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ICC-ES Evaluation Report ESR-3486

DIVISION: 07 00 00—THERMAL AND MOISTURE PROTECTION Section: 07 41 13—Metal Roof Panels

REPORT HOLDER:

BERRIDGE MANUFACTURING COMPANY

EVALUATION SUBJECT:

BERRIDGE CEE-LOCK, ZEE-LOCK, TEE-LOCK, DEEP DECK AND S-DECK METAL ROOF PANELS

1.0 EVALUATION SCOPE

1.1 Compliance with the following codes:

- 2021, 2018, 2015, 2012 and 2009 *International Building Code*[®] (IBC)
- 2021, 2018, 2015, 2012 and 2009 *International Residential Code*[®] (IRC)

Properties evaluated:

- Physical properties
- Wind uplift resistance
- Structural
- Fire classification

1.2 Evaluation to the following green code:

2019 California Green Building Standards Code (CALGreen), Title 24, Part 11

Attributes verified:

See Section 3.1

2.0 USES

The Berridge metal roof panels are used as roof coverings over solid or closely fitted decking and spaced supports.

3.0 DESCRIPTION

3.1 General:

The roof panels, clips, and seam caps are cold-formed from steel or aluminum conforming to the product specifications, aluminum-zinc coatings, and base-metal thicknesses noted in Tables 1 and 2. See Figures 1 through 5 for panel, clip, and seam cap details.



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The attributes of the metal roof panels have been verified as conforming to the provisions of CALGreen Section A5.406.1.2 for reduced maintenance. Note that decisions on compliance for those areas rest with the user of this report. The user is advised of the project-specific provisions that may be contingent upon meeting specific conditions, and the verification of those conditions is outside the scope of this report. These codes or standards often provide supplemental information as guidance.

3.2 Deck Material:

Solid or closely fitted decking must be minimum ¹⁵/₃₂-inchthick (11.9 mm) plywood or lumber sheathing complying with 2021, 2018 and 2015 IBC Section 2304.8.2 [2012 and 2009 IBC Section 2304.7.2] or IRC Section R803, or minimum No. 22 gauge [0.030-inch-thick (0.76 mm)] steel complying with IBC Section 2210.1.1.2.

3.3 Underlayment and Flashing:

Underlayment must be in accordance with IBC Section 1507.4.5 or IRC Section R905.10.5, as applicable. Where specified in Table 6, the underlayment is VersaShield[®] Fire-Resistant Roof Deck Protection (ESR-2053) or Polystick XFR (ESR-1697). Flashing must be in accordance with IBC Section 1503.2 or IRC Section R903.2, as applicable.

4.0 DESIGN AND INSTALLATION

4.1 Installation:

Installation of the roof panels and panel clips must be in accordance with this report, the manufacturer's published installation instructions, and IBC Section 1507.4 or IRC Section R905.10, as applicable. The manufacturer's installation instructions must be available at the jobsite at all times during installation.

The panels must be installed on roofs with a minimum slope of 2:12 (16.7-percent slope). Penetrations and terminations of the panels must be flashed and made weathertight in accordance with the manufacturer's installation instructions and IBC Section 1503.2 or IRC Section R903.2, as applicable.

4.2 Live Loads:

The steel S-Deck and steel Deep Deck panels, when installed as a minimum three-span condition with spans of 5 feet (1.52 m) on center, are capable of withstanding the minimum uniform distributed live load of 20 psf (0.958 kPa)

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and the minimum concentrated live load of 300 lbf (1.33 kN) noted in Table 1607.1 of the IBC.

The steel Tee-Lock and steel Zee-Lock Double Lock panels, when installed as a minimum three-span condition with spans of 4 feet (1.22 m) on center, are capable of withstanding the minimum uniform distributed live load of 20 psf (0.958 kPa) and the minimum concentrated live load of 300 lbf (1.33 kN) noted in Table 1607.1 of the IBC.

When panels are installed over solid or closely fitted deck sheathing, the capacity is limited to the capacity of the sheathing.

4.3 Fire Classification:

When installed in accordance with Table 6, the metal roof panels are components of roof assemblies classified as Class A or B in accordance with ASTM E108 or UL 790.

4.4 Wind Resistance:

The allowable wind uplift pressures of the panels installed over plywood or steel decking are provided in Table 3 and 4, respectively. The allowable positive and negative (uplift) wind pressures for the panels installed over spaced supports are provided in Table 5.

When the panels are installed over solid or closely fitted decking, allowable positive wind load is limited to the capacity of the decking.

