Carrier,Bryant,Payne & Midea Model		38MAQB09R---1	38MAQB12R---1	38MAQB09R---3	38MAQB12R---3	38MAQB18R---3	38MAQB24R---3	38MAQB30R---3	38MAQB36R---3	38MBRQ36A--3
ICP Model		DLCSRAH09AAJ	DLCSRAH12AAJ	DLCSRAH09AAK	DLCSRAH12AAK	DLCSRAH18AAK	DLCSRAH24AAK	DLCSRAH30AAK	DLCSRAH36AAK	DLCLRAH36AAK
Dimensions										
Height	in	21.8	21.8	21.8	21.8	27.6	31.9	31.9	31.9	31.9
Width	in	32.1	32.1	32.1	32.1	33.7	37.2	37.2	37.2	40.6
Depth	in	13.1	13.1	13.1	13.1	14.2	16.1	16.1	16.1	17.9
Weight -Net	lbs	82.9	82.9	91.5	91.5	118.2	145.5	139.8	147.3	136.6

Carrier,Bryant,Payne & Midea Model		38MGRQC18---3	38MGRQD24C--3	38MGRQ30D--3
ICP Model		DLCMRAH18BAK	DLCMRAH27CAK	DLCMRAH36DAK
Dimensions				
Height	in	27.6	41.2	41.2
Width	in	37.3	31.9	31.9
Depth	in	14.8	17.9	17.9
Weight-Net	lbs.	105.8	149.9	156.5

Carrier,Bryant,Payne & Midea Model		38MPRAQ09AA3	38MPRAQ12AA3
ICP Model		DLCPRAH09AAK	DLCPRAH12AAK
Dimensions			
Height	in	27.6	27.6
Width	in	33.3	33.3
Depth	in	14.3	14.3
Weight -Net	lbs	107.6	108.5

Carrier,Bryant,Payne (cooling only)		38MHRC09A--1	38MHRC12A--1	38MHRC09A--3	38MHRC12A--3	38MHRC18A--3	38MHRC24A--3
Carrier,Bryant,Payne (heat pump)		38MHRQ09A--1	38MHRQ12A--1	38MHRQ09A--3	38MHRQ12A--3	38MHRQ18A--3	38MHRQ24A--3
Dimensions							
Height	in	21.9	21.9	21.9	21.9	21.8	27.6
Width	in	30.3	30.3	30.3	30.3	31.5	33.3
Depth	in	11.8	11.8	11.8	11.8	13.1	14.3
Net. Weight Cooling Only	lbs	57.3	57.8	54.7	53.8	70.1	88.6
Net. Weight Heat Pump	lbs	61.5	65	57.1	60.6	94.6	105.2
Carrier,Bryant,Payne,ICP, Midea (cooling)			38MHRBC12AA1		38MHRC12A-3	38MHRC18A-3	38MHRBC24AA3
Carrier,Bryant,Payne,ICP,Midea (H.P.)			38MHRBQ12AA1	38MHRBQ09AA-3	38MHRQ12A-3	38MHRQ18A-3	38MHRBQ24AA3
ICP (cooling only)			DLCERAA12AAJ		DLCERAA12AAK	DLCERAA18AAK	DLCERAA24AAK
ICP (heat pump)			DLCERAH12AAJ	DLCERAH09AAK	DLCERAH12AAK	DLCERAH18AAK	DLCERAH24AAK
Dimensions							
Height	in		21.85	21.85	21.85	21.81	27.64
Width	in		30.31	30.31	30.31	31.5	33.27
Depth	in		11.81	11.81	11.81	13.11	14.29
Net. Weight Cooling Only	lbs		57.8		53.8	70.1	88.6
Net. Weight Heat Pump	lbs		69	63	65.5	79.6	114.2

Carrier Model Cooling Only	38MHRBC12AA1
Carrier, Bryant & Payne Model Heat Pump	38MHRBQ12AA1
Bryant, Payne, ICP Model Cooling Only	DLCERAA12AAJ
Bryant, Payne, ICP Model Heat Pump	DLCERAH12AAJ
Unit Height (in)	21.85
Unit Width (in)	30.31
Unit Depth (in)	11.81
Net Weight (lbs) Cooling Only	57.8
Net Weight (lbs) Heat Pump	69.0

Toshiba , Carrier	Outdoor Models	RAV-SP180AT2-UL	RAV-SP240AT2-UL
Height	in	21.7	35
Width	in	30.7	35.4
Depth	in	11.4	12.6
Weight/Net	lbs	98	144

Carrier Model Number		Carrier Model Number		38GRQB09---3	38GRQB12---3	38GRQB18---3	38GJQC18---3	38GJQD24---3	38GJQF30---3
Bryant Model Number		Bryant Model Number		538FEQ009RBGA	538FEQ012RBGA	538FEQ018RBGA	538KEQ018RCGA	538KEQ024RDGA	538KEQ030RFGA
ICP Model Number		ICP Model Number		DLCAHB09K1A	DLCAHB12K1A	DLCAHB18K1A	DLCBHR18K1A	DLCBHR24K1A	DLCBHR30K1A
Dimensions		Dimensions							
Height	in	Height	in	23.5	23.5	31.1	27.6	31.1	31.1
Width	in	Width	in	35.4	35.4	38.6	37.6	38.6	38.6
Depth	in	Depth	in	14.9	14.9	16.8	15.6	16.8	17.3
Net Weight	lbs	Net Weight	lbs	99.2	97	141.1	114.7	153.2	145.5

Toshiba , Carrier Outdoor Models		RAS-09EACV-UL	RAS-12EACV-UL	RAS-15EACV-UL	RAS-17EACV-UL	RAS-22EACV-UL
		RAS-09EAV-UL	RAS-12EAV-UL	RAS-15EAV-UL	RAS-17EAV-UL	RAS-22EAV-UL
		RAS-09EAV2-UL	RAS-12EAV2-UL	RAS-15EAV2-UL	RAS-17EAV2-UL	RAS-22EAV2-UL
Height	in	21.7	21.7	21.7	21.7	21.7
Width	in	30.7	30.7	30.7	30.7	30.7
Depth	in	11.4	11.4	11.4	11.4	11.4
Weight/Net	lbs	82	88	91	91	93

THE UNIT MODELS LISTED BELOW WERE ANALYZED TO MEET THE REQUIREMENTS OF THE FLORIDA BUILDING CODE (2017) AND THE ASCE 7-16 WIND ANALYSIS CODE. THE UNITS AND CONNECTIONS WERE ANALYZED FOR 186 MPH WIND SPEED AT 60 FEET ABOVE GROUND FOR CATEGORY III AND IV STRUCTURES.

