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Technical Evaluation Report

DIVISION: 23 08 00–COMMISSIONING OF HVAC

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(Subject to Renew July 1, 2022 or next code cycle change)

EVALUATION SUBJECT: CARRIER PACKAGE UNITS

TER-20-33398

REPORT HOLDER:
CARRIER ENTERPRISE OF FLORIDA
2000 PARKS OAKS AVE
ORLANDO, FL 33428 USA
(954) 247-2003 | FL.CARRIERENTERPRISE.COM

Florida Building Code Seventh Edition (2020)
International Building Code (2012, 2015, & 2018)

NOTE: GRAPHICAL DEPICTIONS IN THIS REPORT ARE FOR ILLUSTRATIVE PURPOSES ONLY AND MAY DIFFER IN APPEARANCE

SCOPE OF EVALUATION (compliance with the following codes):

THIS IS A STRUCTURAL (WIND) PERFORMANCE EVALUATION ONLY. NO ELECTRICAL OR TEMPERATURE PERFORMANCE RATINGS OR CERTIFICATIONS ARE OFFERED OR IMPLIED HEREIN.

This Product Evaluation Report is being issued in accordance with the requirements of the **Florida Building Code Seventh Edition (2020)** per FBC Section 104.11.1, FMC 301.15, FBC Building Ch. 16, ASCE-7, FBC Existing Building sections 707.1, 707.2, FBC Building 1522.2, and FBC Residential M1202.1, M1301.1, FS 471.025, including Broward County Administrative Provisions 107.3.4. This Report is also in accordance with the **International Building Code (2012, 2015, & 2018).** The product noted on this report has been tested and/or evaluated as summarized herein. **IN ACCORDANCE WITH THESE CODES, EACH OF THESE REPORTS MUST BEAR THE ORIGINAL SIGNATURE & RAISED SEAL OF THE EVALUATING ENGINEER.**

SUBSTANTIATING DATA:
• Product Evaluation Documents
Substantiating documentation has been submitted to support this TER and is summarized in the sections that follow.
• Structural Engineering Calculations
Structural engineering calculations have been prepared which evaluate the product based on comparative and/or rational analysis to qualify the following design criteria:

- Maximum allowable unit panel wind pressure connection integrity
- Maximum allowable uplift, sliding, & overturning moment for ground and roof applications

Calculation summary for this TER is provided in the forces summary table. No 33% increase in allowable stress has been used in the design of this product. Microsoft Excel was used to carry out the calculations present in this report.

INSTALLATION:
The product(s) listed in this report shall be installed in strict compliance with this TER & manufacturer-provided model specifications.
The product components shall be of the material specified in the manufacturer-provided product specifications. All screws must be installed in accordance with the applicable provisions & anchor manufacturer's published installation instructions.

LIMITATIONS & CONDITIONS OF USE:
Use of this product shall be in strict accordance with this TER as noted herein. See final page for complete limitations and conditions of use.

OPTIONS:
This evaluation is valid for all CARRIER model families 50VL-C, 50VT-C, 50VG-A, 50VR-A, 50ZPC, 50ZPD, 50ZHC, 50VL-D, 50VR-C, 48VL-E capacities 24, 30, 36, 42, 48, 60. Unit Model example: 50VT-C48.

FINISH:
Baked enamel.

UNIT CASING MATERIAL:
0.86mm galvanized sheet steel ASTM A653 EDDS cold rolled steel for removable top panel. 1.14mm galvanized sheet steel ASTM A653 EDDS cold rolled steel for base pan. 0.86mm galvanized steel sheet ASTM A653 for side protector louvers and panels, secured with #10-16 sheet metal screws into top and base pan.

INSTALLATION:
Shall follow manufacturer specifications as well as the information provided herein.

STRUCTURAL PERFORMANCE:
Models referenced herein are subject to the following design limitations:

Maximum Rated Wind Pressures*:
± 119 psf Lateral, 94 psf Uplift

- Required design wind pressures shall be determined according to the design pressure guide provided in the appendix or on a site-specific basis in accordance with ASCE 7 and applicable sections of the building code(s) being referenced in accordance with ASD methodology.
- Required design pressures shall be less than or equal to the maximum pressures listed herein.
- *Maximum Rated Wind Pressures indicate the maximum pressures that all units listed herein are approved for. Valid for at-grade and rooftop applications. See limitations herein.
- Valid for use inside and outside the High-Velocity Hurricane Zone (HVHZ).
- Site-specific wind analysis may produce alternate limitations provided maximum rated wind pressures stated herein are not exceeded.

