



### MODULE AREA & WEIGHT CALCULATIONS

PV PANELS (COUNT, AREA, WEIGHT):

- (64x) SILFAB SOLAR INC. SIL-420 BG (73.4" x 40.5", 45.8 LB)

MICRO-INVERTERS (COUNT, WEIGHT):

- (64x) ENPHASE ENERGY INC. IQ8H-240-72-2-US [240V] (2.43 LB)

### BILL OF MATERIALS

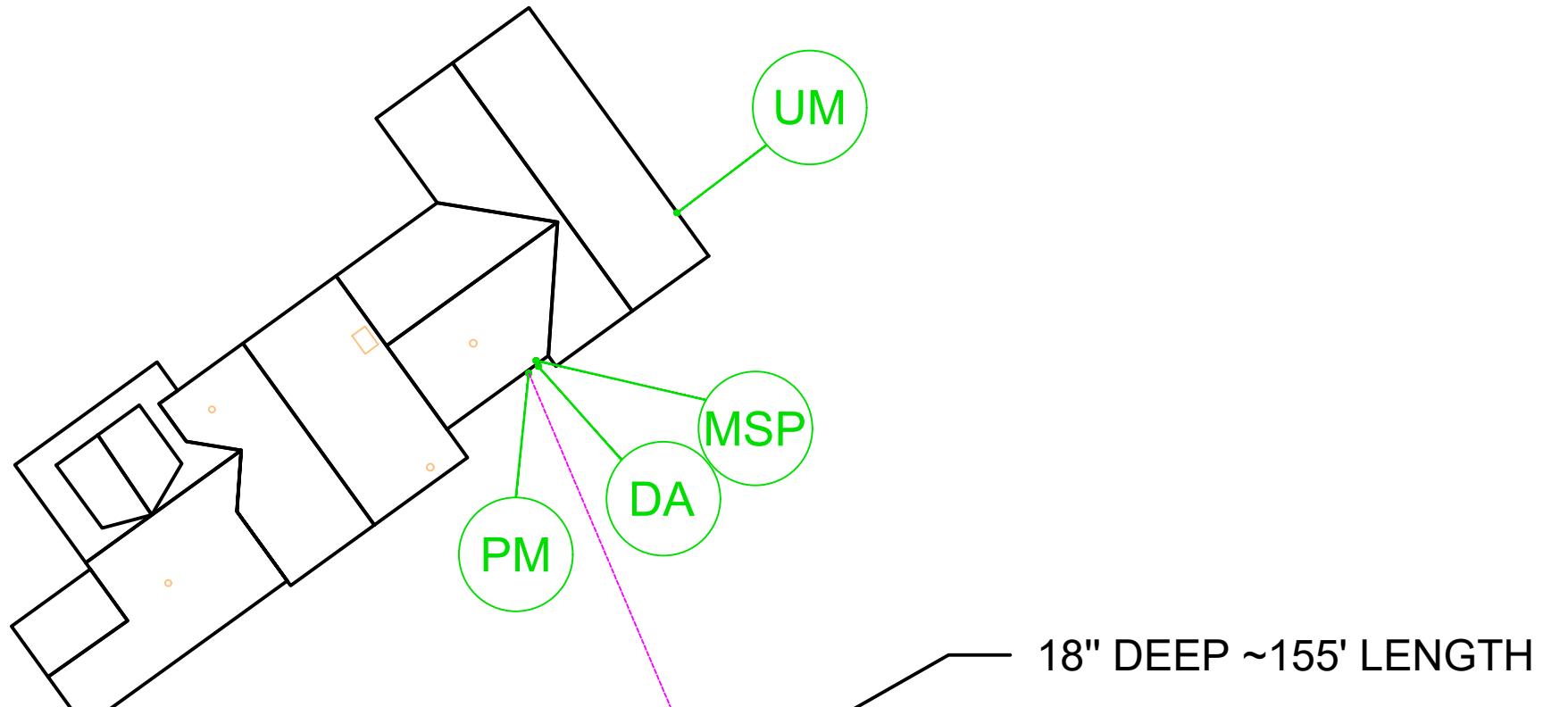
EQUIPMENT	QTY	DESCRIPTION
SOLAR PV MODULES	64	SILFAB SOLAR INC. SIL-420 BG
MICRO INVERTERS	64	ENPHASE ENERGY INC. IQ8H-240-72-2-US [240V]
JUNCTION BOX (AC)	2	JUNCTION BOX 600V, NEMA 3R, UL LISTED
LOAD CENTER (AC)	1	AC COMBINER PANEL
IO GATEWAY	1	ENPHASE IO GATEWAY
PRODUCTION METER	1	REVENUE GRADE METER
AC DISCONNECT	1	PV VISIBLE LOCKABLE LABLED DISCONNECT (200A FUSED 1PH 240VAC)
ATTACHMENTS	-	KRINNER G76X2100-4XM16 - REFER TO PAGE NO:(PV-11 TO PV-15)

### GROUND MOUNT DESCRIPTION

ARRAY	ARRAY TILT	AZIMUTH
#1	30°	180°

### DESIGN CRITERIA

- EXPOSURE CATEGORY = C
- WIND SPEED = 110 MPH
- SNOW LOAD = 40 PSF



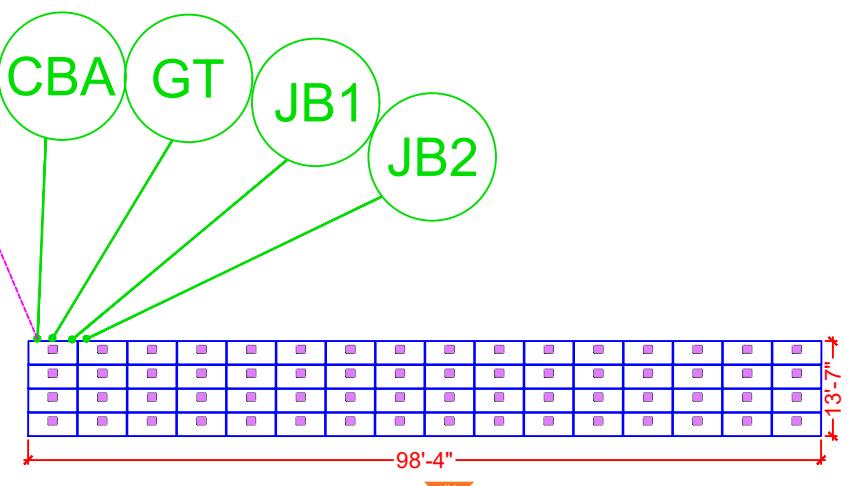
### LEGEND

	NEW PV MODULE
	FIRE SETBACK
	OPTIMIZER
	MICRO-INVERTER
	GROUND ATTACHMENT
	AC JUNCTION BOX (NEW)
	AC JUNCTION BOX (NEW)
	AC COMBINER PANEL (NEW)
	AC DISCONNECT FUSED (NEW)
	FRONT OF HOUSE
	RAFTER/TRUSS
	RAIL
	CONDUIT
	OBSTRUCTION
	MAIN SERVICE PANEL (EXISTING, 200A)
	REVENUE GRADE METER (NEW)
	IQ GATEWAY (NEW)
	UTILITY METER (EXISTING)

LAKE ROAD

## GROUND MOUNT PLAN WITH MODULES

SCALE: 11/256" = 1'-0"



### DAVID STERN

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14580, USA  
APN: 037.03-1-33.1 PHONE: +15857037612  
EMAIL: dstern@elliotstern.com

HOMEOWNER INFO

SHEET NAME  
GROUND  
MOUNT PLAN  
WITH MODULES

SHEET SIZE  
ANSI B  
11" X 17"

SHEET NUMBER  
PV-2

**ACES** II  
GEO THERMAL & SOLAR

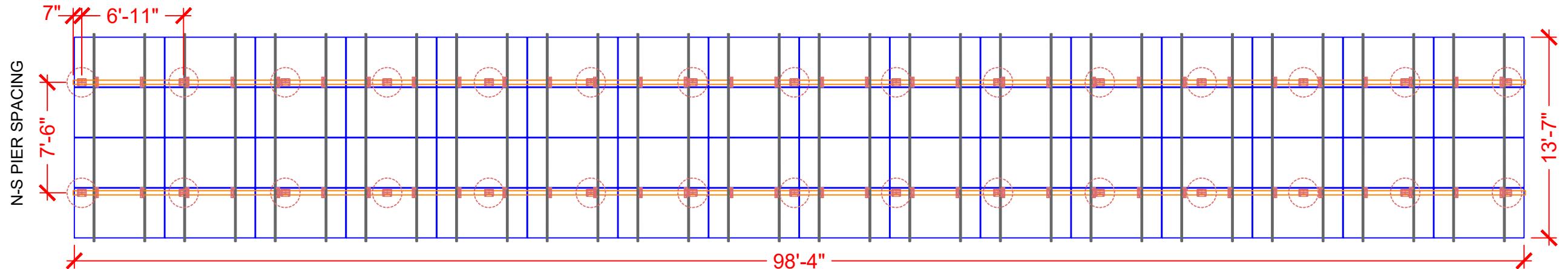
CONTRACTOR: ACES  
ADDRESS: 7288 RUSH LIMA RD,  
HONEOYE FALLS, NY 14472, USA  
PHONE: 1585357186  
EMAIL: Steve@aces-energy.com  
LICENSE #: N/A in New York State

REVISIONS

DESCRIPTION	DATE	REV

SIGNATURE & SEAL

CANTILEVER E-W PIER SPACING



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REVISIONS		
DESCRIPTION	DATE	REV

SIGNATURE & SEAL

HOMEOWNER INFO

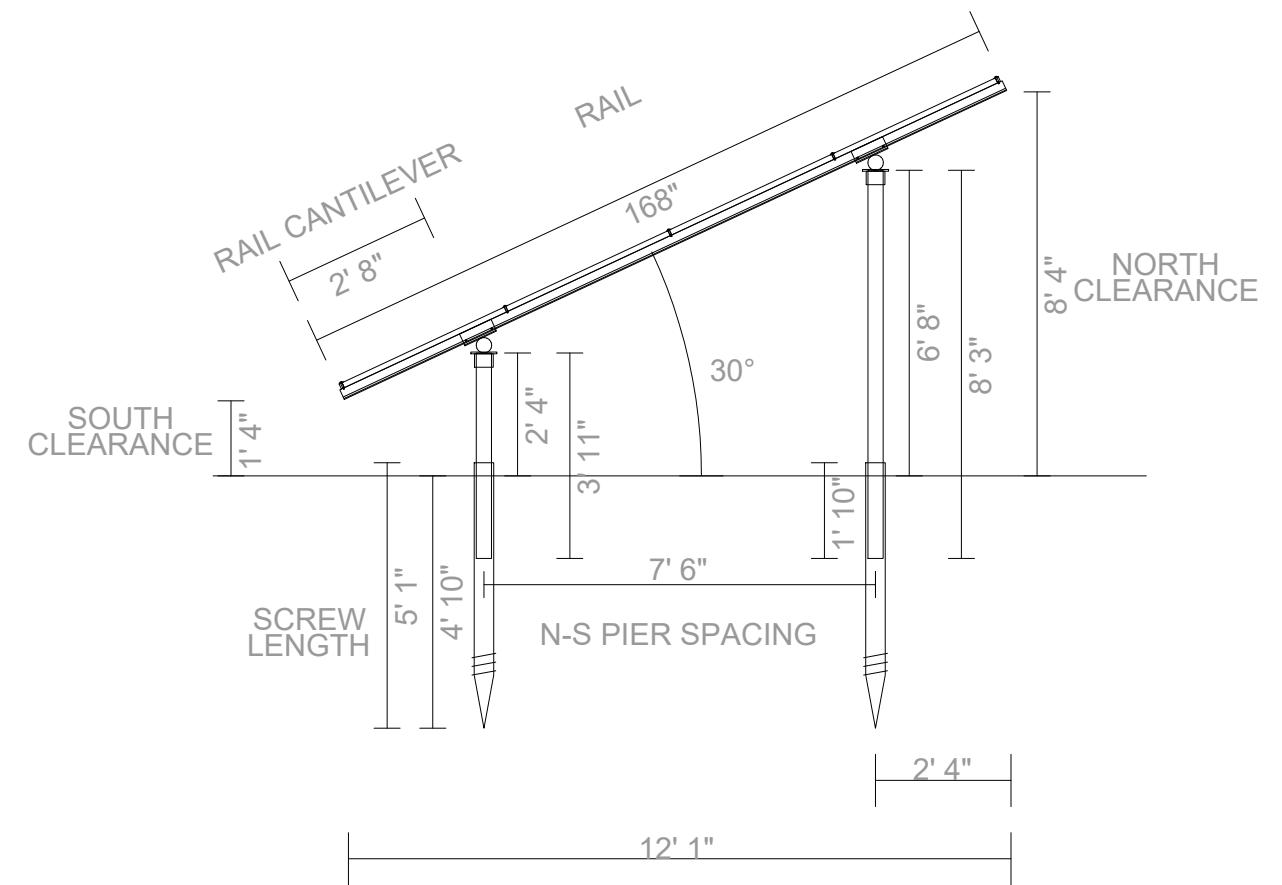
**DAVID STERN**  
1822 LAKE ROAD, WEBSTER, NY  
14580, USA  
APN: 037.03-1-33.1 PHONE: +15857037612  
EMAIL: distern@elliotstern.com