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9/17/18

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JOB NAME: CARRIER,BRYANT AND ICP DUCTLESS SPLIT SYSTEMS 09K TO 36K

TITLE: 2017 CODE REVISION MODELS LIST - GROUP ONE

Job No: 18-1
Date: Rev Date: 04-12-2018
Chk'd By: R. Samara
Drawn By: A.Barnet

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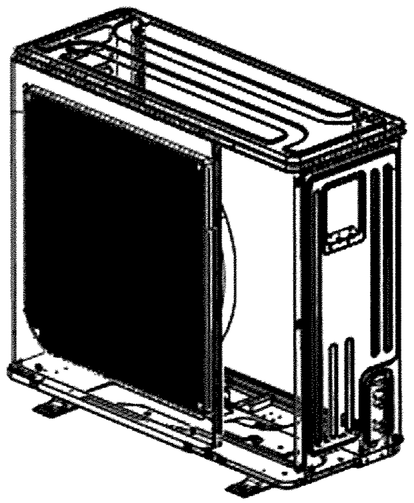
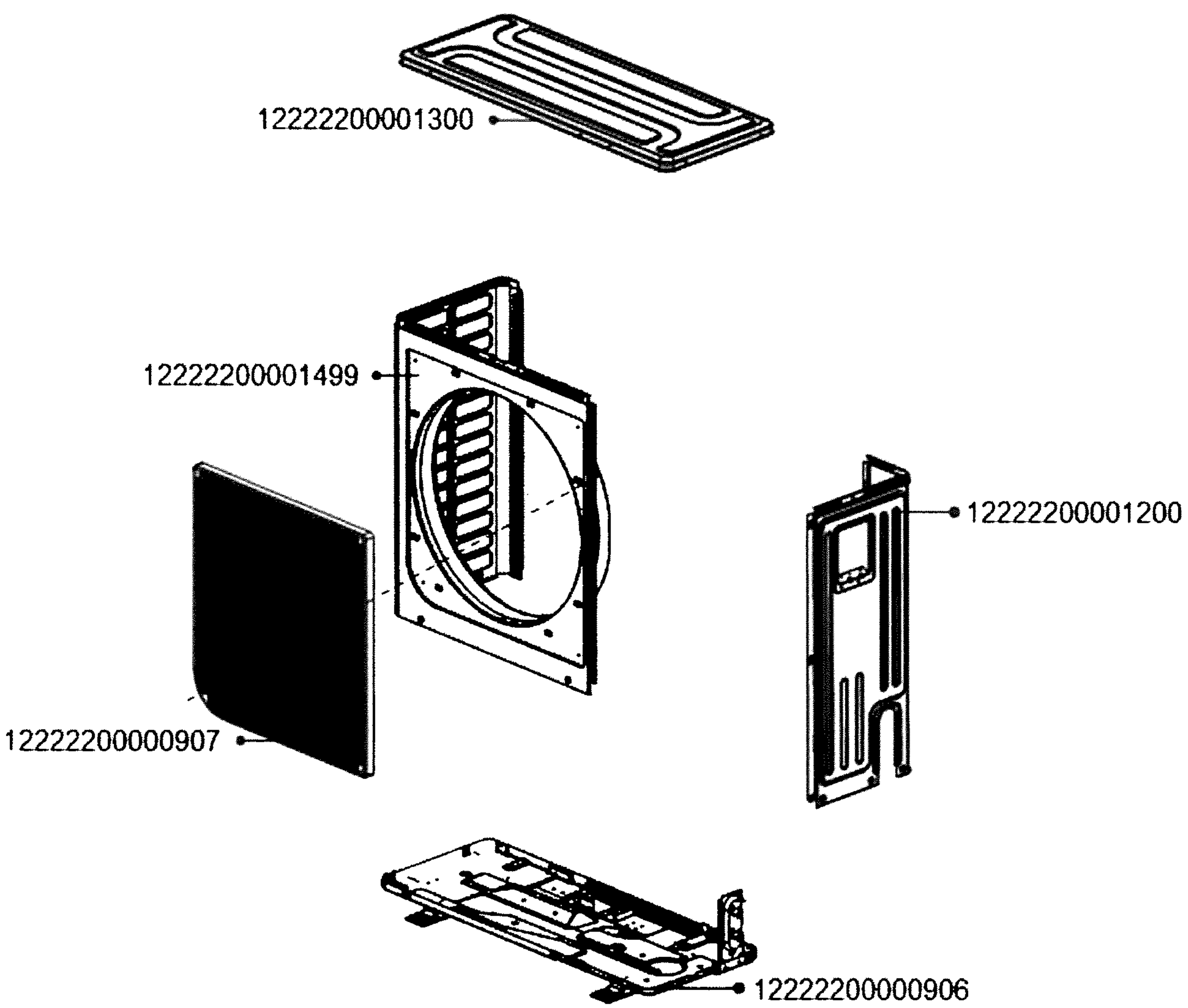
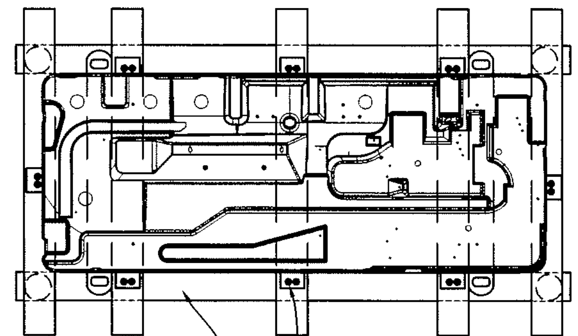
NOTE: ALL OF THE WIND RESISTING EXTERIOR PANELS, INDIVIDUALLY MEET OR EXCEED THEIR CAPACITY TO RESIST THE DESIGN WIND LOADS AS STATED IN THE CALCULATIONS AS REQUIRED BY THE FLORIDA STATE BUILDING CODE 2017 6th EDITION. DUE TO THE INDETERMINANT NATURE OF THESE UNITS, DISTORTION AND DEFLECTION CANNOT BE 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, 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



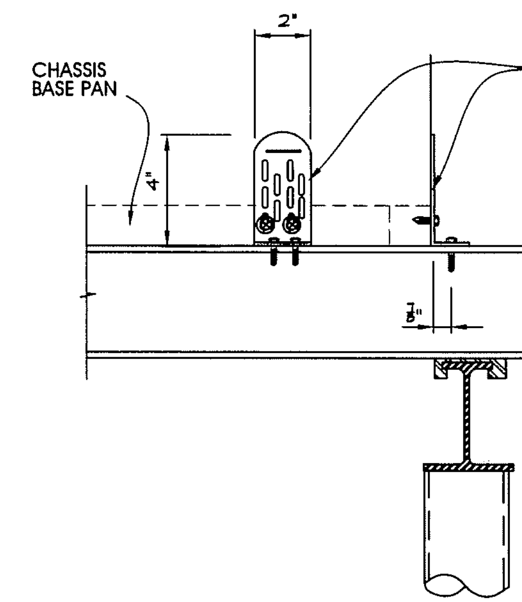


ASSEMBLY DRAWING



ROOF. STAND (BY OTHERS) SEE CALCULATIONS FOR FORCES

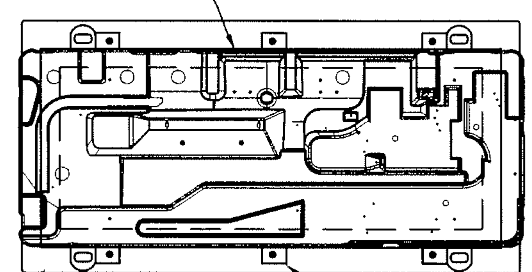
USE 2X4, 15 GA STEEL TIE DOWN CLIPS BY BMP INTERNATIONAL INC WITH (2) 1/4" DIA X 1-1/2" LG SS THRU BOLTS TO STAND w/ WASHERS AND 2 (12-14) TEK SCREWS TO BASE PAN (TYP AS SHOWN)



