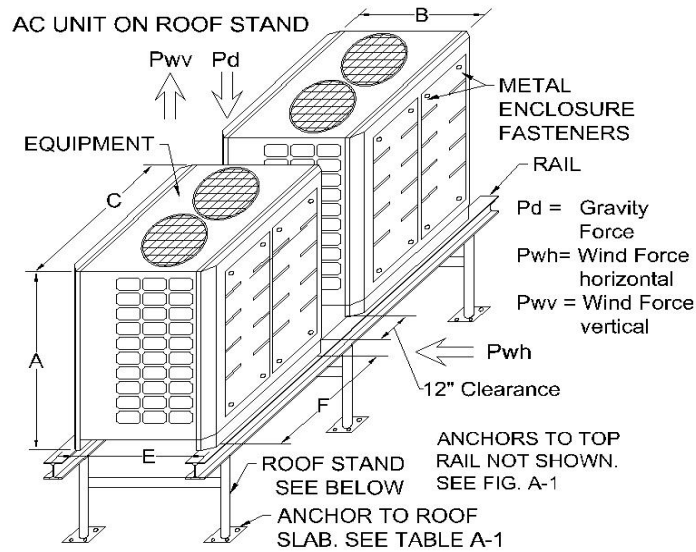


GREE MODULAR / SINGLE CHASSIS OUTDOOR CONDENSING UNITS
ROOF STAND CONFIGURATION AND ANCHOR SELECTION - WIND LOAD EXAMINATION

CODE: FMC and FBC 7th Ed. (2020) BLDG, ASCE 7-16
 MIAMI-DADE WIND SPEED = 195 MPH (Risk Cat. IV)



ENGINEERING CONFORMANCE ANALYSIS:

THE TABLE SHOWS VARIOUS MODELS OF HVAC OUTDOOR EQUIPMENT FROM 6 TO 14 TONS MOUNTED ON A ROOF STAND ON THREE DECK TYPES THAT MEET: • OVERTURN • SLIDING • ANCHOR PULLOUT AND SHEAR STRENGTH.

TABLE A-2

GREE Modular Model No.	Weight (lbs)		Length C (in.)	Width B (in.)	Height A (in.)	Mount E (in.)	Mount F (in.)
	Min.	Max.					
GMV-x72WM/y-z(U)	496	672	36.6	30.1	63.2	28.7	31.2
GMV-x96WM/y-z(U)	662	694	52.8	30.1	63.2	28.7	47.2
GMV-x120WM/y-z(U)	650	816	52.8	30.1	63.2	28.7	47.2
GMV-x144WM/y-z(U)	794	816	52.8	30.1	63.2	28.7	47.2
GMV-x168WM/y-z(U)	849	871	52.8	30.1	68.5	28.7	47.2

Notes: - Model #'s: x = blank, Q or V; y = A, B, or B1; z = F or U; M may be omitted
 - Min and max weights are for similar dimension units but different model #'s

Bri-Ko Engineering, Inc., Structural Analysis Spreadsheet designed by: B. Schwartz, PE

Calc Sht: EC-1 Mechanical Equipment on Roof Stand Calc Date data input: 5-Dec-22

Description: Structural Analysis of roof stand mounted mechanical equipment to resist wind forces.

Code: FBC 7th Ed. (2020) and ASCE 7-16.

Design Meth: LRFD $\Phi = 0.90$ Load: FBC Eqn. 16-6 $0.9 D + 1.0 W$

Wind Forces: $F_h = q_n(GCr)A_f$, $F_v = q_n(GCr)A_r$, ASCE 7-16 Chap 29.4.1 and FBC 1620

Ultimate Design Wind Speed, Vult (3-sec gust):	195 mph	Miami Dade
Nominal Design Wind Speed, Vasd:	151 mph	
Risk Category:	IV	Dir., Topo., Gust Effect: 0.85, 1.00, N/A
Height, h:	60 ft	Exp. Cat.: D, Vel. Pres. Exp Coef., Kz: 1.311
Velocity Pressure $q_h = 0.00256 K_z K_{zt} K_d V^2$ (lb/ft ²)		$q_h = 108.5$ psf
(GC ₁) _{v,l} = (1.5 ver., 1.9 lat.)		F _{ver, Flat} : 162.7 psf, 206.1 psf

Frame:	STWD= 62 in.	STHT= 30 in.	ST-T= 10 in.	STDP= 27.2 in.
Number of Units per stand:	3	Number of leg frames:	4	

Equipment:	Select Unit Type, Model:	MOD HEAT PUMP	GMV-x168WM/y-z(U)	example	
height, width, depth, weight:		68.5 in.	52.8 in.	30.1 in.	849 lbs
Rooftop Structure 1, Frontal Area, Top Area:		25.1 sf	11.0 sf	per unit	
'Space btwn units:	16 in.	rail dist past end unit:	4 in.	rail past post dist.:	6 in.
		rail length:	16 ft - 6 in		

Rooftop Structure Pressures: based on FBC 1620.6, lat: $1.1 \leq (GCr) \leq 1.9$, ver: $1.0 \leq (GCr) \leq 1.5$
 Forces on Long, Short, Top Side: 5177 lbs, 2951 lbs, 1796 lbs