SHEET NAME  
**RACKING  
DETAIL**

SHEET SIZE  
**ANSI B  
11" X 17"**

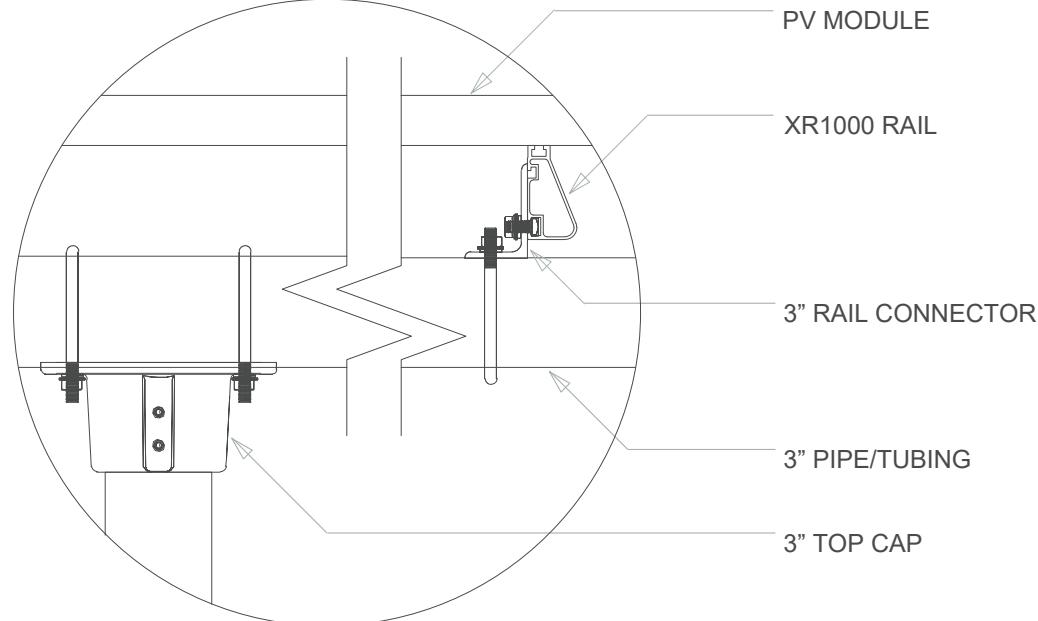
SHEET NUMBER  
**PV-3**

**RACKING DETAIL**  
SCALE: NTS

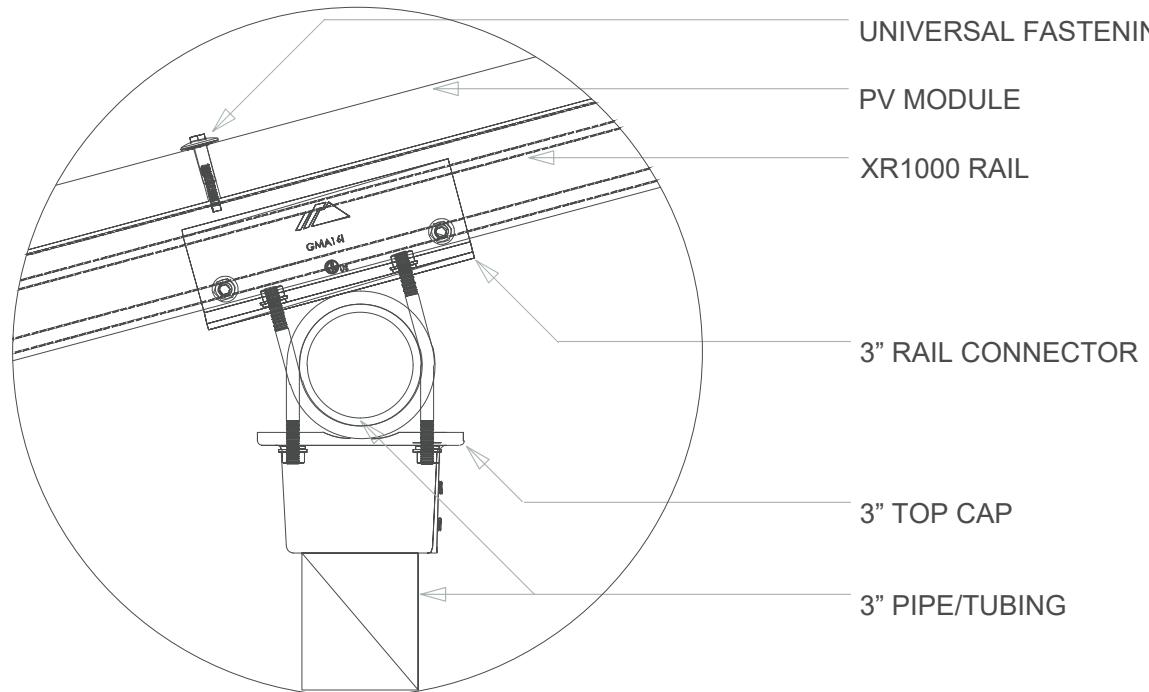


# XR1000 Rail

**ACES**  
GEO THERMAL & SOLAR

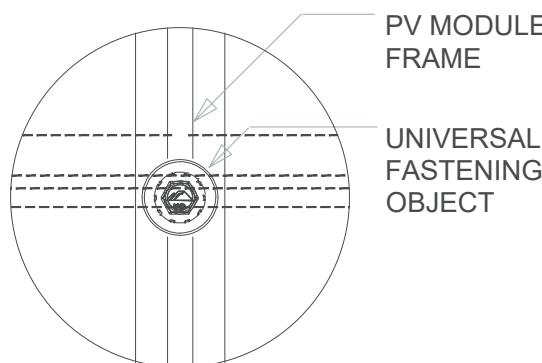


Front View

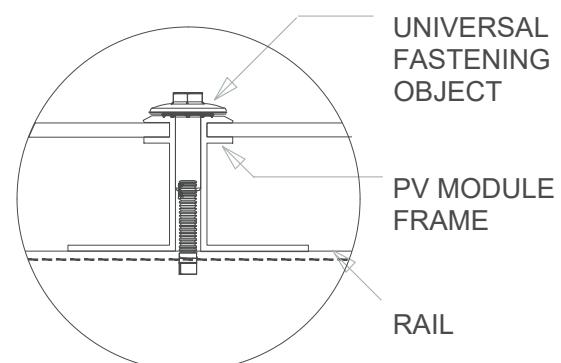


Side View

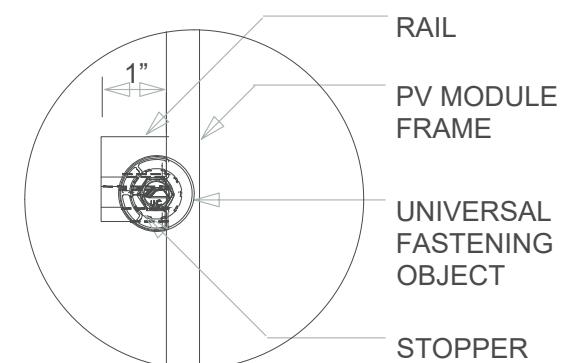
## Clamp Detail



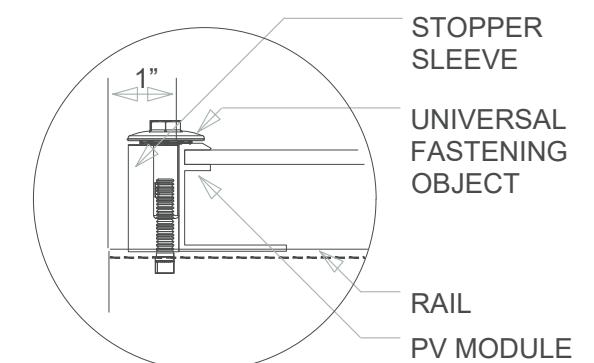
Mid Clamp, Plan



Mid Clamp, Front



End Clamp, Plan



End Clamp, Front

**ATTACHMENT DETAIL**  
SCALE: NTS

**DAVID STERN**

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REVISIONS		
DESCRIPTION	DATE	REV

**SIGNATURE & SEAL**

**HOMEOWNER INFO**

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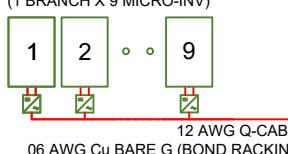
APN: 037-03-1-33.1 PHONE: +15857037612  
EMAIL: dstern@elliotstern.com

**SHEET NAME**  
**ATTACHMENT DETAIL**

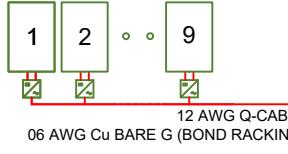
**SHEET SIZE**  
ANSI B  
11" X 17"

**SHEET NUMBER**  
**PV-3.1**

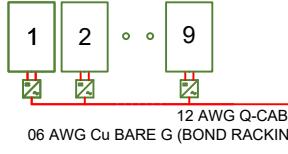
MOD: SILFAB SOLAR INC. SIL-420 BG  
INV: ENPHASE ENERGY INC.  
IQ8H-240-72-2-US [240V]  
(1 BRANCH X 9 MICRO-INV)



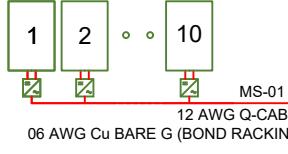
MOD: SILFAB SOLAR INC. SIL-420 BG  
INV: ENPHASE ENERGY INC.  
IQ8H-240-72-2-US [240V]  
(1 BRANCH X 9 MICRO-INV)



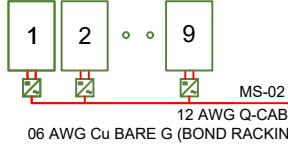
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INV: ENPHASE ENERGY INC.  
IQ8H-240-72-2-US [240V]  
(1 BRANCH X 9 MICRO-INV)



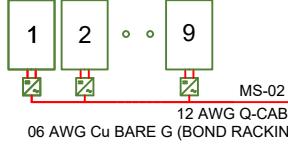
MOD: SILFAB SOLAR INC. SIL-420 BG  
INV: ENPHASE ENERGY INC.  
IQ8H-240-72-2-US [240V]  
(1 BRANCH X 10 MICRO-INV)



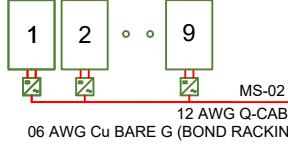
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INV: ENPHASE ENERGY INC.  
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INV: ENPHASE ENERGY INC.  
IQ8H-240-72-2-US [240V]  
(1 BRANCH X 9 MICRO-INV)