USE 2X4, 15 GA STEEL TIE DOWN CLIPS BY BMP INTERNATIONAL INC WITH (2) 1/4" DIA X 1-1/2" LG SS THRU BOLTS TO STAND w/ WASHERS AND 2 (12-14) TEK SCREWS TO BASE PAN (TYP AS SHOWN)

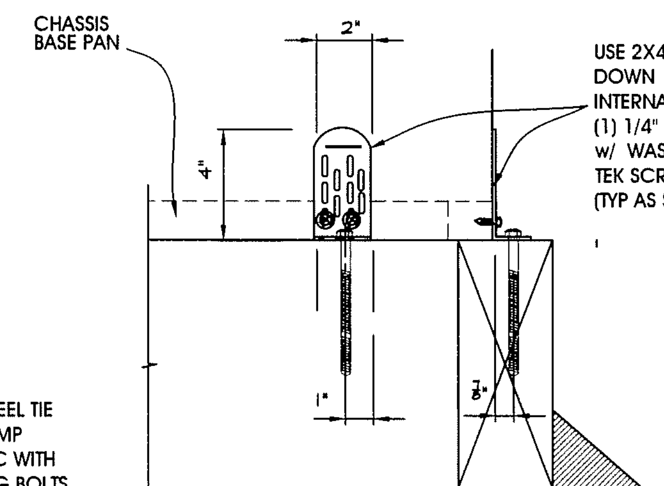
ROOF STAND ATTACHMENT DETAIL

CAULK AROUND PERIMETER OF BASE PAN



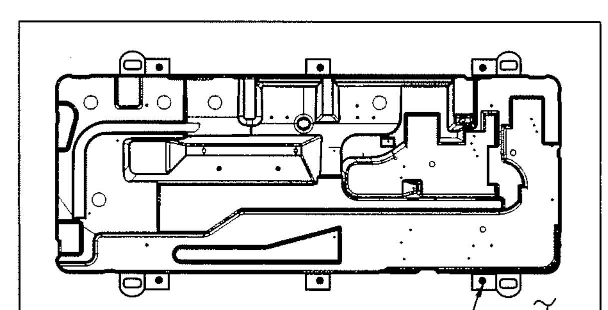
PT WOOD CURB (BY OTHERS) SEE CALCULATIONS FOR FORCES

USE 2X4, 15 GA STEEL TIE DOWN CLIPS BY BMP INTERNATIONAL INC WITH (1) 1/4" X 4" LG LAG BOLTS w/ WASHERS AND 2 (12-14) TEK SCREWS TO BASE PAN (TYP AS SHOWN)



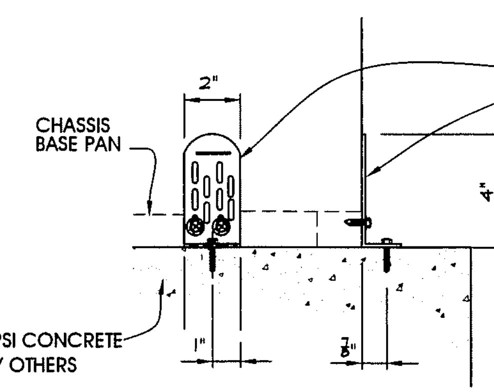
USE 2X4, 15 GA STEEL TIE DOWN CLIPS BY BMP INTERNATIONAL INC WITH (1) 1/4" X 4" LG LAG BOLTS w/ WASHERS AND 2 (12-14) TEK SCREWS TO BASE PAN (TYP AS SHOWN)

WOOD CURB ATTACHMENT DETAIL



USE 2X4, 15 GA STEEL TIE DOWN CLIPS BY BMP INTERNATIONAL INC WITH (1) 1/4" Ø x 3" LG POWERS WEDGE BOLT HEAVY DUTY CONCRETE ANCHORS AND 2 (12-14) TEK SCREWS TO BASE PAN (TYP AS SHOWN)

3000 PSI CONCRETE PAD BY OTHERS



FOR CONCRETE FOUNDATION ATTACHMENT USE:
USE 2X4, 15 GA STEEL TIE DOWN CLIPS BY BMP INTERNATIONAL INC WITH (1) 1/4" Ø x 3" LG POWERS WEDGE BOLT HEAVY DUTY CONCRETE ANCHORS AND 2 (12-14) TEK SCREWS TO BASE PAN (TYP AS SHOWN)

FOUNDATION ATTACHMENT DETAIL

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4/17/18

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Job No:	18-1
Date: Rev Date:	04-12-2018
Chk'd By:	R. Samara
Drawn By:	A.Barnet
JOB NAME:	CARRIER,BRYANT AND ICP DUCTLESS SPLIT SYSTEMS 09K TO 36K- GROUP ONE
TITLE:	ASSEMBLY DRAWING & CONCRETE ATTACHMENT LOCATION PLAN

2017 WIND ANALYSIS AND ANCHOR DESIGN FOR UTC (DUCTLESS 30K UNITS)

References:

ASCE 7-16 " Minimum Design Loads for Buildings and Other Structures"
Florida Building Code 2017 6th Edition

Design Criteria:

FBC 2017, Section 1620. "High Velocity Hurricane Zone, Wind Loads" (Risk Category III & IV)
Section 1620..6 "Roftop Equiptment and Structures"

Wind Analysis (For heights up to 60 feet & 186 MPH wind) with an Importance Factor of 1.0
(Note that vertical uplift is neglected due to the open grille on top and enclosed base curb)

Wind design velocity	$V := 186$		
Wind speed conversion	$V_{asd} := V\cdot\sqrt{0.6}$	$V_{asd} = 144.075$	
Risk Category	III & IV	(Table 1604.5)	(Table 1.5 - 1 (ASCE 7-16)
Importance Factor	$I := 1.0$	FBC − 17	(Table 1.5 - 2 (ASCE 7-16)
Height above ground	$H := 60$	ft	
Height of structure	$h := 35.0$	in	
Width of unit	$D := 12.6$	in	
Length of unit	$L := 35.4$	in	
Area resisting wind forces	$A_f := \frac{h\cdot L}{144}$	$A_f = 8.604$ ft^2	

