



UL Solutions Evaluation Report

UL ER346702-02

Issued: 2015-11-06

Revised: 2024-09-05

Visit the UL Solutions [Product iQ® database](#) for current status of report.

UL Category Code: ULFD - Roof and Wall Specialties and Accessories

CSI MasterFormat®

DIVISION: 07 00 00 – Thermal and Moisture Protection

Sub-level: 07 72 00 - Roof Accessories

DIVISION: 26 00 00 - Electrical

Sub-level 26 31 00 - Photovoltaic Collectors

COMPANY:

Tesla Inc.

3500 Deer Park Road

Palo Alto, CA 94304

Phone – (650) 391-7144

www.tesla.com

1. Subject

ZS SPAN

2. Scope of Evaluation

- 2024, 2021, and 2018 *International Building Code*® (IBC)
- 2024, 2021, and 2018 *International Residential Code*® (IRC)
- 2023, 2020, and 2017 *NFPA 70 National Electrical Code*® (NEC)
- 2024, 2021 and 2018 International Fire Code (IFC)
- 2023 and 2020 Florida Building Code (FBC)
- 2022 and 2019 California Building Code (CBC)

The products were evaluated for the following properties:

- Structural securement to AC13
- Water penetration to UL 2582 - Wind Driven Rain
- Wind driven rain resistance to TAS No. 100
- Electrical grounding and bonding to UL 2703
- Mechanical loading to UL 2703
- Fire classification to UL 2703 (Class A)

3. Referenced Documents

- ANSI/UL1703, Standard for Flat-Plate Photovoltaic Modules and Panels,
- ANSI/UL2703, Standard for Mounting Systems, Mounting Devices, Clamping/Retention Devices, and Ground Lugs for Use with Flat-Plate Photovoltaic Modules and Panels,
- ASCE 7 - Minimum Design Loads and Associated Criteria for Buildings and Other Structures
- ASTM D7147 - Standard Specification for Testing and Establishing Allowable Loads of Joist Hangers
- ICC-ES Acceptance Criteria for Joist Hangers and Similar Devices, AC13,
- IEC 61730-1 Photovoltaic (PV) Module safety qualification – Part 1: Requirements for construction
- IEC 61730-2 Photovoltaic (PV) Module safety qualification – Part 2: Requirements for testing
- National Design Specification for Wood Construction (NDS)
- TAS No. 100: Test Procedure for Wind and Wind Driven Rain Resistance of Discontinuous Roof Systems – modified (110 mph @ 8.8in/h water spray)
- UL 2582, Outline for Ridge Vents

4. Uses

The ZS Span mounting system is designed specifically for mounting of Zep-compatible photovoltaic modules on tile roofs. The system is to be attaches the specific photovoltaic mounting hardware to the wood framing supporting the roof decks.

The ZS Span mounting system is suitable for use in high wind areas such as Florida, including High Velocity Hurricane Zones (HVHZ). See section 6 of this report for structural design requirements.

5. Production Description

ZS Span is comprised of the following components: Spanner Bar (850-1398), (850-1399), (850-1400) Spanner Clamp V2 (850-1554), Splice Assembly (850-1401), Mighty Hook V2 (850-1461), Interlock (850-1388 or 850-1613), Cam Foot (850-1413), Array Skirt (500-0113-XXX), and Ground Zep (850-1511).

An alternate ZS Span assembly is available and consists of the following components: Spanner Bar (850-1627), Spanner Clamp V2 (850-1554), Splice Assembly Kit (850-1401), Span (850-1625), Mighty Hook V2 (850-1461), Cam Foot V2 (850-1564), Interlock (850-1388 or 850-1613), and Ground Zep (850-1511).

The Mighty Hook V2 tile hook, utilized as part of the ZS Span mounting system, is comprised of the following :

1. Base - Constructed of ANSI 1020 steel and hot dipped galvanized per ASTM A123. Length: 6.3 in. Width: 3.05 in. Height: 1.6 in.
2. Car - Constructed of ANSI 1020 steel and hot dipped galvanized per ASTM A123. Length: 5.37 in. Width: 1.39 in. Height: 5.08 in.
3. Carriage Bolt - M10 x 25 mm and is hot dipped galvanized per ASTM A123 and F2329. Length: 1 in.
4. Flange Nut - M10 and is hot dipped galvanized per ASTM A123 and F2329.
5. Lag Screws - 300-series stainless steel in accordance with ANSI/ASME B 18.2.1 and are 5/16" with min. of 2.5" of embedment into structural members with captured washers.

