CARRIER CUBE UNIT

BASED ON A REVIEW AND ANALYSIS THE FOLLOWING UNITS CONFORMS TO THE 2014 FLORIDA BUILDING CODE AND THE ASCE 7-10 WIND ANALYSIS CODE. SEE ENCLOSED ANCHORING DETAIL REQUIREMENT AS SPECIFIED IN SECTION 1620 , HIGH VELOCITY HURRICANE ZONES- WIND LOADS FOR MAX WIND SPEED OF 180 MPH AND MAX HEIGHT OF 60 FEET.

CARRIER AIR CONDITIONER MODEL LIST FOR UTC "CUBE STYLE BASE PAN UNITS"		
UNITS UP TO 39" HIGH FOR 180 MPH WIND VELOCITY WITH A MAXIMUM BUILDING HEIGHT OF 60' EXPOSURE "D"	UNITS OVER 39" HIGH TO 44" HIGH FOR 180 MPH WIND VELOCITY WITH A MAXIMUM BUILDING HEIGHT OF 60' EXPOSURE "D"	UNITS OVER 44" HIGH TO 48" HIGH FOR 180 MPH WIND VELOCITY WITH A MAXIMUM BUILDING HEIGHT OF 60' EXPOSURE "C"
PA13NR (1.5-3.5 ton, 5 ton)	PA13NR (4 ton)	
CA13 (all tonnages)		
CA16 (1.5 -4 Ton)		CA16 (5-Ton)
24ABB3 (all tonnages)		
24ABB3C (all tonnages)		
24ABC6 (1.5 thru 4 Ton)		24ABC6 (5 Ton)
24ACB3 (all tonnages)		
24ACC6 (1.5-4 Ton)		24ACC6(5 Ton)
24ACB7 (2-4 Ton)		24ACB7 (5 Ton)
24ANB6 (1.5-3 Ton)	24ANB6 (3.5-4 Ton)	24ANB6 (5 Ton)
24ANB7 (2-3 Ton)	24ANB7 (4 Ton) 24ANB7 (5 Ton, series 1)	24ANB7 (5 Ton, series 0)
24ANB1 (2 -3,4 ,5 Ton, series 1)		24ANB1(2 -3,4 ,5 Ton, series 1)
24ANB136 (3 ton)	24ANB148 (4 ton)	24ANB160 (5 ton)

CARRIER HEAT PUMP MODEL LIST FOR UTC "CUBE STYLE BASE PAN UNITS"		
UNITS UP TO 39" HIGH FOR 180 MPH WIND VELOCITY WITH A MAXIMUM BUILDING HEIGHT OF 60' EXPOSURE "D"	UNITS OVER 39" HIGH TO 44" HIGH FOR 180 MPH WIND VELOCITY WITH A MAXIMUM BUILDING HEIGHT OF 50' EXPOSURE "D"	UNITS OVER 44" HIGH TO 48" HIGH FOR 180 MPH WIND VELOCITY WITH A MAXIMUM BUILDING HEIGHT OF 60' EXPOSURE "C"
PH13NR (1.5-4 ton)		PH13NR (5 ton)
CH13 (all tonnages)		
25HBB3 (all tonnages)		
25HBB3C (all tonnages)		
25HBC3 (all tonnages)		
25HBC5 (all tonnages)		
25HCD3 (all tonnages)		
25HCD4 (all tonnages)		
25HCC5 (all tonnages)		
25HCB6 (all tonnages)		25HCB6 (5 ton)
25HNB5 (1.5-4 ton)	25HNB5 (5 ton)	
25HNH5 (2-3.5 ton)	25HNH5 (4 ton)	
	25HNB6 (2-4 ton)	25HNB6 (5 ton)
	25HNB9 (2 ton series 1)	25HNB9 (2 ton series 0) 25HNB9 (3-5 ton)
		25VNA0 (all tonnages)

NOTE: ALL OF THE WIND RESISTING EXTERIOR PANELS, INDIVIDUALLY MEET OR EXCEED THEIR CAPACITY TO RESIST THE DESIGN WIND LOADS AS STATED IN THE CALCULATIONS AS REQUIRED BY THE FLORIDA STATE BUILDING CODE 2014. DUE TO THE INDETERMINENT NATURE OF THESE UNITS, DISTORTION AND DEFLECTION CANNOT BE ACCURATELY EVALUATED, BUT WITH DIAPHRAGM ACTION OF EXTERNAL COMPONENTS AND INTERNAL STIFFENERS, THE BASE UNIT HAS THE CAPACITY TO WITHSTAND THESE FORCES WITH INDIVIDUAL EXTERNAL PARTS BEING CONTAINED. YEARLY INSPECTIONS OR DURING EQUIPMENT MAINTENANCE, ALL TECH SCREWS, CABINET COMPONENTS, CLIPS AND ANCHOR BOLTS ARE TO BE VERIFIED BY THE A/C CONTRACTOR. ALL DAMAGED CABINET COMPONENTS, LOOSE, CORRODED, BROKEN TECH SCREWS OR ANCHOR BOLTS SHALL BE REPLACED TO ENSURE STRUCTURAL INTEGRITY FOR HURRICANE WIND FORCES