INTERCONNECTION 120% RULE  
(MAIN PANEL)

INTERCONNECTION  
120% RULE  
NOT REQUIRED

LINE-SIDE PANEL CONNECTION  
DOES NOT AFFECT MAIN BUS

EXTREME CASE MODULE OUTPUT  
(SILFAB SOLAR INC. SIL-420 BG)

$I_{sc}(25^{\circ}C) = 11.40A, T_{isc} = 0.046^{\circ}/C$   
 $I_{sc}(T) = I_{sc}(25^{\circ}C) \times [1 + T_{isc} \times (T-25^{\circ}C)]$   
 $I_{sc}(-16^{\circ}C) = 11.18A, I_{sc}(29^{\circ}C) = 11.42A$   
  
 $V_{oc}(25^{\circ}C) = 46.36V, T_{voc} = -0.279^{\circ}/C$   
 $V_{oc}(T) = V_{oc}(25^{\circ}C) \times [1 + T_{voc} \times (T-25^{\circ}C)]$   
 $V_{oc}(-16^{\circ}C) = 51.66V, V_{oc}(29^{\circ}C) = 45.84V$

## SYSTEM SUMMARY STC (26.880 kW DC / 24.576 kW AC)

STC DC: (64) 420W = 26.880 kW  
STC AC: (64) 384W = 24.576 kW  
• (64) SILFAB SOLAR INC. SIL-420 BG MODULES  
• (64) ENPHASE ENERGY INC. IQ8H-240-72-2-US [240V] MICROINVERTERS  
• 1x BRANCH OF 10 CONNECTED IN PARALLEL  
• 6x BRANCHES OF 9 CONNECTED IN PARALLEL

CONTRACTOR: ACES  
ADDRESS: 7288 RUSH LIMA RD,  
HONEOYE FALLS, NY 14472, USA  
PHONE: 15859357186  
EMAIL: Steve@aces-energy.com  
LICENSE #: N/A in New York State

REVISIONS		
DESCRIPTION	DATE	REV

## SIGNATURE & SEAL

DAVID STERN  
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14580, USA  
APN: 037-03-1-33.1 PHONE: +15857037612  
EMAIL: dsterne@elliotstern.com

SHEET NAME  
**SINGLE LINE  
DIAGRAM**

SHEET SIZE  
**ANSI B  
11" X 17"**

SHEET NUMBER  
**PV-4**

## ELECTRICAL NOTES

- 1) ALL GROUNDING TO COMPLY WITH NEC 690.47.
- 2) GROUNDTOP CONDUIT SHALL BE LOCATED MIN. 7/8" ABOVE GROUND SURFACE.
- 3) ALL TERMINALS SHALL BE MIN. 75°C RATED.

## ELECTRICAL SINGLE LINE DIAGRAM

SCALE: NTS

AC wire details							
Wire	Min Ampacity	Live	Neutral	Ground	Min EMT	Min PVC	Min RMC
MS-01	19.75A	12 AWG (Q-Cable)	-	06 AWG BARE (NOT IN CONDUIT)	-	-	-
MS-02	17.78A	12 AWG (Q-Cable)	-	06 AWG BARE (NOT IN CONDUIT)	-	-	-
MCB-01	19.75A	(2) 10 AWG THWN-2	-	10 AWG THWN-2	1/2 in	1/2 in	1/2 in
MCB-02	17.78A	(2) 10 AWG THWN-2	-	10 AWG THWN-2	1/2 in	1/2 in	1/2 in
LC-01	126.40A	(2) 1/0 AWG THWN-2	1/0 AWG THWN-2	06 AWG THWN-2	-	2 in	-
LC-02	126.40A	(2) 1/0 AWG THWN-2	1/0 AWG THWN-2	06 AWG THWN-2	2 in	2 in	2 in

## SYSTEM SUMMARY STC (26.880 kW DC / 24.576 kW AC)

STC DC: (64) 420W = 26.880 kW

STC AC: (64) 384W = 24.576 kW

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### REVISIONS

DESCRIPTION	DATE	REV

### SIGNATURE & SEAL

### HOMEOWNER INFO

AC wire details																	
WireID	#Modules	Nominal Voltage	Backfeed *1.25 /cond. set	Min OCPD	Total Power	Conductor sets	ccConductors /conduit	Expected max temp	Adjusted ampacity (ampacity x temp derate x conduit fill derate)	Conductor & neutral size	EGC size (Cu)	Conductor metal	Max length	V drop	Min EMT size	Min PVC size	Min RMC size
MS-01	10	240 V	19.75 A	20 A	3.8 kW	1	2	29	25 x 1.00 x - = 25.00 A	12 AWG (Q-Cable)	06 AWG BARE (NOT IN CONDUIT)	Cu	50 ft	1.12 %	-	-	-
MS-02	9	240 V	17.78 A	20 A	3.4 kW	1	2	29	25 x 1.00 x - = 25.00 A	12 AWG (Q-Cable)	06 AWG BARE (NOT IN CONDUIT)	Cu	50 ft	1.01 %	-	-	-
MCB-01	10	240 V	19.75 A	20 A	3.8 kW	1	2	29	35 x 1.00 x 1.00 = 35.00 A	10 AWG THWN-2	10 AWG THWN-2	Cu	50 ft	0.67 %	1/2 in	1/2 in	1/2 in
MCB-02	9	240 V	17.78 A	20 A	3.4 kW	1	2	29	35 x 1.00 x 1.00 = 35.00 A	10 AWG THWN-2	10 AWG THWN-2	Cu	50 ft	0.61 %	1/2 in	1/2 in	1/2 in
LC-01	64	240 V	126.40 A	150 A	24.3 kW	1	2	29	150 x 1.00 x 1.00 = 150.00 A	1/0 AWG THWN-2	06 AWG THWN-2	Cu	155 ft	1.54 %	-	2 in	-
LC-02	64	240 V	126.40 A	150 A	24.3 kW	1	2	29	150 x 1.00 x 1.00 = 150.00 A	1/0 AWG THWN-2	06 AWG THWN-2	Cu	10 ft	0.09 %	2 in	2 in	2 in

### INTERCONNECTION 120% RULE (MAIN PANEL)

INTERCONNECTION  
120% RULE  
NOT REQUIRED

LINE-SIDE PANEL CONNECTION  
DOES NOT AFFECT MAIN BUS

### EXTREME CASE MODULE OUTPUT (SILFAB SOLAR INC. SIL-420 BG)

$I_{sc}(25^{\circ}C) = 11.40A$ ,  $T_{sc} = 0.046\%/{\circ}C$   
 $I_{sc}(T) = I_{sc}(25^{\circ}C) \times [1 + T_{sc} \times (T-25^{\circ}C)]$   
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 $V_{oc}(25^{\circ}C) = 46.36V$ ,  $T_{voc} = -0.279\%/{\circ}C$   
 $V_{oc}(T) = V_{oc}(25^{\circ}C) \times [1 + T_{voc} \times (T-25^{\circ}C)]$   
 $V_{oc}(-16^{\circ}C) = 51.66V$ ,  $V_{oc}(29^{\circ}C) = 45.84V$

### ELECTRICAL NOTES

- 1) ALL EQUIPMENT TO BE LISTED BY UL OR OTHER NRTL, AND LABELED FOR ITS APPLICATION.
- 2) ALL CONDUCTORS SHALL BE COPPER, RATED FOR 600V AND 90°C WET ENVIRONMENT.
- 3) WIRING, CONDUIT, AND RACEWAYS MOUNTED ON GROUNDTOPS SHALL BE ROUTED DIRECTLY TO, AND LOCATED AS CLOSE AS POSSIBLE TO THE NEAREST RIDGE, HIP, OR VALLEY.
- 4) WORKING CLEARANCES AROUND ALL NEW AND EXISTING ELECTRICAL EQUIPMENT SHALL COMPLY WITH NEC 110.26.
- 5) DRAWINGS INDICATE THE GENERAL ARRANGEMENT OF SYSTEMS. CONTRACTOR SHALL FURNISH ALL NECESSARY OUTLETS, SUPPORTS, FITTINGS AND ACCESSORIES TO FULFILL APPLICABLE CODES AND STANDARDS.
- 6) WHERE SIZES OF JUNCTION BOXES, RACEWAYS, AND CONDUITS ARE NOT SPECIFIED, THE CONTRACTOR SHALL SIZE THEM ACCORDINGLY.
- 7) ALL WIRE TERMINATIONS SHALL BE APPROPRIATELY LABELED AND READILY VISIBLE.
- 8) MODULE GROUNDING CLIPS TO BE INSTALLED BETWEEN MODULE FRAME AND MODULE SUPPORT RAIL, PER THE GROUNDING CLIP MANUFACTURER'S INSTRUCTION.
- 9) MODULE SUPPORT RAIL TO BE BONDED TO CONTINUOUS COPPER G.E.C.VIA WEEB LUG OR ILSCO GBL-4DBT LAY-IN LUG.
- 10) PV EQUIPMENT SHALL BE DESIGNED AND INSTALLED IN ACCORDANCE WITH NEC 690.
- 11) EXACT LOCATION OF AUXILIARY GROUNDING TO BE DETERMINED AT TIME OF INSTALL.
- 12) EXISTING WIRES MUST BE REPLACED IF SMALLER THAN LISTED MINIMUM SIZES PER NEC 310.15(B)(16).

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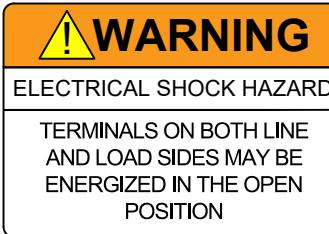
SHEET NAME  
WIRING  
CALCULATIONS

SHEET SIZE  
ANSI B  
11" X 17"

SHEET NUMBER  
PV-5

## WIRING CALCULATIONS

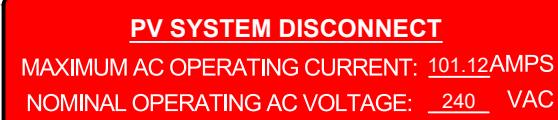
SCALE: NTS



LABEL LOCATION: INVERTERS, DC & AC DISCONNECTS, DC & AC COMBINER PANELS (IF APPLICABLE)  
CODE REF: NEC 2017 - 690.13(B)

### RAPID SHUTDOWN SWITCH FOR SOLAR PV SYSTEM

LABEL LOCATION: UTILITY INTERCONNECTION DISCONNECT (MSP OR AC DISCONNECT), AND WHEREVER REQUIRED BY AHJ (DC DISCONNECTS, INVERTERS)  
CODE REF: NEC 2017 - 690.56(C)(3)



LABEL LOCATION: AC DISCONNECTS, PV POINT OF INTERCONNECTION  
CODE REF: NEC 2017 - 690.54



LABEL LOCATION: AC DISCONNECT, PV BACKFEED BREAKER/POINT OF INTERCONNECTION  
CODE REF: NEC 2017 - 690.13(B)



LABEL LOCATION: INTERCONNECTION DISCONNECT FOR UTILITY ACCESS  
CODE REF: NEC 2017 - 690.13(B) OR UTILITY



LABEL LOCATION: PV PRODUCTION METER  
CODE REF: N/A



LABEL LOCATION: AC COMBINER PANEL (WHEN APPLICABLE FOR PV LOAD CENTER)  
CODE REF: N/A



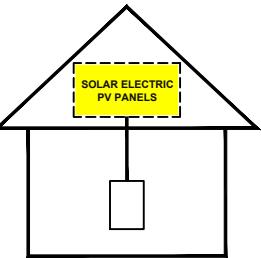
LABEL LOCATION: ADJACENT TO BACKFEED BREAKER IN SUBPANEL/MSP (IF APPLICABLE)  
CODE REF: NEC 2017 - 705.12(B)(2)(3)(b)



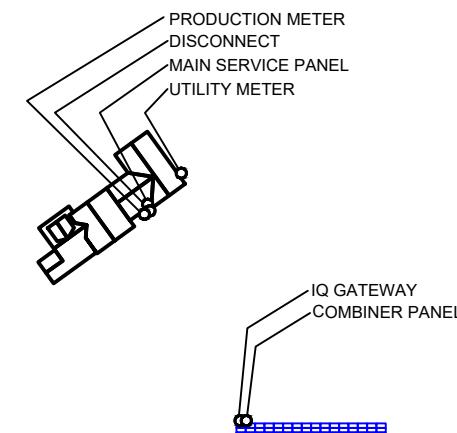
LABEL LOCATION: MAIN PANEL  
CODE REF: UTILITY

### SOLAR PV SYSTEM EQUIPPED WITH RAPID SHUTDOWN

TURN RAPID SHUTDOWN SWITCH TO THE "OFF" POSITION TO SHUT DOWN PV SYSTEM AND REDUCE SHOCK HAZARD IN THE ARRAY.



