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Technical Evaluation Report

DIVISION: 23 08 00–COMMISSIONING OF HVAC

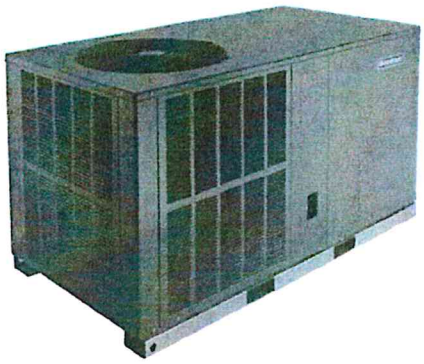
THIS DOCUMENT CONTAINS (5) PAGES: THE FIRST PAGE MUST BEAR AN ORIGINAL SIGNATURE & SEAL OF THE CERTIFYING PE TO BE VALID FOR USE

(Issued March 16, 2016 Subject to Renew March 7th, 2017)

EVALUATION SUBJECT: GOODMAN PACKAGE UNITS

TER-16-3147

REPORT HOLDER:
GOODMAN COMPANY, L.P.
5151 SAN FELIPE STREET
HOUSTON, TX 77056, USA
877-254-4729 | GOODMANMFG.COM



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 5th Edition Florida Building Code (2014) per FBC Section 104.11, FMC 301.15, FBC Building Ch. 16, ASCE-7-10, FBC Existing Building sections 701.1, 706.6.1, FBC Building 1522.2, and FBC Residential M1202.1, M1301.1, FS 471.025, including Broward County Administrative Provisions 107.3.4. 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 provide this TER and is summarized in the sections below.
• 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 is included in this TER and appears below.
NOTE: 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 above 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 GOODMAN models present in the table located on the final page.

FINISH:
Baked enamel.

UNIT CASING MATERIAL:
24ga FS galvanized sheet steel ASTM A653 CS cold rolled steels for side covers. 20ga EDDS galvanized sheet steel ASTM A653 cold rolled steel for bottom base pan. 20ga EDDS galvanized sheet steel ASTM A653 cold rolled steel for top panel. Removable top & side covers secured with #10-16 sheet metal screws.
Knockouts provided for utility & control connections.

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

STRUCTURAL PERFORMANCE:
Models referenced herein are subject to the following design limitations:
ASCE-710 Exposure Categories C
Up to and including 175mph (Vult) for up to 200' MRH**. HVHZ***
Up to and including 170mph (Vult) for up to 260' MRH**. HVHZ***
Up to and including 200mph (Vult) for up to 200' MRH**. Non-HVHZ***
Ground or Roof Application per installation instructions
**Mean Roof Height ***High Velocity Hurricane Zone

Maximum Rated Wind Pressure:

193psf Lateral 93psf Uplift (less Dead Load)

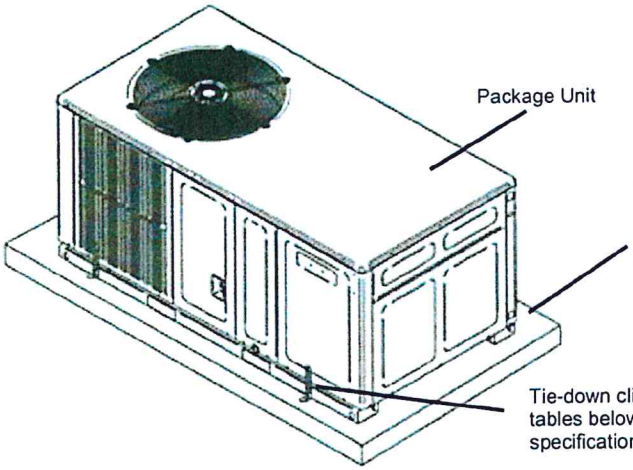
Site specific wind analysis may produce alternate limitations provided maximum rated wind pressure is not exceeded.

