

SOLAR PHOTOVOLTAIC & BATTERY SYSTEM INSTALLATION FOR RESIDENCE

PROJECT DATA	
PROJECT DATA: MODULE: (22) HANWHA Q.CELLS Q.PEAK DUO BLK ML-G10+ 400, 400W INVERTER: (1) HANWHA QCELLS Q.VOLT H7.6SX[240V], 7.608 kW BATTERY: (1) HANWHA QCELLS Q.SAVE D10.0SX, 10 kWh RACKING: IRONRIDGE SYSTEM CAPACITY: 8.800 kW-DC 7.608 kW-AC (NAME PLATE) 10.000 kWh	BUILDING DATA: BUILDING HEIGHT: 10ft STORIES: 1 CLASSIFICATION OCCUPANCY: R-3 RISK OF CATEGORY: II WIND SPEED: 93 mph WIND EXPOSURE: B SNOW LOAD: 0 psf FIRE SPRINKLER SYSTEM: NO

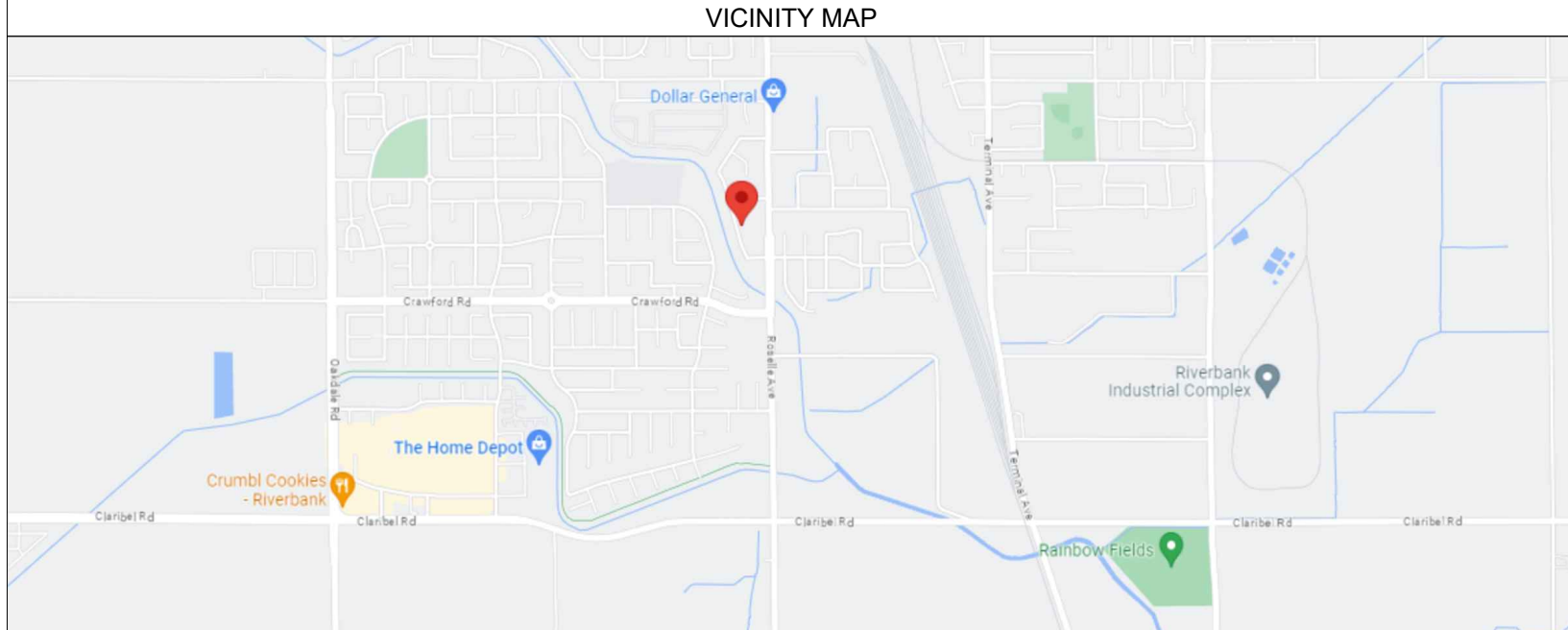
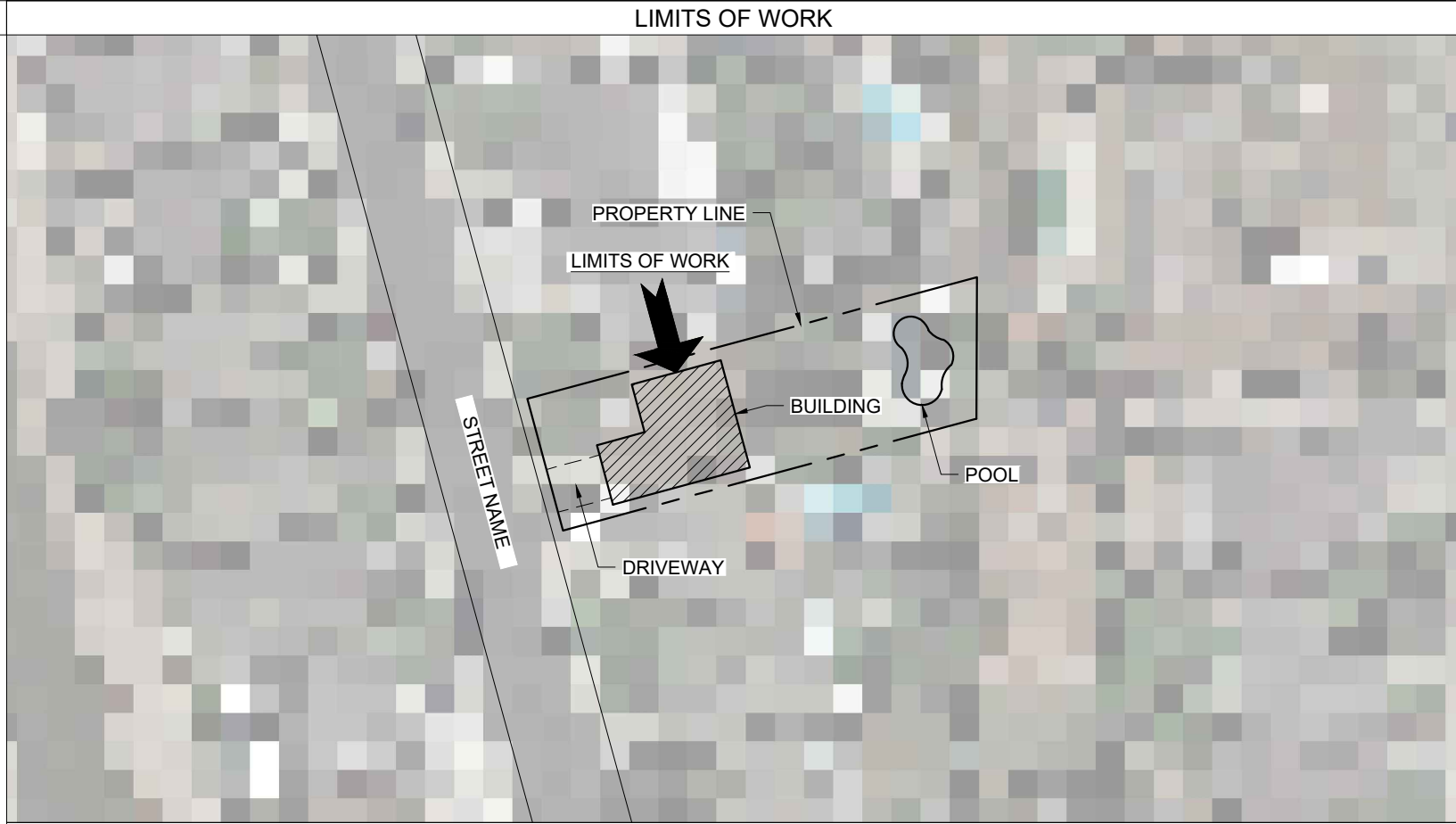
SHEET INDEX	
ELECTRICAL PV1 COVER SHEET PV2 SITE PLAN PV3 ENLARGED SOLAR MODULE LAYOUT PV4 ATTACHMENT LAYOUT PV5 SINGLE LINE DIAGRAM PV6 ELECTRICAL CALCULATION PV7 STRUCTURE DETAIL PV8 SIGNAGE & PLACARD	APPENDIX SOLAR MODULE DATA SHEET INVERTER & BATTERY DATA SHEET STRUCTURAL DATA SHEET STRUCTURAL INTEGRATED GROUNDING CERTIFICATE OF COMPLIANCE

SCOPE OF WORK
1. INSTALLATION OF SOLAR PHOTOVOLTAIC & BATTERY SYSTEM
GOVERNING CODES
1. ALL WORKS TO COMPLY WITH 2022 CALIFORNIA RESIDENTIAL CODE (CRC), 2022 CALIFORNIA FIRE CODE (CFC), 2022 CALIFORNIA ELECTRICAL CODE (CEC), 2022 CALIFORNIA MECHANICAL CODE (CMC), 2022 CALIFORNIA PLUMPING CODE (CPC), 2022 CALIFORNIA GREEN CODE (CGC), 2022 CALIFORNIA ENERGY CODE (CEnc)

CONTRACTOR'S LOGO

CONTRACTOR'S LICENSE NUMBER OR STAMP

- GENERAL NOTES**
1. ALL EQUIPMENT SHALL BE LISTED AND LABELED BY A RECOGNIZED TESTING LABORATORY AND AND INSTALLED PER THE LISTING REQUIREMENT AND THE MANUFACTURER'S INSTRUCTIONS, CEC110.2, 110.3, 690.4(B) AND 390.12(5).
 2. ALL PANELS, SWITCHES, ETC. SHALL HAVE SUFFICIENT GUTTER SPACE AND LUGS IN COMPLIANCE TO UL REQUIREMENTS TO ACCOMMODATE CONDUCTORS SHOWN.
 3. ALL ELECTRICAL MATERIAL SHALL BE LISTED BY "UL" FOR THE TYPE OF APPLICATION AND "UL" LABEL SHALL APPEAR ON ALL ELECTRICAL EQUIPMENT.
 4. ALL EXTERIOR ELECTRICAL DEVICES AND EQUIPMENT INCLUDING THOSE THAT ARE EXPOSED TO OUTSIDE ENVIRONMENT SHALL BE WEATHERPROOF TYPE NEMA 3R.
 5. ALL CONDUCTORS EXPOSED TO WEATHER SHALL BE LISTED AND IDENTIFIED FOR USE IN DIRECT SUNLIGHT, CEC 310.10(D) AND 690.31(C) THROUGH (G).
 6. ALL GROUNDED, (NEUTRAL), CONDUCTOR'S INSULATION SHALL BE SOLID WHITE, GRAY, OR 3-WHITE STRIPES; AND ALL GROUNDING CONDUCTORS SHALL BE OF BARE WIRE WITHOUT COVERING, OR WITH INSULATION OF GREEN OR GREEN WITH YELLOW STRIPES. THE COLOR OF UNGROUNDED CONDUCTOR SHALL BE OTHER THAN FOR GROUNDED, (NEUTRAL), AND GROUNDING CONDUCTORS.
 7. CONTRACTOR SHALL EXTEND WIRING FROM ALL JUNCTION BOXES, SWITCHES, ETC. AND MAKE FINAL CONNECTIONS AS REQUIRED TO ALL BUILDING EQUIPMENT REQUIRING ELECTRICAL CONNECTIONS.
 8. WHERE WIRE SIZES ARE INDICATED ON PLANS FOR INDIVIDUAL CIRCUITS, THE WIRE SIZE INDICATED SHALL APPLY TO THE COMPLETE CIRCUIT, UNLESS OTHERWISE NOTED.
 9. DISCONNECT SWITCHES SHALL BE MOUNTED ON INDIVIDUAL SUPPORTS, OR OTHERWISE DIRECTLY ON EQUIPMENT, PROVIDED NO MODIFICATION TO EQUIPMENT IS NECESSARY.
 10. WIRING METHOD SHALL BE EMT ABOVE GROUND MOUNTED IN CONCEALED SPACES (UNLESS APPROVED OTHERWISE) AND SCHEDULE- 40 PVC FOR BELOW GROUND INSTALLATION UNLESS NOTED OTHERWISE.
 11. ALL CONDUIT TO USE WEATHER TIGHT EXPANSION FITTINGS.
 12. ALL EXTERIOR CONDUITS SHALL BE PAINTED TO MATCH THE COLOR OF THE SURROUNDING AREA.
 13. A LADDER WILL BE IN PLACE FOR INSPECTION IN COMPLIANCE WITH OSHA REGULATIONS.
 14. FIRE INSPECTION REQUIRED. "ALL CONNECTIONS TO EXISTING ROOF FRAMING SHALL REMAIN EXPOSED UNTIL INSPECTED."
 15. INSPECTION REQUIRED FOR ROOF CONNECTION MOUNTING ASSEMBLIES PRIOR TO INSTALLING SOLAR MODULE.
 16. EXISTING PLUMPING VENTS, SKYLIGHTS, EXHAUST OUTLET, & VENTILATION INTAKE AIR OPENINGS SHALL NOT BE COVERED OR BLOCKED BY THE SOLAR PHOTOVOLTAIC SYSTEM
 17. DUE TO THE FACT THAT PV MODULES ARE ENERGIZED WHENEVER EXPOSED TO LIGHT, PV CONTRACTOR SHALL DISABLE THE ARRAY DURING INSTALLATION AND SERVICE BY SHORT CIRCUITING, OPEN CIRCUITING, OR COVER THE ARRAY WITH OPAQUE COVERING.
 18. THESE DRAWINGS ARE REPRESENTATIVE OF THE SCOPE AND NATURE OF WORK. IT IS NOT GUARANTEED TO REPRESENT EXACT FIELD CONDITIONS AND DIMENSIONS. IT SHALL BE THE RESPONSIBILITY OF THE CONTRACTOR TO VERIFY FIELD DIMENSIONS AND TO COORDINATE THE WORK WITH THAT OF THE CONSTRUCTION MANAGER.
 19. THE LAYOUT OF THE CONDUIT SHOWN IN THIS DRAWING PACKAGE IS INDICATIVE ONLY. THE INSTALLATION CONTRACTOR WILL BE RESPONSIBLE FOR FIELD ROUTING AND LOCATING ALL CONDUITS TO SUIT SPECIFIC SITE CONDITIONS. THE CONTRACTOR WILL COORDINATE ALL LOCATIONS WITH THE OWNER/GENERAL CONTRACTOR AND ANY OTHER TRADES THAT THE NEW ROUTING MAY AFFECT.



