

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:

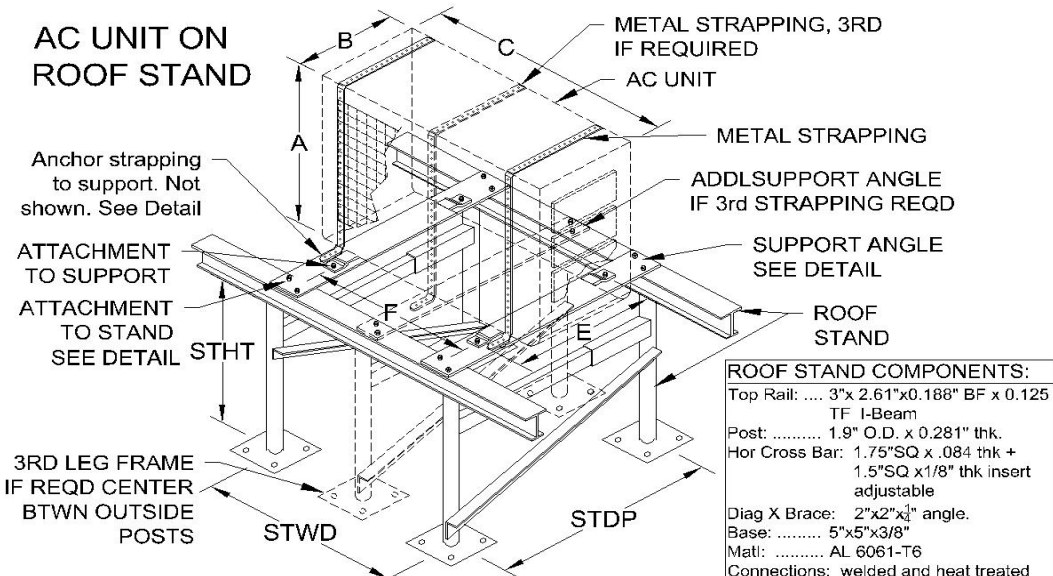
THE TABLE SHOWS ROOF STAND AND ANCHOR TYPES FOR VARIOUS MODELS OF HVAC OUTDOOR EQUIPMENT UP TO 5 TONS THAT MEET THE FOLLOWING ANALYSIS: • OVERTURN • SLIDING • ANCHOR PULLOUT AND SHEAR STRENGTH • EQUIPMENT INTEGRITY.

TABLE A-2

MULTI - Series		Weight	Length	Width B	Height	Mount	Mount
Model No.	(lbs)	C (in.)	(in.)	A (in.)	E (in.)	F (in.)	
MULTI18HP230V1BO/CO	115	35.3	13.4	27.6	15.6	22.0	
MULTI24HP230V1BO/CO	153	36.2	14.6	31.1	15.5	26.4	
MULTI30HP230V1BO/CO	154	36.2	14.6	31.1	15.5	26.4	
MULTI36HP230V1BO/CO	198	37.4	13.4	49.2	16.3	24.8	
MULTI42HP230V1BO/CO	198	37.4	13.4	49.2	16.3	24.8	
MULTI48HP230V1AO	256	35.4	13.4	53.0	14.9	22.5	
MULTI56HP230V1AO	256	35.4	13.4	53.0	14.9	22.5	

Installation Requirements								
Roof Stand	Support Angle	Strapping		Design Check: Nominal /				
		# of Straps If Required	Gauge thickness	Reqd ≥ 1.00 = OK				
Conc Anchor Type	Number of Leg Frames	Support Angle thickness (in.)	Unit foot to Support Anchor	Conc Anc Pullout	Conc Anc Shear	Unit Foot Anchor Pullout		
A-2	2	1/4	A-4	Yes, 2	20ga	1.21	2.61	2.83
A-2	2	1/4	A-4	Yes, 2	20ga	1.03	2.26	2.22
A-2	2	1/4	A-4	Yes, 2	20ga	1.03	2.26	2.22
A-3	3	5/16	A-5	Yes, 3	16ga	1.91	2.49	1.44
A-3	3	5/16	A-5	Yes, 3	16ga	1.91	2.49	1.44
A-3	3	5/16	A-5	Yes, 3	16ga	1.85	2.44	1.22
A-3	3	5/16	A-5	Yes, 3	16ga	1.85	2.44	1.22