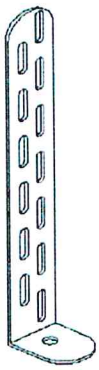
ORIGINAL SIGNATURE AND RAISED SEAL REQUIRED TO BE VALID PER CODE:

March 16, 2016

Frank L. Bennardo, P.E., SECB
ENGINEERING EXPRESS®
PE #0046549 CA #9885

SECTION 2 PRODUCT INSTALLATION





TIE-DOWN CLIP (GROUND APPLICATION)

Miami Tech CUTD 1" ASTM A653 galvanized steel 0.07" thick (FL19731.2) for all cabinets tied down at ground; fasten clip to structure using anchor from Anchor Schedule to Host Structure Table and (4) #10-16 x 3/8" SS 410 self-drilling screw to fasten clip to unit base rail.

TIE-DOWN CABLE & CLIP SCHEDULE

Cabinet	Ground or Roof Height *	Tie-down Cable	Cable Diameter	Cable WLL (lbs)	Bolts to Stand per side	Screw to Curb per side	Min. Curb gage	Tie-down Clips
H1	Ground	NA	NA	NA	NA	NA	NA	4
	Up to 15' (20')	NA	NA	NA	4	4	14	NA
	Up to 60' (80')	2	5/32"	520	2	4	14	NA
	Up to 120' (150')	2	5/32"	520	2	4	11	NA
	Up to 200' (250')	2	3/16"	740	2	4	11	2
H2, M1, M2	Ground	NA	NA	NA	NA	NA	NA	4
	Up to 15' (20')		NA	NA	4	4	14	NA
	Up to 60' (80')	2	5/32"	520	2	4	14	NA
	Up to 120' (150')	2	3/16"	740	2	4	11	NA
	Up to 200' (250')	2	3/16"	740	2	4	11	NA
H3, M3	Ground	NA	NA	NA	NA	NA	NA	4
	Up to 15' (20')	NA	NA	NA	4	4	14	NA
	Up to 60' (80')	2	5/32"	520	2	4	14	NA
	Up to 120' (150')	2	3/16"	740	2	4	11	NA
	Up to 200' (250')	2	7/32"	960	2	4	11	NA
H4, M4	Ground	NA	NA	NA	NA	NA	NA	4
	Up to 15' (20')	NA	NA	NA	4	4	14	NA
	Up to 60' (80')	2	5/32"	520	2	4	14	NA
	Up to 120' (150')	2	3/16"	740	2	4	11	NA
	Up to 200' (250')	2	7/32"	960	2	4	11	NA

*The value shown in parentheses indicates the allowable roof height in 170mph conditions. i.e. 60' (80') indicates an allowable roof height of 60' for 175mph or 80' for 170mph Vult.

Anchor Types to Host Structure:

A. – 1/4" ELCO ULTRACON SS4 Anchor embedded 3" in 3,000 psi concrete. 2 1/2" from edge minimum. NOA No. 15-0226.11
B. – 1/4" SAE Grade 5 screw minimum 1/2" from edges with nut and washer OD 0.75"
C. – 5/16" SAE Grade 5 screw, minimum 1/2" from edges with nut and washer OD 0.75"
D. – 5/16" Sheet metal screw, Grade 5.
NA. - No anchors apply.

Note:
Screw length to tie cabinet to curb shall be verified on site.

Tie-down Cable Type: (for roof applications)

- 7x7 Galvanized cable for industrial and marine application.
- Minimum edge distance 3" from the unit corners.
- Use two tie-down cables per unit.

Note:
Tie-down cable shall be wrapped around roof stand post, and shall be tightened around the unit using the turnbuckle. Provide two cables per unit and one turnbuckle per cable. Neoprene pad shall be placed under the cable to prevent distortion to the cabinet.
Equivalent cable is permitted using the minimum WLL per height.

ANCHOR TO HOST STRUCTURE SCHEDULE

Cabinet	Ground or Roof Height	Anchor Type			
		Concrete 3,000 Psi	1/8" Min A36 Steel	1/8" Min 6061-T6 Aluminum	A36 Steel Curb
H1	Ground	A	NA	NA	NA
	Up to 15' (20')	NA	B	B	D
	Up to 60' (80')	NA	B	B	D
	Up to 120' (150')	NA	C	C	D
	Up to 200' (250')	NA	C	C	D
H2	Ground	A	NA	NA	NA
	Up to 15' (20')	NA	B	B	D
	Up to 60' (80')	NA	B	B	D
	Up to 120' (150')	NA	C	C	D
	Up to 200' (250')	NA	C	C	D
H3	Ground	A	NA	NA	NA
	Up to 15' (20')	NA	B	B	D
	Up to 60' (80')	NA	C	C	D
	Up to 120' (150')	NA	C	C	D
	Up to 200' (250')	NA	C	C	D
H4	Ground	A	NA	NA	NA
	Up to 15' (20')	NA	B	B	D
	Up to 60' (80')	NA	C	C	D
	Up to 120' (150')	NA	C	C	D
	Up to 200' (250')	NA	C	C	D

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.