LABEL LOCATION: INTERCONNECTION POINT (MSP OR AC DISCONNECT IF LINE SIDE TAP)  
CODE REF: NEC 2017 - 690.12, NEC 2017 - 690.56(C)



LAKE ROAD



LABEL LOCATION: MSP  
CODE REF: NEC 2017 - 705.10

### NOTES AND SPECIFICATIONS

- 1) SIGNS AND LABELS SHALL MEET THE REQUIREMENTS OF NEC 110.21(B), UNLESS SPECIFIC INSTRUCTIONS ARE REQUIRED BY SECTION 690, OR IF REQUESTED BY THE LOCAL AHJ.
- 2) SIGNS AND LABELS SHALL ADEQUATELY WARN OF HAZARDS USING EFFECTIVE WORDS, COLORS AND SYMBOLS.
- 3) LABELS SHALL BE PERMANENTLY AFFIXED TO THE EQUIPMENT OR WIRING METHOD AND SHALL NOT BE HAND WRITTEN.
- 4) LABEL SHALL BE OF SUFFICIENT DURABILITY TO WITHSTAND THE ENVIRONMENT INVOLVED.
- 5) SIGNS AND LABELS SHALL COMPLY WITH ANSI Z535.4 - 2017, PRODUCT SAFETY SIGNS AND LABELS, UNLESS OTHERWISE SPECIFIED.
- 6) DO NOT COVER EXISTING MANUFACTURER LABELS.

CONTRACTOR: ACES  
ADDRESS: 7288 RUSH LIMA RD,  
HONEOYE FALLS, NY 14472, USA  
PHONE: 15859357186  
EMAIL: Steve@aces-energy.com  
LICENSE #: N/A in New York State

#### REVISIONS

DESCRIPTION	DATE	REV

#### SIGNATURE & SEAL

#### HOMEOWNER INFO

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14580, USA  
APN: 037.03-1-33.1 PHONE: +15857037612  
EMAIL: dsterne@elliotstern.com

#### SHEET NAME

#### PLACARDS

**SHEET SIZE**  
ANSI B  
11" X 17"

**SHEET NUMBER**  
PV-6

CONTRACTOR: ACES  
ADDRESS: 7288 RUSH LIMA RD,  
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• NOT JUST ANOTHER  
SOLAR PANEL.

**Silfab Elite**

Back-contact technology with an innovative conductive backsheets and integrated cell design delivers the highest performance, durability and beautiful aesthetics.

Manufactured exclusively in the United States.

[SILFABSOLAR.COM](http://SILFABSOLAR.COM)



**SILFAB**  
SOLAR®

**SILFAB ELITE**

SIL - 420 BG



ELECTRICAL SPECIFICATIONS		420
Test Conditions		STC NOCT
Module Power (Pmax)	Wp	420 313
Maximum power voltage (Vpmax)	V	38.51 35.89
Maximum power current (Ipmax)	A	10.91 8.73
Open circuit voltage (Voc)	V	46.36 43.45
Short circuit current (Isc)	A	11.4 9.18
Module efficiency	%	21.9% 20.4%
Maximum system voltage (VDC)	V	1000
Series fuse rating	A	20
Power Tolerance	Wp	0 to +10

Measurement conditions: STC 1000 W/m<sup>2</sup> • AM 1.5 • Temperature 25 °C • NOCT 800 W/m<sup>2</sup> • AM 1.5 • Measurement uncertainty ≤ 3%  
Sun simulator calibration reference modules from Fraunhofer Institute. Electrical characteristics may vary by ±5% and power by 0 to +10W.

MECHANICAL PROPERTIES / COMPONENTS	METRIC	IMPERIAL
Module weight	20.8±0.2	45.8±0.4 lbs
Dimensions (H x L x D)	1864 mm x 1029 mm x 35 mm	73.4 in x 40.5 in x 1.4 in
Maximum surface load (wind/snow)*	5400 Pa rear load / 5400 Pa front load	112.8 lb/ft <sup>2</sup> rear load / 112.8 lb/ft <sup>2</sup> front load
Hail impact resistance	Ø 25 mm at 83 km/h	Ø 1 in at 51.6 mph
Cells	66 high-efficiency mono-PERC MWT c-Si cells 166 x 166 mm	66 high-efficiency mono-PERC MWT c-Si cells 6.53 in x 6.53 in
Glass	3.2 mm high transmittance, tempered, anti-reflective coating	0.126 in high transmittance, tempered, anti-reflective coating
Cables and connectors (refer to installation manual)	1200 mm Ø 5.7 mm, MC4 from Staubli	47.2 in, Ø 0.22 (12AWG), MC4 from Staubli
Backsheet	Multilayer, integrated insulation film and electrically conductive backsheet, superior hydrolysis and UV resistance, fluorine-free PV backsheet	
Frame	Anodized Aluminum (Black)	
Bypass diodes	3 diodes-3OSQ045T (45V max DC blocking voltage, 30A max forward rectified current)	
Junction Box	UL 3730 Certified, IEC 62790 Certified, IP67 rated	

TEMPERATURE RATINGS	WARRANTIES	
Temperature Coefficient Isc	+0.046 %/°C	Module product workmanship warranty 25 years**
Temperature Coefficient Voc	-0.279 %/°C	Linear power performance guarantee 30 years
Temperature Coefficient Pmax	-0.377 %/°C	≥ 98% end 1st yr ≥ 94.7% end 12th yr ≥ 90.8% end 25th yr ≥ 89.3% end 30th yr
NOCT (± 2°C)	43.5 °C	
Operating temperature	-40/+85 °C	

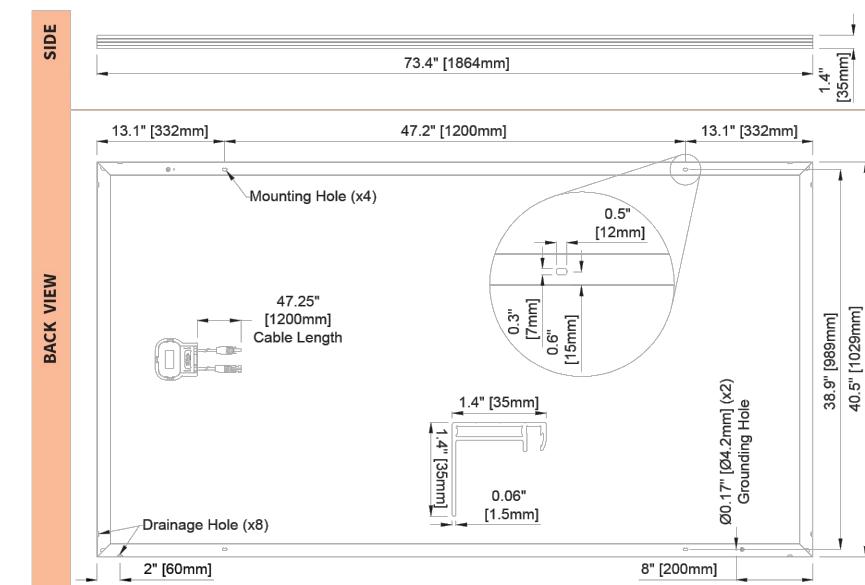
  

CERTIFICATIONS	SHIPPING SPECS	
Product	UL 61215-1:2017 Ed.1, UL 61215-2:2017 Ed.1, UL 61730-1:2017 Ed.1, UL 61730-2:2017 Ed.1, CSA C22.2#61730-1:2019 Ed.2, CSA C22.2#61730-2:2019 Ed.2, IEC 61215-1:2016 Ed.1, IEC 61215-2:2016 Ed.1, IEC 61730-1:2016 Ed.2, IEC 61730-2:2016 Ed.2, IEC 61701-2020 (Salt Mist Corrosion), IEC 62716:2013 (Ammonia Corrosion), CEC Listing, UL Fire Rating: Type 1	Modules Per Pallet: 27 or 27 (California)
Factory	ISO9001:2015	Pallets Per Truck 31 or 30 (California)
		Modules Per Truck 837 or 810 (California)

\* ▲ Warning. Read the Safety and installation Manual for mounting specifications and before handling, installing and operating modules.

\*\* 12 year extendable to 25 years subject to registration and conditions outlined under "Warranty" at [silfabsolar.com](http://silfabsolar.com).

PAN files generated from 3rd party performance data are available for download at: [silfabsolar.com/downloads](http://silfabsolar.com/downloads).



**SILFAB SOLAR INC.**

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**SHEET NAME**  
**EQUIPMENT SPECIFICATION**

**SHEET SIZE**  
**ANSI B**  
**11" X 17"**

**SHEET NUMBER**  
**PV-7**



## IQ8H Microinverters

Our newest IQ8 Microinverters are the industry's first microgrid-forming, software-defined microinverters with split-phase power conversion capability to convert DC power to AC power efficiently. The brain of the semiconductor-based microinverter is our proprietary application-specific integrated circuit (ASIC) which enables the microinverter to operate in grid-tied or off-grid modes. This chip is built in advanced 55nm technology with high speed digital logic and has super-fast response times to changing loads and grid events, alleviating constraints on battery sizing for home energy systems.



Part of the Enphase Energy System, IQ8 Series Microinverters integrate with the Enphase IQ Battery, Enphase IQ Gateway, and the Enphase App monitoring and analysis software.



IQ8 Series Microinverters redefine reliability standards with more than one million cumulative hours of power-on testing, enabling an industry-leading limited warranty of up to 25 years.



Connect PV modules quickly and easily to IQ8 Series Microinverters using the included Q-DCC-2 adapter cable with plug-n-play MC4 connectors.



IQ8 Series Microinverters are UL Listed as PV Rapid Shut Down Equipment and conform with various regulations, when installed according to manufacturer's instructions.

