EVALUATION REPORT OF
BUTLER MANUFACTURING COMPANY
'BUTLERIB II ROOF PANEL'

FLORIDA BUILDING CODE 8TH EDITION (2023)
FLORIDA PRODUCT APPROVAL
FL 12492.1-R7
STRUCTURAL COMPONENTS
ROOF DECK

Prepared For:
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This report consists of
Evaluation Report (3 Pages including cover)
Design Procedure (4 Pages)
Installation Details (2 Pages)

Report No. C2707-1
Date: 8.12.2023

BALA SOCKALINGAM
LICENSE
No. 62240
STATE OF
FLORIDA
PROFESSIONAL ENGINEER

This item has been digitally signed and sealed by Bala Sockalingam, PE, on the date indicated.

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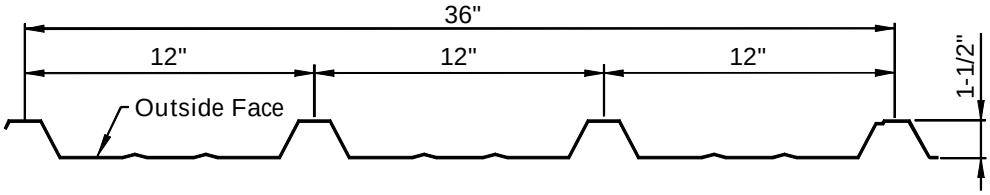
Manufacturer:	Butler Manufacturing Company
Product Name:	Butlerib II
Panel Description:	36" wide coverage with (4) 1-1/2" high ribs
Materials:	Min. 26 ga., 80 ksi steel or min. 24 ga., 50 ksi steel. Galvanized coated steel (ASTM A653) or Galvalume coated steel (ASTM A792). Corrosion resistant as per FBC 2023 Section 1507.4.3.
Support Description:	Min. 16 ga., 55 ksi steel section.
Slope:	1/4:12 or greater in accordance with FBC 2023 Section 1507.4.2
Design Uplift Pressure:	The allowable uniform loads shown on Page 4 of the Design Procedure were determined in accordance with FBC 2023 Section 1504.3.2 and 2210.1 and AISI S100-16(2020) w/S2-20. Panel fastener, purlin, frames and support connections must be designed to resist all loads.
Panel Attachment:	Scrubolt™ with washer for punched supports or #12-14 x 1-1/4" long self-drilling screws with washer for unpunched supports. Alternate fasteners are shown on Page 3 of the Design Procedure. Fasteners are corrosion resistant as per FBC 2023 Section 1507.4.4.
At panel ends	6" o.c. across panel width
At intermediate	12" o.c. across panel width
Sidelap Attachment:	¼"-14 x 7/8" long self-drilling screws with washer at max. 30" o.c. Alternate fasteners are shown on Page 3 of the Design Procedure. Fasteners are corrosion resistant as per FBC 2023 Section 1507.4.4.
Test Standards:	Roof assembly tested in accordance with FM 4471 'Approval Standard for Class I Panel Roofs'.
Code Compliance:	The product described herein has demonstrated compliance with FBC 2023 Section 1507.4.
Product Limitations:	Design wind loads shall be determined for each project in accordance with FBC 2023 Section 1609 or ASCE 7-22 using allowable stress design. The maximum support spacing listed herein shall not be exceeded. The design pressure for reduced support spacing may be computed using rational analysis prepared by a Florida Professional Engineer or based on Butler load span table. This evaluation report is not applicable in High Velocity Hurricane Zone. Fire classification is not within the scope of this Evaluation Report. Refer to FBC 2023 Section 1505 and current approved roofing materials directory or

ASTM E108/UL790 report from an accredited laboratory for fire ratings of this product.

Supporting Documents: FM 4471 Test Report
FM Approvals
3B1A5.AM, Reporting Date 8/1/1997

A. PANEL CROSS SECTION



Panels are rolled using ASTM A 653 or A 792 material, for Grade see Table B1. For complete material specifications and material weights refer to Material Specifications Document MS-05-01.

B. PANEL DESIGN

All applicable panel design procedures according to AISI Standard S-100.