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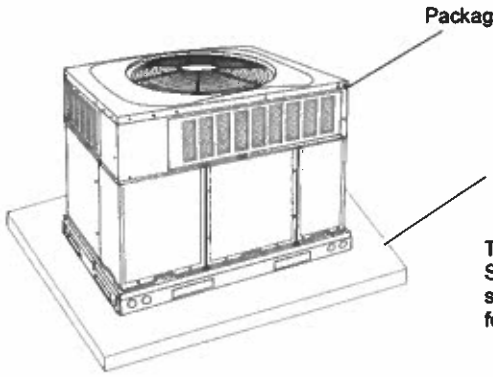
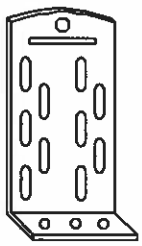
SECTION 2 PRODUCT GROUND INSTALLATION



TIE-DOWN CLIP A
(GROUND APPLICATION)

Tie-down clips 3.25" wide ASTM A653 steel 16ga cabinets tied down to a ground structure (concrete slab); fasten clip to structure using (1) anchor from Anchor Schedule to Host Structure Table (A) and (3) #14 SAE Grade 2 self-drilling screws to fasten clip to unit base pan. Install in unit with quantities shown in Tie-down Clip Schedule. Locate clips at 3" from the appropriate corner, equally spaced. Kit # CBTDC-KGR



TIE-DOWN CLIP B
(GROUND APPLICATION)

When using BMP Clip part# TD042; 2" wide ASTM A283 (Grade D) steel 0.113" thickness of varying length for all cabinets tied to a roof structure or ground structure, fasten number of clips per "Tie Down Strap Clip Schedule". Using qty. 2 anchors from Anchor Types to Host Structure table and qty. 4 #12 SAE grade 5 sheet metal screws to fasten clip to unit base pan. Locate clips at 3" from the appropriate corner using and equal number of clips near corners on opposite sides.

Tie-down Clip Schedule (Ground Installation)

Unit Model+	Max Lateral Pressure	Max Uplift Pressure	Tie Down Clip A Qty	Tie Down Clip B Qty
Table 1 Units	50 psf	39 psf	6	6
Table 2 Units	50 psf	39 psf	N/A	6

Anchor to Host Structure Schedule (Ground Installation) – Concrete Slab

Unit Model+	Clip Type	Anchor Type	Host Structure
Table 1 Units	Type A	1	Concrete 3,000 psi
	Type B	2	
Table 2 Units	Type A	N/A	
	Type B	2	

Anchor Types to Host Structure (to Concrete Slab):

1 (Concrete Slab). – 3/8" ITW RED HEAD Trubolt wedge. Into 3,000 psi concrete minimum, edge distance 2-5/8" minimum and spacing 5-1/4" minimum.

2 (Concrete Slab). – 1/4" Dewalt ULTRACON SS4 Anchor embedded 1 3/4"" in 3,000 psi concrete. 2 1/2" from edge minimum.

NA. - No anchors apply.

Panel Integrity Summary (Ground Installation)

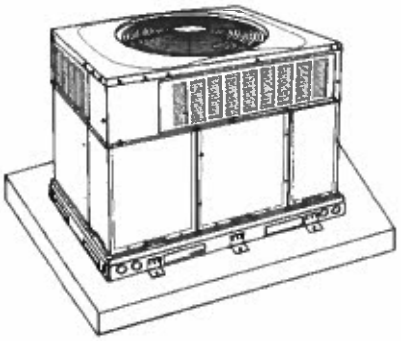
Unit Model+	Panel	Max Applied Wind Pressure	Pressure Direction	Add'l Screws Needed (pcs)	Unit Model+	Panel	Max Applied Wind Pressure	Pressure Direction	Add'l Screws Needed (pcs)
Table 1	Top Panel	39 psf	Uplift	NONE	Table 2	Top Panel	39 psf	Uplift	NONE
	Panel A	50 psf	Lateral	NONE		Panel A	50 psf	Lateral	NONE
	Panel B	50 psf	Lateral	NONE		Panel B	50 psf	Lateral	NONE
	Panel C	50 psf	Lateral	NONE		Panel C	50 psf	Lateral	NONE
	Panel D	50 psf	Lateral	NONE		Panel D	50 psf	Lateral	NONE
	Panel E	50 psf	Lateral	NONE		Panel E	50 psf	Lateral	NONE
	Panel F	50 psf	Lateral	NONE		Panel F	50 psf	Lateral	NONE
	Panel G	50 psf	Lateral	SEE DETAIL		Panel G	50 psf	Lateral	NONE

+ See tables provided below for cabinet classification

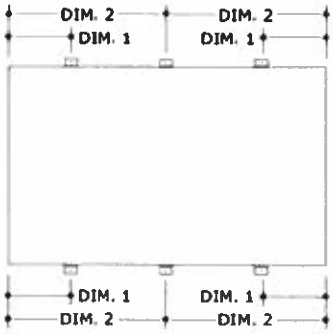
Note:
1. Screw quantities were checked to reinforce unit panels as needed. They shall be spaced evenly throughout the panel bottom part, validating that the screw joins the panel with the supporting element. Screw sizes, quantities on panel, and panel characteristics are according to client's description.
2. Additional screw shall be at least #10 SS 410.
3. For panel G, strap tie shall be no thinner than 16ga (This note applies just for unit models in table 1).
4. Installer shall insulate dissimilar metals.
5. Units on details, may differ from actual units in appearance.
6. Details apply for clip type A & clip type B, with model unit limitation (see Table 2 last page).
7. Slab dimension by others.