AC UNIT ON ROOF STAND



ROOF STAND COMPONENTS:
 Top Rail: 3"x 2.61"x0.188" BF x 0.125 TF I-Beam
 Post: 1.9" O.D. x 0.281" thk.
 Hor Cross Bar: 1.75" SQ x .084 thk + 1.5" SQ x 1/8" thk insert adjustable
 Diag X Brace: 2"x2"x1/4" angle.
 Base: 5"x5"x3/8"
 Matl: AL 6061-T6
 Connections: welded and heat treated

Bri-Ko Engineering, Inc., Structural Analysis
 Spreadsheet designed by: B. Schwartz, PE
 Date data input: 11-Apr-19

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.

Design Methodology and Load Combinations:

Design Method: LRFD $\Phi = 0.90$
 Load Combos: FBC Eqn. 16-6 0.9 D + 1.0 W
 Wind Forces: based on FBC 6th Ed., 1620, $A_f < 0.1B_h$, $A_f < 0.1 B_L$

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
Height, h:	60 ft	Exp. Cat.: C
Enclosure Cat.	N/A	Vel. Pres. Exp Coef., Kz: 1.137
Velocity Pressure	$q_h = 0.00256 K_z K_{zt} K_d V^2$ (lb/ft ²)	qh = 90.6 psf
$F = q_h(GC_p)A_f$	(GC _p) _{v,l} = (1.5 ver., 1.9 lat.)	F _{ver, Flat} : 135.9 psf, 172.1 psf

Limit States: for illustration purposes only:

Select UnitType: MULTI Select Model #: MULTI56HP230V1AO
 Number of Leg Frames is 3

Loads, (lbs): P1= 2243 P2= 448 P3= 849 PD= 256

Resistance to sliding stand post: Req'd Shear/leg = 400 lbs Nominal Shear per leg: 850 lbs CHECKS OK

Resistance to sliding anchors to support: Req'd Sher/anc: 600 lbs Nom Shear per bolt: 1500 lbs CHECKS OK

Resistance to Moment and Uplift: Use Load Combo: 0.90 D + 1.00 W

Overturn M at stand base: 139.6 k-in Base Pullup: 554 lbs

Overturn M at unit foot: 61.1 k-in Foot Pullup: 2107 lbs

Nom Pullup Str, 4xConcAnc, Bolt: 5480 lbs 2500 lbs CHECKS OK

Verification of Support Angle:

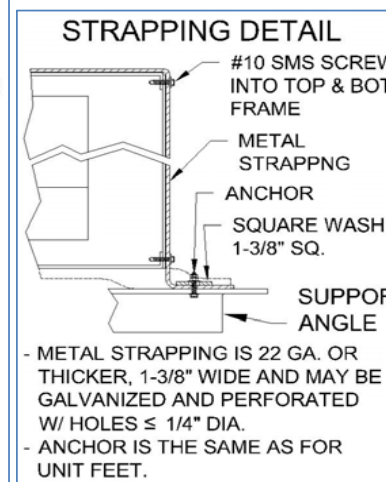
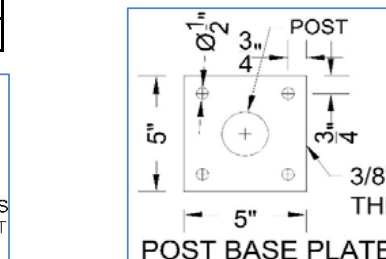
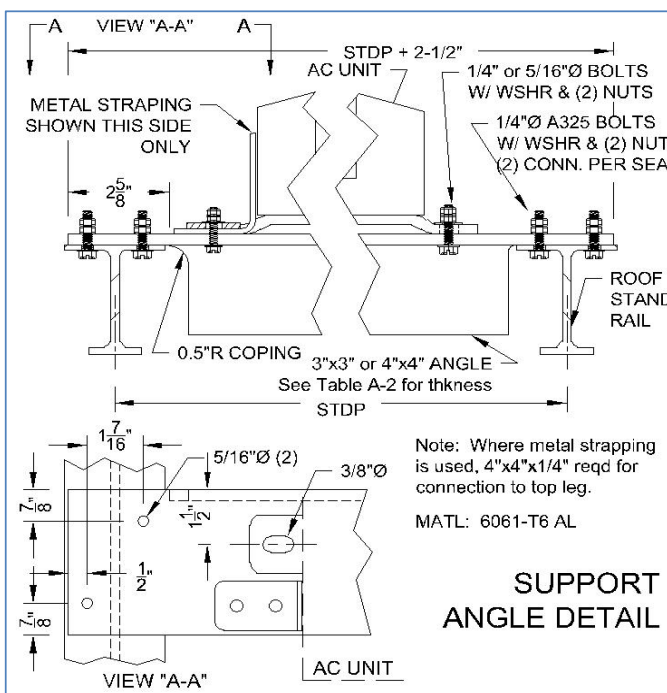
Forces, lbs:	-R ₁ = 938	R ₂ = 2107	R ₃ = 1883	R ₄ = 714
Required Mom.:	9.9 k-in	Req'd Section Modulus:	0.524 in ³	
Use: 3"x3"x5/16" with Sx= 0.677 in ³				

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

Required tension on strap= 1515 lbs
 Strap width, gauge= 1.375 in. 16ga min gauge thickness
 Steel Strength= 45 ksi min. Strength of strap= 1635 lbs Checks OK

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

Roof Stand min, maxs:	Leg Max Forces(lbs)			
limits	STWD	STDP	STHT	Tension: 5860
min:	24 in.	28 in.	18 in.	Comp.: 6000
max:	36 in.	36 in.	33 in.	Shear: 1700



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

GENERAL NOTES:

- 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.
- THE LOAD PATH VERIFIED IS FROM THE EQUIPMENT AS A SINGLE UNIT, ENCLOSURE FASTENERS, UNIT LEG ANCHORS, ROOF STAND CROSS SUPPORT TO ROOF STAND.
- THE AC UNIT IS MOUNTED ON A METAL ROOF STAND WHICH IS SECURED TO THE ROOF.
- ANCHORS USED TO FASTEN THE UNIT TO THE ROOF STAND ARE A307 OR HIGHER STRENGTH STEEL BOLTS.
- THE ROOF STAND IS SUPPLIED BY THE MANUFACTURER INDICATED IN THIS DOCUMENT AND IS INSTALLED IN CONFORMANCE WITH THE ENGINEERING DOCUMENT REFERENCED.
- 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:

- THE WIND LOAD ACTING NORMAL TO THE LARGE VERTICAL SIDE OF THE AC UNIT IS USED FOR WORST CASE SHEAR.
- THE WIND LOAD ACTING ON THE TOP OF THE UNIT UPWARD AND THE HORIZONTAL WIND LOAD IS USED TO CALCULATE UPLIFT AND MOMENT.
- 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.
- 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.
- MAX MOMENT AND SHEAR TO THE SUPPORT BAR DETERMINE SELECTION OF THE SUPPORT BAR.

ROOF STAND NOTES:

- 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
- STHT = STAND HEIGHT WITH MIN 18", MAX 33".
- STWD = STAND WIDTH = 24" MIN, 36" MAX.
- STDP = STAND DEPTH = 28" MIN, 36" MAX.
- SUPPORT ANGLE AND FASTENERS OF SUPPORT TO STAND AND SUPPORT TO AC UNIT ARE DEFINED IN DETAIL BELOW.
- 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
 Gree -MULTI_RoofStand
 Issue Date: 2-Apr-19
 Dwn By: B.S.
 Dwg Size: 11x 17