



ICC-ES Evaluation Report

ESR-3743

Reissued August 2021

This report is subject to renewal August 2023.

DIVISION: 07 00 00—THERMAL AND MOISTURE PROTECTION

Section: 07 41 13—Metal Roof Panels

REPORT HOLDER:

METAL SALES MANUFACTURING CORPORATION

EVALUATION SUBJECT:

T-ARMOR STEEL AND ALUMINUM ROOF PANELS

1.0 EVALUATION SCOPE

1.1 Compliance with the following codes:

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

Properties evaluated:

- Weather resistance
- Fire classification
- Structural
- Wind uplift resistance

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 T-Armor panels are used as roof coverings over solid or closely fitted decking and spaced supports.

3.0 DESCRIPTION

3.1 General:

The T-Armor panels, T-Armor clips, and T-Armor caps are cold-formed from steel and/or aluminum conforming to the product specifications, galvalume or zinc coatings, and base-metal thicknesses noted in Tables 1 and 2. See Figures 1A through 1D for panel, clip, and cap configurations.

The attributes of the metal roofing 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 a minimum of 1⁵/₃₂-inch-thick (11.9 mm) plywood or lumber sheathing complying with 2018 and 2015 IBC Section 2304.8.2 [2012 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 5, the underlayment is VersaShield® Fire-Resistant Roof Deck Protection ([ESR-2053](#)). Flashing must be in accordance with IBC Section 1503.2 or IRC Section R903.2, as applicable.

3.4 Impact Resistance:

The roof panels described in this report meet the requirements of IBC Section 1504.7 for impact resistance when installed on roofs with a slope less than 2:12 (16.7-percent slope).

4.0 DESIGN AND INSTALLATION

4.1 Installation:

Installation of the roof panels and panel clips must be in accordance with this report, IBC Section 1507.4 or IRC Section R905.10, and the manufacturer's published installation instructions. 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 1/4:12 (2-percent slope). Penetrations and terminations of the panels must be flashed and made weathertight in accordance with the manufacturer's published installation instructions and IBC Section 1503.2 or IRC Section R903.2, as applicable.

4.2 Live Loads:

The T-Armor panels, when installed as a three-span condition with spans 5 feet (1.52 m) on center, are capable of withstanding the minimum uniform distributed live load of

20 psf (0.958 kPa) noted in Table 1607.1 of the IBC, and the minimum concentrated live load of 300 lbf (1.33 kN).

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

4.3 Wind Uplift Resistance:

The allowable wind uplift pressures of the panels are provided in Table 4.

4.4 Fire Classification:

When installed as specified in Table 5, the steel and aluminum roof panels are components of roof assemblies classified as Class A or B roof assemblies in accordance with ASTM E108 or UL 790.

5.0 CONDITIONS OF USE

The Metal Sales Manufacturing Corporation’s 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 the applicable code, this report and the manufacturer’s published installation instructions. In the event of conflict between this report and the manufacturer’s instructions, this report governs.
- 5.2 The metal panels must be installed only by applicators approved by Metal Sales Manufacturing Corporation.
- 5.3 Design wind uplift 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 wind uplift pressure for the metal panels as listed in Table 4.

5.4 The allowable wind uplift pressures listed in Table 3 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.

5.5 Calculations demonstrating that the required wind resistance is less than the allowable wind resistance must be submitted to the code official.

5.6 See Table 1 for panel manufacturing location. The manufacturing is 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 October 2012 (editorially revised January 2018).

7.0 IDENTIFICATION

7.1 The panels are identified with a label bearing the product name, the material type, the manufacturer’s name (Metal Sales Manufacturing Corporation), and the evaluation report number (ESR-3743).

7.2 The report holder’s contact information is the following:

METAL SALES MANUFACTURING CORPORATION
545 SOUTH 3RD STREET, SUITE 200
LOUISVILLE, KENTUCKY 40202
(800) 406-7387
www.metalsales.us.com
info@metalsales.us.com

TABLE 1—MANUFACTURING FACILITIES AND ASSOCIATED PANEL PROFILES

MANUFACTURING FACILITY	ASSOCIATED PANEL PROFILES
Metal Sales Manufacturing Corporation Woodland, California 95776	T-Armor

TABLE 2—METAL SALES ROOF PANEL AND CAP¹ SPECIFICATIONS

PANEL	MATERIAL			MIN. BASE METAL THICKNESS (inch)
	Specification	Classification	Coating	
16" x 2 ³ / ₈ " T-Armor 18" x 2 ³ / ₈ " T-Armor 18" x 3" T-Armor	ASTM A792	SS Grade 50 Class I	AZ50 or AZ55	0.0223 (24 gauge) 0.0296 (22 gauge)
	ASTM A653	SS Grade 50 Class I	G90	
	ASTM B209	3105-H24	NA	0.032

For SI: 1 inch = 25.4 mm.

