

GREE DUCTFREE MINI-SPLITS OUTDOOR CONDENSING UNITS
ROOF STAND CONFIGURATION AND ANCHOR SELECTION - WIND LOAD EXAMINATION

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

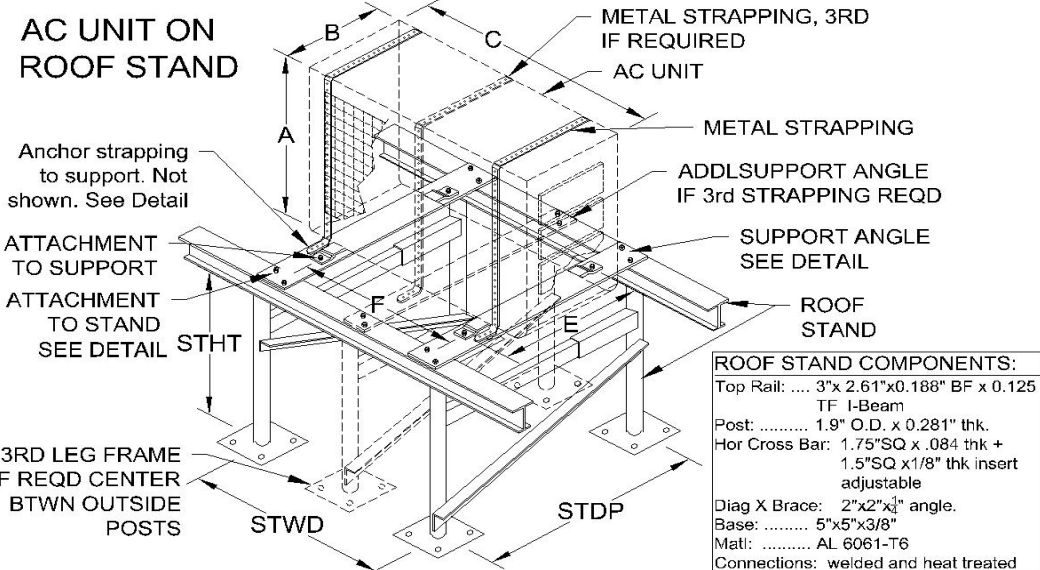
ENGINEERING CONFORMANCE ANALYSIS:

THE TABLE SHOWS ROOF STAND AND ANCHOR TYPES FOR VARIOUS MODELS OF HVAC OUTDOOR EQUIPMENT UP TO 3 TONS THAT MEET THE FOLLOWING ANALYSIS: • OVERTURN • SLIDING • ANCHOR PULLOUT AND SHEAR STRENGTH • EQUIPMENT INTEGRITY.

TABLE A-2

LIVV GEN3 - Series						
Model No.	Weight (lbs)	Length C (in.)	Width B (in.)	Height A (in.)	Mount E (in.)	Mount F (in.)
LIVV09HP230V1AO	55	28.0	10.1	21.3	11.3	20.0
LIVV12HP230V1AO	63	28.0	10.1	21.3	11.3	20.0
LIVV18HP230V1AO	95	33.3	12.3	25.6	13.5	23.0
LIVV24HP230V1AO	97	33.3	12.3	25.6	13.5	23.0
LIVV30HP230V1AO	139	36.3	14.6	31.1	15.6	24.0
LIVV36HP230V1AO	140	36.3	14.6	31.1	15.6	24.0

Installation Requirements									
Roof Stand	Support Angle	Strapping		Design Check: Nomnal / Reqd					
		# of Straps If Required	Gauge thickness	Conc Anc Pullout	Conc Anc Shear	Unit Foot Anchor Pullout	≥ 1.00 = OK		
A-1	2	1/4	A-4	Yes, 2	22ga	1.52	2.33	4.35	
A-1	2	1/4	A-4	Yes, 2	22ga	1.53	2.33	4.37	
A-2	2	1/4	A-4	Yes, 2	22ga	1.42	2.98	3.05	
A-2	2	1/4	A-4	Yes, 2	22ga	1.42	2.98	3.05	
A-2	2	1/4	A-4	Yes, 2	20ga	1.02	2.25	2.21	
A-2	2	1/4	A-4	Yes, 2	20ga	1.03	2.25	2.22	



Bri-Ko Engineering, Inc.,
 Structural Analysis
 Calc Sht: EC-1 Mechanical Equipment on Roof Stand Calc
 Description: Structural Analysis of roof stand mounted mechanical equipment to resist wind forces.
 Code: Florida Building Code 6th Ed. (2017) and ASCE 7-10.

