>
<td>89.9</td>
<td>1.419</td>
<td>0.935</td>
</tr>
<tr>
<td>3 rigid ins., (expand.), 2 in.</td>
<td>No Recor...</td>
<td>Generic...</td>
<td>0.515</td>
<td>84.5</td>
<td>1.195</td>
<td>0.922</td>
</tr>
<tr>
<td>4 poly film, (6mil)</td>
<td>No Recor...</td>
<td>Generic...</td>
<td>16.827</td>
<td>84.4</td>
<td>1.192</td>
<td>0.515</td>
</tr>
<tr>
<td>5 block, 8 in.</td>
<td>No Recor...</td>
<td>Generic...</td>
<td>0.418</td>
<td>83.7</td>
<td>1.166</td>
<td>0.505</td>
</tr>
<tr>
<td>6 batt ins., 4 in.</td>
<td>No Recor...</td>
<td>Generic...</td>
<td>0.040</td>
<td>75.4</td>
<td>0.887</td>
<td>0.504</td>
</tr>
<tr>
<td>7 gypsum bd., 5/8 in., (#1)</td>
<td>No Recor...</td>
<td>Generic...</td>
<td>0.229</td>
<td>75.1</td>
<td>0.878</td>
<td>0.498</td>
</tr>
<tr>
<td>8 paint (#1), (12mil)</td>
<td>No Recor...</td>
<td>Generic...</td>
<td>2.488</td>
<td>75.0</td>
<td>0.876</td>
<td>0.438</td>
</tr>
<tr>
<td>9</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>10</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>11</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>12</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>TOTAL or (Layer 0)</td>
<td></td>
<td></td>
<td>20.810</td>
<td>(91.0)</td>
<td>(1.469)</td>
<td>(0.940)</td>
</tr>
</tbody>
</table>
Appendix I: Solar Panel Breadth

Panasonic ideas for life

HIT® Photovoltaic Module

HIT® Power 220A

HIT Delivers More Real World Performance
19.8% cell conversion efficiency
Hybrid cell produces the highest output on cloudy days
Highest warranted tolerance: -0/+10%
Most PTC Watts: 204.4
Lowest temperature coefficient: -0.33%
Highest PTC/STC Ratio: 93%+

HIT® Photovoltaic Module

VBHN220AA01

High Efficiency
HIT® Power solar panels are leaders in sunlight conversion efficiency. Obtain maximum power within a fixed amount of space. Save money using fewer system attachments and racking materials, and reduce costs by spending less time installing per Watt.

Power Guarantee
The power ratings for HIT Power panels guarantee customers receive 100% of the nameplate rated power (or more) at the time of purchase, enabling owners to generate more kWh per rated Watt, quicken investments returns, and help realize complete customer satisfaction.

Temperature Performance
As temperatures rise, HIT Power solar panels produce 10% or more electricity (kWh) than conventional crystalline silicon solar panels at the same temperature.

Valuable Features
The packing density of the panels reduces transportation, fuel, and storage costs per installed watt.

American Made Quality
Our silicon wafers located inside HIT solar panels are made in Oregon, and the panels are assembled in an ISO 9001 (quality), 14001 (environment), and 18001 (safety) certified factory. Unique eco-packing minimizes cardboard waste at the job site. The panels have a Limited 20-Year Power Output and 10-Year Product Workmanship Warranty.
# HIT® Power 220A

## Electrical Specifications

<table>
<thead>
<tr>
<th>Specification</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Model</td>
<td>HIT Power 220A or VBHN220AA01</td>
</tr>
<tr>
<td>Rated Power (Pmax)</td>
<td>220 W</td>
</tr>
<tr>
<td>Maximum Power Voltage (Vpm)</td>
<td>42.7 V</td>
</tr>
<tr>
<td>Maximum Power Current (Ipm)</td>
<td>5.17 A</td>
</tr>
<tr>
<td>Open Circuit Voltage (Voc)</td>
<td>52.3 V</td>
</tr>
<tr>
<td>Short Circuit Current (Isc)</td>
<td>5.65 A</td>
</tr>
<tr>
<td>Temperature Coefficient (Pmax)</td>
<td>-0.336% /°C</td>
</tr>
<tr>
<td>Temperature Coefficient (Voc)</td>
<td>-0.145 V /°C</td>
</tr>
<tr>
<td>Temperature Coefficient (Isc)</td>
<td>1.96 mA /°C</td>
</tr>
<tr>
<td>NOCT</td>
<td>114.8°F (46°C)</td>
</tr>
<tr>
<td>CEC PTC Rating</td>
<td>204.4 W</td>
</tr>
<tr>
<td>Cell Efficiency</td>
<td>19.8%</td>
</tr>
<tr>
<td>Module Efficiency</td>
<td>17.4%</td>
</tr>
<tr>
<td>Watts per Ft²</td>
<td>16.22 W</td>
</tr>
<tr>
<td>Maximum System Voltage</td>
<td>600 V</td>
</tr>
<tr>
<td>Series Fuse Rating</td>
<td>15 A</td>
</tr>
<tr>
<td>Warranted Tolerance (+/-)</td>
<td>0% /+10%</td>
</tr>
</tbody>
</table>