TIE-DOWN CLIP LAYOUT

FAMILIES: 50VL-C, 50VT-C, 50VG-A, 50VR-A, 50VL-D, 50VR-C, 48VL-E.



Note:
Reinforce louvers per detail 5

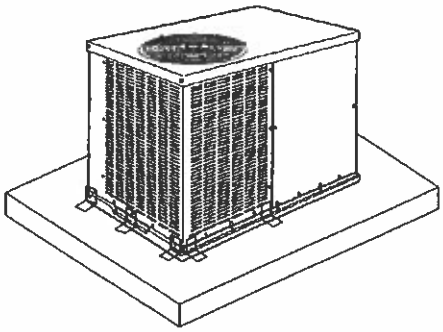


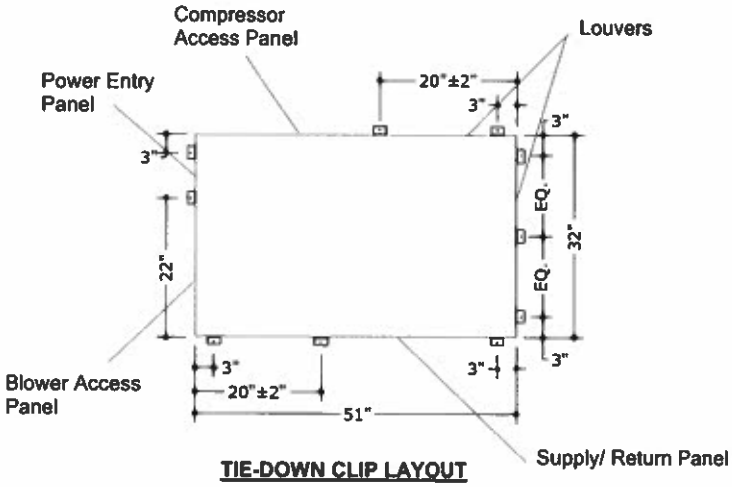
TIE-DOWN CLIP LOCATIONS

DIM. 1	10" MAX.
DIM. 2	ON CENTER (LONG SIDE OF UNIT)

TIE-DOWN CLIP LAYOUT

FAMILIES: 50ZPC, 50ZPD 50ZHC.

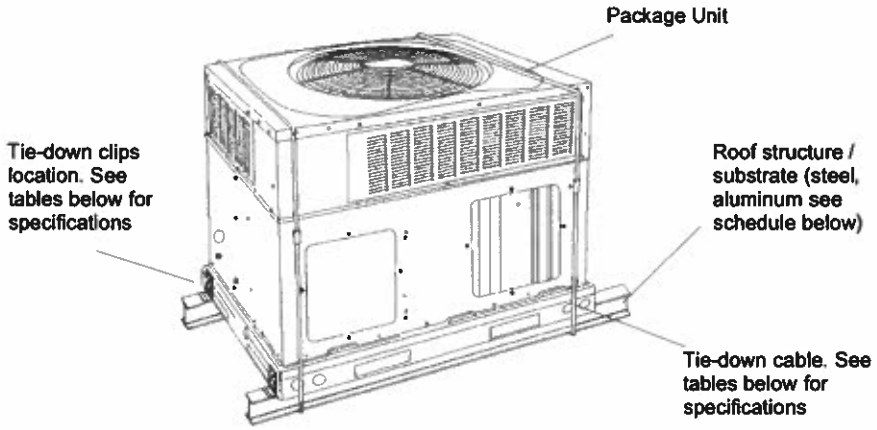


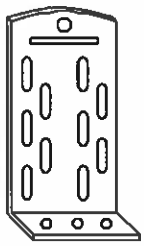


TIE-DOWN CLIP LAYOUT

Note:
Compressor Access panel and Blower Access Panel shall not be blocked with Tie-down Clips

SECTION 3 PRODUCT ROOF INSTALLATION





TIE-DOWN CLIP
(ROOF APPLICATION)

When using BMP Clip part# TD042; 2" wide ASTM A283 (Grade D) steel 0.113" thickness of varying length for all cabinets tied to a roof structure or ground structure, fasten number of clips per "Tie Down Strap Clip Schedule". Using qty. 2 anchors from Anchor Types to Host Structure table and qty. 4 #12 SAE grade 5 sheet metal screws to fasten clip to unit base pan. Locate clips at 3" from the appropriate corner using and equal number of clips near corners on opposite sides.