REVISION	DESCRIPTION	DATE
NO.		

PROJECT NAME

HOMEOWNER

ADDRESS

PROJECT ID:

SYSTEM SIZE

8.800 kW-DC
7.608 kW-AC (NAME PLATE)
10.000 kWh

DRAWN BY EP-HT

APPROVED BY

SCALE N.T.S

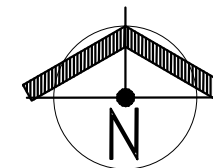
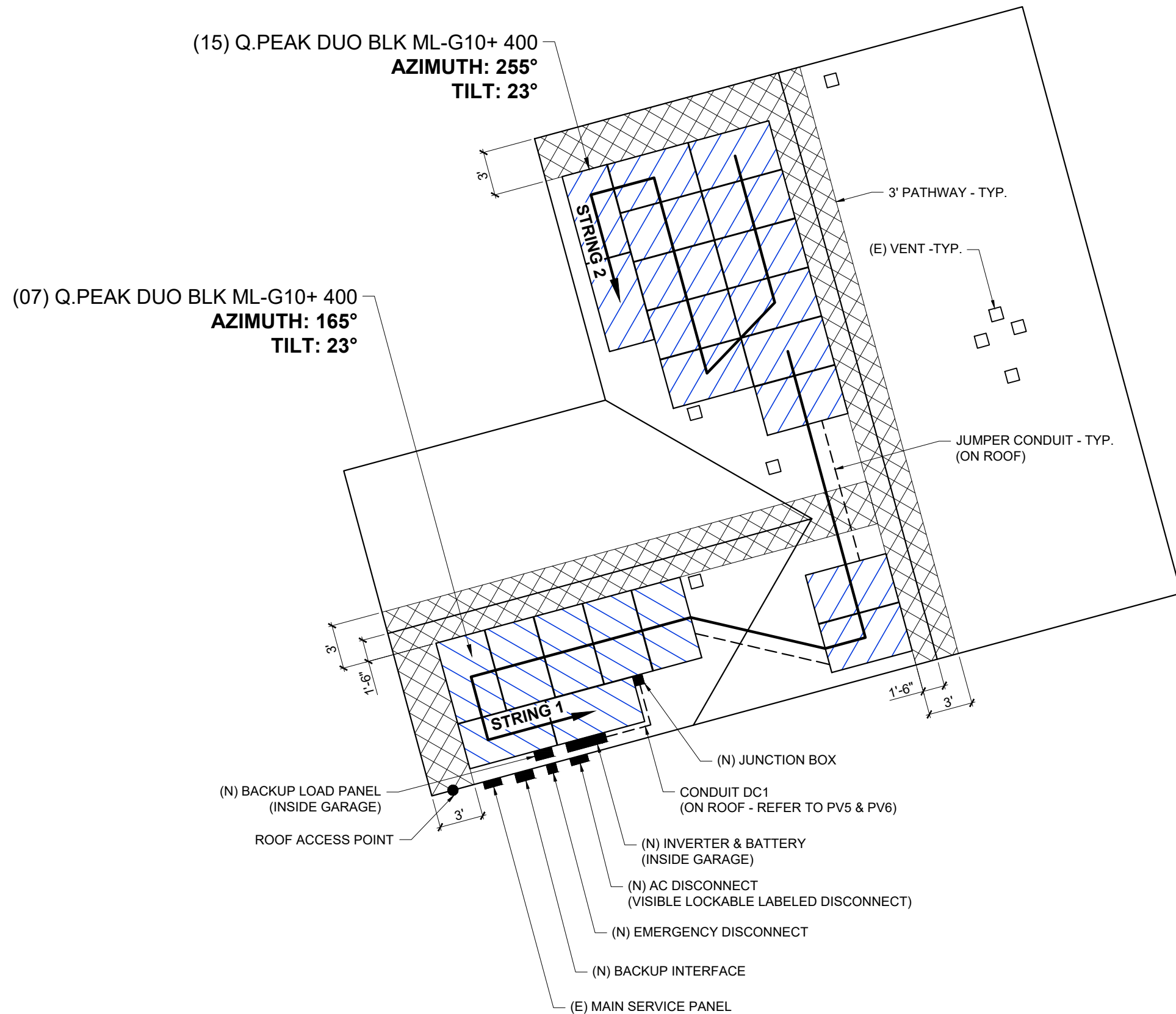
SHEET TITLE

COVER SHEET

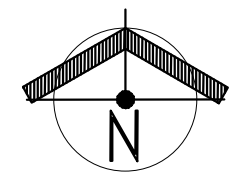
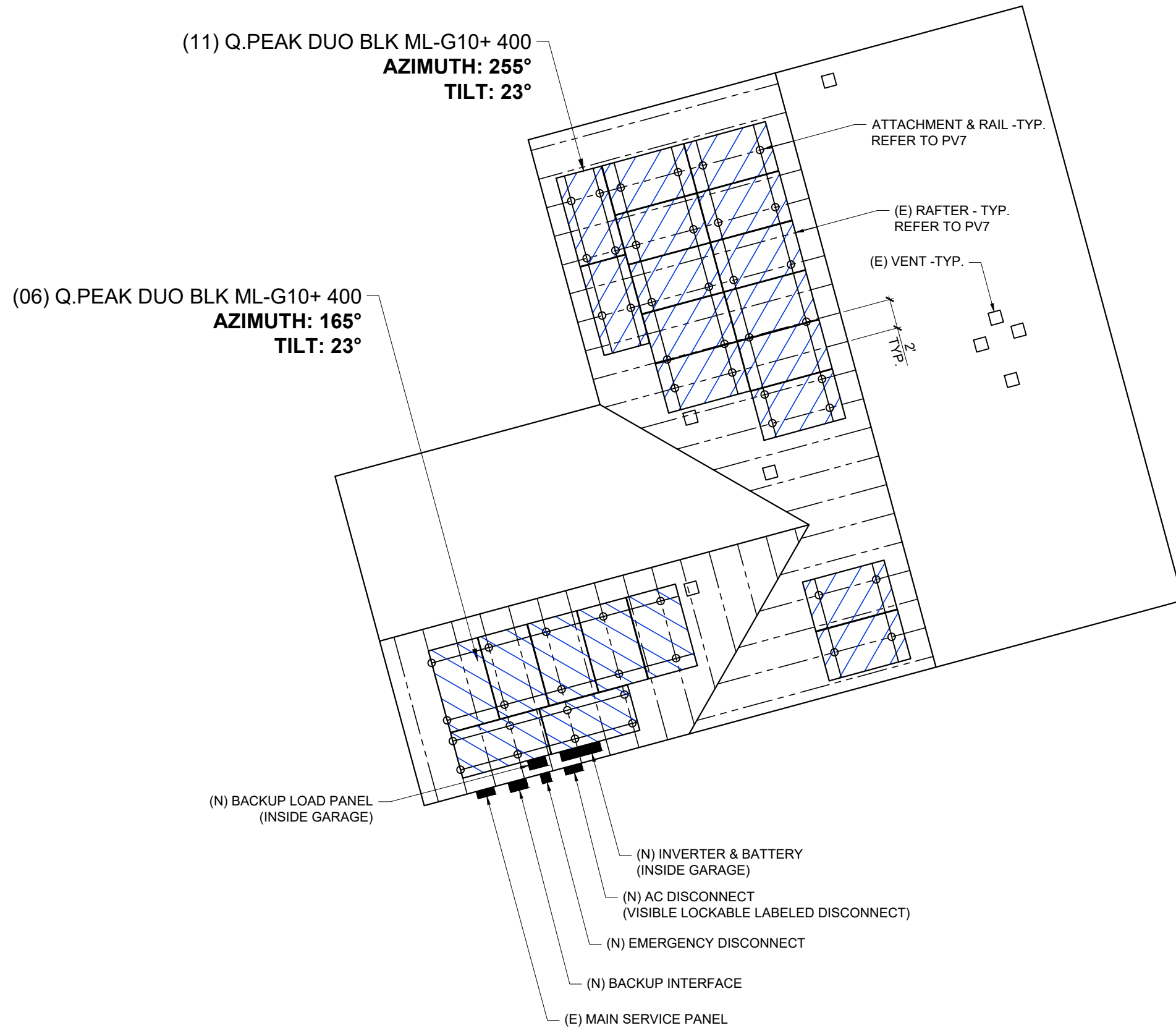
SHEET NO. **PV1**

NOTE

- ALL CONDUIT REFER TO PV5 & PV6.
- ALL CONDUIT MOUNTED ON ROOF SHALL BE MINIMUM 7/8" ABOVE ROOF SURFACE PER CEC 310.15(B)(3)(C).
- AT LEAST TWO 36" - WIDE PATHWAYS ON SEPARATE ROOF PLANES, FROM LOWEST ROOF EDGE TO RIDGE, SHALL BE PROVIDED ON ALL BUILDINGS. THERE SHALL BE AT LEAST ONE PATHWAY ON THE STREET OR DRIVEWAY SIDE OF THE ROOF. FOR EACH ROOF PLANE WITH A PV ARRAY, AT LEAST ONE SUCH PATHWAY SHALL BE PROVIDED ON THE SAME ROOF PLANE, OR ON AN ADJACENT ROOF PLANE, OR STRADDLING THE SAME AND ADJACENT ROOF PLANES. (CFC 1205.2.1.1)
- FOR PV ARRAYS OCCUPYING 33% OR LESS OF THE PLAN VIEW TOTAL ROOF AREA, A MIN. 18" WIDE SETBACK IS REQUIRED ON BOTH SIDES OF A HORIZONTAL RIDGE (CFC 1205.2.1.2)
- PV ARRAY AREA / TOTAL ROOF AREA = 432.98 (SF) / 1857.25 (SF) * 100 = 23.31%



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PROJECT ID:	
SYSTEM SIZE	
8.800 kW-DC 7.608 kW-AC (NAME PLATE) 10.000 kWh	
DRAWN BY	EP-HT
APPROVED BY	
SCALE	1/8" = 1'
SHEET TITLE	
ENLARGED SOLAR MODULE LAYOUT	
SHEET NO.	PV3



CONTRACTOR'S LOGO	
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DESCRIPTION	
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HOMEOWNER	
ADDRESS	
PROJECT ID:	
SYSTEM SIZE	
8.800 kW-DC 7.608 kW-AC (NAME PLATE) 10.000 kWh	
DRAWN BY	EP-HT
APPROVED BY	
SCALE	1/8" = 1'
SHEET TITLE	
ATTACHMENT LAYOUT	
SHEET NO.	PV4

ELECTRICAL CALCULATION											SYSTEM INFORMATION				
Voc AT LOWEST TEMPERATURE (11 MODULES/STRING)			Voc = (11) (45.3) [1 + (-0.0027 ((-2-25)))] = 534.63 V			ALLOWANLE BACKFEED PER CEC 705.12(B)(3)(2): 120% MAIN BUS RATING = 200 A x 1.2 = 240.00 A (PV BACKFEED) 40 A + (MAIN BREAKER) 200 A = 240.0 A ≤ 240.0 A			TEMP. REFERENCE (°C)			TOTAL DC CAPACITY (kW-DC)	8.800		
									MIN. TEMP.		-2	TOTAL AC NAMEPLATE (kW-AC)	7.608		
									2% AVERAGE HIGH. TEMP.		38	TOTAL BATTERY CAPACITY (kWh)	10.000		
CONDUIT LABEL	WIRE TYPE	CONNECTION	OUTPUT CURRENT (A)	MAX. CURRENT PER CEC 690.8(A)(1)	MAX. CURRENT PER CEC 690.8(B)(1)(a)	OVER CURRENT PROTECTION DEVICE PER CEC 690.9	CORRECTION FACTOR		WIRE SIZE	WIRE AMPACITY TEMP. RATING		DERATED WIRE AMPACITY	GROUND WIRE PER CEC 250.122	SOLAR MODULE	
							AMBIENT TEMP. DERATE PER CEC 310.15(B)(2)(a)	CONDUIT FILL. DERATE PER CEC 310.15(B)(3)(a)		75°C	90°C			MANUFACTURER	HANWHA Q.CELLS
DC1	THWN-2 (CU)	STRING 1 TO INV (DC+)	11.14	13.90	17.38	20	0.91	0.8	10		40	29.12	8	MODEL	Q.PEAK DUO BLK ML-G10+ 400
	THWN-2 (CU)	STRING 1 TO INV (DC-)	11.14	13.90	17.38	20	0.91	0.8	10		40	29.12		POWER RATING (W)	400
	THWN-2 (CU)	STRING 2 TO INV (DC+)	11.14	13.90	17.38	20	0.91	0.8	10		40	29.12		QUANTITY	22
	THWN-2 (CU)	STRING 2 TO INV (DC-)	11.14	13.90	17.38	20	0.91	0.8	10		40	29.12		OPEN CIRCUIT VOLTAGE Voc (Vdc)	45.3
A1	THWN-2 (CU)	INV TO ACDS (L1)	31.7	-	39.63	40	0.91	1.00	8		55	50.05	8	MAX. POWER VOLTAGE Vmp (Vdc)	37.13
	THWN-2 (CU)	INV TO ACDS (L2)	31.7	-	39.63	40	0.91	1.00	8		55	50.05		MAX. POWER CURRENT Imp (Adc)	10.77
	THWN-2 (CU)	INV TO ACDS (N)	-	-	-	-	-	-	8		-	-		SHORT CIRCUIT CURRENT Isc (Adc)	11.14
A2	THWN-2 (CU)	ACDS TO BI (L1)	31.7	-	39.63	40	0.91	1.00	8		55	50.05	8	VocTC (%)	-0.27
	THWN-2 (CU)	ACDS TO BI (L2)	31.7	-	39.63	40	0.91	1.00	8		55	50.05		INVERTER	
	THWN-2 (CU)	ACDS TO BI (N)	-	-	-	-	-	-	8		-	-		MANUFACTURER	HANWHA QCELLS
A3	THWN-2 (CU)	BI TO MP (L1)	80	-	100.00	100	0.88	1.00	2	115		101.20	6	MODEL	Q.VOLT H7.6SX[240V]
	THWN-2 (CU)	BI TO MP (L2)	80	-	100.00	100	0.88	1.00	2	115		101.20		MAX. OUTPUT POWER (kVA)	7.608
	THWN-2 (CU)	BI TO MP (N)	-	-	-	-	-	-	2	-		-		QUANTITY	1
L1	THWN-2 (CU)	BI TO BP (L1)	80	-	100.00	100	0.88	1.00	2	115		101.20	6	MAX. DC INPUT VOLTAGE Voc (Vdc)	550
	THWN-2 (CU)	BI TO BP (L2)	80	-	100.00	100	0.88	1.00	2	115		101.20		MAX. DC INPUT CURRENT (Adc)	16
	THWN-2 (CU)	BI TO BP (N)	-	-	-	-	-	-	2	-		-		MAX. AC OUTPUT VOLTAGE (V)	240
													MAX. AC OUTPUT CURRENT (A)	31.7	
													BATTERY		
													MANUFACTURER	HANWHA QCELLS	
													MODEL	Q.SAVE D10.0SX	
													TOTAL ENERGY (kWh)	10	
													QUANTITY	1	
													MAXIMUM POWER (kW)	5.5	
													VOLTAGE Voc (Vdc)	102.4	
													CHARGE/DISCHARGE CURRENT (Adc)	54	