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IQ8H-DS-0004-01-EN-US-2021-10-19

## IQ8H Microinverters

INPUT DATA (DC)	IQ8H-240-72-2-US	IQ8H-208-72-2-US <sup>1</sup>
Commonly used module pairings <sup>2</sup>	W 320 – 540+	295 – 500+
Module compatibility		60-cell/120 half-cell and 72-cell/144 half-cell
MPPT voltage range	V 38 – 45	38 – 45
Operating range	V 25 – 58	
Min/max start voltage	V 30 / 58	
Max input DC voltage	V 60	
Max DC current <sup>3</sup> [module Isc]	A 15	
Oversupply class DC port		II
DC port backfeed current	mA 0	
PV array configuration	1x1 Ungrounded array; No additional DC side protection required; AC side protection requires max 20A per branch circuit	
OUTPUT DATA (AC)	IQ8H-240-72-2-US	IQ8H-208-72-2-US
Peak output power	VA 384	366
Max continuous output power	VA 380	360
Nominal (L-L) voltage/range <sup>4</sup>	V 240 / 211 – 264	208 / 183 – 250
Max continuous output current	A 1.58	1.73
Nominal frequency	Hz 60	
Extended frequency range	Hz 50 – 68	
Max units per 20 A (L-L) branch circuit <sup>5</sup>	10	9
Total harmonic distortion		<5%
Oversupply class AC port		III
AC port backfeed current	mA 30	
Power factor setting		1.0
Grid-tied power factor (adjustable)		0.85 leading – 0.85 lagging
Peak efficiency	% 97.6	97.4
CEC weighted efficiency	% 97	97
Night-time power consumption	mW 60	
MECHANICAL DATA		
Ambient temperature range	-40°C to +60°C (-40°F to +140°F)	
Relative humidity range	4% to 100% (condensing)	
DC Connector type	MC4	
Dimensions (HxWxD)	212 mm (8.3") x 175 mm (6.9") x 30.2 mm (1.2")	
Weight	1.08 kg (2.38 lbs)	
Cooling	Natural convection – no fans	
Approved for wet locations	Yes	
Acoustic noise at 1m	<60 dBA	
Pollution degree	PD3	
Enclosure	Class II double-insulated, corrosion resistant polymeric enclosure	
Environ. category / UV exposure rating	NEMA Type 6 / outdoor	
COMPLIANCE		
Certifications	CA Rule 21 (UL 1741-SA), UL 62109-1, UL1741/IEEE1547, FCC Part 15 Class B, ICES-0003 Class B, CAN/CSA-C22.2 NO. 107.1-01  This product is UL Listed as PV Rapid Shut Down Equipment and conforms with NEC 2014, NEC 2017, and NEC 2020 section 690.12 and C22.1-2018 Rule 64-218 Rapid Shutdown of PV Systems, for AC and DC conductors, when installed according to manufacturer's instructions.	

(1) The IQ8H-208 variant will be operating in grid-tied mode only at 208V AC. (2) No enforced DC/AC ratio. See the compatibility calculator at <https://link.enphase.com/module-compatibility> (3) Maximum continuous input DC current is 10.6A (4) Nominal voltage range can be extended beyond nominal if required by the utility. (5) Limits may vary. Refer to local requirements to define the number of microinverters per branch in your area.

IQ8H-DS-0004-01-EN-US-2021-10-19

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HONEOYE FALLS, NY 14472, USA  
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EMAIL: Steve@aces-energy.com  
LICENSE #: N/A in New York State

### REVISIONS

DESCRIPTION	DATE	REV

### SIGNATURE & SEAL

### HOMEOWNER INFO

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### EQUIPMENT SPECIFICATION

### SHEET SIZE

ANSI B  
11" X 17"

### SHEET NUMBER

PV-8



## IQ Gateway

The IQ Gateway delivers solar production and energy consumption data to Enphase Installer Portal monitoring and analysis software for comprehensive, remote maintenance, and management of Enphase systems.

With integrated production metering and optional consumption monitoring, the IQ Gateway is the platform for total energy management. It integrates with the IQ System Controller and IQ Battery.



**IQ Series Microinverters**  
The high-powered smart grid-ready IQ Series Microinverters (IQ6, IQ7, and IQ8 Series) dramatically simplify the installation process.



**IQ System Controller**  
Provides microgrid interconnect device (MID) functionality by automatically detecting grid failures and seamlessly transitioning the home energy system from grid power to backup power.



**IQ Battery**  
All-in-one AC coupled storage system that is reliable, smart, simple, and safe. It provides backup capability and installers can quickly design the right system size to meet the needs of both new and retrofit solar customers.



**IQ Load Controller**  
Helps prioritize essential appliances during a grid outage to optimize energy consumption and prolong battery life.

### Smart

- Enables web-based monitoring and control
- Provides bidirectional communications for remote upgrades
- Supports power export limiting and zero-export applications

### Simple

- Easy system configuration using Enphase Installer App
- Flexible networking with Wi-Fi, Ethernet, or cellular

### Reliable

- Designed for installation indoors or outdoors in a NEMA 3R rated enclosure
- 5-year limited warranty
- ENV2-IQ-AM1-240 complies with IEEE® 1547:2018 (UL 1741-SB, 3rd Ed.)

## IQ Gateway

MODEL NUMBER	
IQ Gateway	ENV-IQ-AM1-240, ENV2-IQ-AM1-240
ACCESSIONS - ORDER SEPARATELY	
Mobile Connect	- Includes COMMS-KIT-01 and CELLMODEM-M1-06-SP-05 with 5-year Sprint data plan
CELLMODEM-M1-06-SP-05	- 4G based LTE-M1 cellular modem with 5-year Sprint data plan
CELLMODEM-M1-06-AT-05	- 4G based LTE-M1 cellular modem with 5-year AT&T data plan
Consumption monitoring CT and IQ Battery 5P metering CT	CT-200-SPLIT CT-200-CLAMP
	Split-core and clamp style CTs with 2.5% accuracy enable whole home and IQ Battery 5P metering
Communications Kit	Installed at the IQ Gateway. For communications with IQ Battery and IQ System Controller. Includes USB cable for connection to IQ Gateway or IQ Combiner and allows wireless communication with IQ Battery and IQ System Controller.
POWER REQUIREMENTS	
AC power requirements	120/240 V, 120/208Y V, or 127/220Y V. Three-wire, 60 Hz.
IQ Gateway breaker	2-pole and maximum 20 A overcurrent protection required
Typical power consumption	5 W
CAPACITY	
Number of microinverters polled	Up to 300
MECHANICAL AND ELECTRICAL DATA	
Dimensions (W x H x D)	21.3 cm x 12.6 cm x 4.5 cm (8.4 in x 5 in x 1.8 in)
Weight	1.09 lb
Ambient temperature range	-40°C to 65°C (-40°F to 149°F) [ENV-IQ-AM1-240] -40°C to 50°C (-40°F to 122°F) [ENV2-IQ-AM1-240] -40°C to 46°C (-40°F to 115°F) if installed in an enclosure
Environmental rating	IP30. For installation indoors or in an NRTL-certified, NEMA type 3R or better-rated enclosure, if installing outdoors.
Altitude	Up to 2,600 meters (8,530 feet)
COMMUNICATION INTERFACES	
Integrated Wi-Fi	802.11b/g/n (2.4 GHz, 5 GHz), for connecting the Enphase Cloud via the internet.
Wi-Fi range (recommended)	10 m
Ethernet	Optional, 802.3, Cat5E (or Cat 6) UTP Ethernet cable (not included), for connecting to the Enphase Cloud via the internet.
Mobile Connect	CELLMODEM-M1-06-SP-05, CELLMODEM-M1-06-AT-05 (to be purchased separately, mandatory for sites with IQ Battery)
Digital I/O	Digital input/output for grid operator control
USB 2.0	For Mobile Connect and Communications Kit
Access point (AP) mode	For a connection between the IQ Gateway and a mobile device running the Enphase Installer App
Metering ports	Up to two Consumption CTs, one Production CT, and one battery CT (for IQ Battery 5P)
Power line communication (PLC)	90 kHz-110 kHz (Class B), to microinverters.
Web API	Refer to <a href="https://developer-v4.enphase.com">https://developer-v4.enphase.com</a>
Local API	Refer to <a href="#">guide for local API</a>
LED indicators	From top to bottom: Cloud connectivity, Wi-Fi access point mode, PV production state, PLC communications state
Configured via	Enphase Installer App and Enphase Installer Platform

CONTRACTOR: ACES  
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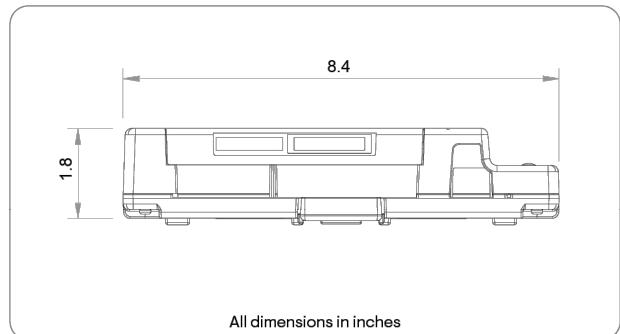
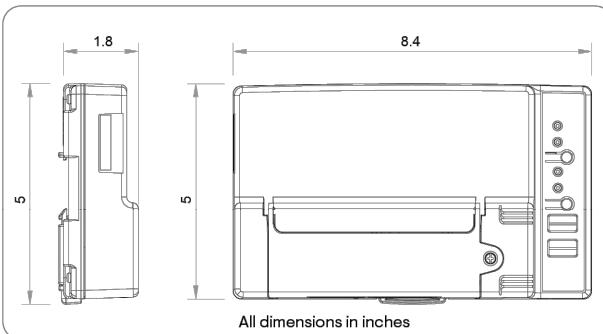
**SHEET NAME**  
**EQUIPMENT SPECIFICATION**

**SHEET SIZE**  
ANSI B  
11" X 17"

**SHEET NUMBER**  
PV-9



POWER PRODUCTION/EXPORT LIMITING VIA THE IQ GATEWAY'S DIGITAL IO	
Maximum relays read	4
Capabilities supported	Power production limiting (Production CT/s required), power export limiting (Production CT/s required and Consumption CT/s – <b>Load with Solar</b> configuration)
Minimum IQ Gateway version	v7.3.120
Cable configurations	18 AWG, UL-Std. 62, 600 V, 105°C, and minimum 0.03 inches average thickness
Signal voltage range	2.5 V–5 V (digital high), 0 V–1.9 V (digital low)
Terminal blocks	Five terminals, up to 0.002 in <sup>2</sup>
Configuration via	Enphase Installer App, Enphase Installer Platform (site settings)
SCOPE OF DELIVERY	
Package dimensions (H x W x D)	6.3 in x 10.8 in x 3.9 in
Package weight	2.2 lb
Aluminium DIN rail	4.9 in
Current transformers (CTs)	One CT-200-SOLID included
COMPLIANCE	
Compliance	CA Rule 21 (UL 1741-SA), IEEE® 1547:2018 – UL 1741-SB, 3rd Ed.(ENV2-IQ-AM1-240), UL 61010-1 CAN/CSA C22.2 No. 61010-1 Title 47 CFR, Part 15, Class B, ICES 003 IEC/EN 61010-1:2010, EN50065-1, EN61000-4-5, EN61000-6-1, EN61000-6-2 Metering: ANSI C12.20 accuracy class 0.5 (PV production only)
COMPATABILITY	
IQ System Controller	SC200D111C240US01, SC200G111C240US01, EP200G101-M240US01, EP200G101-M240US00
IQ Battery	IQBATTERY-5P-1P-NA, ENCHARGE-3T-1P-NA, ENCHARGE-10T-1P-NA
Microinverter	IQ6, IQ7, and IQ8 Series Microinverters



## Accessories



### Enphase Mobile Connect

4G-based LTE-M1 cellular modem with a 5-year data plan  
(CELLMODEM-M1-06-SP-05 for Sprint and  
CELLMODEM-M1-06-AT-05 for AT&T)



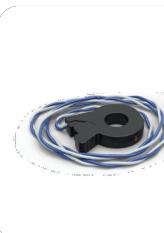
### Circuit breakers

BRK-10A-2-240V Circuit breaker, 2-pole, 10 A, Eaton BR210  
BRK-15A-2-240V Circuit breaker, 2-pole, 15 A, Eaton BR215  
BRK-20A-2P-240V Circuit breaker, 2-pole, 20 A, Eaton BR220  
BRK-15A-2P-240V-B Circuit breaker, 2-pole, 15 A, Eaton BR215B with hold-down kit support  
BRK-20A-2P-240V-B Circuit breaker, 2-pole, 20 A, Eaton BR220B with hold-down kit support



### CT-200-SOLID

200 A revenue grade solid core Production CT with <0.5% error rate (replacement SKU)



### CT-200-CLAMP

200 A clamp-style consumption and battery metering CT with <2.5% error rate (replacement SKU)

IQ-G-DSH-00111-3.0-EN-US-2023-12-20

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**EQUIPMENT  
SPECIFICATION**

**SHEET SIZE**  
ANSI B  
11" X 17"

**SHEET NUMBER**  
PV-10

CONTRACTOR: ACES  
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LICENSE #: N/A in New York State

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DESCRIPTION	DATE	REV

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**HOMEOWNER INFO**



Datasheet

## Ground Mount System



### Mount on all terrains, in no time.

The IronRidge Ground Mount System combines our XR1000 rails with locally-sourced steel pipes, or mechanical tubing, to create a cost-effective structure capable of handling any site or terrain challenge.