Spreadsheet designed by: B. Schwartz, PE
 Date data input: 30-Mar-20

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, Af < 0.1Bh, Af < 0.1 BL		
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:	60 ft	Exp. Cat.:	C
Enclosure Cat.	N/A	Vel. Pres. Exp Coef., Kz:	1.137
Velocity Pressure	qh = 0.00256 KzKztKdV² (lb/ft²)	qh =	90.6 psf
F = qh(GCp)Ar	(GCp) v,l = (1.5 ver., 1.9 lat.)	Fver, Flat:	135.9 psf, 172.1 psf

Limit States: for illustration purposes only:

Select UnitType:	LIVV	Select Model #:	LIVV36HP230V1AO
		Number of Leg Frames is 2	

Loads, (lbs):	P1= 1349	P2= 498	P3= 542	PD= 140
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Resistance to sliding stand post:

Reqd. Shear/leg =	363 lbs	Nominal Shear per leg:	850 lbs	CHECKS OK
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Resistance to sliding anchors to support:

Reqd Sher/anc:	363 lbs	Nom Shear per bolt:	900 lbs	CHECKS OK
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Resistance to Moment and Uplift: Use Load Combo: 0.90 D + 1.00 W

Overturn M at stand base:	75.9 k-in	Base Pullup:	678 lbs
Overturn M at unit foot:	23.9 k-in	Foot Pullup:	799 lbs

Nom Pullup Str, 4xConcAnc, Bolt:	3040 lbs	1700 lbs	CHECKS OK
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Verification of Support Angle:

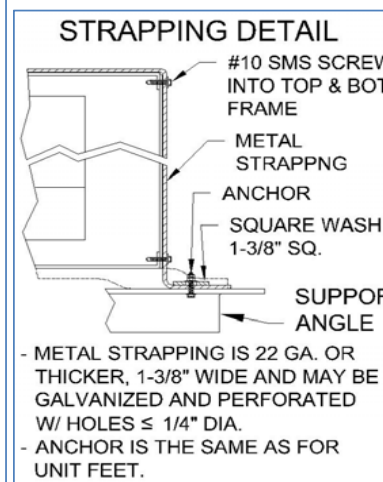
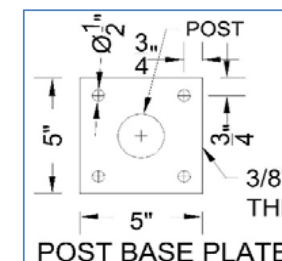
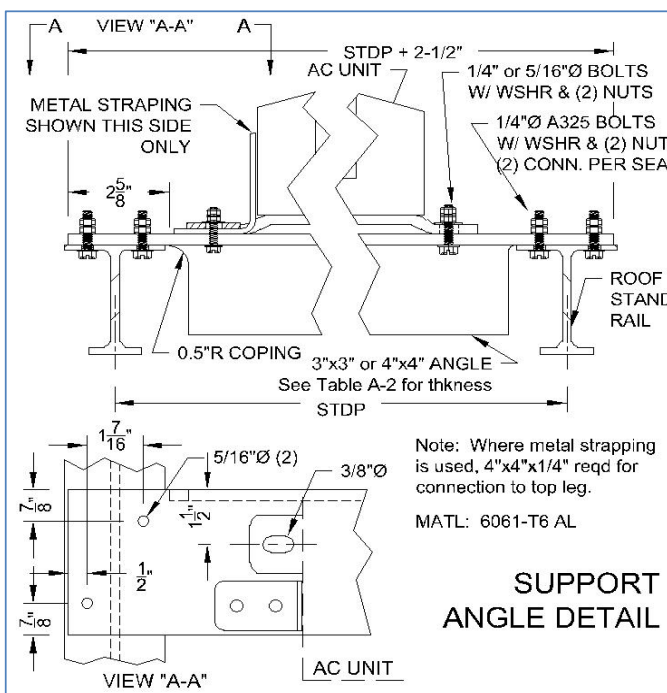
Forces, lbs:	-R1 = 416	R2 = 799	R3 = 550	R4 = 167
Required Mom.:	4.3 k-in	Reqd Section Modulus:	0.225 in³	

Use: 3"x3"x1/4" with Sx= 0.547 in³

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

Required tension on strap=	814 lbs
Strap width, gauge=	1.375 in. 20ga min gauge thickness
Steel Strength=	45 ksi min. Strength of strap= 981 lbs Checks OK

Roof Stand min, maxs:	Leg Max Forces(lbs)		
limits	STWD	STDP	STHT
min:	24 in.	28 in.	18 in.
max:	36 in.	36 in.	33 in.