B1. Panel Section Properties

ref. AISI Section B

Panel Material	Design Thickness (in)	Weight (psf)	E (ksi)	F_y (ksi)	F_u (ksi)	Compression on Outside		Compression on Inside	
						Sx (in^3)	I (in^4)	Sx (in^3)	I (in^4)
26 Ga.	0.018	0.96	29500	80[2]	82[2]	0.055	0.065	0.056	0.044
24 Ga	0.023	1.21	29500	50	65	0.081	0.093	0.079	0.060
22 Ga	0.029	1.52	29500	50	65	0.111	0.127	0.101	0.080

Notes:

1. Design base metal thickness is exclusive of panel finishes.
2. Yield and Tensile values may be limited by AISI Section A3.1.2.
3. 22 Gage panel available as unpunched only

B2. Flexural Strength (Resistance) kip-in./ ft. width of panel

ref. AISI F1, F3.1, F2.4.1

Nominal Gage	Outside of Panel in Compression, S_{xe} (+)				Inside of Panel in Compression, S_{xe} (-)			
	Nominal Strength M_n	Allowable Strength (ASD)	Design Strength (LRFD)	Design Resistance (LSD)	Nominal Strength M_n	Allowable Strength (ASD)	Design Strength (LRFD)	Design Resistance (LSD)
26 Ga.	3.28	1.96	2.95	2.95	3.35	2.00	3.01	3.01
24 Ga	4.03	2.41	3.63	3.63	3.95	2.36	3.55	3.55
22 Ga	5.53	3.31	4.98	4.98	5.03	3.01	4.52	4.52

Notes:

1. Tabulated values are for Allowable and Design Bending Strengths (Resistances) where:
   - Allowable Strength = M_n / Ω_b (ASD), kip-in.
   - Design Strength = $\phi_b M_n$ (LRFD & LSD), kip-in.
   - $\Omega_b = 1.67$ (ASD); $\phi_b = 0.90$ (LRFD); $\phi_b = 0.90$ (LSD-Canada)
2. Nominal Bending Strength: $M_n = S_{xe}F_y$, kip-in.
3. Load reductions or strength (resistance) increases for wind have not been included.

B3. Shear Strength (Resistance) kips / ft. width of panel

ref. AISI Section G

Panel Nominal Gage	Nominal Strength V_n	Allowable Strength (ASD)	Design Strength (LRFD)	Design Resistance (LSD)
26 Ga.	1.18	0.74	1.12	0.94
24 Ga	1.87	1.17	1.78	1.50
22 Ga	2.67	1.67	2.53	2.13

Notes:

1. Tabulated values are for Allowable and Design Shear Strengths (Resistances) where:
   - Allowable Strength = V_n / Ω (ASD), kips per ft. width of panel
   - Design Strength (Resistance) = $\phi_v V_n$ (LRFD & LSD), kips per ft. width of panel
   - $\Omega_v = 1.6$ (ASD); $\phi_v = 0.95$ (LRFD); $\phi_v = 0.80$ (LSD-Canada)
2. Nominal Shear Strength: V_n per AISI, kips per ft. width of panel.
3. Load reductions or strength (resistance) increases for wind have not been included

B4. Web Crippling Strength kips / ft. width of panel

ref. AISI G5

Panel Nominal Gage	End – One Flange Loading				Interior – One Flange Loading			
	Nominal[2] Strength	Allowable Strength	Design Strength	Design Resistance	Nominal[2] Strength	Allowable Strength	Design Strength	Design Resistance
	P_n	ASD	LRFD	LSD	P_n	ASD	LRFD	LSD
26	0.371	0.218	0.334	0.297	0.579	0.331	0.492	0.434
24	0.580	0.341	0.522	0.464	0.913	0.522	0.776	0.685
22	0.883	0.519	0.794	0.706	1.400	0.800	1.190	1.050

Notes:

1. Tabulated values are for Allowable and Design Web Crippling Strengths (Resistances) where:
   - Allowable Strength = P_n / Ω_w (ASD), kips per ft. width of panel
   - Design Strength (Resistance) = $\phi_w P_n$ (LRFD & LSD), kips per ft. width of panel
   - End Loading: $\Omega_w = 1.7$ (ASD); $\phi_w = 0.90$ (LRFD); $\phi_w = 0.80$ (LSD-Canada)
   - Interior Loading: $\Omega_w = 1.75$ (ASD); $\phi_w = 0.85$ (LRFD); $\phi_w = 0.75$ (LSD-Canada)
2. Nominal Web Crippling Strength: P_n per AISI G5, kips per ft. width of panel.
3. Load reductions or strength (resistance) increases for wind have not been included.