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SYSTEM SIZE

8.800 kW-DC
7.608 kW-AC (NAME PLATE)
10.000 kWh

DRAWN BY EP-HT

APPROVED BY

SCALE N.T.S

SHEET TITLE

ELECTRICAL CALCULATION

SHEET NO. **PV6**

Q.PEAK DUO BLK ML-G10+ SERIES



385-405 Wp | 132 Cells
20.6% Maximum Module Efficiency

MODEL Q.PEAK DUO BLK ML-G10+



Breaking the 20% efficiency barrier

Q.ANTUM DUO Z Technology with zero gap cell layout boosts module efficiency up to 20.6%.



A reliable investment

Inclusive 25-year product warranty and 25-year linear performance warranty¹.



Enduring high performance

Long-term yield security with Anti LeTID Technology, Anti PID Technology² and Hot-Spot Protect.



Extreme weather rating

High-tech aluminium alloy frame, certified for high snow (5400 Pa) and wind loads (4000 Pa).



Innovative all-weather technology

Optimal yields, whatever the weather with excellent low-light and temperature behaviour.



The most thorough testing programme in the industry

Qcells is the first solar module manufacturer to pass the most comprehensive quality programme in the industry: The new "Quality Controlled PV" of the independent certification institute TÜV Rheinland.

¹ See data sheet on rear for further information.
² APT test conditions according to IEC/TS 62804-1:2015, method A (-1500 V, 96 h)

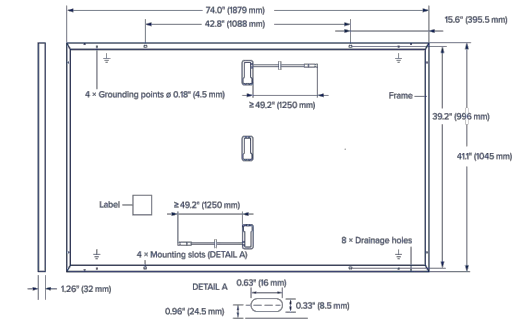
The ideal solution for:
Rooftop arrays on residential buildings



Q.PEAK DUO BLK ML-G10+ SERIES

Mechanical Specification

Format	74.0 in × 41.1 in × 1.26 in (including frame) (1879 mm × 1045 mm × 32 mm)
Weight	48.5 lbs (22.0 kg)
Front Cover	0.13 in (3.2 mm) thermally pre-stressed glass with anti-reflection technology
Back Cover	Composite film
Frame	Black anodised aluminium
Cell	6 × 22 monocrystalline Q.ANTUM solar half cells
Junction box	2.09-3.98 in × 1.26-2.36 in × 0.59-0.71 in (53-101 mm × 32-60 mm × 15-18 mm), IP67, with bypass diodes
Cable	4 mm ² Solar cable; (+) ≥ 49.2 in (1250 mm), (-) ≥ 49.2 in (1250 mm)
Connector	Stäubli MC4; IP68



Electrical Characteristics

POWER CLASS	385	390	395	400	405
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MINIMUM PERFORMANCE AT STANDARD TEST CONDITIONS, STC¹ (POWER TOLERANCE +5 W/-0 W)

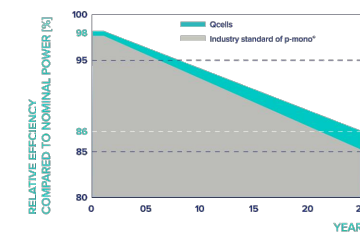
Minimum	Parameter	Unit	385	390	395	400	405
	Power at MPP ¹	P _{MPP} [W]	385	390	395	400	405
	Short Circuit Current ¹	I _{SC} [A]	11.04	11.07	11.10	11.14	11.17
	Open Circuit Voltage ¹	V _{OC} [V]	45.19	45.23	45.27	45.3	45.34
	Current at MPP	I _{MPP} [A]	10.59	10.65	10.71	10.77	10.83
	Voltage at MPP	V _{MPP} [V]	36.36	36.62	36.88	37.13	37.39
	Efficiency ¹	η [%]	≥ 19.6	≥ 19.9	≥ 20.1	≥ 20.4	≥ 20.6

MINIMUM PERFORMANCE AT NORMAL OPERATING CONDITIONS, NMOT²

Minimum	Parameter	Unit	385	390	395	400	405
	Power at MPP	P _{MPP} [W]	288.8	292.6	296.3	300.1	303.8
	Short Circuit Current	I _{SC} [A]	8.90	8.92	8.95	8.97	9.00
	Open Circuit Voltage	V _{OC} [V]	42.62	42.65	42.69	42.72	42.76
	Current at MPP	I _{MPP} [A]	8.35	8.41	8.46	8.51	8.57
	Voltage at MPP	V _{MPP} [V]	34.59	34.81	35.03	35.25	35.46

¹ Measurement tolerances P_{MPP} ± 3%; I_{SC}, V_{OC} ± 5% at STC: 1000 W/m², 25 ± 2°C, AM 1.5 according to IEC 60904-3. ² 800 W/m², NMOT, spectrum AM 1.5

Qcells PERFORMANCE WARRANTY

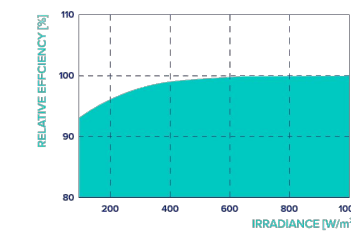


At least 98% of nominal power during first year. Thereafter max. 0.5% degradation per year. At least 93.5% of nominal power up to 10 years. At least 86% of nominal power up to 25 years.

All data within measurement tolerances. Full warranties in accordance with the warranty terms of the Qcells sales organisation of your respective country.

^{*} Standard terms of guarantee for the 5 PV companies with the highest production capacity in 2021 (February 2021)

PERFORMANCE AT LOW IRRADIANCE



Typical module performance under low irradiance conditions in comparison to STC conditions (25°C, 1000 W/m²).

TEMPERATURE COEFFICIENTS

Temperature Coefficient of I _{SC}	α [%/K]	+0.04	Temperature Coefficient of V _{OC}	β [%/K]	-0.27
Temperature Coefficient of P _{MPP}	γ [%/K]	-0.34	Nominal Module Operating Temperature	NMOT [°F]	109 ± 5.4 (43 ± 3°C)

Properties for System Design

Maximum System Voltage	V _{sys} [V]	1000 (IEC)/1000 (UL)	PV module classification	Class II
Maximum Series Fuse Rating	[A DC]	20	Fire Rating based on ANSI/UL 61730	TYPE 2
Max. Design Load, Push/Pull ³	[lbs/ft ²]	75 (3600 Pa)/55 (2660 Pa)	Permitted Module Temperature on Continuous Duty	-40°F up to +185°F (-40°C up to +85°C)
Max. Test Load, Push/Pull ³	[lbs/ft ²]	113 (5400 Pa)/84 (4000 Pa)		

³ See Installation Manual

Qualifications and Certificates

UL 61730, CE-compliant, Quality Controlled PV - TÜV Rheinland, IEC 61215:2016, IEC 61730:2016, U.S. Patent No. 9,893,215 (solar cells),



Qcells pursues minimizing paper output in consideration of the global environment.

Note: Installation instructions must be followed. Contact our technical service for further information on approved installation of this product.
Hanwha Q CELLS America Inc. 400 Spectrum Center Drive, Suite 1400, Irvine, CA 92618, USA | TEL +1 949 748 59 96 | EMAIL hqc-inquiry@qcells.com | WEB www.qcells.com



Specifications subject to technical changes © Qcells Q.PEAK_DUO_BLK_ML-G10+_series_385-405_2022-07_Rev02_NA

Q.HOME CORE

Q.VOLT H3.8 / 7.6SX



- Up to 200% oversizing allowed
- Up to 3 MPPTs
- Maximum 16 A PV input current
- Microgrid supported
- Peak efficiency: 98%
- Integrated arc fault protection and rapid shutdown transmitter

Q.SAVE D10.0 / 15.0 / 20.0SX

- Long life & safe LFP battery
- Up to four 5 kWh stackable batteries, 20 kWh maximum
- Modular design & quick installation
- Floor or wall mounted



Q.HOME HUB 200SX

- Maximum 200 A AC current
- Flexible home backup
- Built-in energy management meter

Q.VOLT H3.8 / 7.6SX

	Q.VOLT H3.8SX	Q.VOLT H7.6SX
INPUT PV		
Maximum recommended PV power	[W] 7600	15200
Maximum DC voltage	[V] 550	
Nominal DC operating voltage	[V] 360	
Maximum input current	[A] A: 16 / B: 16	A: 16 / B: 16 / C: 16
Maximum short circuit current	[A] A: 20 / B: 20	A: 20 / B: 20 / C: 20
MPPT voltage range	[V] 90 to 500	
Start input voltage	[V] 120	
No. of MPP trackers, Strings per MPP tracker	2, 1/1	3, 1/1
DC disconnection switch	YES	
INPUT / OUTPUT AC		
Nominal AC power	[VA] 3816	7608
Maximum apparent AC power	[VA] 3816	7608
Nominal AC voltage / Nominal AC frequency	[V / Hz] 240 / 60	
Nominal AC current	[A] 15.9	31.7
Displacement power factor	0.8 leading to 0.8 lagging	
Total harmonic distortion (THD, rated power)	[%] < 3	
INPUT / OUTPUT BATTERY		
Battery type	Li-Ion (LFP)	
Maximum output power	[W] 3816	7600
Maximum charge / discharge current	[A] 54	
Reverse-polarity protection	YES	
Cycle efficiency charging to discharging	[%] 88.5	92.5
ADDITIONAL FEATURES		
AFCI	YES	
Rapid shutdown transmitter	Integrated PLC Rapid Shutdown Transmitter	
EFFICIENCY		
CEC weighted efficiency	[%] 97.50	
Maximum inverter efficiency	[%] 98.00	
POWER CONSUMPTION		
Internal consumption (night)	[W] < 3	
STANDARD		
Safety	UL1741, UL1741 SA, UL1699B, CSA - C22.2 No. 1071-01, Canadian AFCI according to T.I.L. M-07	
Emissions	FCC Part 15 Class B	
Grid connection standards	IEEE1547, UL 1741 SB, CA Rule 21, Rule 14 (H-I)	
Revenue grade metering	ANSI C12.20	
INSTALLATION SPECIFICATIONS		
Protection class	NEMA 4X	
Operating temperature range	[°F / °C] -13 to +140 / -25 to +60	
De-rating start temperature	[°F / °C] 113 / 45 or above	
Storage temperature range	[°F / °C] -13 to +167 / -25 to +75	
Relative humidity	[%] 0 to 95	
Altitude	[ft / m] 9843 / 3000 MAX	
Typical noise emission	[dBA] < 30	
Over voltage category	IV (electric supply side), II (PV side)	
GENERAL		
Dimensions (W x H x D)	[in / mm] 33.1 x 15.7 x 5.7 / 840 x 400 x 145	
Weight	[lb / Kg] 75 / 34	
Cooling	Natural convection	
Topology	Transformerless	
Communication interfaces	RS485, CAN, WIFI / Dry Contact	
Warranty	10 years	

Q.SAVE D10.0 / 15.0 / 20.0SX

	Q.SAVE D10.0SX	Q.SAVE D15.0SX	Q.SAVE D20.0SX
MODEL			
Battery type	100Ah Lithium (LFP)		
Component	BMS-G2 + 2*BAT50-G2	BMS-G2 + 3*BAT50-G2	BMS-G2 + 4*BAT50-G2
NOMINAL CHARACTER			
Voltage	[V] 102.4	153.6	204.8
Operating voltage range	[V] 90 to 116	135 to 174	180 to 232
Total energy	[kWh] 10	15	20
Usable energy*	[kWh] 9	13.5	18
Battery roundtrip efficiency**	[%] 95		
Maximum power	[kW] 5.5	8.3	11.1
Maximum charge / discharge current	[A] 54		
Cycle life (90% DOD)	6000 cycles		
Warranty	10 years		

* Test Conditions: 90% DOD, 0.2 C charge & discharge at +25°C.