6. Design

A structural designer, or other qualified person acceptable to the Authority Having Jurisdiction must calculate the applicable design forces and relevant load combinations for the system from the applicable code and compare against the load ratings for the attachment as listed in this report. The designer must analyze the wood framing members for the applicable design forces and load combinations from the applicable code and then compare connection capacity in accordance with the National Design Specification for Wood Construction (NDS).

Ultimate uplift, downforce, and lateral load values for the system were determined from test data. Values reported in Table 1 are tabulated for use with Allowable Strength Design (ASD) provisions. Attachment patterns or spacings for the ZS Span mounting system shall be determined based on site-specific parameters including solar module and PV array geometry, building and roof geometry and siting, and any applicable design loads (e.g., dead, wind, and snow loading).

For HVHZ regions, this includes the following as prescribed by the FBC.

- Wind loads calculated per ASCE 7 Chapter 29
- Minimum Exposure Category C; Exposure Category D (as applicable)
- Miami-Dade County Wind Speeds Broward County Wind Speeds
Risk Category 1 = 165 mph Risk Category 1 = 156 mph
Risk Category 2 = 175 mph Risk Category 2 = 170 mph
Risk Category 3 = 186 mph Risk Category 3 = 180 mph
Risk Category 4 = 195 mph Risk Category 4 = 185 mph

7. Installation

Installation of the ZS SPAN shall comply with this report and the manufacturer's published installation instructions. The installation instructions are to be available at the jobsite during installation.

Installation of the ZS SPAN as described in this report is limited to roofs having a minimum slope of 2:12 to maximum 12:12.

The installation of the ZS Span is limited to the mounting hardware as specified in the installation instructions.

In the centered position, the Mighty Hook V2 is installed with the bar secured to the base plate with a carriage bolt and flange nut positioned in the center bracket attachment slot. The two lag screws are to be placed in the center lag attachment slots centered over the structural wood framing member in line with the bar.

In all offset positions, where the lag screws are not installed in-line with the bar, the Mighty Hook V2 is installed with an additional four (4) #10 300-series stainless steel deck screws in addition to the two (2) lag screws. The bar of the Mighty Hook V2 is secured to the base plate with a carriage bolt and flange nut. The four #10 stainless steel deck screws are to be installed in the nearest attachment slot to the location of the bar. There are to be a maximum of two deck screws per slot. Deck screws are to be installed at opposite ends of attachment slot. Lag screws are to be centered over the structural wood framing member.

The loads shown in Table 1 are based upon the above installation positions.

8. Conditions of Use

ZS SPAN described in this report complies with, or is a suitable alternative to what is specified in, those codes listed in Section 2 of this report, subject to the following conditions:

- 8.1** Materials and methods of installation shall comply with this report and the manufacturer's published installation instructions. In the event of a conflict between the installation instructions and this report, this report governs.
- 8.2** A registered design professional's report demonstrating compliance with the applicable code, as referenced in Section 6, shall be provided where required by the authority having jurisdiction.
- 8.3** Wood framing members shall be predrilled for installation of lag screws in conformance with the applicable sections of the National Design Specification for Wood Construction (NDS) and the manufacturer's installation instructions (7/32 inch pilot hole). Edge and end distances of the lag screw in the wood framing member shall be sufficient to prevent unusual splitting and not less than the requirements of the applicable Tables of the National Design Specification for Wood Construction (NDS).
- 8.4** Specific gravity of the wood framing member must meet or exceed those specified in Table 1.
- 8.5** Elastomeric tripolymer sealant shall be installed in the pre-drilled hole of the wood framing member prior to installation of the lag screw.
- 8.6** Manufacturer's installation instructions shall be provided to the code official upon request for inspection purposes.
- 8.7** Photovoltaic modules supported by the modular mounting system shall be listed and labeled in accordance with UL 1703 or both UL 61730-1 and UL 61730-2. Rooftop mounted photovoltaic panel systems must comply with the following Code versions as applicable.