C. Fastener Options

ref. DP 3.7.1.BM

The following chart shows the various fasteners available for Butlerib roof panels. The "X" symbols in the chart indicate recommended fasteners for use with Butlerib roofs. Blank spaces in the chart indicate the particular condition is not recommended.

Location	Part Number	Fastener Description	Finish	Blanket Insulation Thick. [7] (Std. Ga.) Steel			Structural type	
				0"-2"	3"	4" [1,2]	Punched	Un-punched
Panel To Structural	0097196	1" Galv. Scrubolt™ [3] SB	Plain	X	—	—	X	—
	0096306	Green Washer (Short) Lock-Rivet™ [4] LR	Plain	X	—	—	X	—
	0095984	7/8" SS Head Scrubolt ASB	Plain	X	—	—	X	—
	0096932	1 1/4" Galv. Scrubolt [3] LSB	Plain	—	X	X	X	—
	0096583	Gold Washer (long) Lock-Rivet [4,5] LLR	Plain	—	X	X	X	—
	0097104	1 1/4" SS Head Scrubolt LASB	Plain	—	X	X	X	—
	0097373	1 1/4" SS S.D.S. ASD	Plain	X	X	X	—	X
	0097230	1 1/4" Galv. Head S.D.S. [3] SDS	Painted head	X	X	X	—	X
Panel to Panel	0097357	7/8" Galv. Head S.D.S. [3] SDM	Painted head	X	X	X	N.A.	N.A.
	0097374	7/8" SS S.D.S. ASM	Plain	X	X	X	N.A.	N.A.
	0096306	Green Washer (Short) Lock-Rivet [4,6] LR	Plain	X	X	X	N.A.	N.A.

Note:

[1] Will require extra effort to install fasteners.

[2] With 4" thick insulation, there is an increased chance (versus 2" or 3" thick insulation) of dimpling the panels around the fasteners. This could cause ponding of water at the fasteners and increase the potential for leaks. Also, it is possible that roof thermal movement and the intermittent application of live loads may tend to pulverize or "break down" the fiberglass insulation in the areas between the panels and the top of the purlins. This may allow the panel to "drop away" from the sealing washer of the fasteners. To help maintain the weathertight integrity of the roof, the Scrubolts and self-drilling screws should be periodically checked (every 12-18 months) for tightness and retightened if necessary. The MR-24 roof system works well with 4" and thicker insulation and should be considered, where possible, to avoid the potential problem described above.

[3] Where higher levels of weathering resistance of fastener finish are desired, either the aluminum Lock*Rivet or ALZN head fasteners are recommended.

[4] Lock-Rivets are required along with punched panels for roof slopes greater than 80'.

[5] These (long) Lock-Rivets are substituted for 0096306 (short) Lock-Rivets at the panel-to-structural splice connection directly at a continuous purlin lap.

[6] These (short) Lock-Rivets are required for all factory punched holes in the corrugations.

D. Panel Deflections

For pressure loading, panel deflections are obtained by using I_x (+). For suction loading, panel deflections are obtained by using I_x (-).

E. Load Table

		Allowable Uniform Load (psf)							
Panel	Fy	Span = 2.0'		Span = 3.0'		Span = 4.0'		Span = 5.0'	
Material	(ksi)	P	S	P	S	P	S	P	S
26 Ga	80	150	164	100	109	75	82	60	63
24 Ga	50	237	214	158	143	119	107	77	79
22 Ga	50	364	214	242	143	153	107	99	86

Notes:

1. P = Pressure on outside of panel, S = Suction on outside of panel
2. Tabulated values are Allowable Strength Design (ASD) format in accordance with the 2016 AISI Specification considering bending, shear, web crippling, combined bending and shear, and fastener pullover from panel. Panel pullover based on hex head self-drilling screw.
3. Panel allowable loads are limited by L/60 deflection.
4. All values shown are for 3 or more spans.

Document and Revision History

REV. #	DATE	DESCRIPTION
0	12/18/2017	For Florida Product Approval
1	5/29/2018	Revised Section Property and Load Table values
2	09/2020	Renumbered document to align with DP. Updated for 2020 FBC and product approvals
3	08/2023	Removed code-year from AISI reference