Gust effect facto/ Force coeff. for lateral forces	$GC_r := 1.9$	1620.6	(FBC-17)
Velocity Exposure Coefficient at H= 60ft	$K_z := 1.31$	(Table 26.10-1)(Exposure "D") (ASCE 7-16)	
Topographic multipliers	$K_1 := 0$	(Figure 26.8-1 (ASCE 7-16)	
	$K_2 := 0$	(Figure 26.8-1 (ASCE 7-16)	
	$K_3 := 0$	(Figure 26.8-1 (ASCE 7-16)	
Topographic Factor	$K_{zt} := (1 + K_1\cdot K_2\cdot K_3)$	$K_{zt} = 1$	(Equation 26.8-1) (ASCE 7-16)
Wind Directionality Factor	$K_d := 1.0$		(Table 26.6-1 (ASCE 7-16)
Velocity pressure	$q_z := 0.00256K_z\cdot K_{zt}\cdot K_d\cdot V_{asd}^2$	$q_z = 69.613$ psf	(Eq. 26.10-1 (ASCE 7-16)
Design Wind Force	$F := q_z\cdot GC_r$	$F = 132.264$ psf	(Eq. 29.5-1 (ASCE 7-16)

UTC-DUCTLESS-30K_UNITS_ **DESIGN BUILDINGS FOR 186 MPH WIND VELOCITY AND 60 FEET OR LESS IN HEIGHT**

References:

Florida State Building Code 2017 6th Edition
ASCE 7-10 "Minimum Design Loads for Buildings and Other Structures"

Design criteria:

Maximum Load Conditions for Individual interior panels are evaluated for their capacity to resist wind forces for 186 mph velocity at 60 feet height. Stress analysis is based on drawings, dimensions and section properties provided by UTC for their DUCTLESS-30K Units.

Wind force: $F := .919$ psi **Steel pan yield stress :** $f_t := 33\cdot 1.33$ $f_t = 43.89$ ksi

Part No.	Height (in)	Eff Width (in)	Moment (in kips)		Sect. Mod. in^3	Resisting Moment Capacity (in kips)	
SIDE PANEL	$s_1 := 30.56$	$w_1 := 27.49$	$M_1 := \frac{0.125\cdot w_1\cdot F\cdot s_1^2}{1000}$	$M_1 = 2.949$	$S_{1x} := 0.00900$ $S_{1y} := 0.269301$	$M_{r1} := f_t\cdot(S_{1x}) + f_t\cdot S_{1y}$	$M_{r1} = 12.215$
END PANEL	$s_2 := 13.87$	$w_2 := 30.35$	$M_2 := \frac{0.125\cdot s_2\cdot F\cdot w_1^2}{1000}$	$M_2 = 1.204$	$S_{2y} := 0.490418$	$M_{r2} := f_t\cdot(S_{2y})$	$M_{r2} = 21.524$

NOTE: Uplift Force on Top Panel 0.712 psi $F := 0.712$

TOP PANEL (UPLIFT)	$s_3 := 36.41$	$w_3 := 14.47$	$M_3 := \frac{0.125w_3\cdot F\cdot s_3^2}{1000}$	$M_3 = 1.707$	$S_{3x} := 0.06022$ $S_{3y} := 0.010454$	$M_{r3} := f_t\cdot S_{3x} + f_t\cdot S_{3y}$	$M_{r3} = 3.102$

ANCHOR DESIGN OF BASE PAN TO CONCRETE SUPPORT PAD WITH (6) ATTACHED HOLD DOWN BRACKETS

NOTE: The distance from center of clip vertical leg to vertical leg of Unit is 13.0 inches $D := 13.0$ in

Design Criteria:	Width (feet)	Height (feet)	Area (square feet)	Moment arm (feet)
	$w := \frac{L}{12}$	$h_1 := \frac{h}{12}$	$A_{f1} := w\cdot h_1$	$a_1 := \frac{D}{12}$
	$w = 2.95$	$h_1 = 2.917$	$A_{f1} = 8.604$	$a_1 = 1.083$

Maximum wind moments and overturning reaction forces on each unit

$M_1 := A_{f1}\cdot\frac{h_1}{2}\cdot F$ $M_1 = 1.66\times 10^3$ (ft lbs) $F_1 := \frac{M_1}{a_1}$ $F_1 = 1.532\times 10^3$ (pounds per long side)

Screw Design (Vert. Attachment to Base Pan (Shear capacity of (6) 12-14 TEK Screws (Long Side) (540 lbs. / screw) for 15 ga clips and basepan base metal (16 ga)

$V_s := 6\cdot 540$ $V_s = 3.24\times 10^3$ lbs. **Number/Screws/Clip (2)**

Tensile capacity of (3) 1/4 x 3" long Anchor devises for Uplift Clips per long side.

$F_{kb} := 1022\cdot 3$ $F_{kb} = 3.066\times 10^3$ lbs **Number/Anchors/Clip (1)**

Try (3) 2" x 4" Tie-down Clips (15 ga) on each side with minimum capacity of 1070 lbs

$T_s := 3\cdot 1070$ $T_s = 3.21\times 10^3$ **Number/Clips/Unit (6)**

Use 2" X 4", 15 guage, "Steel Tie-Down Clips, by BMP International, Inc. Use (3) Clips evenly spaced along each long side. Use (2) No. 12-14 x 1" (HWH) Hilti Self Drilling steel screws, or equal at each Uplift Clip with a shear capacity of 540 lbs per screw (working stress). Use (1) 1/4" x 3" Power Wedge bolt Heavy duty Anchors and 5/16" dia Stainless Steel washers per clip with uplift cap. of 1022 lbs. per anchor in 3000 P.S.I. concrete (See attached drawings).

ANCHOR DESIGN OF BASE PAN TO WOOD ROOF CURB WITH (6) ATTACHED HOLD DOWN BRACKETS

Design Criteria:	Width (feet)	Height (feet)	Area (square feet)	Moment arm (feet)
	$w := \frac{L}{12}$	$h_1 := \frac{h}{12}$	$A_{f1} := w\cdot h_1$	$a_1 := \frac{D}{12}$
	$w = 2.95$	$h_1 = 2.917$	$A_{f1} = 8.604$	$a_1 = 1.083$

Screw Design (Vert. Attachment to Base Pan (Shear capacity of (2) 12-14 TEK Screws (Long Side) (540 lbs. / screw) for 15 ga clips and 16 ga basepan

$V_s := 6\cdot 540$ $V_s = 3.24\times 10^3$ lbs. **Number/Screws/Clip (2)**

Try (3) 1/4 inch diameter by 4 inch long Wood Lag Bolts with minimum capacity of 260 lbs.per inch.

$T_s := 3\cdot 910$ $T_s = 2.73\times 10^3$ **Number/Lag Bolts/Bracket (1)**

Number/Brackets/Unit (6)

Use (3) 1/4 inch Wood Lag Bolts by 4 inches long 3 1/2 inches effective) , each side with minimum capacity of 910 lbs. each. (See attached drawings.)