S-1

Job No: 15-18
Date: 09-11-2015
Chk'd By: R. Samara
Drawn By: A.Barnet

JOB NAME: CARRIER CUBE UNIT

TITLE: MODELS LIST

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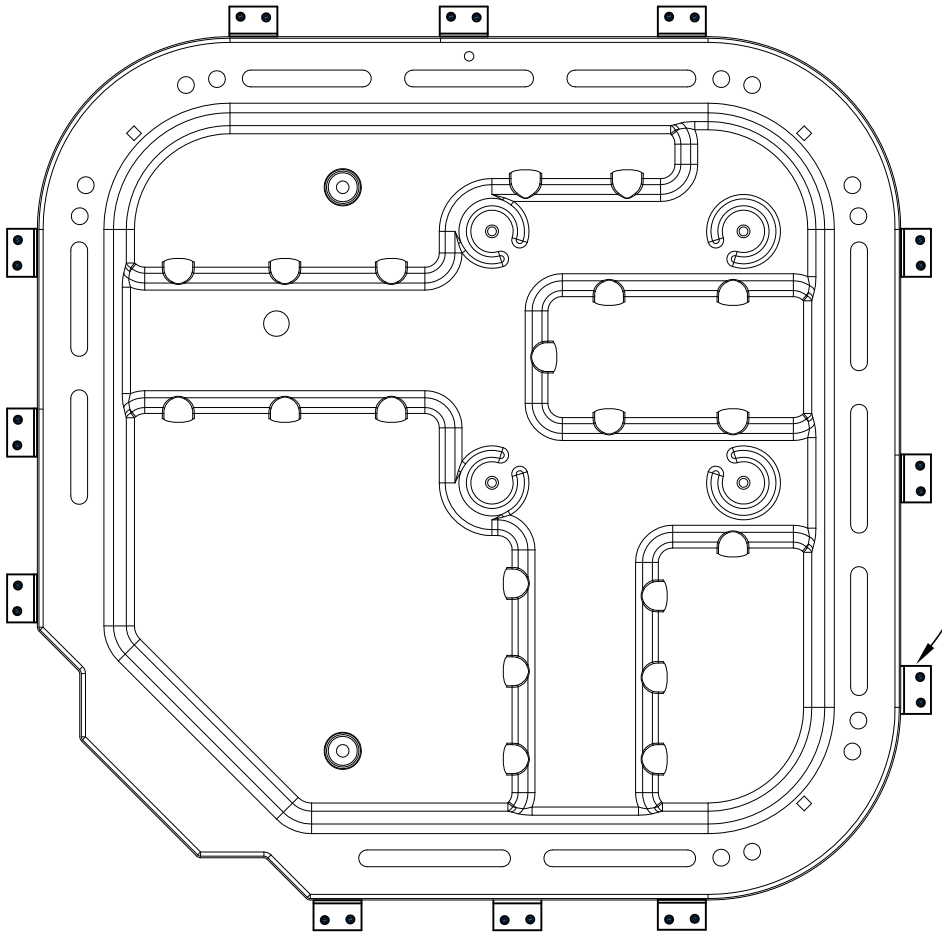
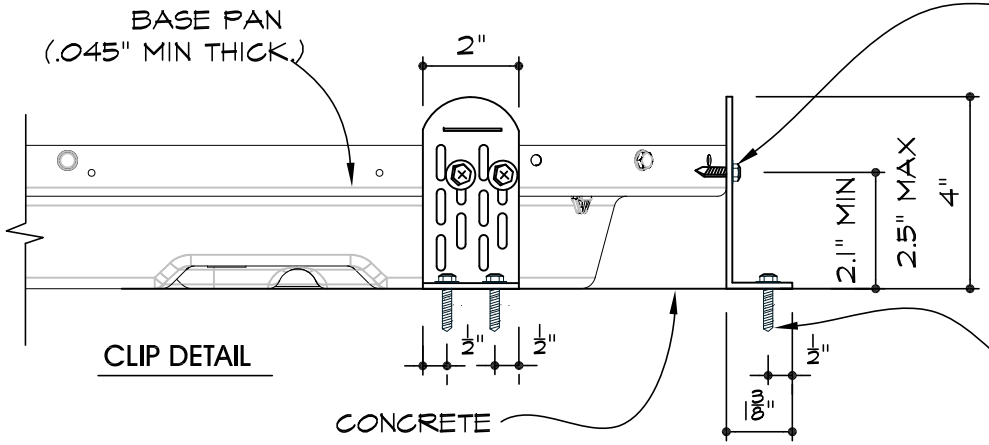