Code Version	Code Section
IBC - 2018, 2021 and 2024	1505.9, 3111.3
IRC - 2018, 2021 and 2024	R324
FBC - 2020	1505.8, 1620, 3111.3
FBC - 2023	1505.9, 1620, 3111.3
CBC- 2019 and 2022	1505.9, 3111.3

- 8.8** Installation of photovoltaic modules must comply with following Code versions as applicable.

Code Version	Code Section
IFC - 2018	1204

IFC - 2021 and 2024	1205
NEC - 2017, 2020 and 2023	690

- 8.9** See UL Online Certification Directory for Mounting Systems, Mounting Devices, Clamping Devices and Ground Lugs for Use with Photovoltaic Modules and Panels – UL Product iQ ([QIMS](#)).
- 8.10** ZS Span, composed of the elements shown in the product description above, is manufactured under the UL LLC Listing and Follow-Up Service Program, which includes regular audits.
- 8.11** The ZS Span assembly shall be installed only by professional personnel trained and approved by the manufacturer.

9. Supporting evidence

- 9.1** Manufacturer’s descriptive product literature, including installation instructions.
- 9.2** Load test data in accordance with ICC-ES Acceptance Criteria for Joist Hanger and Similar Devices AC 13.
- 9.3** Resistance to water infiltration data utilizing the Wind-Driven Rain Test in UL Subject 2582.
- 9.4** Resistance to water infiltration data utilizing TAS No. 100: Test Procedure for Wind and Wind Driven Rain Resistance of Discontinuous Roof Systems – modified (110 mph @ 8.8in/h water spray)
- 9.5** UL test reports and Listing, UL File E346702, in accordance with ANSI/UL 2703. See UL Product Certification Category for Mounting Systems, Mounting Devices, Clamping Devices and Ground Lugs for Use with Photovoltaic Modules and Panels, UL Product iQ ([QIMS](#))

10. Identification

The Tesla Inc. ZS Span described in this evaluation report is identified by a marking bearing the report holder’s name (Tesla Inc.), the plant identification, if applicable, the UL Listing Mark, and the evaluation report number UL ER346702-02. The validity of the evaluation report is contingent upon this identification appearing on the product or on the smallest unit container in which the product is packaged.

11. Use of UL Evaluation Report

- 11.1** The approval of building products, materials or systems is under the responsibility of the applicable authorities having jurisdiction.
- 11.2** UL Evaluation Reports shall not be used in any manner that implies an endorsement of the product, material or system by UL.
- 11.3** The current status of this report, as well as a complete directory of UL Evaluation Reports may be found at UL.com via our On-Line Certifications Directory.
- 11.4** Comprehensive guidance for design and installation of solar photovoltaic systems and associated equipment is beyond the scope of this document. For support on these topics, refer to a contractor, system designer, building official or registered design professional, as appropriate, or where required by the Authority Having Jurisdiction. Evaluation of existing structures for structural sufficiency and code compliance is beyond the scope of this report. It shall be the responsibility of the installer to investigate and comply with all local building code requirements and criteria as may be applicable to the installation of ZS Span to an existing structure.