¹T-Armor Caps have the same material and thickness specifications as the T-Armor panels. Cap overall dimensions are 0.6-inch-high by approximately 1¹/₈-inch-wide (approximately 15 by 29 mm). See Figure 1D for additional details.

TABLE 3—METAL SALES CLIP SPECIFICATIONS

CLIP	MATERIAL			MIN. BASE STEEL THICKNESS (inch)	See Figure
	Specification	Classification	Coating		
T-Armor Clip (Galvanized steel)	ASTM A653	Grade 50	G90	0.060	1C
T-Armor Clip (Stainless steel - Optional)	ASTM A240	Type 410	-	0.060	1C

For SI: 1 inch = 25.4 mm.

TABLE 4—ALLOWABLE WIND UPLIFT PRESSURES

PANEL	SUPPORT	FASTENING PATTERN ¹	SPAN ² (inch)	ALLOWABLE UPLIFT PRESSURE (psf)
16" x 2 ³ / ₈ " T-Armor (24 gauge steel)	Min. 54 mil Steel Spaced Supports	T-Armor Clips with (2) ATLAS 1/4"-14 x 1.5" long hex head self-drilling screws (See Figure 1A)	60	38
			54	42
			48	47
			42	54
			36	63
			30	70
			24	77
18" x 2 ³ / ₈ " T-Armor (24 gauge steel)	Min. 54 mil Steel Spaced Supports	T-Armor Clips with (2) ATLAS 1/4"-14 x 1.5" long hex head self-drilling screws (See Figure 1A)	60	32
			54	36
			48	41
			42	46
			36	54
			30	62
			24	68
16" x 2 ³ / ₈ " T-Armor (22 gauge steel)	Min. 54 mil Steel Spaced Supports	T-Armor Clips with (2) ATLAS 1/4"-14 x 1.5" long hex head self-drilling screws (See Figure 1A)	60	55
			54	61
			48	69
			42	79
			36	91
			30	100
			24	109
18" x 2 ³ / ₈ " T-Armor (22 gauge steel)	Min. 54 mil Steel Spaced Supports	T-Armor Clips with (2) ATLAS 1/4"-14 x 1.5" long hex head self-drilling screws (See Figure 1A)	60	47
			54	53
			48	59
			42	67
			36	74
			30	80
			24	87
16" x 2 ³ / ₈ " T-Armor (0.032" Aluminum)	Min. 54 mil Steel Spaced Supports	T-Armor Clips with (2) ATLAS 1/4"-14 x 1.5" long hex head self-drilling screws (See Figure 1A)	60	42
			54	47
			48	52
			42	60
			36	70
			30	84
			24	93
18" x 2 ³ / ₈ " T-Armor (0.032" Aluminum)	Min. 54 mil Steel Spaced Supports	T-Armor Clips with (2) ATLAS 1/4"-14 x 1.5" long hex head self-drilling screws (See Figure 1A)	60	35
			54	39
			48	44
			42	50
			36	58
			30	70
			24	82
18" x 2 ³ / ₈ " T-Armor (24 gauge steel)	15/32" Plywood	T-Armor Clips with (2) ATLAS 1/4"-14 x 1.5" long hex head self-drilling screws (See Figure 1A)	36	98
18" x 2 ³ / ₈ " T-Armor (24 gauge steel)	Min. 30 mil Steel Deck ²	T-Armor Clips with (2) ATLAS #14-13 #3 Philips pancake head deck screws (See Figure 1A)	36	90
18" x 2 ³ / ₈ " T-Armor (0.032" Aluminum)	Min. 30 mil Steel Deck ²	T-Armor Clips with (2) ATLAS #14-13 #3 Philips head deck screws (See Figure 1A)	36	68
18" x 3" T-Armor (24 gauge steel)	Min. 54 mil Steel Spaced Supports	T-Armor Clips with (2) ATLAS 1/4"-14 x 1.5" long hex head self-drilling screws (See Figure 1B)	60	31
			54	34
			48	37
			42	41
			36	44
			30	47
			24	51
18" x 3" T-Armor (0.032" Aluminum)	Min. 54 mil Steel Spaced Supports	T-Armor Clips with (2) ATLAS 1/4"-14 x 1.5" long hex head self-drilling screws (See Figure 1B)	60	28
			54	31
			48	35
			42	40
			36	46
			30	51
			24	55

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

¹Fastener must be of sufficient length to penetrate through the support a minimum of 3/4 inch.

²Span indicates fastener or clip spacing along panel length.

³Spaced support must have a minimum bearing width of 2 1/2 inches (63.5 mm).