GENERAL NOTES

1. SECTION PROPERTIES WERE DERIVED BY THE MANUFACTURER, SEE COMPONENT (PARTS) DRAWINGS BY UTC.
2. MAXIMUM UNIT WIND DESIGN BY VISUAL COMPARISONS OF MODELS IN EACH GROUP IS USED FOR THE ANALYSIS.
3. ALL UNIT COMPONENT (PARTS) ATTACHMENT TO EACH OTHER HAVE A MINIMUM OF (3) 10-16 TECH SCREWS PROVIDING A CAPACITY OF 2,595 LBS IN SHEAR (S.F.=3)

USE TD042 - 2"X4", 15 ga, "STEEL TIE DOWN CLIPS, BY BMP INT. INC (G-90 GALV) AS SHOWN. PRODUCT APROVAL FL#14239R3 SEE DETAIL .



CLIP DETAIL

FOR CONCRETE FOUNDATION ATTACHMENT USE:

(2) $\frac{1}{4}$"ΦX 2$\frac{1}{4}$" LG HEX HEAD STAINLESS STEEL BUILDEX TAPCON STEEL SCREWS (SHW4-214) AND $\frac{5}{16}$"Φ STAINLESS STEEL WASHERS OR

(2) $\frac{1}{4}$"ΦX 2$\frac{1}{4}$" LG HEX HEAD BLUE COATED BUILDEX TAPCON SCREWS (HW4-214) AND $\frac{5}{16}$"Φ STAINLESS STEEL WASHERS OR

(2) $\frac{1}{4}$"Φ X 3" LG POWERS WEDGE BOLT HEAVY DUTY CONCRETE ANCHORS.

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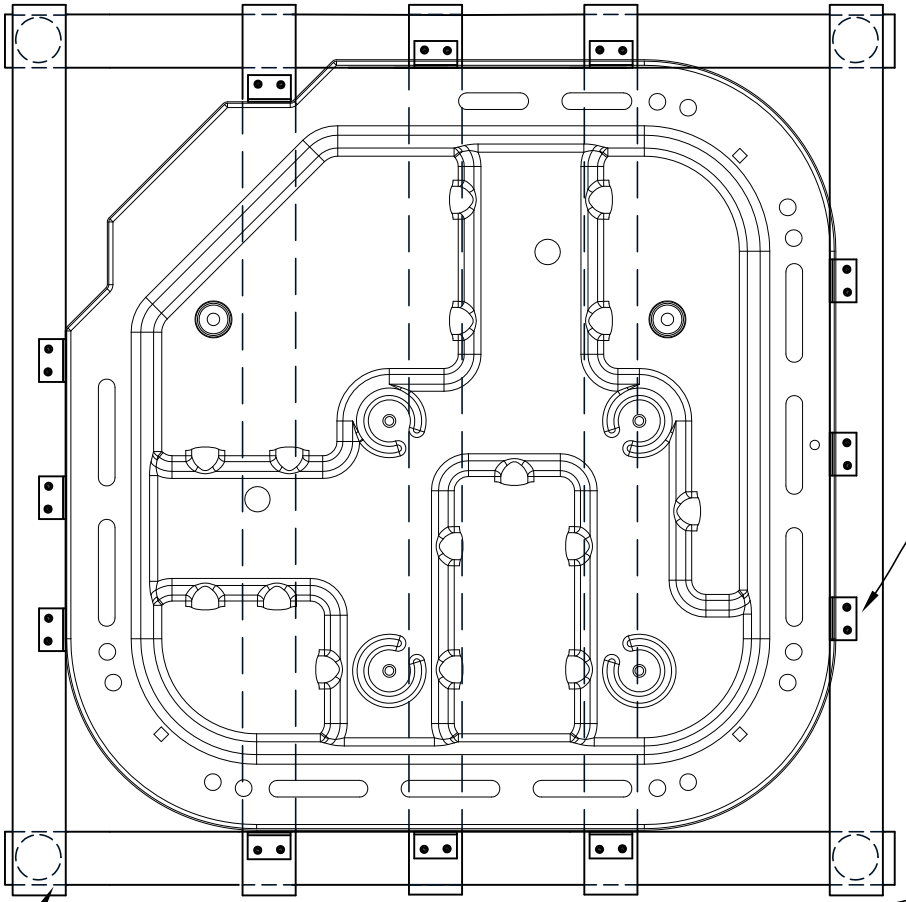
JOB NAME: CUBE UNIT