Tie-down Clip Schedule (Roof Installation)						
Unit Model+	Max Lateral Pressure	Max Uplift Pressure	TIE-Down Cable	Cable Diameter	Screw Curb / Unit Rail	Tie-Down Clips
Table 1 Units	119 psf	94 psf	2	1/4"	(1) B @ 2-1/8"	4

Anchor to Host Structure Schedule (Roof Installation) – Metal Host					
Unit Model+	Max Lateral Pressure	Max Uplift Pressure	1/8" Min A36 Steel	1/8" min 6061-T6 Aluminum	A653 Steel Curb
Table 1 Units	119 psf	94 psf	A	A	B

Panel Integrity Summary (Roof Installation)				
Unit Model+	Panel	Max Applied Wind Pressure	Pressure Direction	Add'l Screws Needed (pcs)
Table 1	Top Panel	94 psf	Uplift	NONE
	Panel A	119 psf	Lateral	2
	Panel B	119 psf	Lateral	NONE
	Panel C	119 psf	Lateral	4
	Panel D	119 psf	Lateral	4
	Panel E	119 psf	Lateral	NONE
	Panel F	119 psf	Lateral	2
	Panel G	119 psf	Lateral	SEE DETAIL 8

+ See tables provided below for cabinet classification

Notes:
1. Screw quantities were checked to reinforce unit panels as needed. They shall be spaced evenly throughout the panel bottom part, validating that the screw joins the panel with the supporting element (base panel, for more details see last page). Screw sizes, quantities on panel, and panel characteristics are according to client's description.
2. Additional screws shall be at least #10 SS 410.
3. For panel G, strap tie shall be no less than 16ga.
4. Installer shall insulate dissimilar metals.

Tie-down Cable Type: (for roof applications)

1.- 7x7 Galvanized cable for industrial application or any cable configuration that meets or exceeds WLL (Working Load Limit) specified.
2.- Minimum edge distance 3" from the unit corners.
3.- Tie-down cable shall be wrapped around the unit and roof stand rail, and shall be tightened to a snug fit using the turnbuckle.
4.- Provide two cables per unit and one turnbuckle per cable, installer shall verify that the capacity of the turn buckle meets or exceeds cable capacity.
5.- Neoprene pad shall be placed between the cable and the cabinet to prevent distortion.

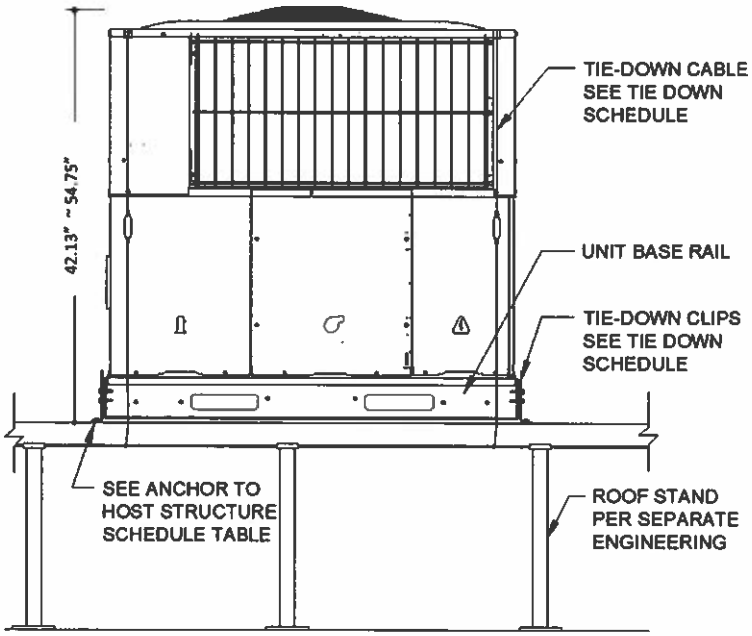
Anchor Types to Host Structure (to Metal Host):