UPLIFT WIND FORCES FOR "DUCTLESS-30K UNITS" WITH ATTACHMENT TO METAL ROOF STAND

UPLIFT WIND FORCES FOR "DUCTLESS-30K UNITS" WITH ATTACHMENT TO METAL ROOF STAND

Gust effect factor $GC_r := 1.5$ (29.5-3)

Design Wind Force $F_{up} := q_z\cdot GC_r$ $F_{up} = 104.419$ $\frac{F_{up}}{144} = 0.725$

ANCHOR DESIGN OF BASE PAN TO METAL ROOF STAND WITH (8) ATTACHED HOLD DOWN BRACKETS, WITH ADDED WIND UPLIFT AT ROOF PANEL

Design Criteria:	Width (feet)	Height (feet)	Area (square feet)	Moment arm (feet)
	$w := \frac{L}{12}$	$h_1 := \frac{h}{12}$	$A_{f1} := w\cdot h_1$	$a_1 := \frac{D}{12}$
	$w = 2.95$	$h_1 = 2.917$	$A_{f1} = 8.604$	$a_1 = 1.083$

Maximum wind moments and overturning reaction forces on each unit

$M_1 := A_{f1}\cdot\frac{h_1}{2}\cdot F$ $M_1 = 1.66\times 10^3$ (ft lbs) $F_1 := \frac{M_1}{a_1}$ $F_1 = 1.532\times 10^3$ (pounds per long side)

$F_{up} := F\cdot A_{f1}$ $F_{up} = 1.138\times 10^3$ $F_{1adj} := F_1 + \frac{F_{up}\cdot A_{f1}}{6}$ $F_{1adj} = 3.164\times 10^3$

Screw Design Vert. Attachment to Base Pan (Shear capacity of (6) 12-14 TEK Screws (Long Side) and (4) 12-14 Tek Screws short sides) , 540 lbs. / screw

$V_s := 6\cdot 540$ $V_s = 3.24\times 10^3$ lbs. " > " $F_1 = 1.532\times 10^3$ **Number/Screws/Clip (2)**

$V_s := 16\cdot 540$ $V_s = 8.64\times 10^3$ lbs. " > " $F_{1adj} = 3.164\times 10^3$ **Number/Screws/Clip (2)**

Tensile capacity of (6) 1/4" Stainless Thru Bolts for "Steel Tie-Down Clips" to Metal Roof Stand at long sides

$F_{kb} := 980\cdot 6$ $F_{kb} = 5.88\times 10^3$ lbs **Number/Thru Bolts/Clip (2)**

Try (3) Uplift Clips on each long side and (1) on each short side with minimum capacity of 1070 lbs. (Controlled by TEK Screw shear capacity)

$T_s := 8\cdot 1070$ $T_s = 8.56\times 10^3$ **Number/Clips/Unit (8)**

Use 2" X 4", 15 gauge, "Steel Tie-Down Clips, by BMP International, Inc. Use (3) Clips evenly spaced along each long side and (1) on each short side . Use (2) 1/4" x 1 1/2" Stainless Steel Thru Bolts per "Steel Tie-Down Clip", with 5/16" dia S.S. washers to Metal Roof Stand connection and (2) #12-14 TEK Screws per clip attached to base pan (See attached drawings).

4/17/18

03

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Job No: 18-1	JOB NAME:	CARRIER,BRYANT AND ICP DUCTLESS SPLIT SYSTEMS 09K TO 36K- GROUP ONE	
Date: Rev Date: 04-12-2018			
Chk'd By: R. Samara	TITLE:	WIND / PARTS ANALYSIS AND CALCULATIONS	
Drawn By: A.Barnet			S-3

Carrier,Bryant,Payne & Midea Model		38MBRQ48A--3	38MBRQ58A--3
ICP Model		DLCLRAH48AAK	DLCLRAH58AAK
Dimensions			
Height	in	52.5	52.5
Width	in	37.5	37.5
Depth	in	16.3	16.3
Weight -Net	lbs	217.4	225.1

Carrier,Bryant,Payne & Midea Model		38MGRQ36D--3	38MGRQ48E--3
ICP Model			DLCMRAH48EAK
Dimensions			
Height	in	52.5	52.5
Width	in	41.2	41.2
Depth	in	17.6	17.6
Weight-Net	lbs.	221.6	223.8

Carrier Model Number		38GJQF36---3	38GJQG42---3	38GJQK48---3	38GJQL56---3
Bryant Model Number		538KEQ036RGGA	538KEQ042RGGA	538KEQ048RKGA	538KEQ056RLGA
ICP Model Number		DLCBHR36K1A	DLCBHR30K1A	DLCBHR48K1A	DLCBHR56K1A
Dimensions					
Height	in	43.4	43.4	43.4	53
Width	in	42.8	42.8	42.8	35.4
Depth	in	17.3	17.3	17.3	13.4
Net Weight	lbs	198.4	198.4	198.4	255.7

Toshiba , Carrier	Outdoor Models	RAV-SP300AT2-UL	RAV-SP360AT2-UL	RAV-SP420AT2-UL
Height	in	52.8	52.8	52.8
Width	in	35.4	35.4	35.4
Depth	in	12.6	12.6	12.6
Weight/Net	lbs	211.5	211.5	211.5

Carrier & Bryant Model	38VMA036HDS301	38VMA048HDS301	38VMA060HDS301
Unit Height (in)	52.3	52.3	52.3
Unit Width (in)	35.5	35.5	35.5
Unit Depth (in)	15.8	15.8	15.8
Net Weight (lbs)	220.0	220.0	220.0

THE UNIT MODELS LISTED BELOW WERE ANALYZED TO MEET THE REQUIREMENTS OF THE FLORIDA BUILDING CODE (2017) AND THE ASCE 7-16 WIND ANALYSIS CODE. THE UNITS AND CONNECTIONS WERE ANALYZED FOR 186 MPH WIND SPEED AT 60 FEET ABOVE GROUND FOR CATEGORY III AND IV STRUCTURES.