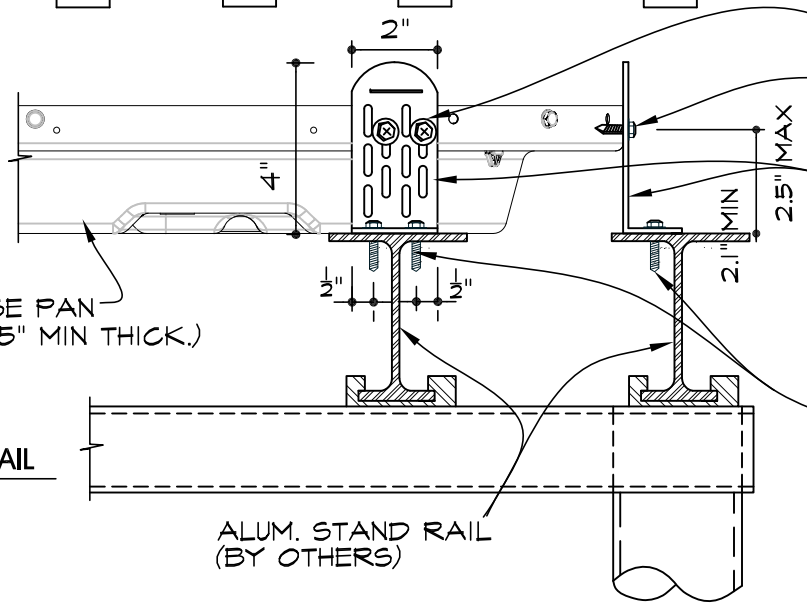
TITLE: CLIP AND ATTACHMENT LOCATION PLAN

Job No:	15-18
Date:	09-11-2015
Chk'd By:	R. Samara
Drawn By:	A.Barnet

S-2



ALUM. STAND RAIL (BY OTHERS)



CLIP DETAIL

ALUM. STAND RAIL (BY OTHERS)

GENERAL NOTES

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3. ALL UNIT COMPONENT (PARTS) ATTACHMENT TO EACH OTHER HAVE A MINIMUM OF (3) 10-16 TECH SCREWS PROVIDING A CAPACITY OF 2,595 LBS IN SHEAR (S.F.=3)

USE TD042 - 2"X4", 15 ga, "STEEL TIE DOWN CLIPS, BY BMP INT. INC (G-90 GALV) AS SHOWN. PRODUCT APPROVAL FL#14239R3 SEE DETAIL .