Installation is simple with only a few structural components and no drilling, welding, or heavy machinery required. In addition, the system works with a variety of foundation options, including concrete piers and driven piles.



#### Rugged Construction

Engineered steel and aluminum components ensure durability.



#### PE Certified

Pre-stamped engineering letters available in most states.



#### Simple Assembly

Just a few simple components and no heavy equipment.



#### Design Software

Online tool generates engineering values and bill of materials.



#### Flexible Architecture

Multiple foundation and array configuration options.



#### 20 Year Warranty

Twice the protection offered by competitors.



360° Product Tour  
Visit [ironridge.com](http://ironridge.com)

### Substructure

#### Top Caps



Connect vertical and cross pipes.

#### Rail Connectors



Attach Rail Assembly to horizontal pipes.

#### Diagonal Braces



Optional Brace provides additional support.

#### Cross Pipe & Piers



Steel pipes or mechanical tubing for substructure.

### Rail Assembly

#### XR1000 Rails



Curved rails increase spanning capabilities.

#### Top-Down Clamps



Secure modules to rails and substructure.

#### Under Clamps



Alternative clamps for pre-attaching modules to rails.

#### Accessories



Wire Clips and End Caps provide a finished look.

### Resources



**Design Assistant**  
Go from rough layout to fully engineered system. For free.  
[Go to ironridge.com/gm](http://ironridge.com/gm)



**NABCEP Certified Training**  
Earn free continuing education credits, while learning more about our systems.  
[Go to ironridge.com/training](http://ironridge.com/training)

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**EQUIPMENT SPECIFICATION**

**SHEET SIZE**  
ANSI B  
11" X 17"

**SHEET NUMBER**  
PV-11

1822 Lake Road (#1381986)  
ground based

**IRONRIDGE**  
2857 INDUSTRIAL BLVD., HAYWARD, CA 94545

1822 Lake Road (#1381986)  
ground based

**IRONRIDGE**  
2857 INDUSTRIAL BLVD., HAYWARD, CA 94545

**Project Details**

Name	1822 Lake Road	Date	10/22/2024
Location	1822 Lake Road, Webster, NY 14580	ASCE code	7.16
Total modules	64	Wind speed	110 mph
Module	Silfab: SIL-420-BG	Snow load	40 psf
Dimensions	Dimensions: 73.39" x 40.51" x 1.38" (1864.0mm x 1029.0mm x 35.0mm)	Wind exposure	C
Total watts	26,880 kW	Piers	30
Inter sub-array spacing	321.0" Calculated using solar azimuth of -43.02° and solar elevation of 10.56° at 9AM (America/New_York) on the winter solstice.		



**Substructure & Foundation**

Tilt	30°	South facing grade	0°
Pipe/tubing diameter	3"	Soil class	2 - 5
Foundation type	Ground screws	Screw length	63" (1600mm)
Freeze thaw depth	None entered	Hex head set screws / Screw	4

**Sub array #1**

Rows	4	Columns	16	# Arrays	1
Area	98' 4" (EW) x 13' 9" (NS)	Rail type	XR1000	Diagonal bracing	no
E/W spacing	6' 11"	Rail cantilever	2' 8"	Pipe cantilever	7"
Piers/array	30	Total south piers	15 (3' 11")	Total north piers	15 (8' 3")
Total cross pipes	2 (98' 4")	Total pipe length	379' 9"		
Shear	1,138 lbs	Moment	2,845 ft-lbs	Uplift	-1,047 lbs

CONTRACTOR: ACES  
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LICENSE #: N/A in New York State

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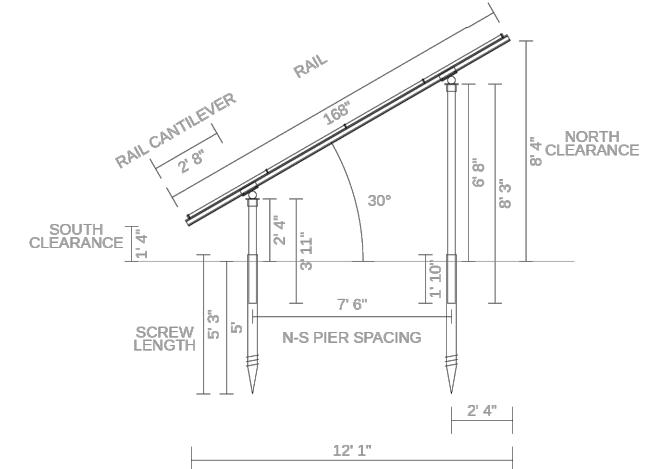
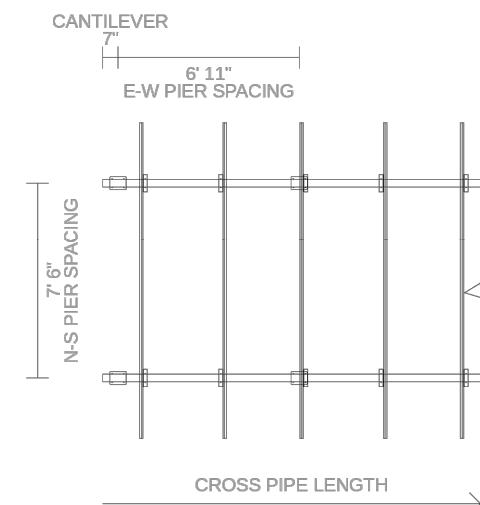
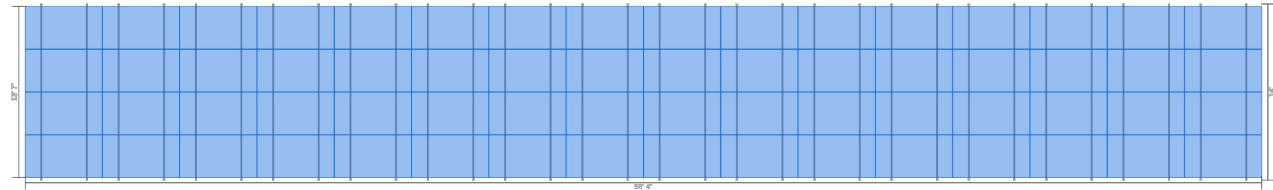
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**SHEET NAME**  
**EQUIPMENT SPECIFICATION**

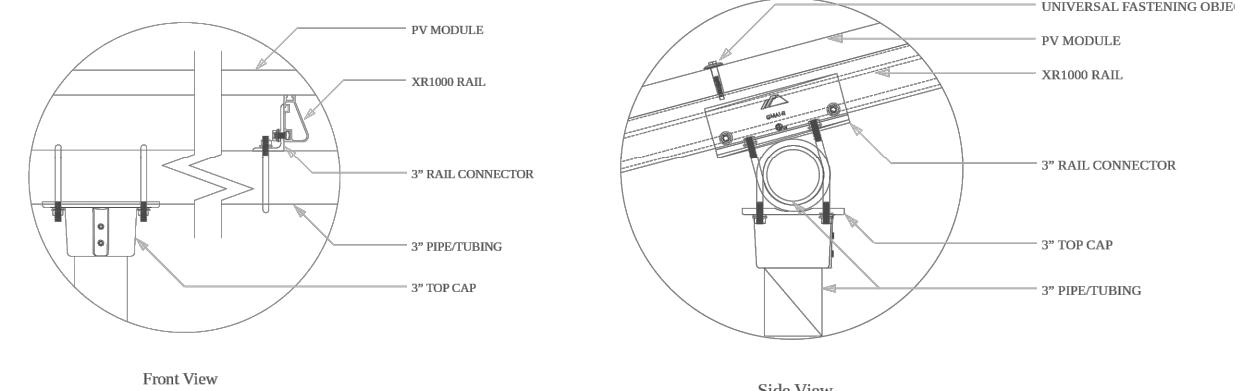
**SHEET SIZE**  
**ANSI B**  
**11" X 17"**

**SHEET NUMBER**  
**PV-12**

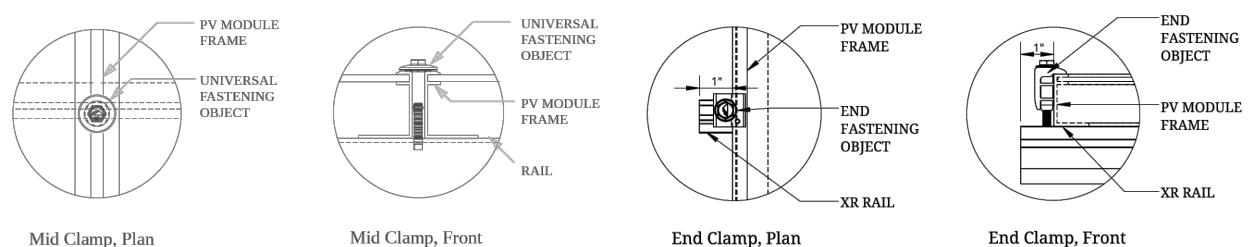


#### Pipe Fitting Detail

##### XR1000 Rail



#### Clamp Detail



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14580, USA

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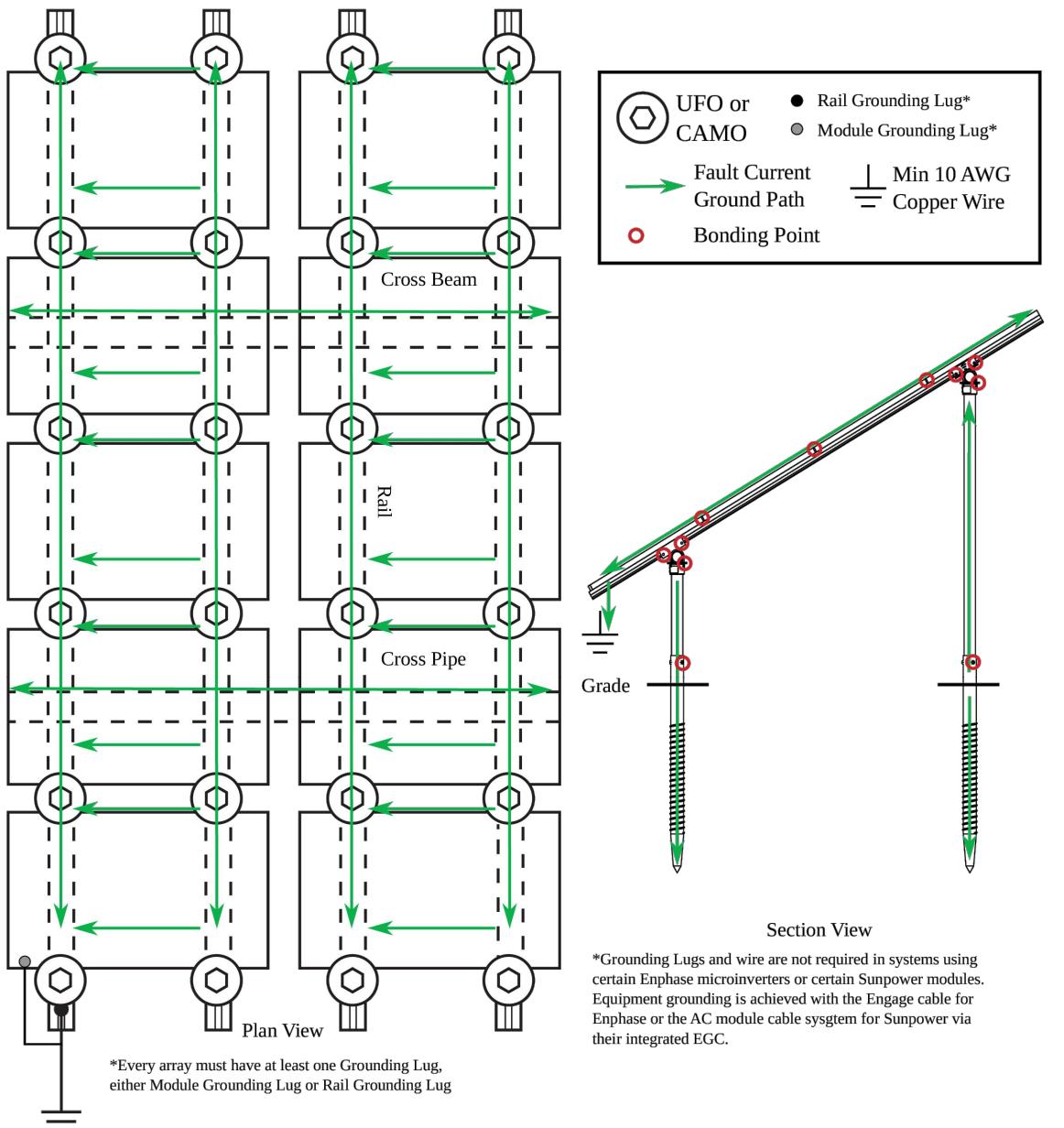
**HOMEOWNER INFO**