A. (Metal Host)– 1/4" SAE Grade 5 screw minimum 1/2" from edges with nut and washer OD 0.75"

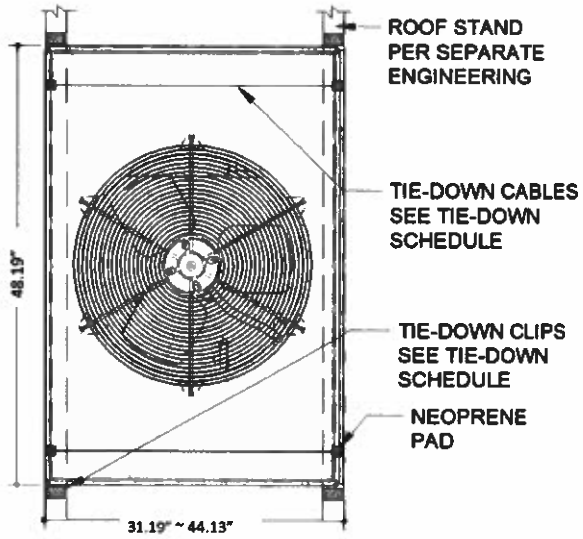
B. (Metal Host)– #12 Stainless Steel 410, Self-drilling screw, no less than ½" long.

Notes:
1.- Minimum steel curb thickness 18ga.