(2) #12-14 x 1" LG (HWH#3) HILTI KWIK-FLEX SELF DRILLING STEEL SCREW w/ WASHERS

USE TD042 - 2" X4", 15 ga, "STEEL TIE DOWN CLIPS, BY BMP INT. INC (G-90 GALV) AS SHOWN. PRODUCT APPROVAL FL#14239R3

(2) SS 1/4"Φ x 1-1/2" LG THRU BOLTS w/ SS WASHERS

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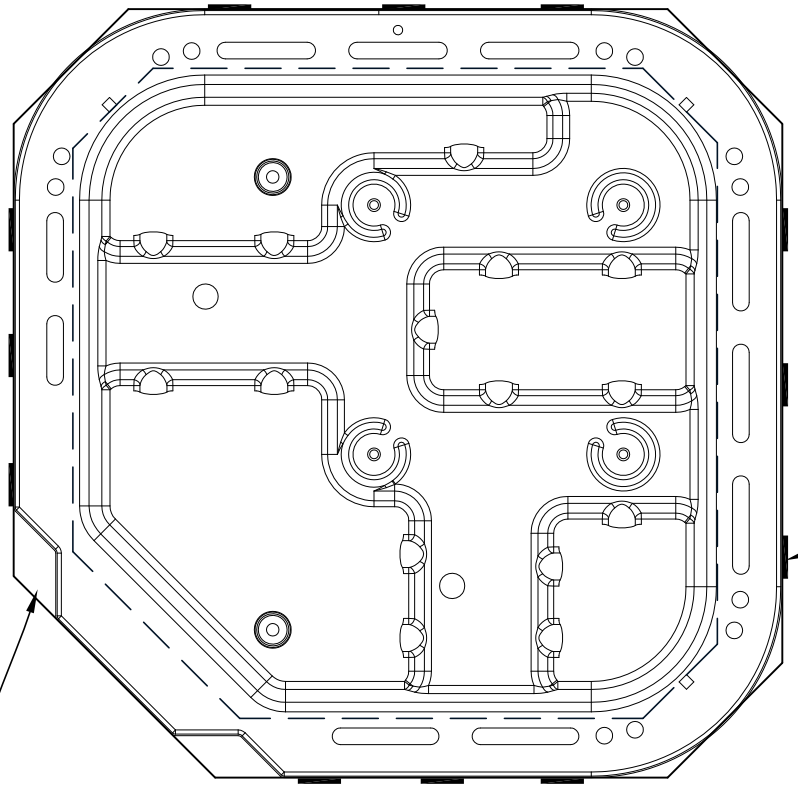
JOB NAME: CUBE UNIT

TITLE: CLIP AND ATTACHMENT LOCATION PLAN (FOR ALUM STAND)

Job No:	15-18
Date:	09-11-2015
Chk'd By:	R. Samara
Drawn By:	A.Barnet

S-3



GENERAL NOTES

1. SECTION PROPERTIES WERE DERIVED BY THE MANUFACTURER, SEE COMPONENT (PARTS) DRAWINGS BY UTC.
2. MAXIMUM UNIT WIND DESIGN BY VISUAL COMPARISONS OF MODELS IN EACH GROUP IS USED FOR THE ANALYSIS.
3. ALL UNIT COMPONENT (PARTS) ATTACHMENT TO EACH OTHER HAVE A MINIMUM OF (3) 10-16 TECH SCREWS PROVIDING A CAPACITY OF 2,595 LBS IN SHEAR (S.F.=3)

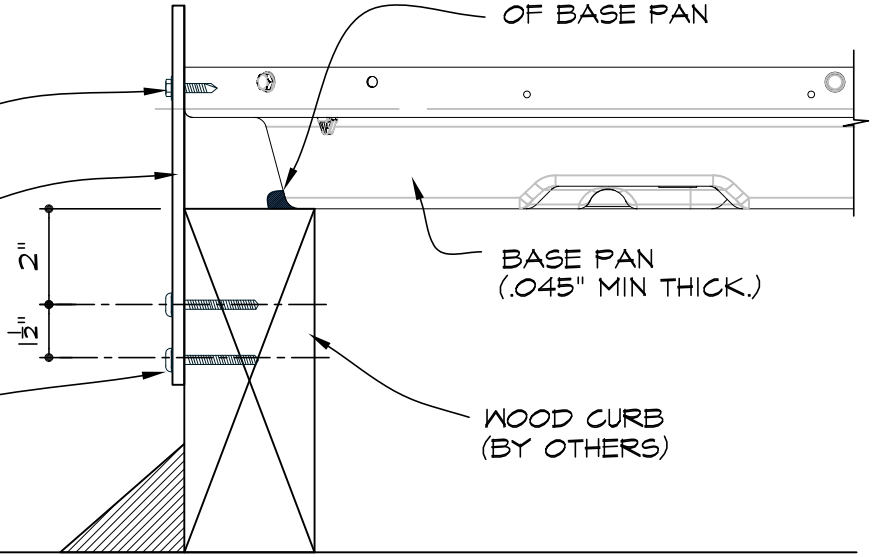
USE 2" X 8", 15 ga, STRAP (G-90) AS PER PLAN SEE DETAIL

WOOD CURB (BY OTHERS)

(2) #12-14 x 1" LG (HWH#3) HILTI KWIK-FLEX SELF DRILLING STEEL SCREW w/ WASHERS (OR EQUIVALENT)

USE 2" X 8", 15 ga, (G-90) STRAP AS PER PLAN

(4) #12 x2" LG WOOD SCREWS w/ WASHERS



STRAP DETAIL

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JOB NAME: CUBE UNIT

TITLE: CLIP AND ATTACHMENT LOCATION PLAN (FOR WOOD CURB)

