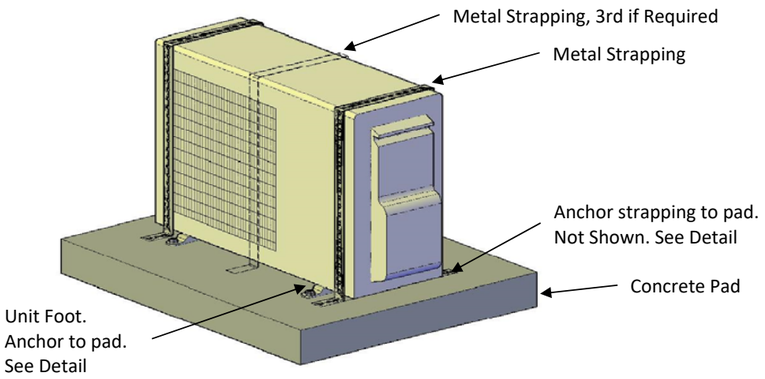
GREE DUCTFREE MINI-SPLITS OUTDOOR CONDENSING UNITS

PAD MOUNT CONFIGURATION AND ANCHOR SELECTION - WIND LOAD EXAMINATION

CODE: FBC 6th Ed. (2017) and ASCE 7-10
MIAMI-DADE WIND SPEED = 186 MPH



Bri-Ko Engineering, Inc.,
Structural Analysis

Spreadsheet designed by: B. Schwartz, PE

Date data input: 29-Mar-19

Calc Sht: EC-1 Mechanical Equipment on Concrete Pad Calc

Description: Structural Analysis of concrete pad mounted mechanical equipment to resist wind forces.

Code: Florida Building Code 6th Ed. (2017) and ASCE 7-10.

Design Methodology and Load Combinations:

Design Method: LRFD Φ = 0.90

Load Combos: FBC Eqn. 16-6 0.9 D + 1.0 W

Wind Forces: *based on FBC 6th Ed., 1620 (equipment is stand-alone structure.)*

Ultimate Design Wind Speed, Vult (3-sec gust):		**186 mph**	Miami Dade		
Nominal Design Wind Speed, Vasd:		144 mph			
Risk Category:	IV	Dir., Topo., Gust Effect:	0.90	1.00	N/A
Height, h:	15 ft	Exp. Cat.:	C	Vel. Pres. Exp Coef., Kz:	0.849
Enclosure Cat.	N/A				

Velocity Pressure $q_h = 0.00256 K_z K_{zt} K_d V^2$ (lb/ft²) q_h= **67.7 psf**

F = $q_h(GC_r)A_f$ (GC_r) v,l = (1.0 ver., 1.1 lat.) Fver, Flat: **67.7 psf, 74.4 psf**

Limit States:

Select UnitType: LIVO

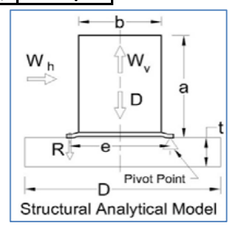
Select model # for illustration purposes: LIVS36HP230V1AO/BO/CO

Verify Pad and anchor clearances:

Anchor critical edge distance is 12d = 4.5" for 0.375" dia.

Distance from pad edge to AC unit = 4.9 in. **CHECKS OK**

Dist from pad edge to anchor center = 9.8 in. **CHECKS OK**



Structural Analytical Model

Resistance to Pad overturn: Use Load Combo: 0.67 D + 0.78 W *FBC 1605.3.2 Eqn. 16-18*

Concrete Pad wt: 735 lbs

Overturn moment due to wind = 13.3 k-in

Counter moment due to dead weight = 13.8 k-in **Checks OK**

Resistance to sliding: Use Load Combo: 0.90 D + 1.00 W *FBC 1605.2 Eqn. 16-6*

Reqd Shear = 1.00*(Pwh*Area) = 582 lbs

Nominal Shear from Table A-1 *4 anchors = 1660 lbs **Checks OK**

Anchor hold down: Use Load Combo: 0.67 D + 0.78 W *FBC 1605.3.2 Eqn. 16-18*

Required overturn moment about unit edge = 7.7 k-in

Nominal Anchor pull-down from Table A-1* E * 2 anchors = 15.7 k-in **Checks OK**

Unit Integrity: *If Required. Only if manufacturer does not state design wind pressure.*