5.0 CONDITIONS OF USE

The Berridge Standing Seam roof panels described in this report comply with, or are suitable alternatives to what is specified in, those codes listed in Section 1.0 of this report, subject to the following conditions:

- **5.1** Installation must comply with this report, the applicable code, and the manufacturer's published installation instructions. If there is a conflict between this report and the manufacturer's published installation instructions, this report governs.
- **5.2** Design wind pressure on any roof area, including edge and corner zones, must not exceed the allowable wind pressure for the system installed in that particular area. Refer to the allowable pressures for the metal panels as listed in Tables 3 through 5.

- **5.3** The allowable wind pressures listed in Tables 3 through 5 are for the roof covering only. The deck and framing to which the roof covering is attached must be designed for the applicable components and cladding wind loads in accordance with the IBC or IRC, as applicable.
- **5.4** Calculations demonstrating that the required wind resistance is less than the allowable wind resistance must be submitted to the code official.
- 5.5 The roofing panels are manufactured in Seguin, Texas, under a quality control program with inspections by ICC-ES.

6.0 EVIDENCE SUBMITTED

Data in accordance with the ICC-ES Acceptance Criteria for Metal Roof Coverings (AC166), dated February 2021.

7.0 IDENTIFICATION

- 7.1 The ICC-ES mark of conformity, electronic labeling, or the evaluation report number (ICC-ES ESR-3486) along with the name, registered trademark, or registered logo of the report holder (Berridge Manufacturing Company) must be included in the product label.
- **7.2** In addition, each metal roof panel is identified with a label bearing the manufacturer's address, the product name, the material type and gage or thickness, and the production date code.
- 7.3 The report holder's contact information is the following:

BERRIDGE MANUFACTURING COMPANY 2610 HARRY WURZBACH ROAD SAN ANTONIO, TEXAS 78209 (210) 650-3050 www.berridge.com

DANEL		MIN. BASE METAL			
PANEL	Specification Classification Coating		Coating	(inch)	
18" Tee-Lock,	ASTM A792 (steel)	SS Grade 40	AZ50	0.023 (24 gauge) 0.029 (22 gauge)	
16" Zee-Lock ¹	ASTM B209 (aluminum)	3105-H24	N/A	0.032 0.040	
16 ¹ / ₂ " Cee-Lock,	ASTM A792 (steel)	SS Grade 40	AZ50	0.023 (24 gauge) 0.029 (22 gauge)	
11 ¹ / ₂ " Cee-Lock	ASTM B209 (aluminum)	3105-H24	N/A	0.032	
Deep Deck, S-Deck	ASTM A792 (steel)	SS Grade 40	AZ50	0.023 (24 gauge) 0.029 (22 gauge)	

TABLE 1—BERRIDGE MANUFACTURING COMPANY ROOF PANEL SPECIFICATIONS

For SI: 1 inch = 25.4 mm, 1 psf = 0.0479 kPa.

¹The Zee-Lock panel is referred to as the Zee-Lock Single Lock when installed with a 90-degree seam and the Zee-Lock Double Lock when installed with a 180-degree seam. See Figure 2A.

		MATERIAL	MIN BASE STEEL		
CLIP OR SEAM CAP	Specification	Classification	Coating	THICKNESS (inch)	See Figure
Cee Clip ¹	ASTM A792	SS Grade 40	AZ50	0.023 (24 gauge)	1B
Cee Clip ² (stainless steel)	ASTM A240	Туре 304	N/A	0.023 (24 gauge)	1B
Continuous Cee Rib ¹	ASTM A792	SS Grade 40	AZ50	0.023 (24 gauge) 0.029 (22 gauge)	- 1C
Zee Clip ³	ASTM A792	SS Grade 40	AZ50	0.023 (24 gauge)	2D
Floating Zee Clip ³	Top – ASTM A792 Base – ASTM A792	Top – SS Grade 40 Base – SS Grade 40	Top – AZ50 Base – AZ50	Top – 0.029 (22 gauge) Base – 0.064 (16 gauge)	2C
Floating Zee Clip ⁴ (stainless steel top)	Top – ASTM A240 Base – ASTM A792	Top – SS Grade 40 Base – SS Grade 40	Top – N/A Base – AZ50	Top – 0.029 (22 gauge) Base – 0.064 (16 gauge)	2C
Fixed Zee Clip ³	ASTM A792	SS Grade 40	AZ50	0.023 (24 gauge)	2B
Continuous Zee Rib ³	ASTM A792	SS Grade 40	AZ50	0.023 (24 gauge)	2D
Tee-Lock Clip⁵	ASTM A792	SS Grade 50	AZ50	0.064 (16 gauge)	3В
Tee-Lock Clip ⁶ (stainless steel)	ASTM A240	Туре 304	N/A	0.064 (16 gauge)	3В
Continuous Tee-Lock Rib⁵	ASTM A792	SS Grade 40	AZ50	0.029 (22 gauge)	3C
Tee-Lock Seam Cap ⁷ (steel)	ASTM A792	SS Grade 40	AZ50	0.023 (24 gauge) 0.029 (22 gauge)	- 3A
Tee-Lock Seam Cap ⁸ (aluminum)	ASTM B209	3105-H14	N/A	0.032	- 3A
()				0.040	