## Mechanical Specifications

<table>
<thead>
<tr>
<th>Specification</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Internal Bypass Diodes</td>
<td>3 Bypass Diodes</td>
</tr>
<tr>
<td>Module Area</td>
<td>13.56 ft² (1.26 m²)</td>
</tr>
<tr>
<td>Weight</td>
<td>35.3 lbs (16kg)</td>
</tr>
<tr>
<td>Dimensions LxWxH</td>
<td>62.2 x 31.4 x 1.8 in. (1580 x 798 x 46 mm)</td>
</tr>
<tr>
<td>Cable Length Male/Female</td>
<td>46.45/40.55 in. (1180/1030 mm)</td>
</tr>
<tr>
<td>Cable Size / Type</td>
<td>No. 12 AWG / PV Cable</td>
</tr>
<tr>
<td>Connector Type</td>
<td>Multi-Contact Type IV (MC4™)</td>
</tr>
<tr>
<td>Static Wind / Snow Load</td>
<td>600 PSF (2880 Pa) / 3900 Pa (1667 Pa)</td>
</tr>
<tr>
<td>Pallet Dimensions LxWxH</td>
<td>63.2 x 32 x 7.28 in. (1607 x 815 x 1850 mm)</td>
</tr>
<tr>
<td>Quantity per Pallet / Pallet Weight</td>
<td>35 pcs./1322.7 lbs (600 kg)</td>
</tr>
<tr>
<td>Quantity per 53’ Trailer</td>
<td>980 pcs.</td>
</tr>
</tbody>
</table>

## Operating Conditions & Safety Ratings

- **Ambient Operating Temperature**: -4°F to 115°F (-20°C to 46°C)
- **Hail Safety Impact Velocity**: 1” hailstone (25mm) at 52 mph (23m/s)
- **Fire Safety Classification**: Class C
- **Safety & Rating Certifications**: UL 1703, CUL, CEC
- **Limited Warranty**: 10 Years Workmanship, 20 Years Power Output

---

⚠️ **CAUTION!** Please read the installation manual carefully before using the products.

---

**Panasonic Eco Solutions Energy Management North America**  
**Unit of SANYO North America Corporation**

10900 N. Tantau Ave., Suite 200  
Cupertino, CA 95014  
Phone 408-861-8424  
Fax 408-861-3990  
http://www.panasonic.com/solar
SB 3300 / 3800 / 3800/V

**Powerful**
- Efficiency up to 95.6 %
- OptiCool active temperature management
- The best tracking efficiency with OptiTroc MPP tracking

**Safe**
- Galvanic isolation
- Integrated ESS DC load-disconnecting unit
- Rated nominal power at temperatures up to 45 °C

**Flexible**
- For indoor and outdoor installation
- Suitable for generator grounding

**SUNNY BOY 3300 / 3800**
The generalist

It is robust, easy-to-handle, and, thanks to its galvanic isolation, used in all kinds of AC grids: the Sunny Boy 3300 / 3800. Due to its suitability for generator grounding, it can be combined with all module types. The generously-proportioned die-cast aluminum housing together with the OptiCool active cooling system guarantee the highest yields and a long service life, even under extreme conditions.
## Technical Data