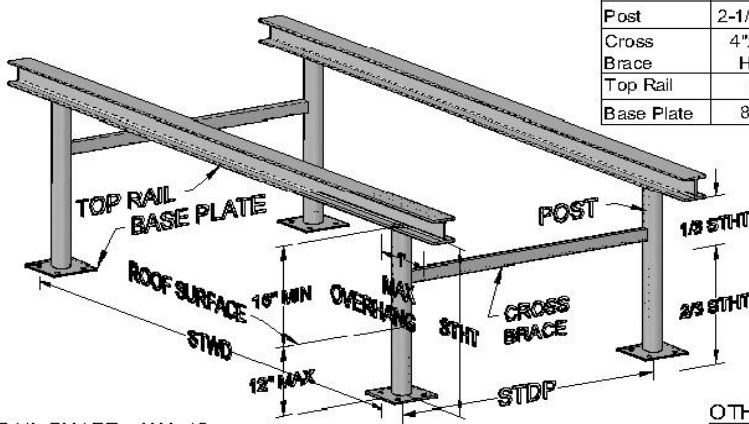
Member & Nominal Strengths:	ϕP_n (k)		ϕV_n (k)		ϕM_n (k-in)		Interaction
	Reqd	Nominal	Reqd	Nominal	Reqd	Nominal	
Post:	Pipe 2.5" STD	Steel Pipe A53 Gr B	47	15.2	43.2		
Cross Bar:	Rect HSS 4"x2"x3/16"	HSS Rect A500 Gr B	68	15.9	96.9		
Top Rail:	W4x13	Steel A992	124	94.0	245.7		
	Axial, kips		Shear, kips		Moment, k-in		
	Reqd	Nominal	Reqd	Nominal	Reqd	Nominal	<1.00 is OK
Post:	6.8	47.0	1.5	15.2	24.0	43.2	0.604
Cross Bar:	0.1	68.0	2.4	15.9	33.4	96.9	0.358
Top Rail:	2.4	124.0	4.4	94.0	23.3	96.9	0.240

Unit to Rail Fasteners: Required Forces [Ten, Shr]: 4.45 k, 2.65 k
 1/2" Stl Grade 5 bolt: Nominal Strength [Ten, Shr]: 13.25 k, 8.84 k Checks OK (Int= 0.64)

Base Plate Moment and pullup: $M_u, P_u, V_u = 18$ k-in, 6.8 k, 0.8 k
 For Conc Deck Only: Reqd Pullup, Shear: 1261 lbs, 203 lbs Checks OK with Int = 0.77

Unit Integrity: If Required. Only if manufacturer does not state design wind pressure.
 Required screw pullout strength= 363 lbs Manufacturer shall provide this data.

Roof Stand Members		
Member	Type	Material
Post	2-1/2" SCH 40	A500 Gr B
Cross Brace	4"x2"x3/16"	A500 Gr B
Top Rail	W4x13	A992
Base Plate	8" SQ FB	A36

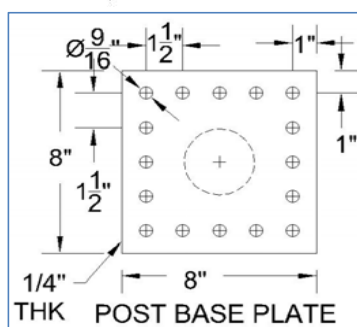


RAIL SHAPE: W4x13

STAND FABRICATION NOTES:

- All material is steel with min Fy = 36 ksi
- All joints welded continuous w/ 3/16" fillet

OTHER NOTES:
 Minimum number of posts is 4. 6 or more as in sketch typically used for double or multiple condensers.
 Clearance below raised roof >= 18"



Place anchors in corner holes unless located in unacceptable slab location. Number of anchors / side and total as per table.

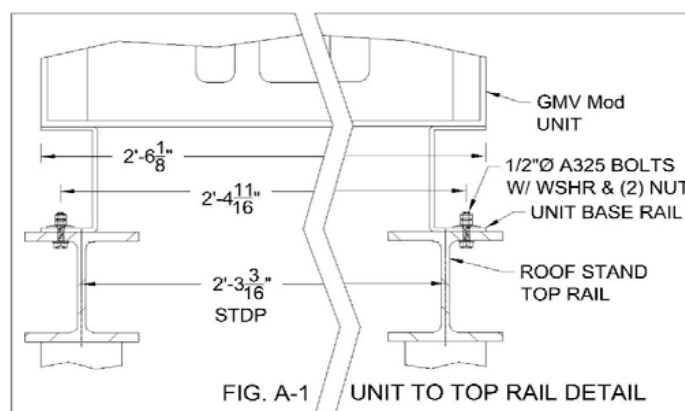


TABLE A-1 ANCHOR TYPE AND ALLOWABLE STRENGTHS				
SYM	ANCHOR DESCRIPTION & MANUFACTURER	EMBED (min)	ANCHOR STRENGTH	
			PULL OUT (LBS)	SHEAR (LBS)
A-5	1/2" Power Stud+ SD1 (Powers)	3-3/4"	2180	1050
A-6	3/8" Drop-In Shallow Anchor HDI/-L	1-9/16"	1090	1375
A-7	1/2" Thru bolts Stl Alloy Gr.8	NA	4600	5800

Notes: 1. Allowable strengths have safety factor of 4 are for poured concrete min 3000 psi from manufacturer's specs.