Job No:	15-18
Date:	09-11-2015
Chk'd By:	R. Samara
Drawn By:	A.Barnet

S-4

WIND ANALYSIS AND ANCHOR DESIGN FOR UTC CARRIER "Cube Style Base Pan Units", FOR RESIDENTIAL OCCUPANCY, WITH BASE PAN SIZE NO GREATER THAN 35 INCHES SQUARE(CATEGORY II)(FOR BUILDINGS OF 60 FEET OR LESS IN HEIGHT AND MAXIMUM WIND VELOCITY OF 180 MPH)(MAXIMUM HEIGHT OF UNIT 47.44 iINCHES)

References:

ASCE 7-10 " Minimum Design Loads for Buildings and Other Structures"
Florida Building Code 2014, 5th Edition

Design Criteria:

Paragraph 6.5.15 "Design Wind Loads on Open Buildings and Other Structures"

Note that 2 sides of these units are open and the other 2 sides are partially open)

Wind Analysis (For heights up to 60 feet and 180 mph velocity) Risk Factor = 1.0

Wind design velocity $V := 180$

Wind speed conversion $V_{asd} := V\cdot\sqrt{0.6}$ $V_{asd} = 139.427$

Structure Category II (Table 1.5-1 "(ASCE)

Height above ground $H := 60$ ft

Height of structure $h := 48$ in

Dimension of unit $D := 35$ in

Area resisting wind forces $A_f := \frac{h\cdot D}{144}$ $A_f = 11.667\ ft^2$

Gust effect factor $GC_f := 3.1$ 1620.6 FBC-14)

Velocity Exposure Coefficient $K_z := 1.13$ (Table 29.3-1) Exposure C) (ASCE)

Topographic multipliers $K_1 := 0$ Section 26.6-1) (ASCE)

$K_2 := 0$ Section 26.6-1) (ASCE)

$K_3 := 0$ Section 26.6-1) (ASCE)

Topographic Factor $K_{zt} := \left(1 + K_1\cdot K_2\cdot K_3\right)$ $K_{zt} = 1$ (Section 26.8-1) (ASCE)

Wind Directionality Factor $K_d := 0.9$ Section 26.6-1) (ASCE)

Velocity pressure $q_z := \left(0.00256 K_z\cdot K_{zt}\cdot K_d\cdot V_{asd}^2\right)$ $q_z = 50.612$ psf (29.3-1) (ASCE)

Design Wind Force $F := q_z\cdot GC_f$ $F = 156.899$ psf (Eq. 29.5-2) (ASCE)

$\frac{F}{144} = 1.09$ ksi

Note that vertical Unit Panels are attached to Base Pans with at least (3) S-MD 10-16 Screws , each side, with a shear capacity of 865 pounds each, with a safety factor of (3) and a total capacity of 2595 pounds

S-5	Job No: 15-18 Date: 09-11-2015 Chk'd By: R. Samara Drawn By: A.Barnet	JOB NAME: CUBE BASE UNIT TITLE: WIND ANALYSIS AND CALCULATIONS	ROBERT E. SAMARA P.E.,P.A. email: samara@ppsenginc.com Consulting Engineers Structural PE # 19649 4675 PONCE de LEON BLVD, #303 CORAL GABLES, FL 33146 Ph: 305-662-1916 Fax: 305-662-2491

Atttachment of the "35" X 35" Base Cube" units are designed to resist 180 mph wind forces for use up to heights of 60 feet with Uplift Clips as described below.

Design Criteria:	Width (feet)	Height (feet)	Area (square feet)	Moment arm (feet)
	$w := \frac{D}{12}$	$h_1 := \frac{h}{12}$	$A_{fl} := w \cdot h_1$	$a_1 := \frac{D}{2 \cdot 12}$
	$w = 2.917$	$h_1 = 4$	$A_{fl} = 11.667$	$a_1 = 1.458$

Maximum wind moments and overturning reaction forces on each unit

$M_1 := A_{fl} \cdot \frac{h_1}{2} \cdot F$ $\quad M_1 = 3.661 \times 10^{\hat{}}(\text{ft lbs})$ $\quad F_1 := \frac{M_1}{a_1}$ $\quad F_1 = 2.51 \times 10^3$ (pounds)

Anchor design of base pan to support pad

ANCHOR DESIGN OF BASE PAN TO CONCRETE SUPPORT PAD WITH 2" X 4" TIE-DOWN CLIPS

Screw Design (Vertical Attachment to Base Pan (Shear capacity of (2) 12-14 screws per Clip)

$V_s := 6 \cdot 526$ $\quad V_s = 3.156 \times 10^3$ lbs. **Number/Screws/Clip (2)**

Tensile capacity of (3) 1/4" Anchor devises for Uplift Clips

$F_{kb} := 505 \cdot 6$ $\quad F_{kb} = 3.03 \times 10^3$ lbs **Number/Anchors/Clip (2)**

Try (3) 2" x 4" Tie-down Clips on each side with minimum capacity of 914 lbs.