**SUNNY BOY 3300 / 3800 / 3800/V**

<table>
<thead>
<tr>
<th></th>
<th>SB 3300</th>
<th>SB 3800</th>
<th>SB 3800/V*</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Input (DC)</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Max. DC power</td>
<td>2320 W</td>
<td>4040 W</td>
<td>4040 W</td>
</tr>
<tr>
<td>Max. DC voltage</td>
<td>500 V</td>
<td>500 V</td>
<td>500 V</td>
</tr>
<tr>
<td>PV voltage range, MPP</td>
<td>200 V - 400 V</td>
<td>200 V - 400 V</td>
<td>200 V - 400 V</td>
</tr>
<tr>
<td>Max. input current</td>
<td>20 A</td>
<td>20 A</td>
<td>20 A</td>
</tr>
<tr>
<td>Number of MPPT trackers</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Max. number of strings (parallel)</td>
<td>3</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td><strong>Output (AC)</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Nominal AC output</td>
<td>3300 W</td>
<td>3800 W</td>
<td>3800 W</td>
</tr>
<tr>
<td>Max. AC power</td>
<td>3300 W</td>
<td>3800 W</td>
<td>3800 W</td>
</tr>
<tr>
<td>Max. output current</td>
<td>18 A</td>
<td>18 A</td>
<td>18 A</td>
</tr>
<tr>
<td>AC grid frequency (self-adjusting) / range</td>
<td>50 Hz / 60 Hz / 4.5 Hz</td>
<td>50 Hz / 60 Hz / 4.5 Hz</td>
<td>50 Hz / 60 Hz / 4.5 Hz</td>
</tr>
<tr>
<td>Phase shift (cos φ)</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>AC connection</td>
<td>single-phase</td>
<td>single-phase</td>
<td>single-phase</td>
</tr>
<tr>
<td><strong>Efficiency</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Max. efficiency / Euro-Ita</td>
<td>95.2% / 94.4%</td>
<td>93.6% / 94.7%</td>
<td>95.6% / 94.7%</td>
</tr>
<tr>
<td><strong>Protection devices</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>DC reverse polarity protection</td>
<td>●</td>
<td>●</td>
<td>●</td>
</tr>
<tr>
<td>ESS DC load disconnecting switch</td>
<td>●</td>
<td>●</td>
<td>●</td>
</tr>
<tr>
<td>AC short-circuit protection</td>
<td>●</td>
<td>●</td>
<td>●</td>
</tr>
<tr>
<td>Ground fault monitoring</td>
<td>●</td>
<td>●</td>
<td>●</td>
</tr>
<tr>
<td>Grid monitoring (SMA Grid Guard)</td>
<td>●</td>
<td>●</td>
<td>●</td>
</tr>
<tr>
<td>Geometrically isolated</td>
<td>●</td>
<td>●</td>
<td>●</td>
</tr>
<tr>
<td><strong>General Data</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dimensions (W / H / D) in mm</td>
<td>450 / 352 / 236</td>
<td>459 / 353 / 236</td>
<td>450 / 352 / 236</td>
</tr>
<tr>
<td>Weight</td>
<td>38 kg</td>
<td>38 kg</td>
<td>38 kg</td>
</tr>
<tr>
<td>Operating temperature range</td>
<td>-25 °C - +60 °C</td>
<td>-25 °C - +60 °C</td>
<td>-25 °C - +60 °C</td>
</tr>
<tr>
<td>Noise emission (typical)</td>
<td>≤ 40 dB(A)</td>
<td>≤ 42 dB(A)</td>
<td>≤ 42 dB(A)</td>
</tr>
<tr>
<td>Consumption (standby / night)</td>
<td>&lt; 7 W / 0.1 W</td>
<td>&lt; 7 W / 0.1 W</td>
<td>&lt; 7 W / 0.1 W</td>
</tr>
<tr>
<td>Topology</td>
<td>IF transformer</td>
<td>IF transformer</td>
<td>IF transformer</td>
</tr>
<tr>
<td>Cooling concept</td>
<td>OptiCool</td>
<td>OptiCool</td>
<td>OptiCool</td>
</tr>
<tr>
<td>Mounting location: indoors / outdoors (IP65)</td>
<td>● / ●</td>
<td>● / ●</td>
<td>● / ●</td>
</tr>
<tr>
<td><strong>Features</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>DC connection: WC3 / MCA / Tyco</td>
<td>● / ● / ●</td>
<td>● / ● / ●</td>
<td>● / ● / ●</td>
</tr>
<tr>
<td>AC connection plug connector (LC)</td>
<td>●</td>
<td>●</td>
<td>●</td>
</tr>
<tr>
<td>Interfaces: Bluetooth / ES4B5</td>
<td>● / ●</td>
<td>● / ●</td>
<td>● / ●</td>
</tr>
<tr>
<td>Warranty: 5 years / 10 years</td>
<td>● / ●</td>
<td>● / ●</td>
<td>● / ●</td>
</tr>
<tr>
<td>Certificates and approvals</td>
<td><a href="http://www.SMA.de">www.SMA.de</a></td>
<td><a href="http://www.SMA.de">www.SMA.de</a></td>
<td><a href="http://www.SMA.de">www.SMA.de</a></td>
</tr>
<tr>
<td>Certificate number (please include when ordering)</td>
<td>-</td>
<td>-</td>
<td>V0153</td>
</tr>
</tbody>
</table>

- Standard
- Optional

Data at nominal conditions – Last update: March 2009

*Version for country requirements is accordance with EN 50438 with IAC = 16 A

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**Efficiency zone SUNNY BOY 3800**

![Efficiency Graph]

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**Accessories**

- [BLuetransfer interface type 1804] (ESHVANR)
- [Bluetooth Piggy-Back] (ESHVANR)
- [GroundingKit "Patina"] (ESHVANR)
- [GroundingKit "Nachtweiss"] (ESHVANR)