Roof Stand Installation Requirements			
Note: Rail Length and STWD are calculated for units 96 kBTU or greater. 72 kBTU units may have smaller lengths.			
Unit Configuration		Base Plate Anchors	
Num Units	Num Leg Frames	Conc Deck	Core Metal Deck
1	2	Table A-1 Anchors	
2	3	A-5	A-6
3	4	[2, 4]	[3, 8]
		[2, 4]	[2, 4]
		[2, 4]	[3, 8]
		[2, 4]	[2, 4]

Note: Leg frame is two posts and a cross brace btwn.

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 ANALYSIS CONFORMS TO THE REQUIREMENTS OF THE FBC 7th ed. (HIGH VELOCITY HURRICANE ZONE) AND ASCE 7-16.
3. THE AC UNIT IS MOUNTED ON A METAL ROOF STAND WHICH IS SECURED TO THE ROOF. THREE TYPES OF ROOF ARE VERIFIED.
4. ANCHORS USED TO FASTEN THE UNIT TO THE ROOF STAND ARE A325 OR HIGHER STRENGTH STEEL BOLT.
5. THE ROOF STAND, AS SPECIFIED IN THE ROOF STAND NOTES, IS DESIGNED AND VERIFIED BY STRUCTURAL ANALYSIS BY THIS ENGINEER.
6. UNIT INTEGRITY, IF NOT DESIGNATED BY THE MANUFACTURER FOR THE STATED WIND PRESSURES, IS MET BY VERIFYING SCREW PULLOUT STRENGTH RESISTANCE TO WIND NEGATIVE PRESSURE ON SHELL. INTERNAL FRAME INTEGRITY IS NOT INVESTIGATED.

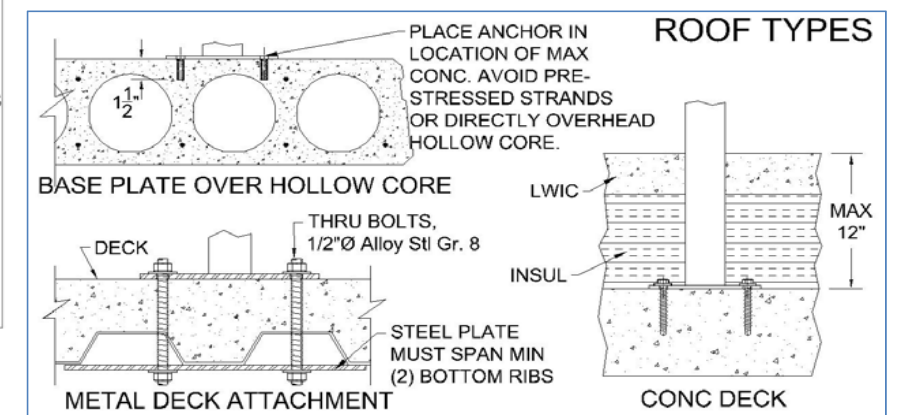
CALCULATIONS:

OVERTURN:

1. WIND LOAD IS VERIFIED FOR NORMAL TO LARGE SIDE OF UNIT OR 75% ON EACH OF TWO ADJACENT SIDES AND 100% TO TOP.
2. THESE FORCES MUST BE RESISTED BY THE SHEAR AND TENSILE STRENGTH OF THE ANCHORS HOLDING THE UNIT TO THE ROOF STAND AND ANCHORS HOLDING ROOF STAND BASE PLATE TO THE ROOF. THE ROOF STAND INTERNAL STRESSES ARE VERIFIED BY THIS ENGINEER TO BE WITHIN THE ALLOWABLE STRENGTHS OF ITS ELEMENTS AND CONNECTIONS.
3. IF REQUIRED, SCREW STRENGTH RESISTS SHELL AND FRAME SEPARATION.

ROOF STAND NOTES:

1. STHT = STAND HEIGHT WITH MIN 18", MAX 32".
2. STWD = STAND POST SPACING: 36" <= STWD <= 72"
3. STDP = STAND DEPTH: 26" <= STDP <= 48".
4. SEE TABLE A-1 FOR BASE PLATE TO CONC ROOF SLAB PERMISSIBLE ANCHORS.



Sheet: Pg 1 of 1	ENG-1	BRI-KO ENGINEERING INC	Cert. Of Auth.: #27622	tel: 954.648.6218
Doc: Mod Heat Pump on Roof Stand		This item has been digitally signed and sealed by Brian I Schwartz on the date adjacent to the seal. Printed copies of this document are not considered signed and sealed and the signature must be verified on any electronic copies.		
Issue Date: 28-Dec-22				
Dwn By: B.S.				
Dwg Size: 11x 17				