TABLE 2—BERRIDGE MANUFACTURING COMPANY CLIP AND SEAM CAP SPECIFICATIONS

For **SI:** 1 inch = 25.4 mm, 1 psf = 0.0479 kPa.

¹Used with steel Cee-Lock roof panels.

²Used with aluminum Cee-Lock roof panels.

³Used with steel Zee-Lock roof panels.

⁴Used with aluminum Zee-Lock roof panels.

⁵Used with steel Tee-Lock roof panels.

⁶Used with aluminum Tee-Lock roof panels.

⁷24 gauge steel seam cap is used with the 24 gauge steel T-Lock roof panel; 22 gauge steel seam cap is used with the 22 gauge steel T-Lock roof panel.

⁸0.032" aluminum seam cap is used with the 0.032" aluminum T-Lock roof panel; 0.040" aluminum steel seam cap is used with the 0.040" aluminum T-Lock roof panel.

PANEL	SUPPORT	FASTENING PATTERN	SUPPORT FASTENER SPACING ¹ (inch)	ALLOWABLE UPLIFT PRESSURE (psf)
Cee-Lock	15/32" Pluwood	Continuous Cee Ribs (24 ga.) with one (1) #10-13 x	20	50
16.5" width)	15/52 Flywood	attachment point	10	108
Cee-Lock (24 gauge <i>or</i> 22 gauge steel, 16.5" width)	15/32" Plywood	Cee Clips with two (2) #10 by 1" long corrosion-resistant screws	36	53
Cee-Lock	15/22" Dhavood	Continuous Cee Ribs (24 ga.) with one (1) #12-11 x	20	56
(24 gauge of 22 gauge steel, 11.5" width)	15/32 Plywood	point	8	176
Cee-Lock	45/20" Dhave ad	Cee Clips (stainless steel) with two (2)	20	63
(0.032 aluminum, 11.5" or 16.5" width)	15/32 Plywood	#12-11 x 1" long GP Concealor screws by TFC	8	116
Zee-Lock Double Lock	15/32" Phavood	Continuous Zee Ribs with one (1) #12-11 x 1" long	16	93
16" width)	13/32 Flywood	Type A screw by Buildex per attachment point	8	119
Zee-Lock Double Lock	15/32" Pluwood	Floating Zee Clips with two (2) #14-10 x 2" long	24	101
16" width)	13/32 Flywood	by TFC	12	131
Zee-Lock Double Lock (0.032" <i>or</i> 0.040" aluminum, 16" width)	15/32" Plywood	Floating Zee Clips (stainless steel top) with two (2) #14-10 x 2" long Panel-Tite HWH Type screws (no washer) by TFC	24	86
Zee-Lock Single Lock (24 gauge <i>or</i> 22 gauge steel, 16" width)	15/32" Plywood	Zee Clips with two (2) #10 by 1" long corrosion-resistant screws	36	53
Tee-Lock (24 gauge <i>or</i> 22 gauge steel, 18" width)	15/32" Plywood	Tee-Lock Clips with two (2) #12-11 x 1" long GP Pancake screws by TFC	12	101
Tee-Lock (24 gauge <i>or</i> 22 gauge steel, 18" width)	15/32" Plywood	Tee-Lock Clips with two (2) #14-10 x 2" long Panel- Tite HWH Type S screws (no washer) by TFC	36	86

TABLE 3—ALLOWABLE WIND UPLIFT PRESSURES – PANELS OVER PLYWOOD DECK

For **SI:** 1 inch = 25.4 mm, 1 psf = 0.0479 kPa.

¹Indicates the maximum clip spacing along the panel length (for Cee Clips, Zee Clips, Floating Zee Clips, and Tee-Lock Clips) or the maximum spacing of fasteners along the length of Continuous Cee Ribs or Continuous Zee Ribs, as applicable.