Required tension on strap= 336 lbs

Strap width, gauge= 1.375 in. 22ga *min gauge thickness*

Steel Strength= 36 ksi min. Strength of strap= 654 lbs **Checks OK**

ENGINEERING CONFORMANCE ANALYSIS:

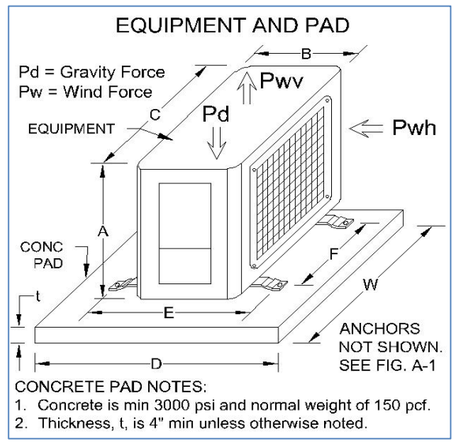
THE TABLE SHOWS PAD SIZE AND ANCHOR TYPES FOR VARIOUS MODELS OF HVAC OUTDOOR EQUIPMENT UP TO 5 TONS THAT MEET THE FOLLOWING ANALYSIS: • OVERTURN • EDGE CLEARANCES • ANCHOR PULLOUT AND SHEAR STRENGH • EQUIPMENT INTEGRITY.

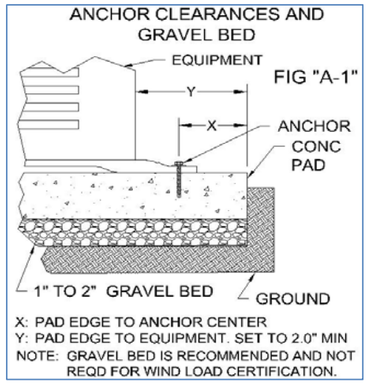
TABLE A-2

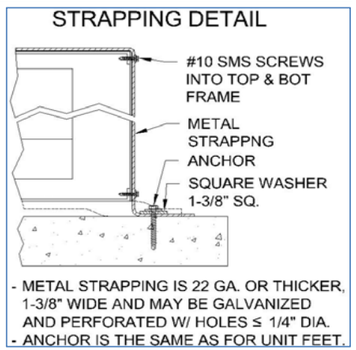
LIVO - Series Model No.	Weight (lbs)	Length C (in.)	Width B (in.)	Height A (in.)	Mount E (in.)	Mount F (in.)	Anchor Type	Pad Size, minimum (in.) W, D, t	# of Straps If Required	Design Check: Nomnal / Reqd ≥ 1.00 = OK Overturn	Anchor Pullout	Anchor Sliding
LIVS09HP115V1AO/BO	59	30.7	10.1	21.3	11.3	21.3	A-1	36 36 4	Yes, 2	1.04	3.54	4.91
LIVS12HP115V1AO/BO	64	30.7	10.1	21.3	11.3	21.3	A-1	36 36 4	Yes, 2	1.05	3.56	4.91
LIVS09HP230V1AO/BO	65	28.0	10.0	21.3	11.3	20.1	A-1	36 36 4	Yes, 2	1.17	3.94	5.38
LIVS12HP230V1AO/BO	69	28.0	10.0	21.3	11.3	20.1	A-1	36 36 4	Yes, 2	1.18	3.96	5.38
LIVS18HP230V1AO/BO	90	35.3	13.4	27.6	15.6	22.0	A-1	44 44 4	Yes, 2	1.04	2.50	3.30
LIVS24HP230V1AO/BO	104	35.3	13.4	27.6	15.6	22.0	A-1	44 44 4	Yes, 2	1.06	2.53	3.30
LIVS30HP230V1AO/BO/CO	152	36.2	14.6	31.1	15.5	26.4	A-1	46 46 4	Yes, 2	1.03	2.01	2.85
LIVS36HP230V1AO/BO/CO	161	36.2	14.6	31.1	15.5	26.4	A-1	46 46 4	Yes, 2	1.04	2.03	2.85

When multiple models with similar dimensions but differing weights, lowest weight is stated for worse case overturn verification.

Input Criteria:	
Concrete Pad weight:	150 pcf
Pad edge to anch distance (min):	4.5 in.
Pad edge to AC unit (min):	2.0 in.







- Must have pad oriented with long side perpendicular to width of unit.