**SHEET NAME**  
**EQUIPMENT SPECIFICATION**

**SHEET SIZE**  
**ANSI B**  
**11" X 17"**

**SHEET NUMBER**  
**PV-13**

### Grounding Diagram



### Bill of Materials

Part	Spares	Total Qty
<b>Rails</b>		
XR-1000-168A XR1000, Rail 168" Clear	0	32
<b>Clamps &amp; Grounding</b>		
UFO-CL-01-A1 Universal Module Clamp, Clear	0	96
UFO-END-01-A1 End Fastening Object (End Clamp, 30-40mm), Mill	0	64
XR-LUG-03-A1 Grounding Lug, Low Profile	0	1
<b>Substructure</b>		
70-0300-SGA SGA Top Cap at 3"	0	30
GM-BRC3-01-M1 Ground Mount Bonded Rail Connector - 3"	0	64
GM-HSHW-01-M1 Hex Head Set Screw	0	120

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DESCRIPTION	DATE	REV

### SIGNATURE & SEAL

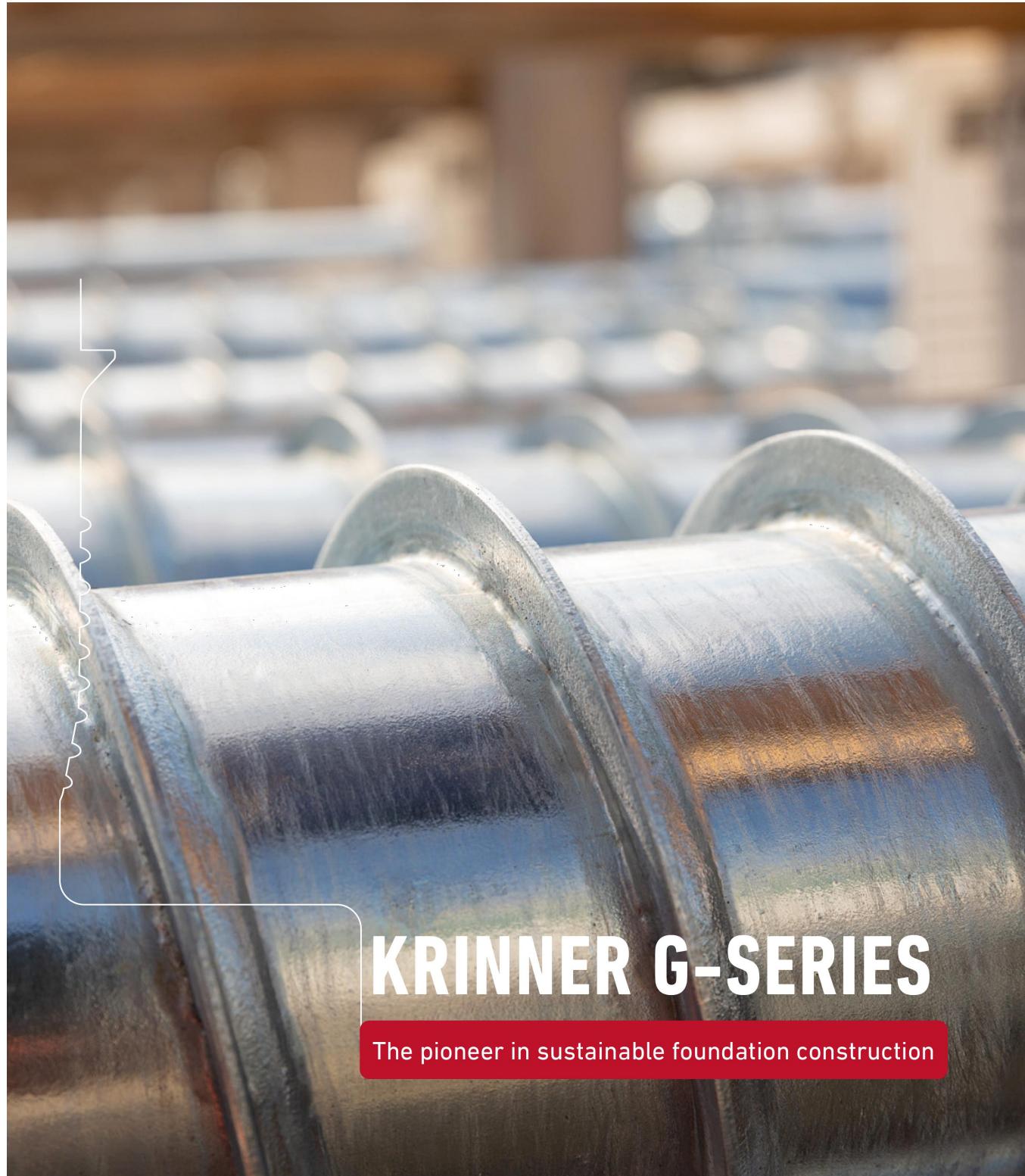
DAVID STERN  
1822 LAKE ROAD, WEBSTER, NY  
14580, USA  
APN: 037-03-1-33.1 PHONE: +15857037612  
EMAIL: dsterne@stern.com

**SHEET NAME**  
**EQUIPMENT SPECIFICATION**

**SHEET SIZE**  
**ANSI B**  
**11" X 17"**

**SHEET NUMBER**  
**PV-14**

# KRINNER



## KRINNER G-SERIES

The pioneer in sustainable foundation construction

# KRINNER

## G76x2100-4xM16



### Basic Information

#### KSF G 76x2100-4xM16

Nominal length (mm)

2100

Tube diameter (mm)

76.10

Weight (kg)

13.9

Item number

29003

### Construction

- Nut: DIN EN ISO 4032 - 8
- Continuous welded helix
- Coating: Hot-dip galvanized according to ASTM A123/A123M 09

### Technical Data

#### KSF G 76x2100- 4xM16

a Length (mm) (+-35 mm)

2060

b Shaft outer diameter (mm)

76.10

c Inner diameter (mm)

68.90

d Diameter setting (mm)

60

e Depth setting (mm) (+-25 mm)

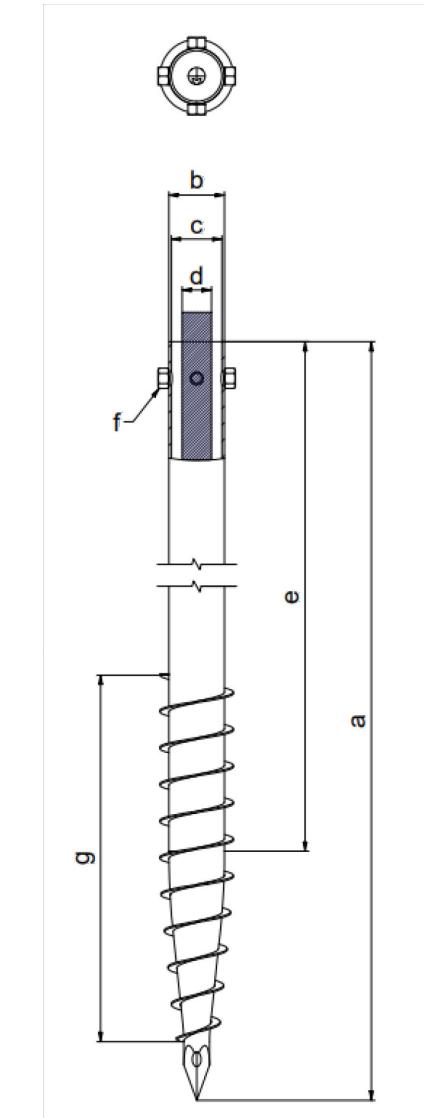
1790

f Nut

4xM16

g Length of helix (mm)

1150



Subject to technical change.

Krinner Foundation Systems | 3127 E South St. Suite C1 | Long Beach, CA 90805 US  
Phone: +1 877 465 7466 | E-Mail: info@krinnerfoundations.com | https://www.krinner.io

sustainable · durable · revolutionary

**ACES**  
GEOThermal & SOLAR

CONTRACTOR: ACES  
ADDRESS: 7288 RUSH LIMA RD,  
HONEOYE FALLS, NY 14472,USA  
PHONE: 15859357186  
EMAIL: Steve@aces-energy.com  
LICENSE #: N/A in New York State

REVISIONS		
DESCRIPTION	DATE	REV

SIGNATURE & SEAL

**DAVID STERN**  
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14580, USA  
APN: 037.03-1-33.1 PHONE: +15857037612  
EMAIL: dsterne@elliotstern.com

**SHEET NAME**  
EQUIPMENT  
SPECIFICATION

**SHEET SIZE**  
ANSI B  
11" X 17"

**SHEET NUMBER**  
PV-15

## CHECKLIST

### PRE-INSTALLATION

- Verify module compatibility. See [Page 14](#) for info.
- Purchase 2" or 3" Pipe or Mechanical Tubing

**Pipe:** 2" or 3" (NPS) ASTM A53 Grade B SCH 40 Pipe, galvanized to a min of ASTM A653 G90 or ASTM A123 G35.

**Mechanical Tubing:** 2.375" x 12 ga (O.D) or 3.500" x 8 ga (O.D.) Mechanical Tubing with one of the following Galvanizations (ASTM A1057).

- Allied Gatorshield
- Allied Flo-Coat Coating
- Wheatland ThunderCoat

### TOOLS REQUIRED

- Post Hole Digger or Powered Auger
- Socket Drive (7/16", 9/16", 15/16" and 1/2" Sockets)
- Torque Wrenches (0-240 in-lbs and 10-40 ft-lbs)
- Transit, String Line, or Laser Level
- 3/16" Allen Head

### TORQUE VALUES

Top Cap Set Screws (3/16" Allen Head)

- 2" or 3" NPS Schedule 40 Grade B Pipe: 20 ft-lbs
- 2.375" x 12 ga OD Mechanical Tubing: 11 ft-lbs
- 3.500" x 8 ga OD Mechanical Tubing: 16 ft-lbs

For Ground Screw to Pipe Connection Hardware see [Page 5.](#)

Top Cap U-Bolt Nuts (9/16" Socket): 15 ft-lbs

Rail Connector Bracket Nuts (9/16" Socket): 21 ft-lbs

Rail Connector U-Bolt Nuts (9/16" Socket): 60 in-lbs

Rail Grounding Lug Nut (7/16" Socket): 80 in-lbs

- Rail Grounding Lug Terminal Screws (7/16" Socket): 20 in-lbs

Module Grounding Lug Nut (3/8" Socket): 60 in-lbs

- Module Grounding Lug Terminal Screws (1/2" Socket): 20 in-lbs

Universal Fastening Objects (7/16" Socket): 80 in-lbs

Diagonal Brace Set Screws (1/2" Socket): 15 ft-lbs

Diagonal Brace Bolts (1/2" Socket): 40 ft-lbs

Microinverter Kit Nuts (7/16" Socket): 80 in-lbs

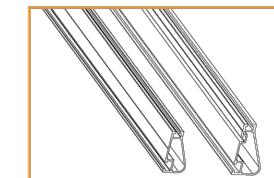
Frameless Module Kit Nuts (7/16" Socket): 80 in-lbs

➤ If using previous version of: Integrated Grounding Mid Clamps, Grounding Lug and End Clamps please refer to Alternate Components Addendum (Version 1.90).