ENGINEERING EXPRESS®
E.X.P.E.R.T. (Engineering Express Product Evaluation Report)

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Technical Evaluation Report

DIVISION: 23 08 00–COMMISSIONING OF HVAC

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(Issued March 16th, 2016 Subject to Renew March 15th, 2017)

EVALUATION SUBJECT: GOODMAN SPLIT UNITS

TER-16-3146.4a

REPORT HOLDER:
GOODMAN MANUFACTURING COMPANY, L.P.
5151 SAN FELIPE STREET
HOUSTON, TX 77056, USA
877-254-4729 | GOODMANMFG.COM

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

SCOPE OF EVALUATION (compliance with the following codes):

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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 provide this TER and is summarized in the sections below.
• 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 is included in this TER and appears below.
NOTE: 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 above 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 GOODMAN models present in the table located on the final page.

FINISH:
Baked enamel.

UNIT CASING MATERIAL:
26ga galvanized sheet steel ASTM A653 CS cold rolled steels for side covers. 22ga galvanized sheet steel ASTM A653 cold rolled steel for bottom base pan. 20ga galvanized sheet steel ASTM A653 cold rolled steel for top panel. Removable top & side covers secured with #10-12 sheet metal screws.
Knockouts provided for utility & control connections.

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

STRUCTURAL PERFORMANCE:
Models referenced herein are subject to the following design limitations:
ASCE-710 Exposure Categories C
Up to and including 175mph (Vult) for up to 200' MRH**. HVHZ***
Up to and including 170mph (Vult) for up to 260' MRH**. HVHZ***
Up to and including 200mph (Vult) for up to 200' MRH**. Non-HVHZ***
Ground or Roof Application per installation instructions
**Mean Roof Height ***High Velocity Hurricane Zone

Maximum Rated Wind Pressure:

193psf Lateral 93psf Uplift (less Dead Load)

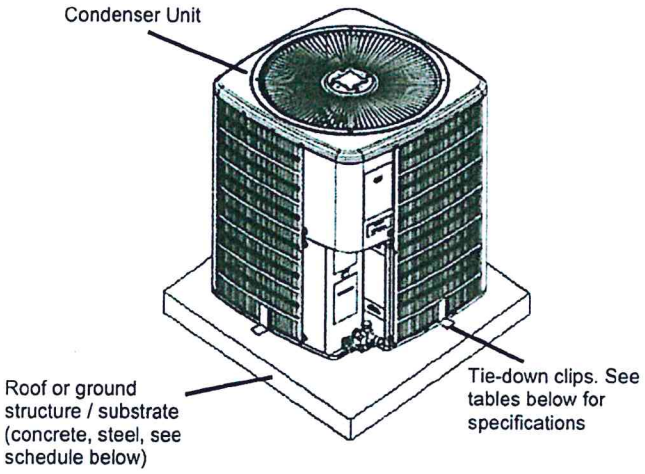
Site specific wind analysis may produce alternate limitations provided maximum rated wind pressure is not exceeded.

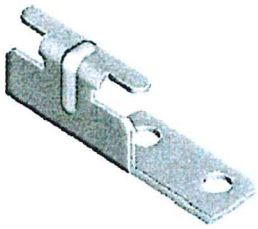
ORIGINAL SIGNATURE AND RAISED SEAL REQUIRED TO BE VALID PER CODE:

March 16th, 2016

Frank L. Bennardo, P.E., SECB
ENGINEERING EXPRESS®
PE #0046549 CA #9885

SECTION 2 PRODUCT INSTALLATION





TIE-DOWN CLIP (GROUND APPLICATION)

ASTM A653 G60 galvanized cold rolled steel 0.072" thick for all cabinets tied down at ground (Goodman Bracket); fasten cabinet using (2) anchors per clip from Anchor to Host Structure Schedule Table. Clip integrates into base pan slot.