- Anchor Type is the minimum, h igher strength types permitted.

GENERAL NOTES:

1. THIS ENGINEERING REPORT DOCUMENTS THE ANALYSIS OF THE PERFORMANCE OF HVAC MECHANICAL EQUIPMENT TO MEET WIND LOAD OVERTURN AND ANCHOR STRENGTH.
2. THE ANALYSIS CONFORMS TO THE REQUIREMENTS OF THE FBC 6th ed. (HIGH VELOCITY HURRICANE ZONE) AND ASCE 7-10 DESIGN WIND LOADS - OTHER STRUCTURES SECTION 29.5. NOTE: THE CONCRETE PAD AND AC UNIT IS NOT A ROOFTOP STRUCTURE.
3. THE LOAD PATH VERIFIED IS FROM THE EQUIPMENT AS A SINGLE UNIT, UNIT LEG ANCHORS TO CONC SLAB.
4. PADS ARE EITHER POURED IN PLACE OR PRE-FABRICATED NORMAL WEIGHT CONCRETE WITH A MINIMUM STRENGTH OF 3000 PSI AND ARE LOCATED AT GROUND LEVEL.
5. ANCHORS USED TO FASTEN THE CONDENSER FEET TO THE CONCRETE PAD ARE DEFINED IN TABLE A-1 AND SPECIFIED IN TABLE A-2. THE EMBED IS SPECIFIED IN TABLE A-1. THESE ANCHORS ARE TYPICALLY MANUFACTURED FROM HEAT-TREATED STEEL AND HAVE CORROSION RESISTANCE AS SPECIFIED BY THE MANUFACTURER.
6. AC UNIT MUST BE CENTERED ON PAD WITH OPPOSITE SIDES HAVING EQUAL CLEARANCE.
7. UNIT INTEGRITY, IF NOT DESIGNATED BY THE MANUFACTURER FOR THE STATED WIND PRESSURES, IS MET BY STRAPPING THE UNIT DIRECTLY TO THE PAD.

CALCULATIONS:

OVERTURN:

1. THE CRITICAL WIND LOAD IS ON THE LONG FACE OF THE CONDENSER. THE MOMENT CREATED BY THE WIND LOAD MUST BE RESISTED BY THE MOMENT CREATED FROM THE WEIGHT OF THE PAD AND THE CONDENSER.

CLEARANCES:

2. DISTANCE FROM THE EDGE OF THE PAD TO THE CONDENSER SIDE (Y IN FIG.) MUST BE GREATER THAN 2.0 INCH. DISTANCE FROM THE EDGE OF THE PAD TO THE CENTER OF THE ANCHOR MUST BE GREATER THAN THAT SPECIFIED IN THE INPUT CRITERIA.

ANCHOR STRENGTH:

3. THE SLIDING RESISTANCE IS TRANSFERRED TO THE PAD BY THE SHEAR STRENGTH IN THE ANCHORS. THE OVERTURN RESISTANCE IS TRANSFERRED TO THE PAD BY THE ANCHORS. CONFIGURATION AND ANCHOR STRENGTH BASED ON MINIMUM EDGE DISTANCE YIELD MOMENT RESISTANCE.

UNIT INTEGRITY:

4. IF REQUIRED, STRAPPING ATTACHED TO THE UNIT AND ANCHORED TO THE PAD RESISTS SHELL AND FRAME SEPARATION.

TABLE A-1 ANCHOR TYPE AND ALLOWABLE STRENGTHS

SYM	ANCHOR DESCRIPTION & MANUFACTURER	EMBED	STRENGTH AT MIN EDGE DISTANCE PULL OUT (LBS)	SHEAR (LBS)
A-1	1/4" TAPCON (Buildex)	1-3/4"	505	415
A-2	5/16" Hvy Duty Tapcon (Buildex)	1-3/4"	695	760
A-3	3/8" WEDGE BOLT (Powers)	2-1/2"	1025	1370

Notes: 1. Allowable strengths have safety factor of 4 are for poured concrete min 3000 psi from manufacturer's specs.
2. Each anchor includes a 1"Ø fender washer.

Sheet:	ENG-1
Doc:	Page 1 of 1
Gree -LIVO_ConcPad	
Issue Date:	29-Mar-19
Dwn By:	B.S.
Dwg Size:	11x 17

Brian I Schwartz P.E. 62081 State of Florida

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