Figure 1: ZS Span Components

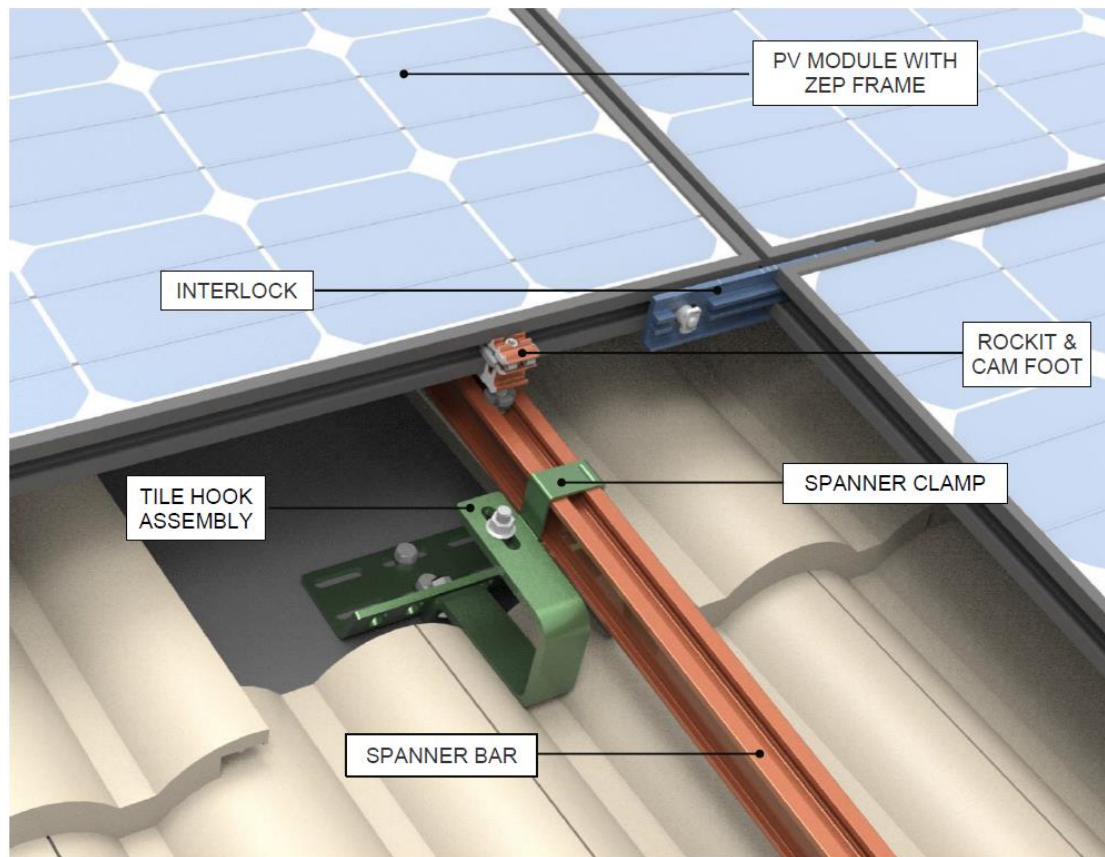


Table 1: Ultimate Test Loads on ZS Span

Offset (Curved tile types: S, W, etc.) Configuration Average Ultimate Test Loads

Load Direction	Minimum Specific Gravity of Lumber	Average Ultimate Test Loads (lbs)
Uplift	0.37	929
Lateral	0.40	1126
Downward	0.39	747

Notes: Ultimate load values are based the following:

1. Ultimate test load based on 5/16" lag screws installed through 1/2 in. Structural I plywood into 2 x 4 rafter with a min. of 2.5" of embedment and an additional four (4) #10 300-series stainless steel deck screws fastened to the plywood.
2. Appropriate factor of safety needs to be applied to the average ultimate test load to determine the allowable load.

Centered Configuration (flat tile) Average Ultimate Test Loads:

Load Direction	Minimum Specific Gravity of Lumber	Average Ultimate Test Loads (lbs)
Uplift	0.44	1464
Lateral	0.41	1129
Downward	0.41	789

Notes: Ultimate load values are based the following:

1. Ultimate test load based on 5/16" lag screws installed through 1/2 in. Structural I plywood into 2 x 4 rafter with a min. of 2.5" of embedment.
2. Appropriate factor of safety needs to be applied to the average ultimate test load to determine the allowable load.

UL Solutions Evaluation Reports

© 2024 UL LLC

This UL Solutions Evaluation Report is not an endorsement or recommendation for use of the subject and/or product described herein. This Report is not the UL Solutions Listing or UL Solutions Classification Report that covers the subject product. The subject product's UL Solutions Listing or UL Solutions Classification is covered under a separate UL Solutions Report. UL Solutions disclaims all representations and warranties whether express or implied, with respect to this Report and the subject or product described herein. Contents of this Report may be based on data that has been generated by laboratories other than UL Solutions that are accredited as complying with ISO/IEC Standard 17025 by the International Accreditation Service (IAS) or by any other accreditation body that is a signatory to the International Laboratory Accreditation Cooperation (ILAC) Mutual Recognition Arrangement (MRA). The

scope of the laboratory's accreditation shall include the specific type of testing covered in the test Report. As the accuracy of any non-UL Solutions data is the responsibility of the accredited laboratory, UL Solutions does not accept responsibility for the accuracy of this data.

UL Solutions Headquarters
333 Pfingsten Road
Northbrook, IL 60062-2096 USA
T: 847.272.8800
UL.com/Solutions