** Maximum Charge/Discharge power may be variant with different inverter models.

INSTALLATION SPECIFICATIONS	
Charge / Discharge temperature range	[°F / °C] Charge: 32 to 127.4 / 0 to 53, Discharge: 14 to 127.4 / -10 to 53
Storage temperature range	[°F / °C] 3 months: 4 to 122 / -20 to 50, 1 year: 32 to 104 / 0 to 40
Relative humidity	[%] 0 to 100
Altitude	[ft / m] 9843 / 3000 MAX
Protection class	NEMA 4X

STANDARD	
Certification	UN38.3, UL1973, UL9540, UL9540A
Hazardous materials classification	Class 9

GENERAL				
Cooling	Natural convection			
Dimensions (W x H x D) - BMS-G2	[in / mm]	33.5 x 5.2 x 5.8 / 850 x 133 x 148		
Dimensions (W x H x D) - BAT50-G2	[in / mm]	33.5 x 23.6 x 5.8 / 850 x 600 x 148	33.5 x 35.4 x 5.8 / 850 x 900 x 148	33.5 x 47.2 x 5.8 / 850 x 600 x 148
Dimensions (W x H x D) - Base	[in / mm]	33.5 x 2.2 x 5.8 / 850 x 55 x 148		
Weight	[lb / kg]	BMS-G2: 22 / 10 + (2) BAT50-G2: 238 / 108	BMS-G2: 22 / 10 + (3) BAT50-G2: 357 / 162	BMS-G2: 22 / 10 + (4) BAT50-G2: 476 / 216

Q.HOME HUB 200SX

GRID INPUT	
Nominal AC input voltage / Nominal AC frequency	[V / Hz] 120 / 240, 60
Maximum AC input current	[A] 160
OUTPUT TO MAIN PANEL IN GRID TIED OPERATION	
Nominal AC output voltage	[V] 120 / 240
Maximum AC input current	[A] 160
OUTPUT TO MAIN PANEL IN BACKUP OPERATION	
Nominal AC output voltage	[V] 120 / 240
Imbalance compensation in backup operation	[VA] 5000
Split phase imbalance output current	[A] 41.7
Maximum AC output current	[A] 126.8
GENERAL	
Dimensions (H x W x D)	[in / mm] 27.8 x 17.7 x 5.9 / 706 x 450 x 15
Weight	[lb / Kg] 69.4 / 31.5
Energy meter accuracy	[%] 1
Communication interfaces	RS485, CAN, Dry Contact
Cooling	Fan
Warranty	10 years
STANDARD	
Safety	UL1741, CSA 22.2 NO.107
Emissions	FCC part 15 Class B
INSTALLATION SPECIFICATIONS	
Altitude	[ft / m] 9843 / 3000 MAX
Operating temperature range	[°F / °C] -13 to +140 / -25 to +60
Protection class	NEMA 3R
Typical noise emission	[dBA] < 50

Qcells pursues minimizing paper output in consideration of the global environment.

Note: Installation instructions must be followed. Contact our technical service for further information on approved installation of this product.
Hanwha Q CELLS America Inc. 400 Spectrum Center Drive, Suite 1400, Irvine, CA 92618, USA | TEL: +1 949 748 59 96 | EMAIL: hqc-inquiry@qcells.com | WEB: www.qcells.com

qcells



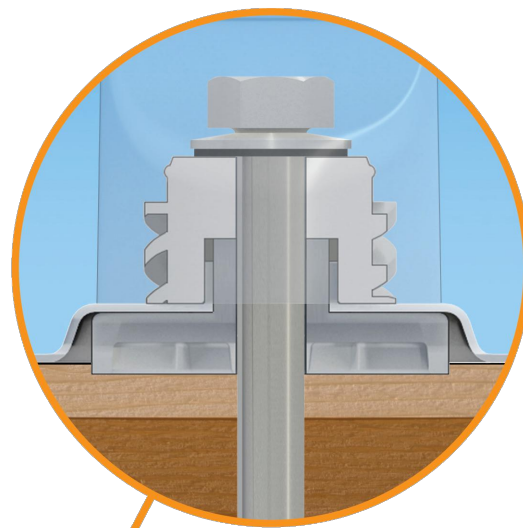
FlashFoot2®

The Strongest Attachment in Solar

IronRidge® FlashFoot2® raises the bar in solar roof protection. The unique water seal design is both elevated and encapsulated, delivering redundant layers of protection against water intrusion. In addition, the twist-on Cap perfectly aligns the rail attachment with the lag bolt to maximize mechanical strength.

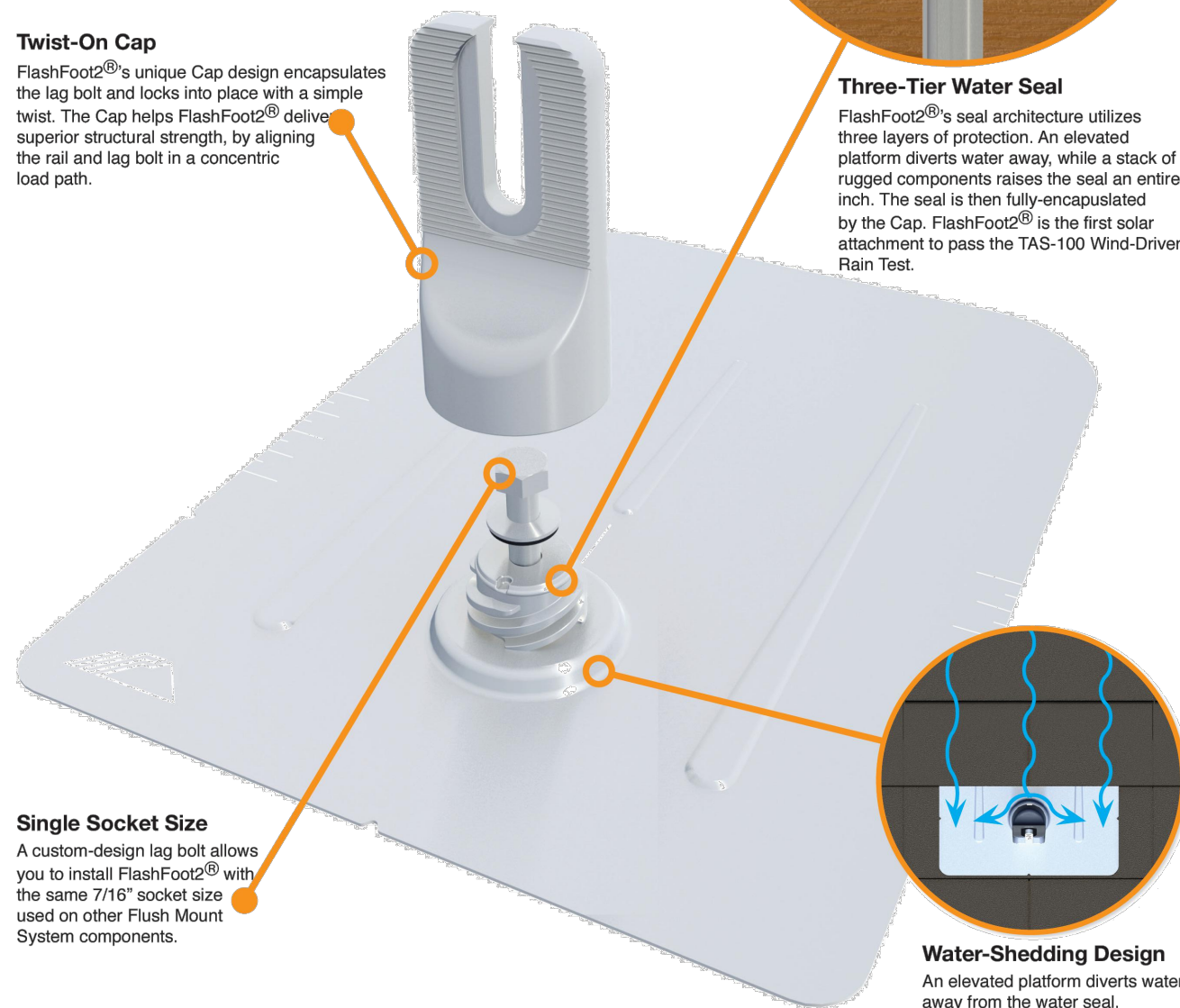
Twist-On Cap

FlashFoot2®'s unique Cap design encapsulates the lag bolt and locks into place with a simple twist. The Cap helps FlashFoot2® deliver superior structural strength, by aligning the rail and lag bolt in a concentric load path.



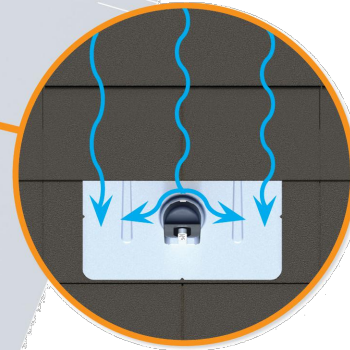
Three-Tier Water Seal

FlashFoot2®'s seal architecture utilizes three layers of protection. An elevated platform diverts water away, while a stack of rugged components raises the seal an entire inch. The seal is then fully-encapsulated by the Cap. FlashFoot2® is the first solar attachment to pass the TAS-100 Wind-Driven Rain Test.



Single Socket Size

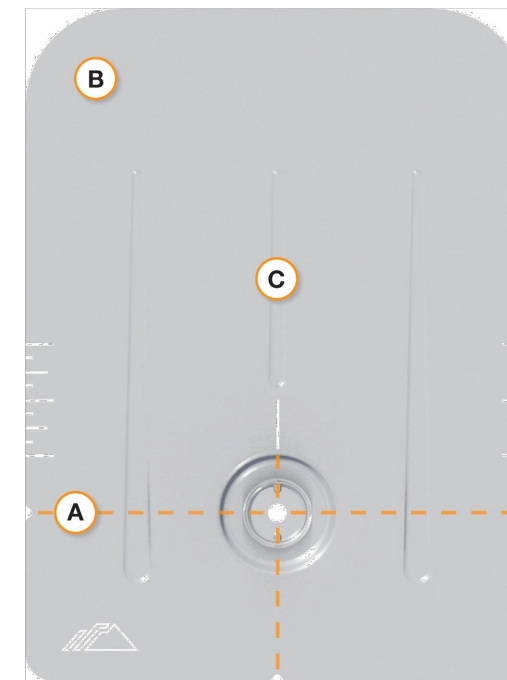
A custom-design lag bolt allows you to install FlashFoot2® with the same 7/16" socket size used on other Flush Mount System components.



Water-Shedding Design

An elevated platform diverts water away from the water seal.

Installation Features



A Alignment Markers

Quickly align the flashing with chalk lines to find pilot holes.

B Rounded Corners

Makes it easier to handle and insert under the roof shingles.

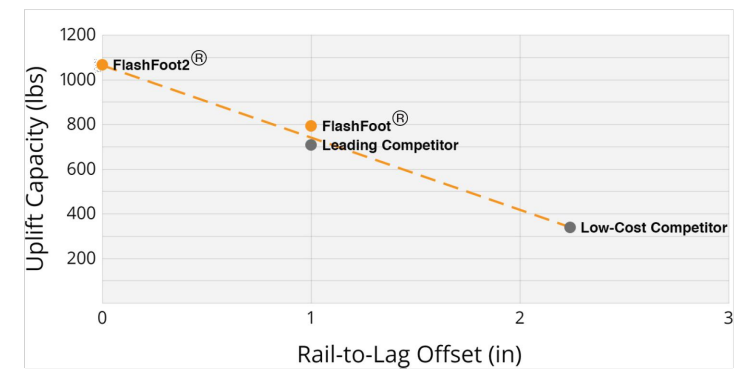
C Reinforcement Ribs

Help to stiffen the flashing and prevent any bending or crinkling during installation.

Benefits of Concentric Loading

Traditional solar attachments have a horizontal offset between the rail and lag bolt, which introduces leverage on the lag bolt and decreases uplift capacity.

FlashFoot2® is the only product to align the rail and lag bolt. This concentric loading design results in a stronger attachment for the system.