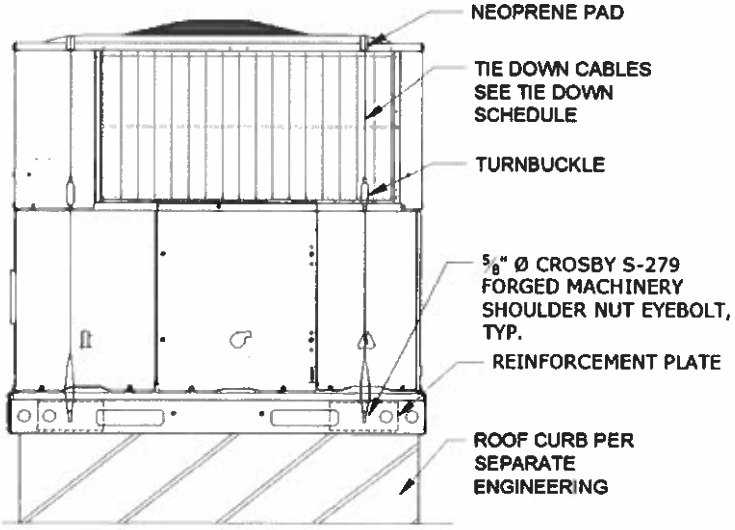
TIE-DOWN CABLE AND CLIP LAYOUT



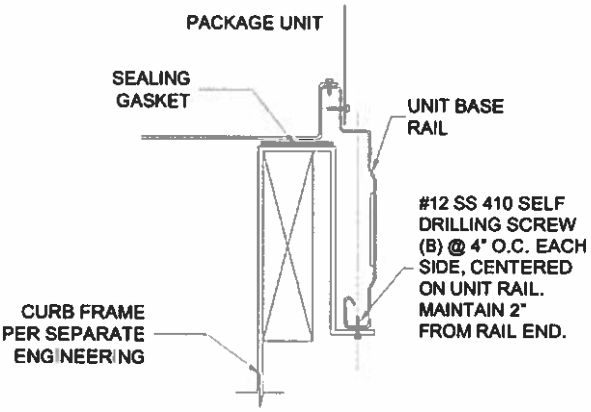
1 TYPICAL ROOF MOUNT ON STAND
SCALE: N.T.S. ELEVATION VIEW



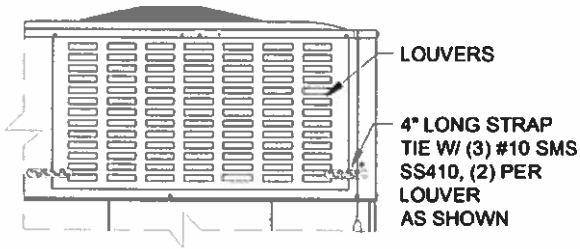
2 TYPICAL ROOF MOUNT ON STAND
SCALE: N.T.S. PLAN VIEW



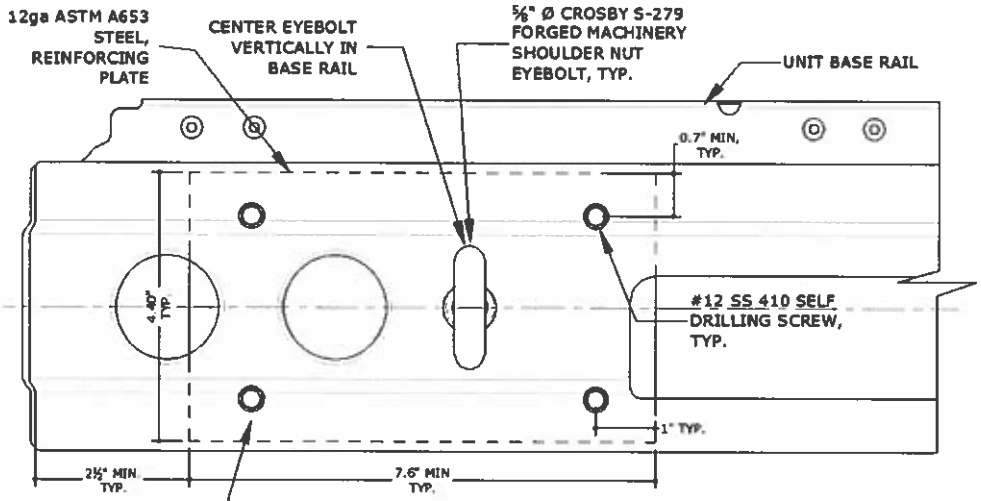
3 TYPICAL ROOF MOUNT ON CURB
SCALE: N.T.S. ELEVATION VIEW



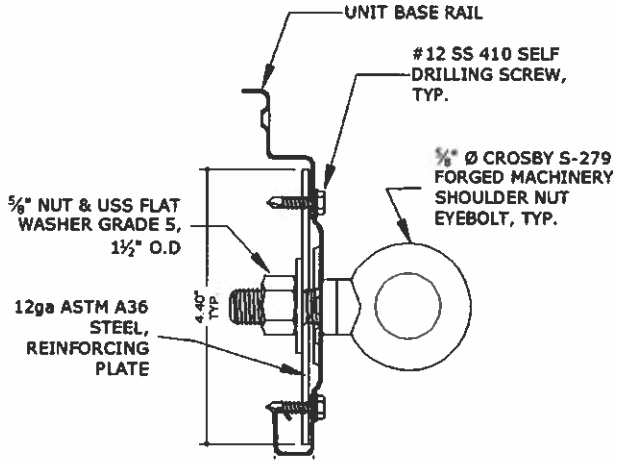
4 ROOF MOUNT ON CURB
SCALE: N.T.S. DETAIL VIEW



5 LOUVERS REINFORCEMENT
SCALE: N.T.S. FRONT VIEW



6 REINFORCING PLATE
N.T.S DETAIL VIEW



7 REINFORCING PLATE
N.T.S DETAIL VIEW

SECTION 4 UNIT FAMILIES, DIMENSIONS & PANEL LOCATION

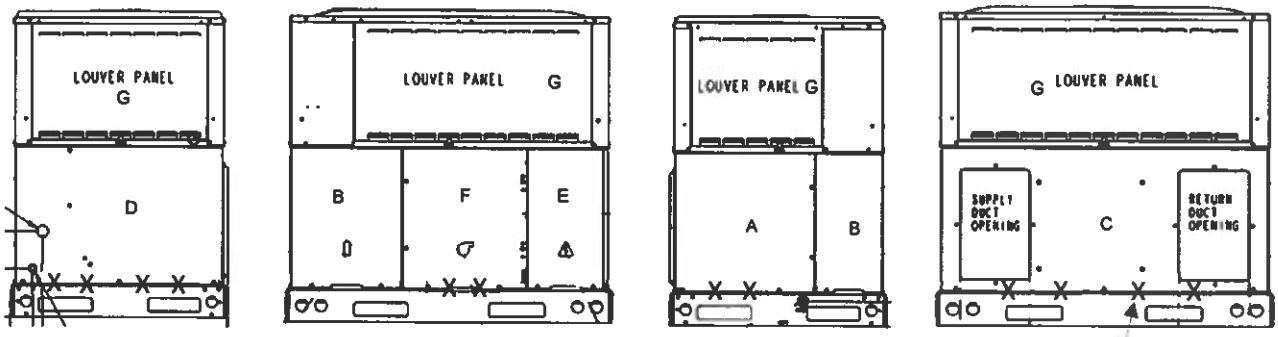


TABLE 1
FAMILIES: 50VL-C, 50VT-C, 50VG-A, 50VR-A, 50ZPC, 50ZHC, 50VL-D, 50VR-C, 48VL-E.
CAPACITIES: 24, 30, 36, 42, 48, 60
UNITS DIMENSIONS:
WIDTH: 31.19" ~ 44.13"
DEPTH: 48.19"
HEIGHT: 42.13" ~ 54.75"

Recommended reinforcing screw location. See panel integrity for quantities per panel.