$T_s := 3 \cdot 914$ $\quad T_s = 2.742 \times 10^3$ **Number/Clips/Unit (12)**

Use 2" X 4", 15 guage, "Steel Tie-Down Clips, by BMP International, Inc." Attach (3) Clips at each side as close to each corner as possible. Use (2) No. 12-14 x 1" (HWH) HIlti Self Drilling steel screws, or equal, at each Uplift Clip with a shear capacity of 526 lbs per screw (working stress). For Clip to foundation attachment use 1/4" x 2 1/4" hex head stainless steel "Buildex" Tapcon Steel Screws (SHW4-214) and 5/16" stainless steel washer with an uplift capacity of 505 lbs. per anchor, or 1/4" x 2 1/4" hex head blue coated "Buildex" Tapcon Screws (HW4-214) and 5/16" stainless steel washer, or use (2) 1/4" x 3" long "Powers Wedge Bolt" heavy duty anchors and 5/16" stainless steel washer, with uplift capacity of 900 lbs per anchor in 2500 psi concrete. (See attached drawing)

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Maximum wind moments and overturning reaction forces on each unit

$M_1 := A_{f1} \cdot \frac{h_1}{2} \cdot F$ $\quad M_1 = 3.661 \times 10^{3}$ (ft lbs) $\quad F_1 := \frac{M_1}{a_1}$ $\quad F_1 = 2.51 \times 10^{3}$ (pounds)

Screw Design (Vertical Attachment to Base Pan (Shear capacity of (2) 12-14 Tech screws per strap)

$V_s := 6 \cdot 526$ $\quad V_s = 3.156 \times 10^{3}$ lbs. **Number/Screws/strap (2)**

Shear capacity of (12) #12 x 2" long stainless Wood Screws for Uplift Clips (256 lbs. per Screw)

$F_{kb} := 256 \cdot 12$ $\quad F_{kb} = 3.072 \times 10^{3}$ lbs **Number of wood Screws/ strap (4)**

Try (2) Tie-Down Straps on each side with minimum capacity of 914 lbs. (Controlled by wood screws)

$T_s := 3 \cdot 914$ $\quad T_s = 2.742 \times 10^{3}$ **Number/straps/Unit (12)**

Use 2" X 8", 15 guage, "Steel Tie-Down Straps, by BMP International, Inc." Attach (3) Straps at each side as close to each corner as possible. Use (2) No. 12-14 x 1" (HWH) HIlti Self Drilling steel Screws at each Uplift Strap to Base Pan, with a shear capacity of 526 lbs per screw (working stress) . Use (4) No. 12 x 2" stainless steel Wood Screws at each Uplift Strap to Wood Base Curb with a shear capacity of 256 lbs per screw

ANCHOR DESIGN OF BASE PAN TO ROOF STAND WITH 2" X 4" TIE-DOWN CLIPS, WITH ADDED UPLIFT

$GC_f := 1.5$ (1620.6) **(FBC-14)**

$F_r := GC_f \cdot q_z$ $\quad F_r = 75.919$ $\quad F_{up} := F_r \cdot A_{f1}$ $\quad F_{up} = 885.718$

$F_{1adj} := F_1 + \frac{F_{up}}{8}$ $\quad F_{1adj} = 2.621 \times 10^{3}$

Screw Design (Vertical Attachment to Base Pan) Shear capacity of (6) Tech Screws for uplift)

$V_s := 6 \cdot 526$ $\quad V_s = 3.156 \times 10^{3}$ lbs. **Number/Screws per Clip (2)**

Shear capacity of (6) 1/4" stainless #12-14 Tech Screws for Uplift Straps to Metal Roof Stand

$F_{kb} := 526 \cdot 6$ $\quad F_{kb} = 3.156 \times 10^{3}$ lbs **Number/Anchors/Clip (2)**

Try (3) Uplift Clips on each side with minimum capacity of 914 lbs. (Controlled by Clip capacity)

$T_s := 3 \cdot 914$ $\quad T_s = 2.742 \times 10^{3}$ **Number/Clips/Unit (12)**

Use 2" X 4", 15 guage, "Steel Tie-Down Clips, by BMP International, Inc." Attach (3) Clips at each side. Use (2) No. 12-14 x 1" (HWH) HIlti Self Drilling steel Screws at each Uplift Clip to Base Pan, with a shear capacity of 526 lbs per screw (working stress), or equal . Use (2) 1/4" x 1 1/2" stainless steel thru bolts, with washers for Uplift Clips to Metal Roof Stand connection.