Testing & Certification

Structural Certification

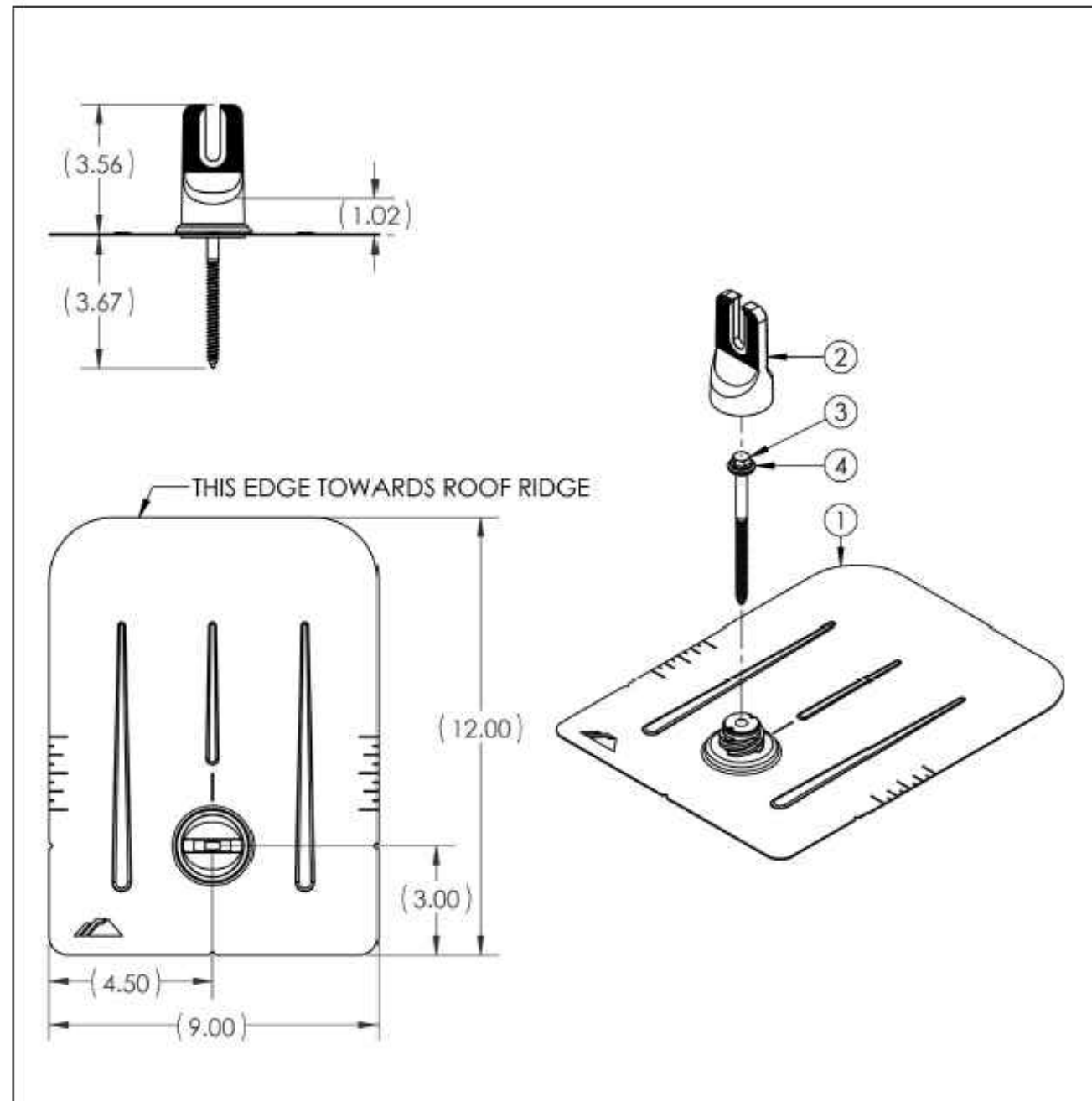
Designed and Certified for Compliance with the International Building Code & ASCE/SEI-7.

Water Seal Ratings

Water Sealing Tested to UL 441 Section 27 "Rain Test" and TAS 100-95 "Wind Driven Rain Test" by Intertek. Ratings applicable for composition shingle roofs having slopes between 2:12 and 12:12.

UL 2703

Conforms to UL 2703 Mechanical and Bonding Requirements. See Flush Mount Install Manual for full ratings.



NO.	DESCRIPTION
1	ASSY, FLASHING, MILL OR BLACK
2	ASSY, CAP, MILL OR BLACK
3	BOLT LAG 5/16 X 4.75'
4	WASHER, EPDM BACKED

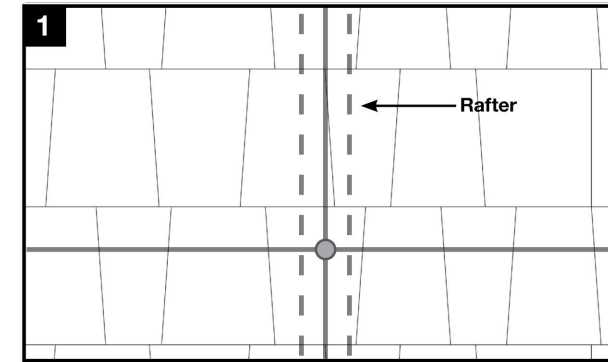
KIT, FLASHFOOT2®

SHEET A DO NOT SCALE DRAWING

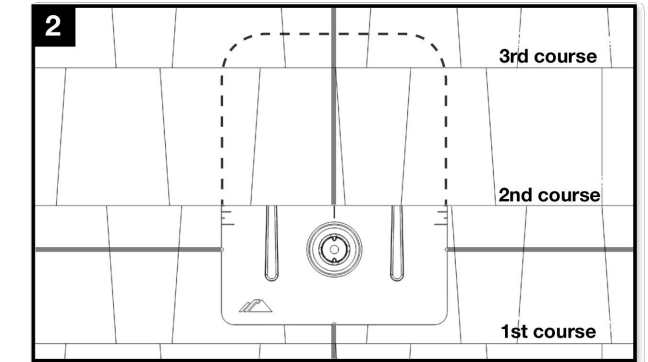
SCALE: 1/4" = 1" WEIGHT: 1.89 lbs SHEET 1 OF 1

Installation

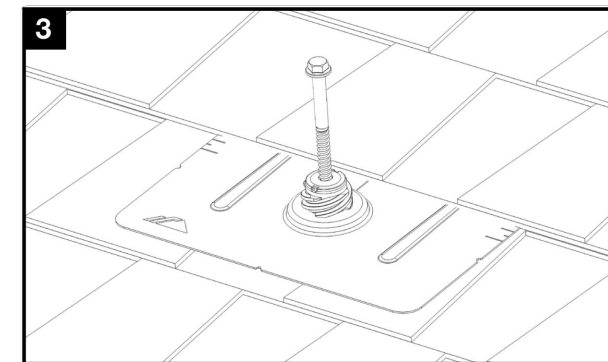
Tools Required: tape measure, chalk line, stud finder, roofing bar, caulking gun, driver with 1/4" bit and 7/16" hex socket.



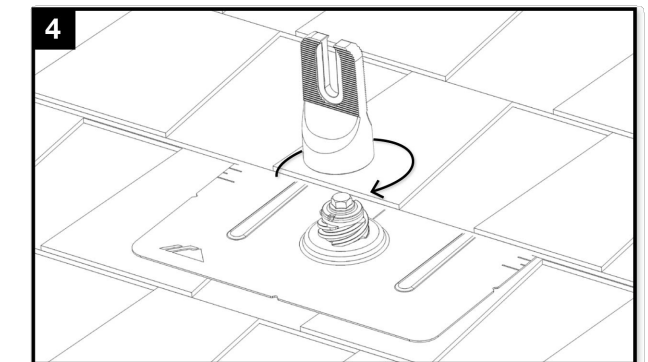
Locate rafters and snap vertical and horizontal lines to mark flashing locations. Drill 1/4" pilot holes, then fill with roofing manufacturer's approved sealant.



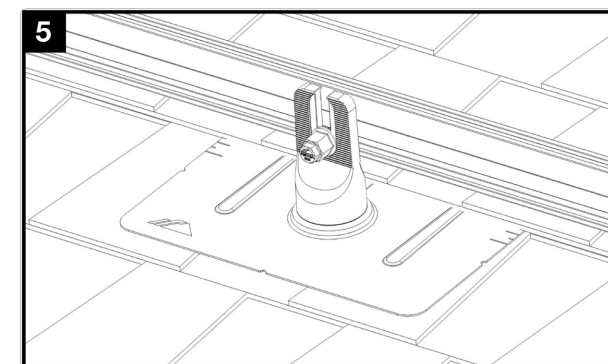
Slide flashing, between 1st and 2nd course, so the top is at least 3/4" above the edge of the 3rd course and the bottom is above the edge of the 1st course.



Line up pilot hole with flashing hole and insert lag bolt with bonded washer through flashing. Tighten lag bolt until fully seated.



Place Cap onto flashing in desired orientation for E/W or N/S rails and rotate 180 degrees. FlashFoot 2 is now installed and ready for IronRidge XR Rails.



Attach rails to either side of the open slot using bonding hardware. Level rail at desired height, then torque to 250 in-lbs (21 ft-lbs).

Structural Certification
Designed and Certified for Compliance with the International Building Code & ASCE/SEI-7.

Water Seal Ratings
Water Sealing Tested to UL 441 Section 27 "Rain Test" and TAS 100-95 "Wind Driven Rain Test" by Intertek. Ratings applicable for composition shingle roofs having slopes between 2:12 and 12:12. Tested and evaluated without sealant. Any roofing manufacturer approved sealant is allowed.

UL 2703
Conforms to UL 2703 Mechanical and Bonding Requirements. See IronRidge Flush Mount Installation Manual for full ratings.

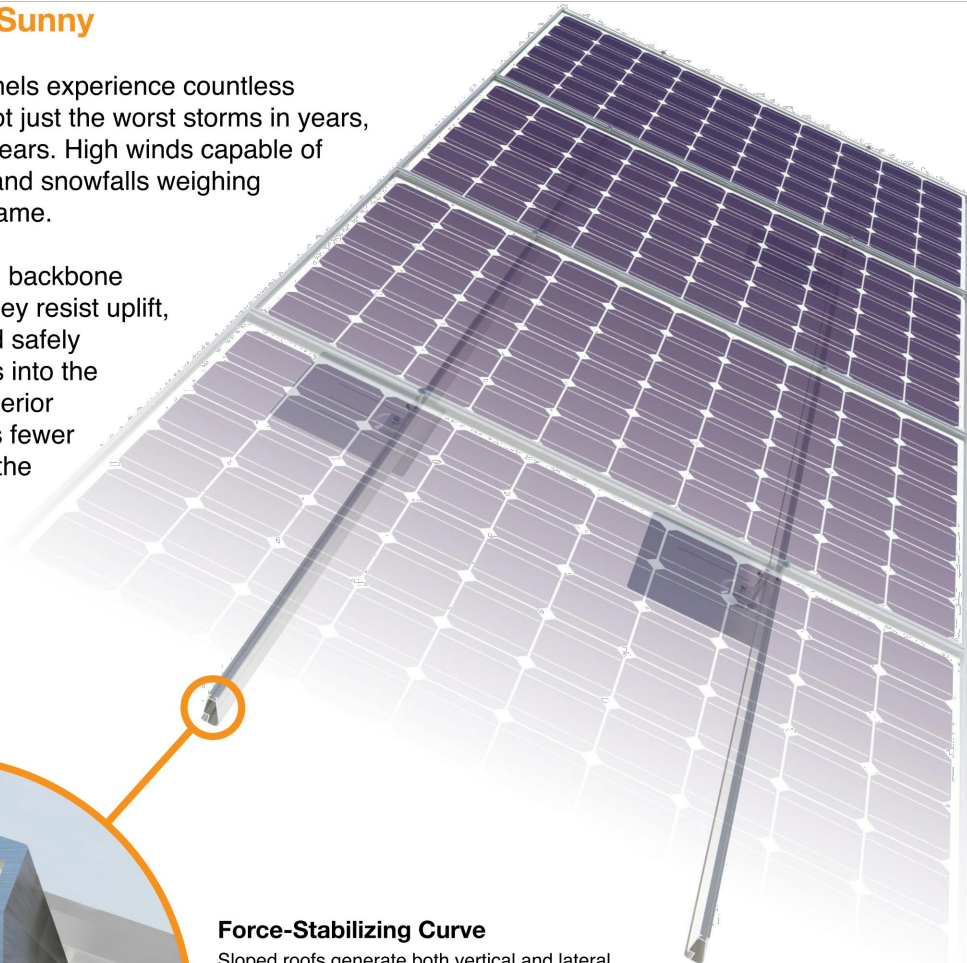


XR Rail® Family

Solar Is Not Always Sunny

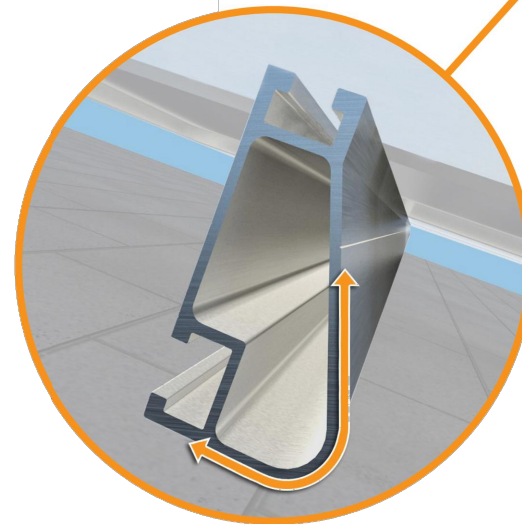
Over their lifetime, solar panels experience countless extreme weather events. Not just the worst storms in years, but the worst storms in 40 years. High winds capable of ripping panels from a roof, and snowfalls weighing enough to buckle a panel frame.

XR Rails® are the structural backbone preventing these results. They resist uplift, protect against buckling and safely and efficiently transfer loads into the building structure. Their superior spanning capability requires fewer roof attachments, reducing the number of roof penetrations and the amount of installation time.



Force-Stabilizing Curve

Sloped roofs generate both vertical and lateral forces on mounting rails which can cause them to bend and twist. The curved shape of XR Rails® is specially designed to increase strength in both directions while resisting the twisting. This unique feature ensures greater security during extreme weather and a longer system lifetime.



Compatible with Flat & Pitched Roofs



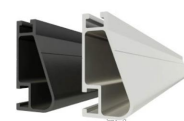
XR Rails® are compatible with FlashFoot® and other pitched roof attachments.