TABLE 5—FIRE CLASSIFICATION ASSEMBLIES

ROOF CLASS	SUBSTRATE ¹	MAX. ROOF SLOPE	ASSEMBLY DETAIL ²	
A	Noncombustible	Unlimited	Panels:	22 and 24 gauge, 16" x 2 ³ / ₈ " T-Armor 22 and 24 gauge, 18" x 2 ³ / ₈ " T-Armor 22 and 24 gauge, 18" x 3" T-Armor (All panels are steel)
A	Combustible	Unlimited	Underlayment:	One Layer of VersaShield® Fire-Resistant Roof Deck Protection
			Panels:	22 and 24 gauge, 16" x 2 ³ / ₈ " T-Armor 22 and 24 gauge, 18" x 2 ³ / ₈ " T-Armor 22 and 24 gauge, 18" x 3" T-Armor (All panels are steel)
A	Noncombustible	Unlimited	Panels:	0.032" thick, 16" x 2 ³ / ₈ " T-Armor 0.032" thick, 18" x 2 ³ / ₈ " T-Armor 0.032" thick, 18" x 3" T-Armor (All panels are aluminum)
A	Combustible	Unlimited	Underlayment:	Two Layers of VersaShield® Fire-Resistant Roof Deck Protection
			Panels:	0.032" thick, 16" x 2 ³ / ₈ " T-Armor 0.032" thick, 18" x 2 ³ / ₈ " T-Armor 0.032" thick, 18" x 3" T-Armor (All panels are aluminum)
B	Combustible	Unlimited	Underlayment:	One Layer of VersaShield® Fire-Resistant Roof Deck Protection
			Panels:	0.032" thick, 16" x 2 ³ / ₈ " T-Armor 0.032" thick, 18" x 2 ³ / ₈ " T-Armor 0.032" thick, 18" x 3" T-Armor (All panels are aluminum)

¹Wood deck must be a minimum of 1⁵/₃₂-inch-thick (11.9 mm) plywood.