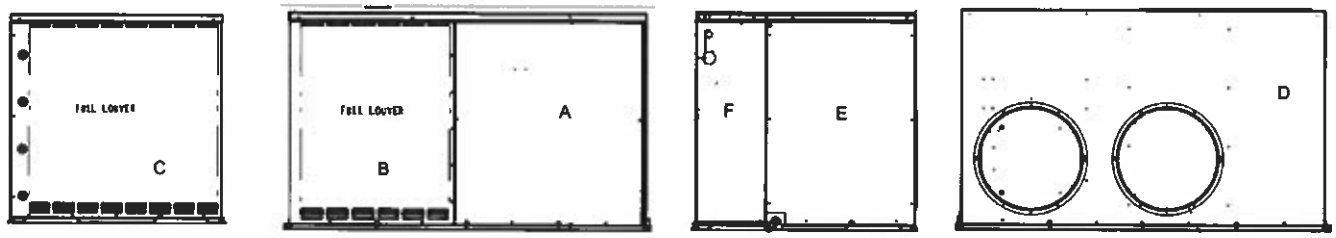


TABLE 2
FAMILIES: 50ZPC, 50ZPD, 50ZHC.
CAPACITIES: 24, 30, 36, 42, 48, 60
UNITS DIMENSIONS:
WIDTH: 32.00"
DEPTH: 51.00"
HEIGHT: 30.13" ~ 42.13"
WEIGHT: 230 lbs. ~ 425 lbs.
CABINET NOTE: 50ZPC & 50ZHC are not suitable for Clip A, Rail, or Roof Curb installations. Approved for Concrete Slab and Ground Mounting designs.

Proj. #	Remarks	By	Checked	Date
16-3190.13	Initial Issue	LAO	FLB	8/24/16
20-33398	Update to 2020 FBC	CCB	RWN	12/16/20

LIMITATIONS & CONDITIONS OF USE:
Use of this product shall be in strict accordance with this TER as noted herein.
The supporting host structure shall be designed to resist all superimposed loads as determined by others on a site specific basis as may be required by the Authority Having Jurisdiction. Host structure conditions which are not accounted for in this product's respective anchor schedule shall be designed on a site-specific basis by a registered professional engineer. No evaluation is offered for the host supporting structure by use of this document; Adjustment factors noted herein and the applicable codes must be considered, where applicable. All supporting components which are permanently installed shall be protected against corrosion, contamination, and other such damage at all times. Fasteners must penetrate the supporting members such that the full length of the threaded portion is embedded within the main member. All anchors, screws, straps, clips, and attachment part can be substituted for equivalent parts, as long as the capacities of the equivalent parts are equal or stronger.
This evaluation does not offer any evaluation to meet large missile impact debris requirements which typically are not required for this type of product.
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 codes and standards stated herein. Due to the indeterminate 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, during equipment maintenance or after a named storm; all screws, cabinet components, clips, anchor, bolts, straps and cables are to be verified by the A/C contractor. All damaged cabinet components, loose, corroded, broken screws or anchor bolts shall be replaced to ensure structural integrity for hurricane wind forces.

APPENDIX A: DESIGN WIND PRESSURE GUIDE

Max. Ult. Wind Speed (V_{ult})	Max. MRH (Roof Height)	Exposure Category	Required Design Wind Pressures (ASD)	
			Lateral Pressure	Uplift Pressure
140 mph	At-Grade (0 ft)	C	26 psf	21* psf
		D	31 psf	25* psf
	100 ft	C	67 psf	53 psf
		D	75 psf	59 psf
	200 ft	C	76 psf	60 psf
		D	84 psf	67 psf
175 mph	At-Grade (0 ft)	C	40 psf	32* psf
		D	49 psf	39* psf
	100 ft	C	104 psf	82 psf
		D	117 psf	93 psf
	200 ft	C	119 psf	94 psf
		D	~~131 psf~~	~~104 psf~~
186 mph	At-Grade (0 ft)	C	46 psf	36* psf
		D	55 psf	44* psf
	100 ft	C	117 psf	93 psf
		D	~~132 psf~~	~~105 psf~~
	200 ft	C	~~135 psf~~	~~106 psf~~
		D	~~148 psf~~	~~117 psf~~

indicates a design wind pressure that is not approved for use by this evaluation. Seek additional engineering or contact this office for design solutions.

DIRECTIVE: This design pressure guide is for reference only and shall be approved for use by the Authority Having Jurisdiction (AHJ). If the design pressures listed in this guide are not used, required design pressures shall be calculated on a site-specific basis by others. For site-specific scenarios classified as Exposure Category B, the required design pressures stated for Exposure Category C in the above guide shall be used or design pressures shall be calculated separately. For heights and parameters beyond the above values, consult with an engineer for a site-specific analysis.

The required ASD design pressures listed in the above guide were calculated based on the parameters listed below. The project design professional or permitting contractor shall verify that the site-specific conditions are equal to or less than the design parameters listed below.

*Note: Per the codes and standards referenced herein, uplift is optional for mechanical equipment at-grade. At the discretion of the AHJ, uplift may be taken as 0 psf or as the value listed in the guide.