4/17/18

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JOB NAME: CARRIER,BRYANT AND ICP DUCTLESS SPLIT SYSTEMS 36K TO 60K

TITLE: 2017 CODE REVISION MODELS LIST - GROUP TWO

Job No: 18-1
Date: Rev Date: 04-12-2018
Chk'd By: R. Samara
Drawn By: A.Barnet

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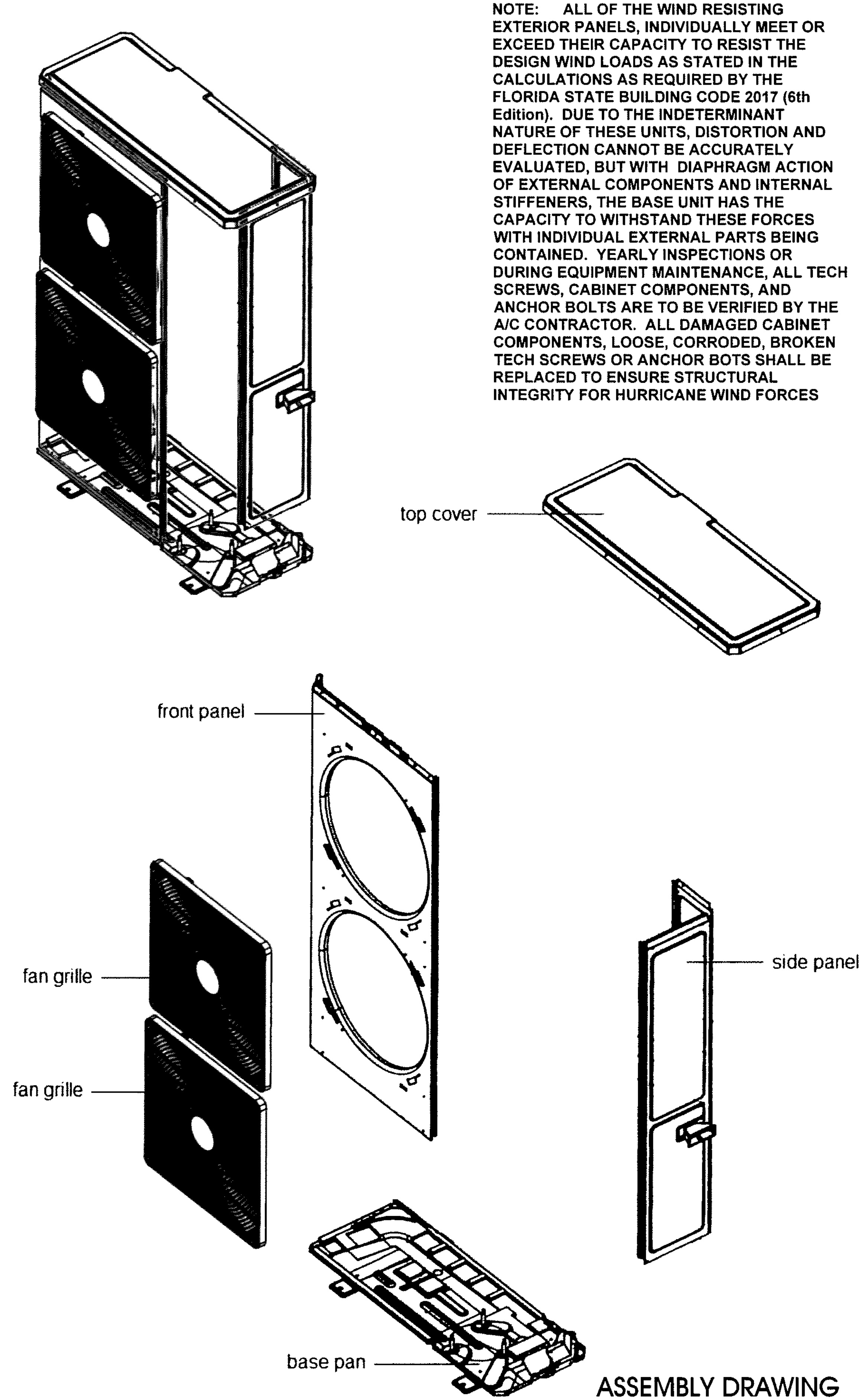
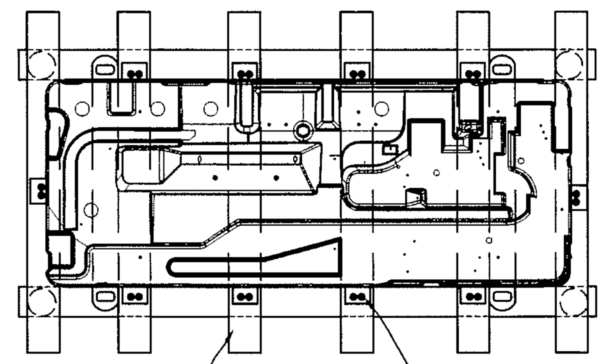
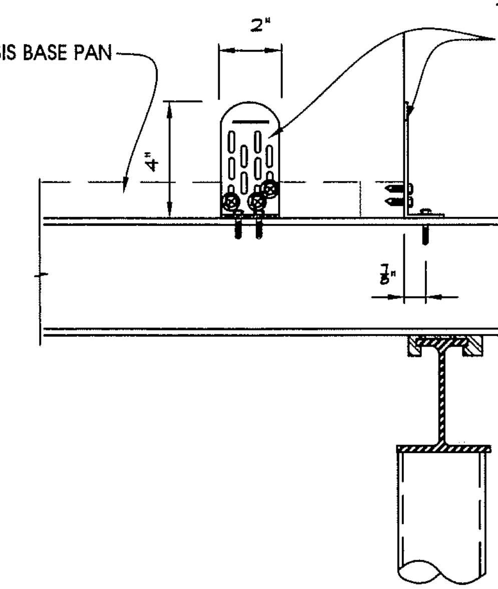
NOTE: ALL OF THE WIND RESISTING EXTERIOR PANELS, INDIVIDUALLY MEET OR EXCEED THEIR CAPACITY TO RESIST THE DESIGN WIND LOADS AS STATED IN THE CALCULATIONS AS REQUIRED BY THE FLORIDA STATE BUILDING CODE 2017 (6th Edition). DUE TO THE INDETERMINANT NATURE OF THESE UNITS, DISTORTION AND DEFLECTION CANNOT 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, 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