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

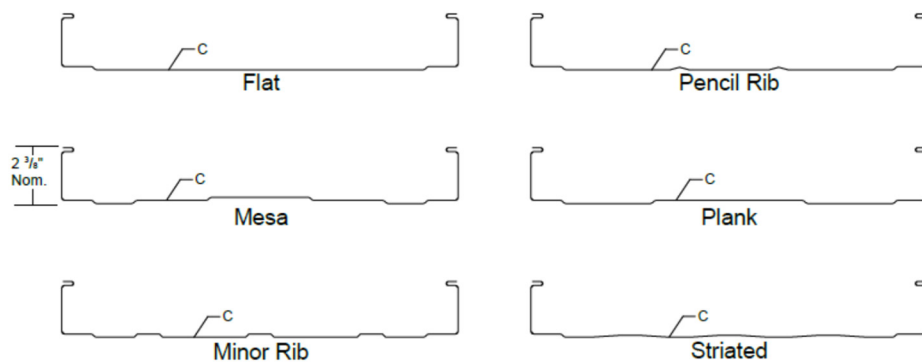


FIGURE 1A—2³/₈" T-ARMOR

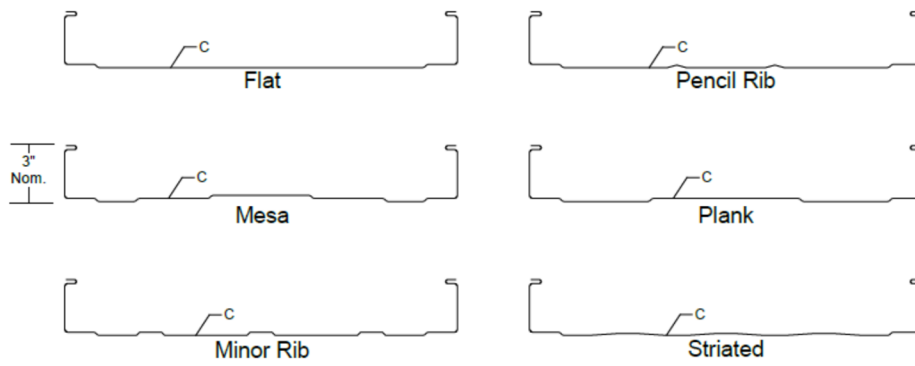


FIGURE 1B—3" T-ARMOR

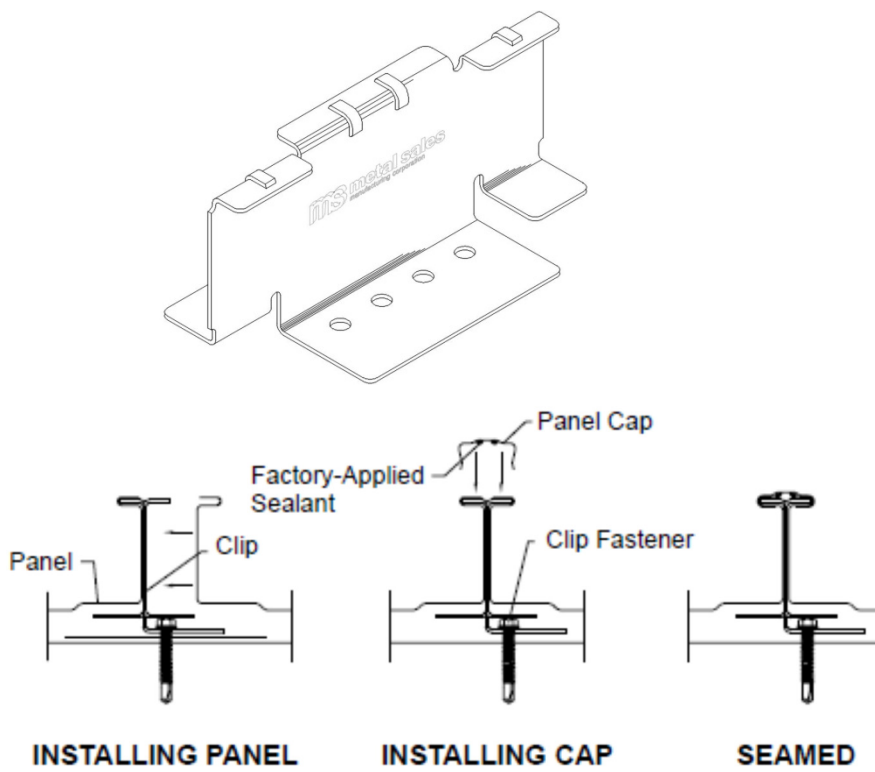


FIGURE 1C—T-ARMOR CLIP

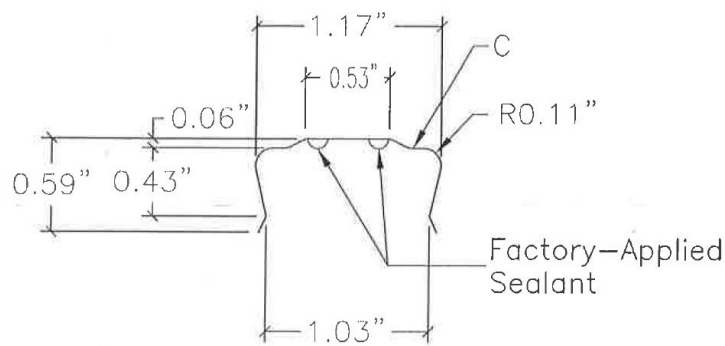


FIGURE 1D—T-ARMOR PANEL CAP

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Section: 07 41 13— Metal Roof Panels

REPORT HOLDER:

METAL SALES MANUFACTURING CORPORATION

EVALUATION SUBJECT:

T-ARMOR STEEL AND ALUMINUM ROOF PANELS

1.0 REPORT PURPOSE AND SCOPE**Purpose:**

The purpose of this evaluation report supplement is to indicate that Metal Sales Manufacturing Corporation T-Armor Steel and Aluminum Roof Panels, described in ICC-ES evaluation report ESR-3743, have also been evaluated for compliance with the codes noted below.

Applicable code editions:

- 2019 *California Building Code* (CBC)

For evaluation of applicable chapters adopted by the California Office of Statewide Health Planning and Development (OSHPD) and Division of State Architect (DSA), see Sections 2.1.1 and 2.1.2 below.

- 2019 *California Residential Code* (CRC)

2.0 CONCLUSIONS**2.1 CBC:**

The Metal Sales Manufacturing Corporation T-Armor Steel and Aluminum Roof Panels described in Sections 2.0 through 7.0 of the evaluation report ESR-3743, comply with CBC Chapter 15, provided the design and installation are in accordance with the 2018 *International Building Code*® (IBC) provisions noted in the evaluation report and the additional requirements of CBC Section 1505.1.1 for a Class A roof covering, Section 1505.1.2 for a Class B roof covering or Section 1505.1.3 for a Class C roof covering, as applicable.

2.1.1 OSHPD: The applicable OSHPD Sections of the CBC are beyond the scope of this supplement.

2.1.2 DSA: The applicable DSA Sections of the CBC are beyond the scope of this supplement.

2.2 CRC:

The Metal Sales Manufacturing Corporation T-Armor Steel and Aluminum Roof Panels described in Sections 2.0 through 7.0 of the evaluation report ESR-3743, comply with CRC Chapter 9, provided the design and installation are in accordance with the 2018 *International Residential Code*® (IRC) provisions noted in the evaluation report and the additional requirements of Section R902.1.1 for a Class A roof covering, Section R902.1.2 for a Class B roof covering or Section R902.1.3 for a Class C roof covering and Section R905.10 of the CRC.

This supplement expires concurrently with the evaluation report, reissued August 2021.