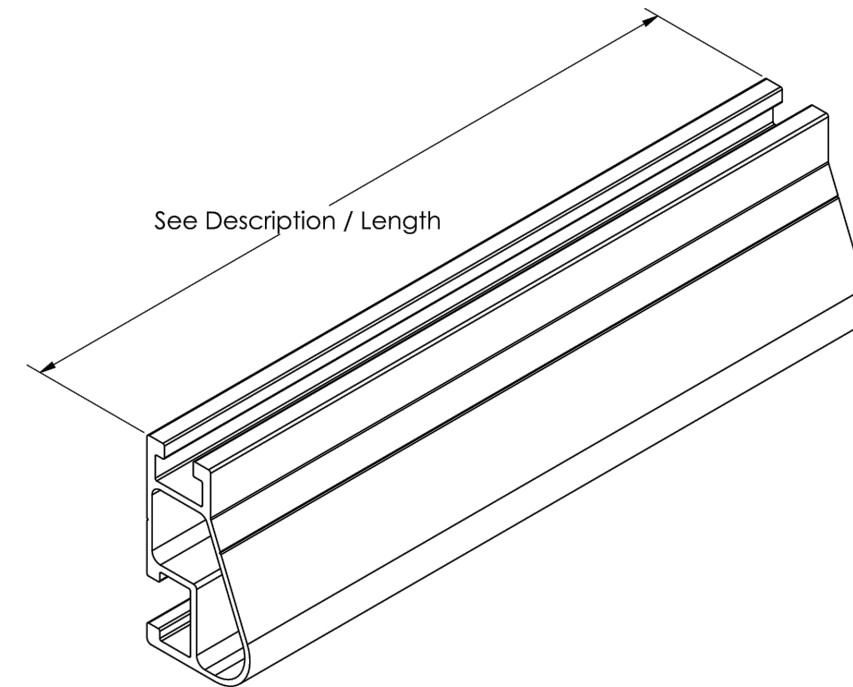
IronRidge® offers a range of tilt leg options for flat roof mounting applications.

Corrosion-Resistant Materials

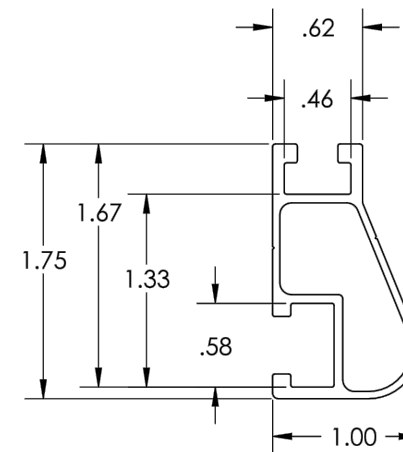
All XR Rails® are made of 6000-series aluminum alloy, then protected with an anodized finish. Anodizing prevents surface and structural corrosion, while also providing a more attractive appearance.



XR10® Rail



See Description / Length



Rail Section Properties	
Property	Value
Total Cross-Sectional Area	0.363 in ²
Section Modulus (X-axis)	0.136 in ³
Moment of Inertia (X-axis)	0.124 in ⁴
Moment of Inertia (Y-axis)	0.032 in ⁴
Torsional Constant	0.076 in ³
Polar Moment of Inertia	0.033 in ⁴

Clear Part Number	Black Part Number	Description / Length	Material	Weight
XR-10-132A	XR-10-132B	XR10, Rail 132" (11 Feet)	6000-Series Aluminum	4.67 lbs.
XR-10-168A	XR-10-168B	XR10, Rail 168" (14 Feet)		5.95 lbs.
XR-10-204A	XR-10-204B	XR10, Rail 204" (17 Feet)		7.22 lbs.



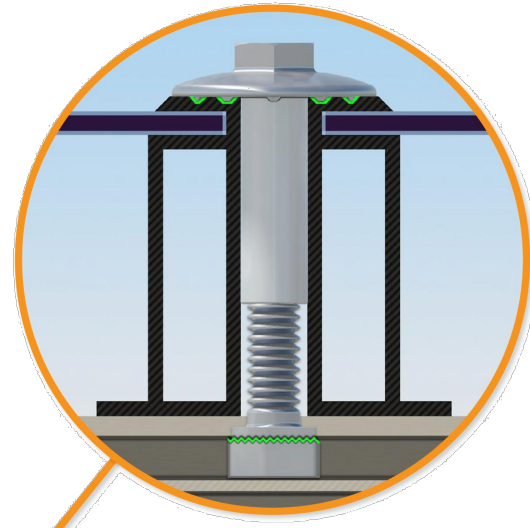
UFO® Family of Components

Simplified Grounding for Every Application

The UFO® family of components eliminates the need for separate grounding hardware by bonding solar modules directly to IronRidge® XR Rails®. All system types that feature the UFO® family—Flush Mount®, Tilt Mount® and Ground Mount®—are fully listed to the UL 2703 standard.

UFO® hardware forms secure electrical bonds with both the module and the rail, resulting in many parallel grounding paths throughout the system. This leads to safer and more reliable installations.

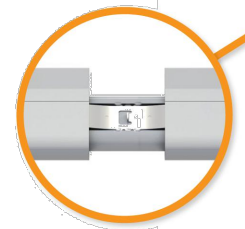
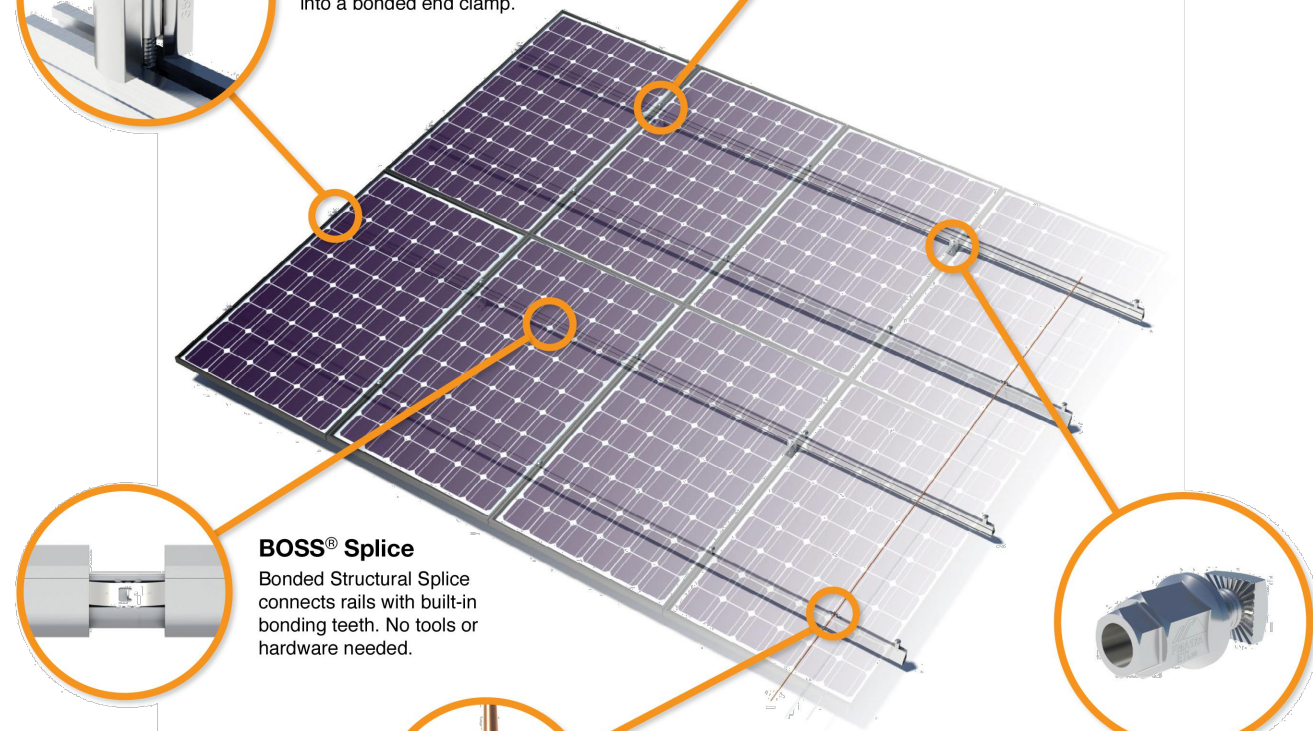
Only for installation and use with IronRidge products in accord with written instructions. See IronRidge.com/UFO



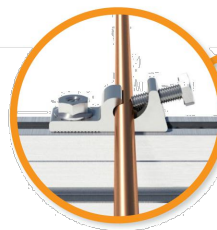
Universal Fastening Object (UFO®)
The UFO® securely bonds solar modules to XR Rails®. It comes assembled and lubricated, and can fit a wide range of module heights.



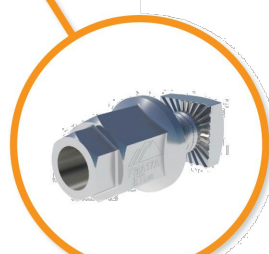
Stopper Sleeve
The Stopper Sleeve snaps onto the UFO®, converting it into a bonded end clamp.



BOSS® Splice
Bonded Structural Splice connects rails with built-in bonding teeth. No tools or hardware needed.

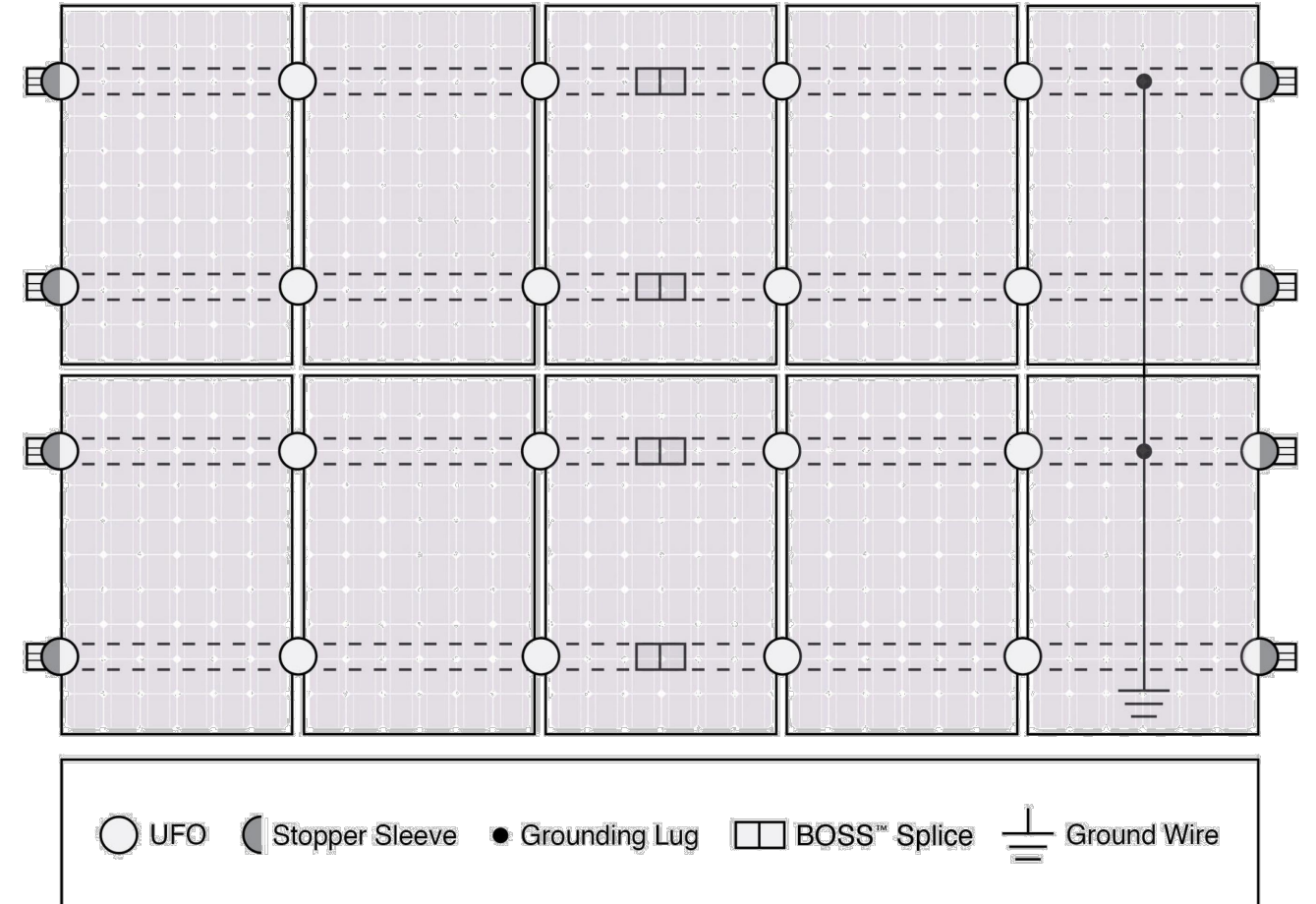


Grounding Lug
A single Grounding Lug connects an entire row of PV modules to the grounding conductor.



Bonded Attachments
The bonding bolt attaches and bonds the L-foot® to the rail. It is installed with the same socket as the rest of the system.

System Diagram



⚠ Approved Enphase microinverters can provide equipment grounding of IronRidge systems, eliminating the need for grounding lugs and field installed equipment ground conductors (EGC). A minimum of two microinverters mounted to the same rail and connected to the same Engage cable is required. Refer to installation manuals for additional details.

UL Certification

The IronRidge® Flush Mount®, Tilt Mount®, and Ground Mount Systems have been listed to UL 2703 by Intertek Group plc.

UL 2703 is the standard for evaluating solar mounting systems. It ensures these devices will maintain strong electrical and mechanical connections over an extended period of time in extreme outdoor environments.

Go to IronRidge.com/UFO

Cross-System Compatibility			
Feature	Flush Mount	Tilt Mount	Ground Mount
XR Rails®	✓	✓	XR100 & XR1000
UFO®/Stopper	✓	✓	✓
BOSS® Splice	✓	✓	N/A
Grounding Lugs	1 per Row	1 per Row	1 per Array
Microinverters & Power Optimizers	Compatible with most MLPE manufacturers. Refer to system installation manual.		
Fire Rating	Class A	Class A	N/A
Modules	Tested or Evaluated with over 400 Framed Modules Refer to installation manuals for a detailed list.		

3. SECURE LUGS

Grounding Lugs

Only one Grounding Lug (Rail or Module) required per continuous subarray, regardless of subarray size (Unless frameless modules are used, see [Page 20](#)).