- Anchor Type is the minimum, higher strength types permitted.

GENERAL NOTES:

1. THIS ENGINEERING REPORT DOCUMENTS THE ANALYSIS OF AC EQUIPMENT MOUNTED ON A ROOF STAND AND THE ASSOCIATED ANCHORING SYSTEMS TO RESIST DEAD WEIGHT AND WIND LOAD FORCES.
2. THE LOAD PATH VERIFIED IS FROM THE EQUIPMENT AS A SINGLE UNIT, ENCLOSURE FASTENERS, UNIT LEG ANCHORS, ROOF STAND CROSS SUPPORT TO ROOF STAND.
3. THE AC UNIT IS MOUNTED ON A METAL ROOF STAND WHICH IS SECURED TO THE ROOF.
4. ANCHORS USED TO FASTEN THE UNIT TO THE ROOF STAND ARE A307 OR HIGHER STRENGTH STEEL BOLTS.
5. THE ROOF STAND IS SUPPLIED BY THE MANUFACTURER INDICATED IN THIS DOCUMENT AND IS INSTALLED IN CONFORMANCE WITH THE ENGINEERING DOCUMENT REFERENCED.
6. UNIT INTEGRITY, IF NOT DESIGNATED BY THE MANUFACTURER FOR THE STATED WIND PRESSURES, IS ADDRESSED BY STRAPPING ATTACHED TO THE UNIT AND ANCHORED TO THE SUPPORT ANGLES. THIS RESISTS SHELL AND FRAME SEPARATION.

CALCULATIONS:

1. THE WIND LOAD ACTING NORMAL TO THE LARGE VERTICAL SIDE OF THE AC UNIT IS USED FOR WORST CASE SHEAR.
2. THE WIND LOAD ACTING ON THE TOP OF THE UNIT UPWARD AND THE HORIZONTAL WIND LOAD IS USED TO CALCULATE UPLIFT AND MOMENT.
3. THESE FORCES MUST BE RESISTED BY THE SHEAR AND TENSILE STRENGTH OF THE ANCHORS BOTH HOLDING THE UNIT TO THE SUPPORT BAR AND THE SUPPORT BAR TO THE ROOF STAND.
4. THE MOMENT AND SHEAR MUST BE TRANSFERRED FROM THE AC UNIT TO THE ROOF STAND BY A SUPPORT BAR AS THE AC UNIT DEPTH IS LESS THAN THE ROOF STAND DEPTH.
5. MAX MOMENT AND SHEAR TO THE SUPPORT BAR DETERMINE SELECTION OF THE SUPPORT BAR.

ROOF STAND NOTES:

- 1) ROOF STAND IS "AIR CONDITIONING ALUM. STAND" ASBLY NO. 1 WITH (4) LEGS, AS BY R.M. ENTERPRISES, PER ENGINEERING DRWG DATED 03-09-2012 SIGNED AND SEALED BY P.E.#56902
- 2) STHT = STAND HEIGHT WITH MIN 18", MAX 33".
- 3) STWD = STAND WIDTH = 24" MIN, 36" MAX.
- 4) STDP = STAND DEPTH = 28" MIN, 36" MAX.
- 5) SUPPORT ANGLE AND FASTENERS OF SUPPORT TO STAND AND SUPPORT TO AC UNIT ARE DEFINED IN DETAIL BELOW.
- 6) AC UNIT MUST BE CENTERED ON SUPPORT.W. (ROOF STAND LIMITS.) MAX COMPRESSION PER FOOT = 6000 LBS. MAX UPLIFT PER FOOT = 5860 LBS. MAX SHEAR PER TWO FEET = 1700 LBS.

TABLE A-1 ANCHOR TYPE AND ALLOWABLE STRENGTHS				
SYM	ANCHOR DESCRIPTION & MANUFACTURER	EMBED	STRENGTH AT MIN SPACING	
			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
A-4	1/4" A307 Bolt	N/A	1700	900
A-5	5/16" A307 Bolt	N/A	2500	1500

Sheet:	ENG-1	BRI-KO ENGINEERING INC	Cert. Of Auth.:#27622	tel: 954-648-6218
Doc:	Page 1 of 1			
Green -LIVV GEN3_RoofStand				
Issue Date:	30-Mar-20			
Dwn By:	B.S.			
Dwg Size:	11x 17			