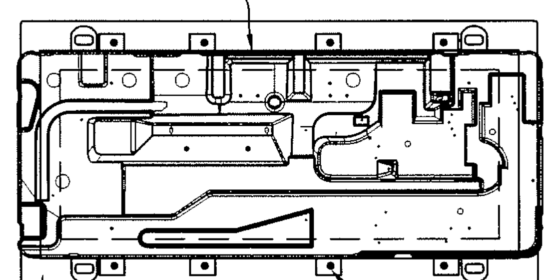


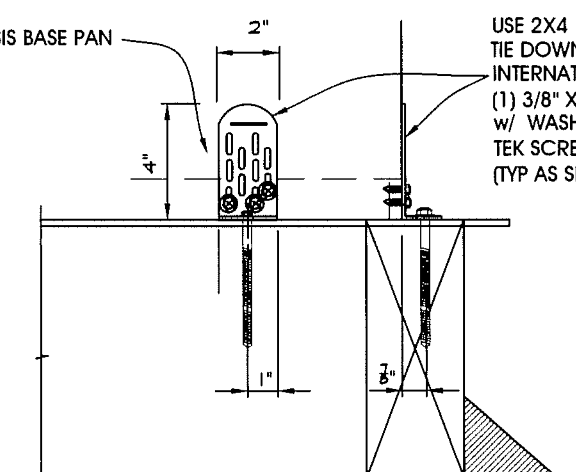
ASSEMBLY DRAWING



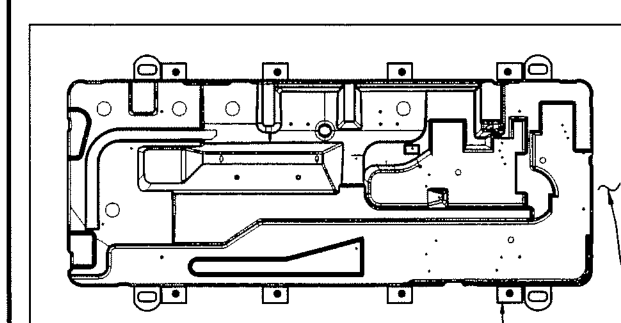


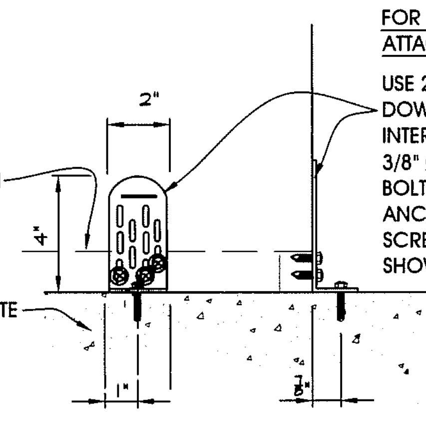
ROOF STAND ATTACHMENT DETAIL





WOOD CURB ATTACHMENT DETAIL





FOR CONCRETE FOUNDATION ATTACHMENT USE:

USE 2X4, 12 GA STEEL TIE DOWN CLIPS BY BMP INTERNATIONAL INC WITH (1) 3/8" Ø x 4" LG POWERS WEDGE BOLT HEAVY DUTY CONCRETE ANCHORS AND 3 (12-14) TEK SCREWS TO BASE PAN (TYP AS SHOWN)

FOUNDATION ATTACHMENT DETAIL

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[signature] 4/17/18

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Job No:	18-1
Date: / Rev Date:	04-12-2018
Chk'd By:	R. Samara
Drawn By:	A.Barnet

JOB NAME: CARRIER,BRYANT AND ICP DUCTLESS SPLIT SYSTEMS 36K TO 60K - GROUP TWO

TITLE: ASSEMBLY DRAWING & CONCRETE ATTACHMENT LOCATION PLAN

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2017 WIND ANALYSIS AND ANCHOR DESIGN FOR UTC (DUCTLESS 60K UNITS)

References:

ASCE 7-16 " Minimum Design Loads for Buildings and Other Structures"
Florida Building Code 2017, 6th Edition

Design Criteria:

FBC 2017, Section 1620. "High Velocity Hurricane Zone, Wind Loads" (Risk Category III & IV) Section 1620.6 " Roof top Equitment and Structures"

Wind Analysis (For heights up to 60 feet & 186 MPH wind) Importance Factor= 1.0 (Note that vertical uplift is neglected due to the open grille on top and enclosed base curb)

Wind design velocity	$V := 186$		
Wind speed conversion	$V_{asd} := V \cdot \sqrt{0.6}$	$V_{asd} = 144.075$	
Risk Category	III & IV	(Table 1.5 - 1 (ASCE 7-16)	
Importance Factor	$I := 1.0$	FBC -17 (TABLE 1.5-2 , ASCE 7-16)	
Height above ground	$H := 60$	ft	
Height of structure	$h := 52.8$	in	
Depth of unit	$D := 13.4$	in	
Length of unit	$L := 35.4$	in	
Area resisting wind forces	$A_f := \frac{h \cdot L}{144}$	$A_f = 12.98$ ft^2	
Gust effect factor/Force Coeff.	$GC_r := 1.9$	1620.6 (FBC-17)	
Velocity Exposure Coefficient at H=60 ft	$K_z := 1.31$	(Table 26.10-1)(Exposure "D") (ASCE 7-16)	
Topographic multipliers	$K_1 := 0$	(Section 26.8-1 (ASCE 7-16)	
	$K_2 := 0$	(Section 26.8-1 (ASCE 7-16)	
	$K_3 := 0$	(Section 26.8-1 (ASCE 7-16)	
Topographic Factor	$K_{zt} := (1 + K_1 \cdot K_2 \cdot K_3)$	$K_{zt} = 1$	(Equation 26.8-1) (ASCE 7-16)
Wind Directionality Factor	$K_d := 1$		(Table 26.6-1 (ASCE 7-16)
Velocity pressure	$q_z := 0.00256 K_z \cdot K_{zt} \cdot K_d \cdot V_{asd}^2$	$q_z = 69.613$ psf	(Eq. 26.10-1 (ASCE 7-16)
Design Wind Force	$F := q_z \cdot GC_r$	$F = 132.264$ psf	(Eq. 29.5-2(ASCE 7-16)
	$\frac{F}{144} = 0.919$	psi	

UTC-DUCTLESS-60K_UNITS_ DESIGN BUILDINGS FOR 186 MPH WIND VELOCITY AND 60 FEET OR LESS IN HEIGHT

References:

Florida State Building Code 2017 6th Edition
ASCE 7-16 "Minimum Design Loads for Buildings and Other Structures"

Design criteria:

Maximum Load Conditions for Individual interior panels are evaluated for their capacity to resist wind forces for 186 mph velocity at 60 feet height. Stress analysis is based on drawings, dimensions and section properties provided by UTC for their DUCTLESS-56K Units.

Wind force: $F := .919$ psi **Steel pan yield stress :** $f_t := 33 \cdot 1.33$ $f_t = 43.89$ ksi

Part No.	Height (in)	Eff Width (in)	Moment (in kips)		Sect. Mod. in^3	Resisting Moment Capacity (in kips)	
FRONT PANEL	$s_1 := 51.52$	$w_1 := 26.58$	$M_1 := \frac{0.125 w_1 \cdot F \cdot s_1^2}{1000}$	$M_1 = 8.105$	$S_{1x} := 0.05722$ $S_{1y} := 0.37590$	$M_{r1} := f_t \cdot (S_{1x}) + f_t \cdot S_{1y}$	$M_{r1} = 19.01$
END PANEL	$s_2 := 52.39$	$w_2 := 12.42$	$M_2 := \frac{0.125 s_2 \cdot F \cdot w_1^2}{1000}$	$M_2 = 4.252$	$S_{2y} := 0.399681$	$M_{r2} := f_t \cdot (S_{2y})$	$M_{r2} = 17.542$
TOP COVER (UPLIFT)	$s_3 := 18.46$	$w_3 := 14.47$	$M_3 := \frac{0.125 w_3 \cdot F \cdot s_3^2}{1000}$	$M_3 = 0.566$	$S_{3x} := 0.026922$ $S_{3y} := 0.010454$	$M_{r3} := f_t \cdot S_{3x} + f_t \cdot S_{3y}$	$M_{r3} = 1.64$

ANCHOR DESIGN OF BASE PAN TO CONCRETE SUPPORT PAD WITH (8) ATTACHED HOLD DOWN BRACKETS

NOTE: The distance from compresion face of Unit to center of anchor location is 14.3 inches $D := 14.3$ in

Design Criteria:	Width (feet)	Height (feet)	Area (square feet)	Moment arm (feet)
	$w := \frac{L}{12}$	$h_1 := \frac{h}{12}$	$A_{f1} := w \cdot h_1$	$a_1 := \frac{D}{12}$
	$w = 2.95$	$h_1 = 4.4$	$A_{f1} = 12.98$	$a_1 = 1.192$

Maximum wind moments and overturning reaction forces on each unit

$M_1 := A_{f1} \cdot \frac{h_1}{2} \cdot F$ $M_1 = 3.777 \times 10$ (ft lbs) $F_1 := \frac{M_1}{a_1}$ $F_1 = 3.169 \times 10^3$ (pounds per long side)

Screw Design (Vert. Attachment to Base Pan (Shear capacity of (12) 12-14 TEK Screws (Long Side) (540 lbs. / screw) for 12 ga clips and basepan base metal (16 ga.)