- Grounding Lugs are intended to for use with one solid or stranded copper wire, conductor size 10-4 AWG.

Rail Grounding Lug

Insert T-bolt in Top Rail slot and torque Hex Nut to **80 in-lbs**. Install a minimum 10 AWG solid copper or stranded grounding wire. Torque terminal screw to **20 in-lbs**.

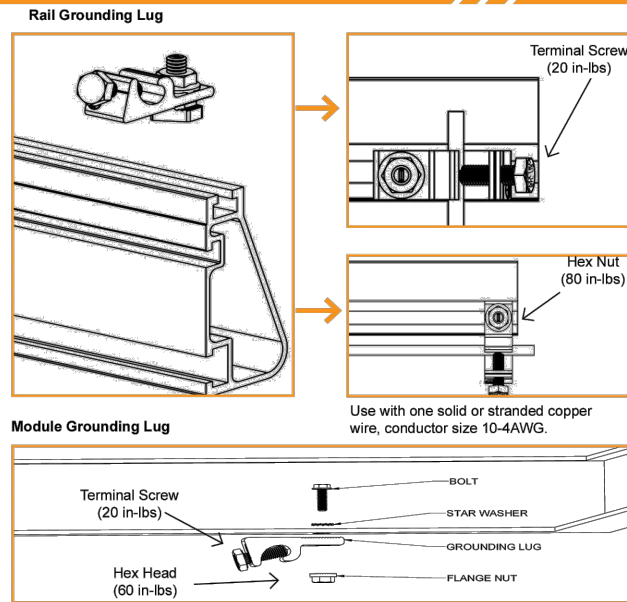
- Module Grounding Lugs can be installed anywhere along the Rail and in either orientation shown.

Module Grounding Lug

Insert Bolt through Manufacturer approved grounding location and torque Hex nut to **60 in-lbs**. One Module Grounding Lug may be installed to one module per row. Install a minimum 10 AWG solid copper or stranded grounding wire. Torque terminal screw to **20 in-lbs**.

- If using Enphase microinverters or Sunpower AC modules, Grounding Lugs may not be needed. See [Page 19](#) for more info.

- Refer to module manufacturer for mounting location and instructions.

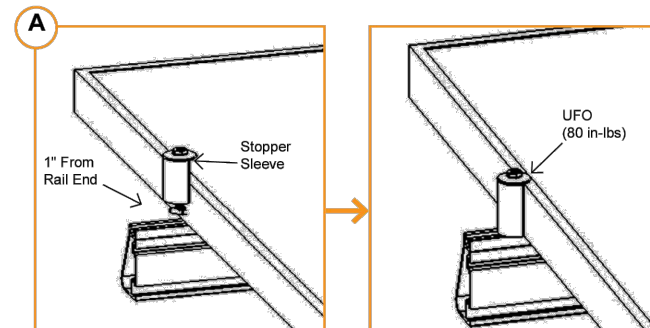


4. SECURE MODULES

A. SECURE FIRST END

Place first module in position on rails, a minimum of 1" from rail ends. Snap Stopper Sleeves onto UFO. Fasten module to rail using the UFO, ensuring that the UFO is hooked over the top of the module. Torque to **80 in-lbs**.

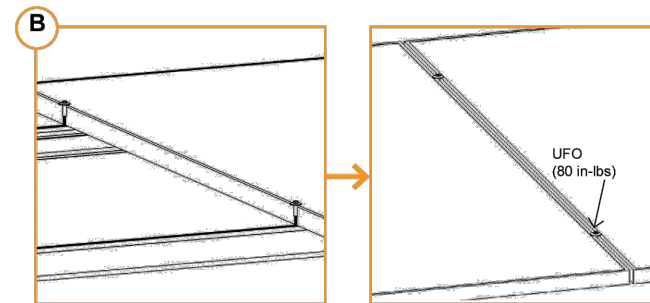
- Ensure rails are square before placing modules.
- Hold Stopper Sleeves on end while torquing to prevent rotation.
- If using CAMO instead of UFO + Stopper Sleeve, refer to [Page 19](#) for CAMO installation procedure.
- UFO can be installed on modules 30 to 46mm.



B. SECURE NEXT MODULES

Place UFO into each rail, placing them flush against first module. Slide second module against UFO. Torque to **80 in-lbs**. Repeat for each following module.

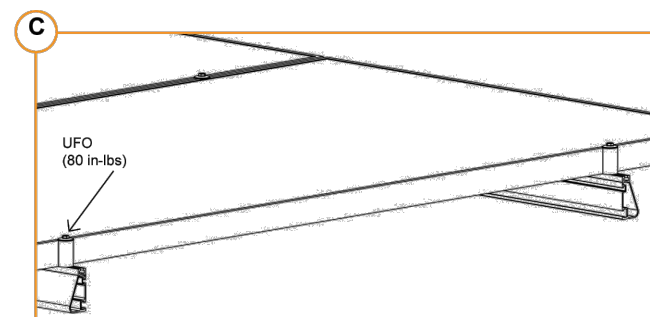
- When reinstalling UFO, move modules a minimum of 1/16" so UFOs are in contact with a new section of module frame.
- When UFOs are loosened and re-tightened, ensure UFO T-bolt bottoms out in rail channel before re-torquing UFO to achieve full engagement between T-bolt and rail.
- If using Wire Clips, refer to [Page 18](#).



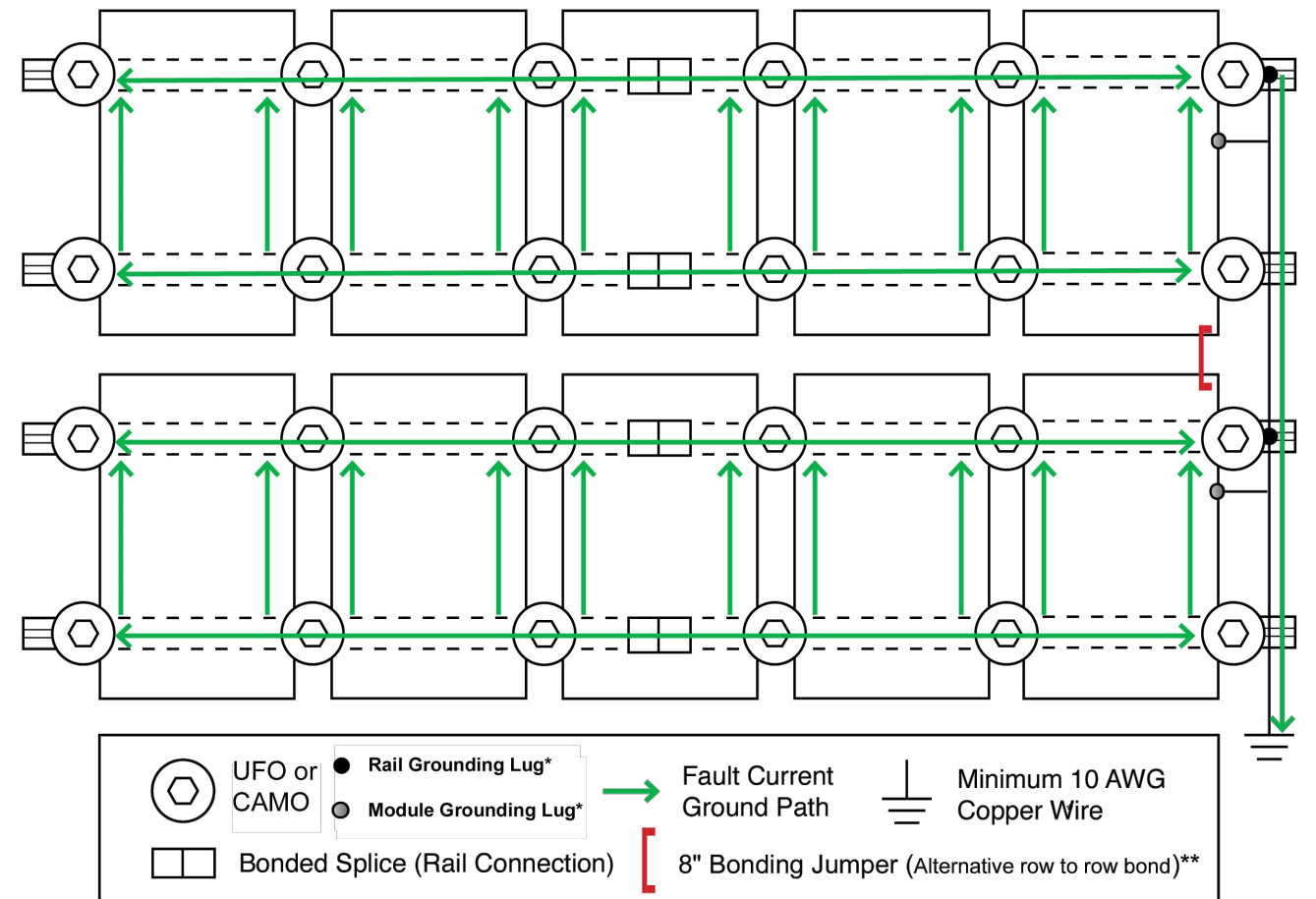
C. SECURE LAST END

Place last module in position on rails, a minimum of 1" from rail ends. Snap Stopper Sleeves onto UFO. Secure UFO Clamps on rails, ensuring they are hooked over top of module. Torque to **80 in-lbs**.

- Hold Stopper Sleeves on end while torquing to prevent rotation.
- Repeat all steps for each following row of modules, leaving a minimum 3/8" gap between rows
- If using CAMO instead of UFO + Stopper Sleeve, refer to [Page 6](#)



ELECTRICAL DIAGRAM



*One Module Grounding Lug or Rail Grounding lug is required per row of a system.

** The use of the 8" Bonding Jumper eliminates the need for row to row bonding. A minimum of one grounding lug per continuous array is required for earth ground.

Grounding Lugs and wire are not required in systems using certain Enphase microinverters or certain Sunpower modules. Equipment grounding is achieved with the Engage cable for Enphase or the AC module cable system for Sunpower via their integrated EGC.

MODULE COMPATIBILITY

The Flush Mount System may be used to ground and/or mount a PV module complying with UL 2703 only when the specific module has been evaluated for grounding and/or mounting in compliance with the included instructions. Unless otherwise noted, "xxx" refers to the module power rating and both black and silver frames are included in the certification.

FRAMED MODULE LIST

MAKE	MODELS
Adani	Adani modules with 35 and 40mm frames ASX-Y-ZZ-xxx Where "X" can be B, M or P, "Y" can be 6, 7 or M10 and "ZZ" can be blank, 144, PERC, B-PERC, or AB-PERC
AIONRISE	AIONRISE modules with 35 and 40mm frames AIONyyG1-xxx Where "yy" can be 60 or 72
Amerisolar	Amerisolar modules with 35 and 40 mm frames AS-bYxxxZ Where "b" can be 5 or 6; "Y" can be M, P, M27, P27, M30, or P30; and "Z" can be blank, W or WB
Aptos Solar	Aptos modules with 35 and 40 mm frames DNA-yy-zzaa-xxx Where "yy" can be 120 or 144; "zz" can be MF or BF; and "aa" can be 23 or 26
Astronergy Solar	Astronergy modules with 30, 35 and 40 mm frames aaSMbbyC/zz-xxx Where "aa" can be CH or A; "bb" can be 60, 66, or 72; "yy" can be blank, 10 or 12; "C" can M, P, M(BL), M-HC, M(BL)-HC, P-HC, M(DG), or M(DGT); and "zz" can be blank, HV, F-B, or F-BH
ASUN	ASUN modules with 35 and 40 mm frames ASUN-xxx-YYZZ-aa Where "YY" can be 60 or 72; "ZZ" can be M, or MH5; and "aa" can be blank or BB
Auxin	Auxin modules with 40 mm frames AXN6y6zAxxxB Where "y" can be M or P; "z" can be 08, 09, 10, 11, or 12; and "A" can be F, M or T; and "B" can be blank, A, B or C
Axitec	Axitec Modules with 30, 35 and 40 mm frames AC-xxxY/aaZZb Where "Y" can be M, P, MB or MH; "aa" can be blank, 125- or 156-; "ZZ" can be 54, 60, 72, 108, 120, or 144; "b" can be S, X, V, VB, XV, or MX
Bluesun Solar	Bluesun modules with 30 and 35mm frames BSMxxxY-AAA Where "Y" can be M or M10; and "AAA" can be 54HPH, 60HPH or 72HBD
Boviet	Boviet modules with 35 and 40mm frames BVMZZaaYY-xxxBcc Where "ZZ" can be 66 or 76; "aa" can be 9, 10 or 12; "YY" is M or P; and "B" can be blank, L or S; and "cc" can be blank, H, H-BF, H-BF-DG, H-HC, H-HC-BF, H-HC-BF-DG, HC-BF or HC-BF-DG
BYD	BYD modules with 35 mm frames BYDxxxAY-ZZ Where "A" can be M6, P6, MH or PH; "Y" can be C or K; and "ZZ" can be 30 or 36
Canadian Solar	Canadian Solar modules with 30, 32, 35 and 40 mm frames CSbY-xxxZ Where "b" can be 1, 3, 6 or 7 "Y" can be H, K, L, N, P, R, U, V, W, X or Y; and "Z" can be M, P, MS, PX, M-SD, P-AG, P-SD, MB-AG, PB-AG, MS-AG, MS-HL, or MS-SD
CertainTeed	CertainTeed modules with 35 and 40 frames CTxxxYZZ-AA Where "Y" can be M, P, or HC; "ZZ" can be 00, 01, 10, or 11; and "AA" can be 01, 02, 03, 04 or 06