At-Grade (0 ft MRH) Required Design Pressures:

- ASCE 7 "Design Wind Loads: Other Structures"
- Structure Shape = Square, flat terrain
- Height of structure (unit + stand or curb, if used) = 6 ft max.
- Width of unit = 1 ft min., Depth of unit = 1 ft min.
- Uplift Pressure = Lateral Pressure x 1.5 / 1.9 (if considered)

Rooftop (>15 ft MRH) Required Design Pressures:

- ASCE 7 "Design Wind Loads: Other Structures: Rooftop Structures and Equipment for Buildings"
- Structure Shape = Square, flat terrain
- z = up to 7 ft, where z = height of stand or curb + ½ unit height
- Lateral GC_f = 1.90; Uplift GC_f = 1.50

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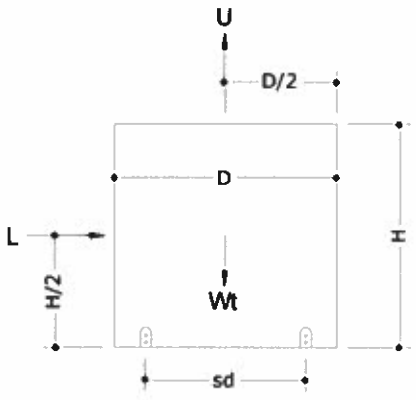
FOR HELP DETERMINING DESIGN PARAMETERS AND TO SEE MORE EXAMPLES, OR SCAN THE QR CODE TO THE RIGHT >

UNIT REACTIONS FROM WIND GUIDE



DIRECTIVE: This guide is intended for use by a project design professional. Design parameters shall abide all specifications and limitations stated in this report. Design Professional shall consider all forces, including seismic and snow loads per governing building codes. Unit reactions obtained from this guide shall be verified by a registered Professional Engineer. Reactions are applicable for unit-to-host connections only. Sample calculations are provided below.

Design Parameters:

- Lateral Wind Pressure, P_lat
- Unit Height, H
- Unit Width, W
- Support Spacing across Depth, sd
- Uplift Wind Pressure, P_up
- Unit Depth, D
- Unit Weight, Wt
- Support Spacing across Width, sw

Unit Reaction Equations:

Long Side (Width x Height):

- Sliding Force, L = P_lat x W x H
- Uplift Force, U = P_up x W x D
- Total Tension per Long Side = (L x H/2 + U x sd/2 – Wt x 0.6 x sd/2) / sd

Short Side (Depth x Height):

- Sliding Force, L = P_lat x D x H
- Uplift Force, U = P_up x W x D
- Total Tension per Short Side = (L x H/2 + U x sd/2 – Wt x 0.6 x sd/2) / sw

Example: A (48" W x 36" D x 42" H), 250 lb net weight unit at wind pressures of 120 psf lateral and 95 psf uplift, on a 24" wide roof stand, shall have the following unit reactions:

Long Side (Width x Height)

1. Sliding Force, L = P_lat x W x H
= (120 psf) x (48 in) x (42 in) x (1 in^2 / 144 ft^2) = **1680 lb**
2. Uplift Force, U = P_up x W x D
= (95 psf) x (48 in) x (36 in) x (1 in^2 / 144 ft^2) = **1140 lb**
3. Total Tension per Long Side =
= (L x H/2 + U x sd/2 – Wt x 0.6 x sd/2) / sd
= ((1680 lb x 42/2 in) + (1140 lb x 24/2 in) – (250 lb x 0.6 x 24/2 in)) / 24 in = **1965 lb**

Short Side (Depth x Height):

1. Sliding Force, L = P_lat x D x H
= (120 psf) x (36 in) x (42 in) x (1 in^2 / 144 ft^2) = **1260 lb**
2. Uplift Force, U = P_up x W x D
= (95 psf) x (48 in) x (36 in) x (1 in^2 / 144 ft^2) = **1140 lb**
3. Total Tension per Short Side =
= (L x H/2 + U x sd/2 – Wt x 0.6 x sd/2) / sw
= ((1260 lb x 42/2 in) + (1140 lb x 24/2 in) – (250 lb x 0.6 x 24/2 in)) / 48 in = **1046 lb**

IN ALL CONDITIONS IT IS THE RESPONSIBILITY OF THE PERMIT HOLDER TO ENSURE THE HOST STRUCTURE IS CAPABLE OF WITHSTANDING THE RATED GRAVITY, LATERAL, AND UPLIFT FORCES BY SITE-SPECIFIC DESIGN. NO WARRANTY OF ANY KIND, EXPRESSED OR IMPLIED, IS OFFERED BY ENGINEERING EXPRESS AS TO THE INTEGRITY OF THE HOST STRUCTURE TO CARRY DESIGN FORCE LOADS INCURRED BY THIS UNIT.

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