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UTC **35" X35" BASE CUBE HP UNITS** **DESIGN FOR BUIDINGS 60 FEET OR LESS IN HEIGHT**

References:

Florida State Building Code 2014 5th Edition
ASCE 7-10 "Minimum Design Loads for Buildings and Other Structures"

Design criteria:

Individual exterior and wind exposed panels are evaluated for their capacity to resist wind forces for 180 mph velocity and 60 feet in height . Stress analysis is based on drawings, dimensions and section properties provided by UTC for their Cube Units.

Wind force: $F := 1.09$ psi **Steel pan yield stress :** $f_t := 30 \cdot 1.33$ $f_t = 39.9$ ksi

Part No.	Height (in)	Eff Width (in)	Moment (in kips)		Sect. Mod. in^3		Resisting Moment Capacity (in kips)	
SERVICE PANEL	$s_1 := 41.3$	$w_1 := 14.63$	$M_1 := \frac{0.125 \cdot w_1 \cdot F \cdot s_1^2}{1000}$	$M_1 = 3.4$	$S_{1x} := 0.007788$ $S_{1y} := 0.9377$		$M_{r1} := f_t \cdot (S_{1x} + S_{1y})$	$M_{r1} = 37.725$
CNTR BOX COVE R	$s_2 := 18.02$	$w_2 := 11.47$	$M_2 := \frac{0.125 \cdot w_2 \cdot F \cdot s_2^2}{1000}$	$M_2 = 0.507$	$S_{2x} := 0.003443$ $S_{2y} := 0.6209$		$M_{r2} := f_t \cdot (S_{2x} + S_{2y})$	$M_{r2} = 24.911$
LOUVER PANEL 1	$s_3 := 40.78$	$w_3 := 20.27$	$M_3 := \frac{0.125 w_3 \cdot F \cdot s_3^2}{1000}$	$M_3 = 4.593$	$S_{x3} := 0.0020911$ $S_{3y} := 0.69759$		$M_{r3} := f_t \cdot (S_{x3} + S_{3y})$	$M_{r3} = 27.917$
LOUVER PANEL 2	$s_4 := 40.78$	$w_4 := 17.14$	$M_4 := \frac{0.125 \cdot w_4 \cdot F \cdot s_4^2}{1000}$	$M_4 = 3.884$	$S_{x4} := 0.021$	$S_{4y} := 0.30364$	$M_{r4} := f_t \cdot (S_{x4} + S_{4y})$	$M_{r4} = 12.953$
SHEET TUBE	$s_5 := 40.78$	$w_5 := 17.14$	$M_5 := \frac{1.976 \times 10^3 \cdot 12}{1000}$	$M_5 = 23.712$	$S_{x5} := 6.7116$		$M_{r5} := f_t \cdot S_{x5}$	$M_{r5} = 267.793$

.NOTE: ALL OF THE WIND RESISTING EXTERIOR PANELS, INDIVIDUALLY MEET OR EXCEED THEIR CAPACITY TO RESIST THE DESIGN WIND LOADS AS STATED IN THE CALCULATIONS AS REQUIRED BY THE FLORIDA STATE BUILDING CODE 2014. DUE TO THE INDETERMINENT NATURE OF THESE UNITS, DISTORTION AND DEFLECTION CANNOT BE ACCURATELY EVALUATED, BUT WITH DIAPHRAGM ACTION OF EXTERNAL COMPONENTS AND INTERNAL STIFFENERS, THE BASE UNIT HAS THE CAPACITY TO WITHSTAND THESE FORCES WITH INDIVIDUAL EXTERNAL PARTS BEING CONTAINED. YEARLY INSPECTIONS OR DURING EQUIPMENT MAINTENANCE, ALL TECH SCREWS, CABINET COMPONENTS, CLIPS AND ANCHOR BOLTS ARE TO BE VERIFIED BY THE A/C CONTRACTOR. ALL DAMAGED CABINET COMPONENTS, LOOSE, CORRODED, BROKEN TECH SCREWS OR ANCHOR BOTS SHALL BE REPLACED TO ENSURE STRUCTURAL INTEGRITY FOR HURRICANE WIND FORCES

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JOB NAME: CUBE BASE UNITS

TITLE: PARTS ANALYSIS AND CALCULATIONS

Job No: 15-18
Date: 09-11-2015
Chk'd By: R. Samara
Drawn By: A.Barnet

S-8