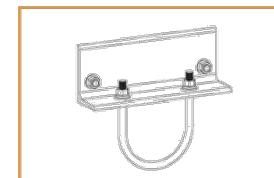
➤ If installing on a low slope roof please refer to Ground Mount for Flat Roof Applications Addendum (Version 3.30).

➤ Unless otherwise noted, all components have been evaluated for multiple use. They can be uninstalled and reinstalled in the same or new location.

### IRONRIDGE COMPONENTS



XR100 & XR1000 Rail



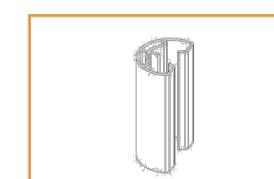
Rail Connector



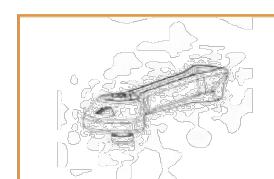
Top Cap



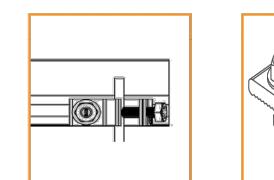
UFO (30-46mm)



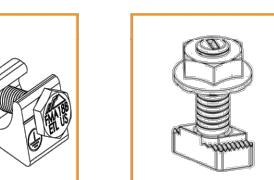
Stopper Sleeve



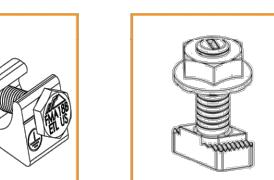
CAMO



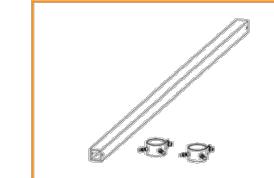
Rail Grounding Lug



Module Grounding Lug



Microinverter Kit



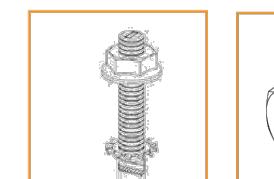
Diagonal Brace



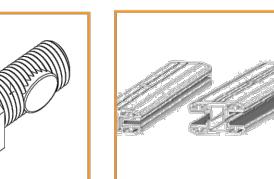
End Cap



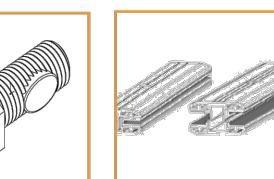
Wire Clip



Frameless Module Kit



Hex Head Set Screw



Frameless End/Mid Clamp

IronRidge

Mr. Corey Geiger

Ground Mounting System with Ground Screws – Structural Analysis – 4 Module (XR1000)

February 1, 2023

Page 6 of 22

CONTRACTOR: ACES

ADDRESS: 7288 RUSH LIMA RD,

HONEOYE FALLS, NY 14472,USA

PHONE: 15859357186

EMAIL: Steve@aces-energy.com

LICENSE #: N/A in New York State

### REVISIONS

DESCRIPTION	DATE	REV

### SIGNATURE & SEAL

### HOMEOWNER INFO

**DAVID STERN**

1822 LAKE ROAD, WEBSTER, NY  
14580, USA

APN: 037-03-1-33.1 PHONE: +15857037612  
EMAIL: dster@eliostern.com

Table 2B - MAXIMUM PIER SPACING (in) (APPLICABLE TO PANELS UP TO 80in)										
3" Unbraced Pipe Frame	Snow psf	Slope (deg)								
		0	5	10	15	20	25	30	35	
90 mph Exposure C	0	224	224	203	197	187	174	128	108	92
	10	197	197	187	184	181	174	128	108	92
	20	169	169	162	161	161	162	128	108	92
	30	158	158	153	152	153	155	128	108	92
	40	144	144	140	140	142	145	128	108	92
	50	131	131	131	130	133	137	128	108	92
	60	121	121	121	123	126	130	128	108	92
	0	221	224	194	189	179	156	114	97	82
	10	196	197	181	179	175	156	114	97	82
95 mph Exposure C	20	167	169	159	157	157	156	114	97	82
	30	157	158	150	149	150	151	114	97	82
	40	143	144	138	138	139	142	114	97	82
	50	131	131	129	128	131	134	114	97	82
	60	121	121	121	121	124	128	114	97	82
	0	212	217	186	181	171	141	103	87	74
	10	191	194	176	174	170	141	103	87	74
	20	165	167	155	154	153	141	103	87	74
	30	155	156	147	146	146	141	103	87	74
100 mph Exposure C	40	142	143	136	135	137	139	103	87	74
	50	131	131	127	127	129	131	103	87	74
	60	121	121	120	119	122	125	103	87	74
	0	204	209	178	173	164	128	94	79	67
	10	186	190	171	169	164	128	94	79	67
	20	162	164	152	150	149	128	94	79	67
	30	152	154	144	143	143	128	94	79	67
	40	140	141	134	133	134	128	94	79	67
	50	130	131	125	125	126	128	94	79	67
110 mph Exposure C	60	121	121	118	118	120	123	103	87	74
	0	196	202	171	166	157	116	85	72	61
	10	182	185	167	164	157	116	85	72	61
	20	159	161	149	147	145	116	85	72	61
	30	150	152	141	140	139	116</			

## CERTIFICATE OF COMPLIANCE

**Certificate Number** 20220917-E341165  
**Report Reference** E341165-20210317  
**Date** 2022-09-17

**Issued to:** Enphase Energy Inc.  
1420 N. McDowell Blvd. Petaluma, CA 94954-6515

**This is to certify that representative samples of** Photovoltaic Grid Support Utility Interactive Inverter with Rapid Shutdown Functionality

Models: IQ8-60, IQ8PLUS-72, IQ8M-72, IQ8A-72, IQ8H-208-72, IQ8H-240-72, may be f/b -2, -5, -E or -M, may be f/b -ACM, f/b -US, may be f/b -NM, may be f/b -RMA, may be f/b -&, where "&" designates additional characters.

Have been investigated by UL in accordance with the Standard(s) indicated on this Certificate.

**Standard(s) for Safety:** See Page 2

**Additional Information:** See the UL Online Certifications Directory at [www.ul.com/database](http://www.ul.com/database) for additional information

This Certificate of Compliance does not provide authorization to apply the UL Mark. Only the UL Follow-Up Services Procedure provides authorization to apply the UL Mark.

Only those products bearing the UL Mark should be considered as being UL Certified and covered under UL's Follow-Up Services.

Look for the UL Certification Mark on the product.

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Bruce Mahrenholz, Director North American Certification Program

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## CERTIFICATE OF COMPLIANCE

**Certificate Number** 20220917-E341165  
**Report Reference** E341165-20210317  
**Date** 2022-09-17

This is to certify that representative samples of the product as specified on this certificate were tested according to the current UL requirements.  
Standards for Safety:

UL 1741, Inverters, Converters, Controllers and Interconnection System Equipment for Use With Distributed Energy Resources, Edition 3, Issue Date 09/28/2021. Including the requirements in UL 1741 Supplements SA and SB.

IEEE 1547, Interconnection and Interoperability of Distributed Energy Resources (DERs) with Associated Electric Power Systems (EPSSs) Interfaces, Issue Date 02/15/2018

IEEE 1547.1, IEEE Standard Conformance Test Procedures for Interconnecting Distributed Energy Resources (DERs) with Electric Power Systems (EPSSs) Associated Interfaces, Issue Date 03/05/2020.

UL 62109-1, Safety of Converters for Use in Photovoltaic Power Systems - Part 1: General Requirements; IEC 62109-2, Safety of Power Converters for use in Photovoltaic Power Systems - Part 2: Particular Requirements for Inverters.

CAN/CSA C22.2 No. 62109-1, Safety of Power Converters for use in photovoltaic power systems - Part 1: General Requirements, 2016/07

CAN/CSA C22.2 No. 62109-2, Safety of Power Converters for use in photovoltaic power systems - Part 2: Particular requirements for inverters, 2016/07

R21: The evaluation to the Standards above provides evidence of compliance to the intent of the existing California Rule 21 Interconnection (references to the past publication of IEEE 1547 standards) and UL1741 Table SA1.1 option to use the IEEE 1547.1-2020 and UL1741SB test methods in conjunction with using IEEE 1547-2018 as the SRD under which SA11.2 Normal Ramp Rate is not addressed. Additional testing was conducted to confirmed compliance to Normal Ramp Rate SA11.2 . See also Appendix A.

14H (SA): The evaluation to the Standards above provides evidence of compliance to HECO Rule 14H, SRD V1.0, Interconnection Application.

14H (SB): The evaluation to the Standards above provides evidence of compliance to HECO Rule 14H, SRD V2.0, Interconnection Application.



Bruce Mahrenholz, Director North American Certification Program

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EMAIL: [dsterne@elliotstern.com](mailto:dsterne@elliotstern.com)

**SHEET NAME**

**EQUIPMENT  
SPECIFICATION**

**SHEET SIZE**

**ANSI B  
11" X 17"**

**SHEET NUMBER**

**PV-17**

## CERTIFICATE OF COMPLIANCE

**Certificate Number** 20220917-E341165  
**Report Reference** E341165-20210317  
**Date** 2022-09-17

### Inverter Firmware Version:

Model	UL 1998 (grid support)	Date	Version/Revision
IQ8-60, IQ8PLUS-72, IQ8M-72, IQ8A-72, IQ8H-208-72, IQ8H-240-72	Yes	2022-08-02	2.45.04
	Yes	2022-09-09	2.48.01

## CERTIFICATE OF COMPLIANCE

**Certificate Number** 20220917-E341165  
**Report Reference** E341165-20210317  
**Date** 2022-09-17

### APPENDIX A

As permitted by UL1741, 3<sup>rd</sup> Edition, Table SA1.1, shown below, allows for the evaluation of products using either the UL 1741 SA tests or alternative testing methods using the requirements of IEEE 1547.1-2020 in accordance with IEEE 1547-2018 and IEEE 1547.1-2020.

UL1741 SA test name	SA test section	Comparable IEEE 1547.1-2020 test section	Subject Inverter complies with UL1741SA
Anti-Islanding Protection	SA8	5.10.2	✓
Low and High Voltage Ride-Through	SA9	5.4.4, 5.4.7	✓
Low and High Frequency Ride-Through	SA10	5.5.3, 5.5.4	✓
Normal Ramp Rates	SA11.2	NA <sup>a</sup>	✓
Soft-Start Ramp Rates	SA11.4	5.6	✓
Specified Power Factor	SA12	5.14.3	✓
Volt/Var Mode	SA13	5.14.4	✓ <sup>b</sup>
Frequency-Watt	SA14	5.15.2	✓
Volt-Watt	SA15	5.14.9	✓
Disable Permit Service	SA17	5.6	✓
Limit Active Power	SA18	5.13	✓

<sup>a</sup> IEEE 1547-2018 and IEEE 1547.1-2020 do not have a requirement for, or test equivalent to, the UL 1741 SA Normal Ramp Rate which is presently a local requirement per California Rule 21 and/or Hawaii 14H. This inverter has been additionally tested and is compliant with the Normal Ramp Rate test of SA11.2.

<sup>b</sup> - Functional in the following priority modes:  active power  reactive power

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Bruce Mahrenholz, Director North American Certification Program

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**SHEET NAME**  
**EQUIPMENT SPECIFICATION**

**SHEET SIZE**  
ANSI B  
11" X 17"

**SHEET NUMBER**  
PV-18