$V_s := 12 \cdot 540$ $V_s = 6.48 \times 10^3$ lbs. **Number/Screws/Clip (3)**

Tensile capacity of (3) 3/8' x 4" long Anchor devises for Uplift Clips per long side.

$F_{kb} := 2205 \cdot 4$ $F_{kb} = 8.82 \times 10^3$ lbs **Number/Anchors/Clip (1)**

Try (4) 2" x 4" Tie-down Clips (12 ga) on each side with minimum capacity of 3300 lbs

$T_s := 4 \cdot 3300$ $T_s = 1.32 \times 10^4$ **Number/Clips/Unit (8)**

Use 2" X 4", 12 guage, "Steel Tie-Down Clips, by BMP International, Inc. Use (4) Clips evenly spaced along each long side. Use (3) No. 12-14 x 1" (HWH) Hilti Self Drilling steel screws, or equal at each Uplift Clip with a shear capacity of 540 lbs per screw (working stress). Use (1) 3/8" x 4" Power Wedge bolt Heavy duty Anchors and 7/16" dia Stainless Steel washers per clip with uplift cap. of 2205 lbs. per anchor in 3000 P.S.I. concrete (See attached drawings).

UPLIFT WIND FORCES FOR "DUCTLESS-56K UNITS" WITH ATTACHMENT TO METAL ROOF STAND

Gust effect factor $GC_p := 1.50$ (29.5-3)

Design Wind Force $F_{up} := q_z \cdot GC_r$ $F_{up} = 104.419$ psf $\frac{F_{up}}{144} = 0.725$ psi

ANCHOR DESIGN OF BASE PAN TO METAL ROOF STAND WITH (10) ATTACHED HOLD DOWN BRACKETS, WITH ADDED WIND UPLIFT AT ROOF PANEL

Design Criteria:	Width (feet)	Height (feet)	Area (square feet)	Moment arm (feet)
	$w := \frac{L}{12}$	$h_1 := \frac{h}{12}$	$A_{f1} := w \cdot h_1$	$a_1 := \frac{(D)}{12}$
	$w = 2.95$	$h_1 = 4.4$	$A_{f1} = 12.98$	$a_1 = 1.192$

Maximum wind moments and overturning reaction forces on each unit

$M_1 := A_{f1} \cdot \frac{h_1}{2} \cdot F$ $M_1 = 3.777 \times 10$ (ft lbs) $F_1 := \frac{M_1}{a_1}$ $F_1 = 3.169 \times 10^3$ (pounds per long side)

$F_{up} := F \cdot A_{f1}$ $F_{up} = 1.717 \times 10^3$ $F_{1adj} := F_1 + \frac{F_{up} \cdot A_{f1}}{8}$ $F_{1adj} = 5.955 \times 10^3$ $a_1 = 1.192$

Screw Design Vert. Attachment to Base Pan (Shear capacity of (12) 12-14 TEK Screws (Long Side) and (6) 12-14 Tek Screws short sides) , 540 lbs. / screw

$V_s := 12 \cdot 540$ $V_s = 6.48 \times 10^3$ lbs. **Number/Screws/Clip (3)**

$V_s := 18 \cdot 540$ $V_s = 9.72 \times 10^3$ lbs. **Number/Screws/Clip (3)**

Tensile capacity of overturning and uplift (12) 1/4" Stainless Thru Bolts for "Steel Tie-Down Clips" to Metal Roof Stand (8) at ea. long side and (2) each short side.

Number/Thru Bolts/Bracket (2)

$F_{kb} := 980 \cdot 20$ $F_{kb} = 1.96 \times 10^4$ lbs

Try (4) Uplift Clips on each long side and (1) on each short side with minimum capacity of 3300 lbs. (Controlled by TEK Screw shear capacity)

$T_s := 10 \cdot 3300$ $T_s = 3.3 \times 10^4$ **Number/Clips/Unit (10)**

Use 2" X 4", 12 gauge, "Steel Tie-Down Clips, by BMP International, Inc. Use (4) Clips evenly spaced along each long side and (1) each short side. Use (2) 1/4" x 1 1/2" Stainless Steel Thru Bolts per "Steel Tie-Down Clip", with 5/16" dia S.S. washers to Metal Roof Stand connection and (3) #12-14 TEK Screws per clip attached to base pan (See attached drawings).

ANCHOR DESIGN OF BASE PAN TO WOOD ROOF CURB WITH (8) ATTACHED HOLD DOWN BRACKETS

Design Criteria:	Width (feet)	Height (feet)	Area (square feet)	Moment arm (feet)
	$w := \frac{L}{12}$	$h_1 := \frac{h}{12}$	$A_{f1} := w \cdot h_1$	$a_1 := \frac{D}{12}$
	$w = 2.95$	$h_1 = 4.4$	$A_{f1} = 12.98$	$a_1 = 1.192$

Screw Design (Vert. Attachment to Base Pan (Shear capacity of (12) 12-14 TEK Screws (Long Side) (540 lbs. / screw) for 12 ga clips and basepan

$V_s := 12 \cdot 540$ $V_s = 6.48 \times 10^3$ lbs. **Number/Screws/Clip (3)**

Try (4) 3/8 inch diameter by 5 inch long Wood Lag Bolts with minimum capacity of 260 lbs.per inch.

$T_s := 4 \cdot 1584$ $T_s = 6.336 \times 10^3$ **Number/Lag Bolts/Bracket (1)**

Number/Brackets/Unit (8)

Use (4) 3/8 inch Wood Lag Bolts by 5 inches long (4 1/2 inches effective) (each side with minimum capacity of 1584 lbs. each. (See attached drawings.)

4/17/18

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Job No: 18-1	JOB NAME:	CARRIER,BRYANT AND ICP DUCTLESS SPLIT SYSTEMS 36K TO 60K - GROUP TWO	
Date: 04-12-2018 Rev Date:			
Chk'd By: R. Samara	TITLE:	WIND / PARTS ANALYSIS AND CALCULATIONS	
Drawn By: A.Barnet			S-3