PANEL	SUPPORT	FASTENING PATTERN ¹	SUPPORT FASTENER SPACING ² (inch)	ALLOWABLE UPLIFT PRESSURE (psf)
Cee-Lock	Min. 22 ga.	Continuous Cee Ribs (24 ga.) with one (1) #14-13	16	81
11.5" width)	Steel Deck	point	8	140
Cee-Lock (22 gauge steel, 11.5" width)	Min. 22 ga. (0.030-inch) Steel Deck	Continuous Cee Ribs (22 ga.) with one (1) #14-13 DP1 Concealor screws by TFC per attachment point	8	182
Cee-Lock	Min. 22 ga.	Cee Clips (stainless steel) with two (2)	20	71
11.5" <i>or</i> 16.5" width)	Steel Deck	#14-13 DP1 Concealor screws by TFC	12	116
Zee-Lock Single Lock (24 gauge <i>or</i> 22 gauge steel, 16" width)	Min. 22 ga. (0.030-inch) Steel Deck	Continuous Zee Ribs with one (1) #14-13 DP1 Concealor screw by TFC per attachment point	16	101
Zee-Lock Single Lock (22 gauge <i>or</i> 22 gauge steel, 16" width)	Min. 22 ga. (0.030-inch) Steel Deck	Continuous Zee Ribs with one (1) #14-13 DP1 Concealor screws by TFC per attachment point	16	116
Zee-Lock Double Lock	Min. 22 ga.	Fixed Zee Clips with two (2) #14-13 DP1 Concealor	24	108
16" width)	Steel Deck	screws by TFC	12	138
Zee-Lock Double Lock	Min. 22 ga.	Floating Zee Clips with two (2) #14-13 DP1	36	93
16" width)	Steel Deck	Concealor screws by TFC	12	168
Zee-Lock Double Lock	Min. 22 ga.	Floating Zee Clips (stainless steel top) with two (2)	24	108
16" width)	Steel Deck	#14-13 DP1 Concealor screws by TFC	6	123
Tee-Lock	Min. 22 ga. (0.030-inch)	Tee-Lock Clips with two (2) #14-13 DP1 Concealor	36	101
18" width)	Steel Deck	screws by TFC	12	153
Tee-Lock	Min. 22 ga.	Tee-Lock Clips (stainless steel) with two (2) #14-13	36	78
18" wide)	Steel Deck	DP1 Concealor screws by TFC	12	101

TABLE 4—ALLOWABLE WIND UPLIFT PRESSURES – PANELS OVER STEEL DECK

For **SI:** 1 inch = 25.4 mm, 1 psf = 0.0479 kPa.

¹Fasteners must be of sufficient length to penetrate through the support with a minimum of three threads protruding past the back side of the support.

²Indicates the maximum clip spacing along the panel length (for Cee Clips, Zee Clips, Floating Zee Clips, and Tee-Lock Clips) or the maximum spacing of fasteners along the length of Continuous Cee Ribs or Continuous Zee Ribs, as applicable.