TIE-DOWN CLIP (GROUND AND ROOF APPLICATION)

Miami Tech CUTD 1" wide and any length ASTM A653 galvanized steel 0.07" thick for all cabinets tied down to a roof structure; fasten clip to structure using anchor from Anchor Schedule to Host Structure Table and (2) #10 x 3/8" SS 410 self-drilling screw to fasten clip to unit base pan. See Tie-down Strap & Clip Schedule Table for clip amount. For ground application use tie-down clip schedule corresponding to 60' height.

TIE-DOWN STRAP & CLIP SCHEDULE

Cabinet	Roof Height*	Tie-down Straps	Strap WLL (lbs)	Tie-down Clips per Side
A1	Ground	0	NA	1
	Up to 60' (80')	2	300	1
	Up to 120' (150')	2	300	1
	Up to 200' (250')	2	400	1
B1, B2	Ground	0	NA	1
	Up to 60' (80')	2	400	1
	Up to 120' (150')	2	400	2
	Up to 200' (250')	2	400	2
C1, C2, C3, C4, C5	Ground	0	NA	1
	Up to 60' (80')	2	400	2
	Up to 120' (150')	2	500	2
	Up to 200' (250')	2	600	2
D1, D2, D3, D4, D5, D6	Ground	0	NA	1
	Up to 60' (80')	2	800	2
	Up to 120' (150')	2	1000	2
	Up to 200' (250')	2	1000	3

Tie-down Strap & Clip Type: (for roof applications)

Working Load Limit (WLL) is strap's manufacturer - specified per strap. A minimum strap width of 1" and minimum length of 15 ft. is required for all cabinets.
Clips heights shall be adequate to fit SMS within base pan height. Verify height on site.
Clips shall be placed at center on each side and equally spaced.
Cross member shall be added and fixed to roof stand see detail A.

*The value shown in parentheses indicates the allowable roof height in 170mph conditions. i.e. 60' (80') indicates an allowable roof height of 60' for 175mph or 80' for 170mph Vult.

ANCHOR TO HOST STRUCTURE SCHEDULE

Cabinet	Ground or Roof Height*	Anchor Type		
		Concrete 3,000 Psi	1/8" Min A36 Steel	1/8" Min 6061-T6 Aluminum
A1	Ground	A	N/A	N/A
	Up to 60' (80')	N/A	B	B
	Up to 120' (150')	N/A	B	B
	Up to 200' (250')	N/A	B	B
B1, B2	Ground	A	N/A	N/A
	Up to 60' (80')	N/A	B	B
	Up to 120' (150')	N/A	B	B
	Up to 200' (250')	N/A	B	B
C1, C2, C3, C4, C5	Ground	A	N/A	N/A
	Up to 60' (80')	N/A	B	B
	Up to 120' (150')	N/A	B	B
	Up to 200' (250')	N/A	B	B
D1, D2, D3, D4, D5, D6	Ground	A	N/A	N/A
	Up to 60' (80')	N/A	B	B
	Up to 120' (150')	N/A	B	B
	Up to 200' (250')	N/A	B	B

Note: *(Horizontal and Vertical Strapping)*

1. Tie-down straps shall be wrapped around unit and roof stand rail, and shall be tightened using the buckle. Provide two straps per unit.
2. Strap material shall be high strength webbing and shall be compliant for exterior grade use if they contain plastic components, per FBC chapter 26. Select strap from table based on WLL requirements.
3. For Non-HVHZ, use (2) straps with minimum WLL of 500lbs each, up to 200' MRH.

Anchor Types to Host Structure:

A. – 1/4" ELCO ULTRACON SS4 Anchor embedded 3" in 3,000 psi concrete. 2 1/2" from edge minimum. NOA No. 15-0226.11
B. – 1/4" -20 UNC SAE Grade 5 screw min. 1/2" from edges with nut and washer OD 0.75"
NA. - No anchors apply.

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.