MODULE COMPATIBILITY

CSUN	Csun modules with 35 and 40 mm frames YYxxx-zzAbb Where "YY" is CSUN or SST; "zz" is blank, 60, or 72; and "A" is blank, P, M or MM; "bb" is blank, BB, 5BB, BW, or ROOF
Dehui	Dehui modules with 30, 35 and 40mm frames DH-MYYYY-xxx Where "YYY" can be 760, 772, 860, 872; and "Z" can be B, F or W
Ecosolargy	Ecosolargy modules with 35 and 40 mm frames ECOxxxYzza-bbD Where "Y" can be A, H, S, or T; "zz" can be 125 or 156; "A" can be M or P; "bb" can be 60 or 72; and "D" can be blank or B
ET Solar	ET Solar modules with 30, 35 and 40 mm frames ET-YZZZxxxAA Where "Y" can be P, L, or M; "ZZZ" can be 660, 660BH, 672, 672BH, 754BH, 766BH, 772BH; and "AA" can be GL, TB, TW, WB, WW, BB, WBG, WWG, WBAC, WBCO, WWCO, WWBCO or BBAC
Flex	Flex modules with 35 and 40 mm frames FXS-xxxYY-ZZ; Where "YY" can be BB or BC; and "ZZ" can be MAA1B, MAA1W, MAB1W, SAA1B, SAA1W, SAC1B, SAC1W, SAD1W, SBA1B, SBA1W, SBC1B, or SBC1W
Freedom Forever	Freedom Forever modules with 35mm frames FF-MP-BBB-xxx
GCL	GCL modules with 35 mm and 40 mm frames GCL-ab/YY xxx Where "a" can be M or P; "b" can be 3 or 6; and "YY" can be 60, 72, 72H, or 72DH
GigaWatt Solar	Gigawatt modules with 40 mm frames GWxxxYY Where "YY" can be either PB or MB
Hansol	Hansol modules with 35 and 40 frames HSxxxYY-zz Where "YY" can be PB, PD, PE, TB, TD, UB, UD, or UE; and "zz" can be AH2, AN1, AN3, AN4, HH2, HV1, or JH2
Hanwa Solar	Hanwa Solar modules with 40 mm frames HSLaaP6-YY-1-xxxZ Where "aa" can be either 60 or 72; "YY" can be PA or PB; and "Z" can be blank or B
Hanwa Q CELLS	Hanwa Q CELLS Modules with 32, 35, 40mm frames aaYY-ZZ-xxx where "aa" can be Q. or B.; "YY" can be PLUS, PRO, PEAK, LINE PRO, LINE PLUS, PLUS DUO or PEAK DUO; and "ZZ" can be G3, G3.1, G4, G4.1, L-G2, L-G2.3, L-G3, L-G3.1, L-G3y, L-G4, L-G4.2, L-G4y, LG4.2/TAA, BFR-G3, BLK-G3, BFR-G3.1, BLK-G3.1, BFR-G4, BFR-G4.1, BFR G4.3, BLK-G4.1, G4/SC, G4.1/SC, G4.1/TAA, G4.1/MAX, BFR G4.1/TAA, BFR G4.1/MAX, BLK G4.1/TAA, BLK G4.1/SC, EC-G4.4, G5, G5/SC, G5/TS, BLK-G5, BLK-G5/SC, BLK-G5/TS, L-G5, L-G5.1, L-G5.2, L-G5.2/H, L-G5.3, G6, G6/SC, G6/TS, G6+/TS, G6+, BLK-G6, L-G6, L-G6.1, L-G6.2, L-G6.3, G7, BLK-G6+, BLK-G6+/AC, BLK-G6+/HL, BLK-G6+/SC, BLK-G6/TS, BLK-G6+/TS, BLK-G7, G7.2, G8, BLK-G8, G8+, BLK-G8+ L-G7, L-G7.1, L-G7.2, L-G7.3, L-G8, L-G8.1, L-G8.2, L-G8.3, L-G8.3/BFF, L-G8.3/BFG, L-G8.3/BGT, ML-G9, BLK ML-G9, ML-G9+, BLK ML-G9+, BLK-G10+, BLK G10+/AC, ML-G10, BLK ML-G10, ML-G10+, BLK ML-G10+, ML-G10.a, BLK ML-G10.a, ML-G10.a+, BLK ML-G10.a+, XL-G9, XL-G9.2, XL-G9.3, XL-G9.3/BFG, XL-G10.2, XL-G10.3, XL-G10.c, XL-G10.d, XL-G10.d/BFG, XL-G10.3/BFG, XL-G11.2, XL-G11.3 or XL-G11.3/BFG
Heliene	Heliene modules with 35 and 40 mm frames YYZZxxxA Where "YY" can be 36, 60, 72, 96, 120 or 144; "ZZ" can be HC, M, P, or MBLK; and "A" can be blank, HomePV, Bifacial, M10 Bifacial or M10 SL-Bifacial
HT-SAAE	HT-SAAE modules with 35 and 40 mm frames HTyy-aaaZ-xxx Where "yy" can be 60, 66, 72 or 78, "aaa" can be 18, 156 or 166, "Z" can be M, P, M-C, P-C, M(S), M(VS), M(V), P(V), M(V)-C, P(V)-C, or X



28357 Industrial Blvd.
Hayward, CA 94545
1-800-227-9523
IronRidge.com

Attn: Corey Geiger, COO, IronRidge Inc.
Date: September 5th, 2019

Re: Structural Certification for the IronRidge FlashFoot2

This letter addresses the structural capacity of the IronRidge FlashFoot2 (FF2) component for use as a roof attachment for PV solar systems. FF2 is composed of an aluminum Cap, a 9" x 12" aluminum flashing, and an aluminum stabilizing base. The flashing component is attached to an underlying roof rafter using a 5/16" lag bolt. The assembly details are shown in Exhibit EX-0013.

The referenced uplift and lateral resistance of FF2 is based on structural tests conforming to ASTM D1761-12 "Standard Test Methods for Mechanical Fasteners in Wood." Testing was performed by installing a FF2 component on a sample roof deck composed of composition shingles covering 1/2" OSB Board over a 2x4 Douglas Fir rafter as shown in Figure 1. The moisture content and specific gravity of the rafter was measured and recorded per ASTM D2395-14 "Standard Test Methods for Density and Specific Gravity (Relative Gravity) of Wood and Wood-Based Materials." The moisture content for uplift test samples was between 8% and 15% with an average specific gravity of 0.54. The moisture content for lateral test samples was 13% with an average specific gravity of 0.54.

The critical failure mode observed for both the uplift and lateral tests was pullout of the 5/16" lag screw from the rafter. The average peak loads recorded at the critical failure point for the uplift and lateral tests were 3203 lbs. and 1237 lbs., respectively. **A safety factor of 3.0 was applied to certify the allowable uplift capacity to 1067 lbs. and the allowable lateral capacity to 412 lbs. for a substrate with a specific gravity of 0.54.**

For rafter wood species with specific gravity other than 0.54, the allowable uplift capacity shall be adjusted by a factor of $\left(\frac{G}{0.54}\right)^{\frac{3}{2}}$ per AP&PA National Design Specification Eq. (12.2-1), and the allowable lateral capacities shall be adjusted per the equation $1 - (0.5 - G)$ from APA Engineering Wood Construction Guide APA 2011 (G is wood specific gravity). For the common wood species, the allowable capacities are provided in Table 1.

Wood Species	NDS Assigned Specific Gravity ⁽²⁾	Allowable Uplift Capacity (lbs) ⁽³⁾	Allowable Lateral Capacity (lbs) ⁽³⁾
Douglas Fir, Larch	0.50	951	396
Douglas Fir, South	0.46	839	380
Hem, Fir	0.43	758	368
Hem, Fir (North)	0.46	839	380
Southern Pine	0.55	1097	416
Spruce, Pine, Fir	0.42	732	364

(1) The minimum size rafter is 2x4.

(2) The listed specific gravities are per 2015 NDS Table 12.3.3A.

(3) Values are based on securing lag bolt within center 1/3 of rafter width with a minimum 2.5" end distance, and loading directions as shown in Figure 1.

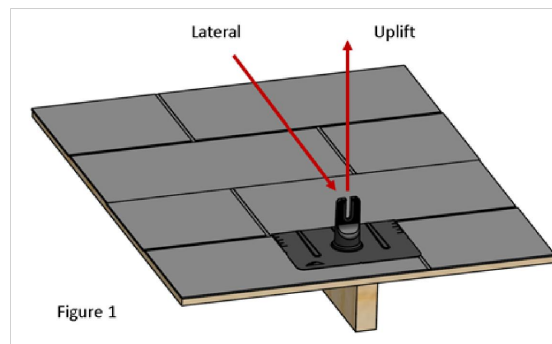


Figure 1



28357 Industrial Blvd.
Hayward, CA 94545
1-800-227-9523
IronRidge.com

Sincerely,



Gang Xuan, SE
Senior Structural Engineer

Date:
2019.09.05
10:51:36
-07'00'



Class A Fire Rating

Background

All roofing products are tested and classified for their ability to resist fire.

Recently, these fire resistance standards were expanded to include solar equipment as part of the roof system. Specifically, this requires the modules, mounting hardware and roof covering to be tested together as a system to ensure they achieve the same fire rating as the original roof covering.

These new requirements are being adopted throughout the country in 2016.

IronRidge Certification

IronRidge was the first company to receive a Class A Fire Rating—the highest possible rating—from Intertek Group plc., a Nationally Recognized Testing Laboratory.

IronRidge Flush Mount and Tilt Mount Systems were tested on sloped and flat roofs in accordance with the new UL 1703 & UL 2703 test standards. The testing evaluated the system's ability to resist flame spread, burning material and structural damage to the roof.

Refer to the table below to determine the requirements for achieving a Class A Fire Rating on your next project.

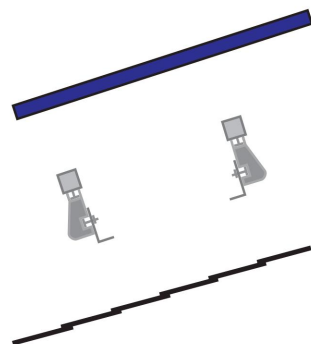
Fire Testing Process

Test Setup

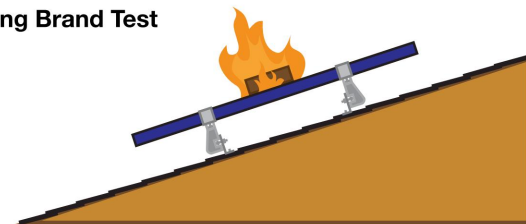
Solar Modules
Solar modules are given a Type classification based on their materials and construction.

Mounting System
Mounting is tested as part of a system that includes type-tested modules and fire-rated roof covering.

Roof Covering
Roof covering products are given a Fire Class Rating of A, B or C based on their tested fire resistance.

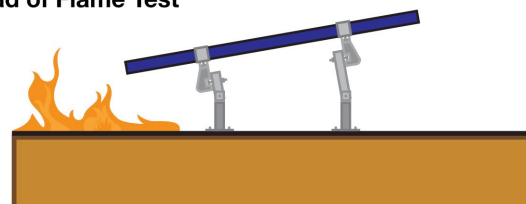


Burning Brand Test





A burning wooden block is placed on module as a fan blows at 12 mph. Flame cannot be seen on underside of roof within 90 minutes.

Spread of Flame Test



Flame at southern edge of roof is aimed up the roof as a fan blows at 12 mph. The flame cannot spread 6 feet or more in 10 minutes.

System	Roof Slope	Module	Fire Rating*
Flush Mount 	Any Slope	Type 1, 2, & 3	Class A
Tilt Mount 	≤ 9.5 Degrees	Type 1, 2, & 3	Class A

*Class A rated PV systems can be installed on Class A, B, and C roofs.



8431 Murphy Drive
Middleton, WI 53562 USA

Telephone: 608.836.4400
Facsimile: 608.831.9279
www.intertek.com

Test Verification of Conformity

In the basis of the tests undertaken, the sample(s) of the below product have been found to comply with the requirements of the referenced specifications at the time the tests were carried out.

Applicant Name & Address:

IronRidge, Inc.
28357 Industrial Blvd
Hayward, CA 94545
USA

Product Description: Ratings & Principle Characteristics:

Flush Mount System with XR Rails.
Fire Class Resistance Rating:
-Flush Mount (Symmetrical). Class A Fire Rated for Low Slope applications when using Type 1, 2, 3, 13, 19, 25 and 29 listed photovoltaic modules. Class A Fire Rated for Steep Slope applications with Type1, 2 and 3, listed photovoltaic modules. Tested with a 5" gap (distance between the bottom the module frame and the roof covering), per the standard this system can be installed at any gap allowed by the manufacturers installation instructions. No perimeter guarding is required. This rating is applicable with any IronRidge or 3'rd party roof anchor.

Models:

IronRidge Flush Mount with XR Rails

Brand Name:

IronRidge Flush Mount

Relevant Standards:

UL 2703 (Section 15.2 and 15.3) Standard for Safety Mounting Systems, Mounting Devices, Clamping/Retention Devices, and Ground Lugs for Use with Flat-Plate Photovoltaic Modules and Panels, First Edition dated Jan. 28, 2015 **Referencing** UL1703 Third Edition dated Nov. 18, 2014, (Section 31.2) Standard for Safety for Flat-Plate Photovoltaic Modules and Panels.

Verification Issuing Office:

Intertek Testing Services NA, Inc.
8431 Murphy Drive
Middleton, WI 53562

Date of Tests:

08/27/2014 to 03/17/2015

Test Report Number(s):

101769343MID-001r1, 101769343MID-001a, 101915978MID-001 & 101999492MID-001ar1-cr1, 104428358MID-001 EEV


Revision Summary


8/27/2020 Added type 13, 19, 25 and 29 to system, update address.

This verification is part of the full test report(s) and should be read in conjunction with them. This report does not automatically imply product certification.

Completed by: Chris Zimbrich
Title: Technician I, Fire Resistance

Reviewed by: Chad Naggs
Title: Technical Team Lead, Fire Resistance

Signature: 
Date: 08/27/2020

Signature: 
Date: 08/27/2020

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