PANEL	SUPPORT ¹	FASTENING PATTERN ²	SPAN ³ (inch)	ALLOWABLE NEGATIVE (UPLIFT) PRESSURE (psf)	ALLOWABLE POSITIVE PRESSURE (psf)
Deep Deck (24 gauge steel, 36" coverage) Min. 16 gage (0.060-inch) Steel Spaced Supports	Min. 16 gage (0.060-inch)	One (1) ¹ / ₄ "-14 x 1" long HWH #3 point screw w/ sealing washer by SFS per low (7.2" o.c.) across panel width at all supports	60	100	51
	Steel Spaced Supports	Sidelap fasteners are 1/4"-14 x 7/8" long HWH screw with sealing washer at 18" o.c. along panel length. (See Fig. 4)	30	182	100
Deep Deck (24 gauge steel, 36" coverage)	Min. 16 gage (0.060-inch) Steel Spaced Supports	Two (2) ¹ / ₄ "-14 x 1" long HWH #3 point screws w/ sealing washer by SFS per low (7.2" o.c.) across panel width at all supports Sidelap fasteners are ¹ / ₄ "-14 x ⁷ / ₈ " long HWH screw with sealing washer at 18" o.c. along panel length. (See Fig.4)	60	110	51
Deep-Deck (22 gauge steel, 36" coverage)	Min. 16 gage (0.060-inch) Steel Spaced Supports	Two (2) ¹ / ₄ "-14 x 1" long HWH #3 point screws w/ sealing washer by SFS per low (7.2" o.c.) across panel width at all supports Sidelap fasteners are ¹ / ₄ "-14 x ⁷ / ₈ " long HWH screw with sealing washer at 18" o.c. along panel length. (See Fig. 4)	60	150	51
S-Deck (24 gauge <i>or</i> 22 gage steel, 32" coverage)	Min. 16 gage (0.060-inch) Steel Spaced Supports	One (1) #12-14 x 1" long HWH self-drilling screw w/ washer by Buildex at every third low (8" o.c.) across panel width at all supports Sidelap fasteners are #12-14 x 1" long HWH screw with washer by Buildex @ 12" o.c. along panel length (See Fig. 5)	60	77	40
S-Deck (24 gauge <i>or</i> 22 gage steel, 32" coverage)	Min. 16 gage (0.060-inch) Steel Spaced Supports	One (1) #12-14 x 1" long HWH self-drilling screw w/ washer by Buildex at every second low (5 ¹ / ₃ " o.c.) across panel width at all supports Sidelap fasteners are #12-14 x 1" long HWH screw with washer by Buildex @ 12" o.c. along panel length (See Fig. 5)	30	190	114
Zee-Lock Double Lock (24 gauge or 22	Min. 16 gage (0.060-inch)	Continuous Zee Ribs with two (2) ¹ /4"-14 x 1"	48	62	51
gauge steel, 16" width)		TFC at all supports	24	120	92
Tee-Lock (24 gauge <i>or</i> 22 gauge steel	Min. 16 gage (0.060-inch) Steel Spaced	Tee-Lock Clips with two (2) $#12-14 \times 1^{1/4}$ " long Fenderhead T-3 self-drilling screws (no	48	34	44
18" width)	Supports	washer) by DF at all supports.	30	68	121
Tee-Lock (24 gauge <i>or</i> 22 gauge steel, 18" width)	Min. 16 gage (0.060-inch) Steel Spaced Supports	Continuous Tee-Lock Ribs with two (2) #12- 14 x 1 ¹ /4" long Fenderhead T-3 self-drilling screws (no washer) by DF per Rib at all supports	48	94	44

TABLE 5—ALLOWABLE WIND PRESSURES - PANELS OVER SPACED SUPPORTS

(See Footnotes for Table 5 at top of next page)

For **SI:** 1 inch = 25.4 mm, 1 psf = 0.0479 kPa.

¹Spaced support must have a minimum bearing width of 2 inches (50.8 mm).

²Fasteners must be of sufficient length to penetrate through the support with a minimum of three threads protruding past the back side of the support.

⁴Span indicates the maximum center-to-center spacing of supports.

ROOF CLASS	SUBSTRATE ¹	MAX. ROOF SLOPE	ASSEMBLY DETAILS ^{2,3}		
А	Noncombustible	Unlimited	Panels:	Cee-Lock, Zee-Lock, Tee-Lock, S-Deck and Deep Deck steel roof panels	
			Panels:	Cee-Lock, Zee-Lock, Tee-Lock, S-Deck and Deep Deck steel roof panels	
A	A Combustible		Underlayment:	One layer of VersaShield [®] Fire-Resistant Roof Deck Protection mechanically fastened per ESR-2053 -or- One layer of Polystick XFR self-adhered installed per ESR-1697	
А	Noncombustible	Unlimited	Panels:	Cee-Lock, Zee-Lock and Tee-Lock aluminum roof panels	
A Combustible	Unlimited	Panels:	Cee-Lock, Zee-Lock and Tee-Lock aluminum roof panels		
	Combustible	Unimitied	Underlayment:	Two layers of VersaShield® Fire-Resistant Roof Deck Protection (ESR-2053)	
В	Combustible	Unlimited	Panels:	Cee-Lock, Zee-Lock and Tee-Lock aluminum roof panels	
			Underlayment:	One layer of VersaShield® Fire-Resistant Roof Deck Protection (ESR-2053)	

TABLE 6—FIRE CLASSIFICATION ASSEMBLIES

¹Wood deck must be a minimum of ¹⁵/₃₂-inch-thick (11.9 mm) plywood. Steel deck must be a minimum of No. 22 gauge (0.030-inch-thick) steel.

²GAF's VersaShield[®] Fire-Resistant Roof Deck Protection is evaluated under ICC-ES evaluation report ESR-2053 and must be installed in accordance with that report.

³Polyglass USA Polystick XFR self-adhered underlayment is evaluated under ICC-ES evaluation report ESR-1697 and must be installed in accordance with that report.







FIGURE 1B—CEE CLIP



FIGURE 1C—CONTINUOUS CEE RIB





SEAM SECTION

1

2.453





Panel Fastener Every 2nd Low

