GENERAL NOTES

CODE AND STANDARDS

1. ALL WORK SHALL COMPLY WITH 2017 NATIONAL ELECTRIC CODE (NEC), 2018 INTERNATIONAL BUILDING CODE (IBC), 2018 INTERNATIONAL RESIDENTIAL CODE (IRC), 2018 UNIFORM PLUMBING CODE (UPC), AND ALL STATE AND LOCAL BUILDING, ELECTRICAL, AND PLUMBING CODES.
2. DRAWINGS HAVE BEEN DETAILED ACCORDING TO UL LISTING REQUIREMENTS.

SITE NOTES / OSHA REGULATION

1. A LADDER SHALL BE IN PLACE FOR INSPECTION IN COMPLIANCE WITH OSHA REGULATIONS.
2. THE PV MODULES ARE CONSIDERED NON-COMBUSTIBLE AND THIS SYSTEM IS A UTILITY INTERACTIVE SYSTEM.
3. THE SOLAR PV INSTALLATION SHALL NOT OBSTRUCT ANY PLUMBING, MECHANICAL, OR BUILDING ROOF VENTS.
4. ROOF COVERINGS SHALL BE DESIGNED, INSTALLED, AND MAINTAINED IN ACCORDANCE WITH THIS CODE AND THE APPROVED MANUFACTURER'S INSTRUCTIONS SUCH THAT THE ROOF COVERING SHALL SERVE TO PROTECT THE BUILDING OR STRUCTURE.

SOLAR CONTRACTOR

1. MODULE CERTIFICATIONS WILL INCLUDE UL1703, IEC61646, IEC61730.
2. IF APPLICABLE, MODULE GROUNDING LUGS MUST BE INSTALLED AT THE MARKED GROUNDING LUG HOLES PER THE MANUFACTURER'S INSTALLATION REQUIREMENTS.
3. AS INDICATED BY DESIGN, OTHER NRTL LISTED MODULE GROUNDING DEVICES MAY BE USED IN PLACE OF STANDARD GROUNDING LUGS AS SHOWN IN MANUFACTURER DOCUMENTATION AND APPROVED BY THE AHJ.
4. CONDUIT AND WIRE SPECIFICATIONS ARE BASED ON MINIMUM CODE REQUIREMENTS AND ARE NOT MEANT TO LIMIT UP-SIZING AS REQUIRED BY FIELD CONDITIONS.
5. CONDUIT POINT OF PENETRATION FROM EXTERIOR TO INTERIOR TO BE INSTALLED AND SEALED WITH A SUITABLE SEALING COMPOUND.
6. DC WIRING LIMITED TO MODULE FOOTPRINT W/ ENPHASE AC SYSTEM.
7. ENPHASE WIRING SYSTEMS SHALL BE LOCATED AND SECURED UNDER THE ARRAY W/ SUITABLE WIRING CLIPS.
8. MAX DC VOLTAGE CALCULATED USING MANUFACTURER PROVIDED TEMP COEFFICIENT FOR VOC UNLESS NOT AVAILABLE.
9. ALL INVERTERS, MOTOR GENERATORS, PHOTOVOLTAIC MODULES, PHOTOVOLTAIC PANELS, AC PHOTOVOLTAIC MODULES, DC COMBINERS, DC-TO-DC CONVERTERS,SOURCE CIRCUIT COMBINERS, AND CHARGE CONTROLLERS INTENDED FOR USE IN A PHOTOVOLTAIC POWER SYSTEM WILL BE IDENTIFIED AND LISTED FOR THE APPLICATION PER NEC 690.4(B).
10. ALL SIGNAGE TO BE PLACED IN ACCORDANCE WITH LOCAL BUILDING CODE.
11. TERMINALS AND LUGS WILL BE TIGHTENED TO MANUFACTURER TORQUE SPECIFICATIONS (WHEN PROVIDED) IN ACCORDANCE WITH NEC CODE 110.14(D) ON ALL ELECTRICAL CONNECTIONS.

EQUIPMENT LOCATIONS

1. PROPER ACCESS AND WORKING CLEARANCE AROUND EXISTING AND PROPOSED ELECTRICAL EQUIPMENT WILL BE PROVIDED AS PER SECTION NEC 110.26.
2. EQUIPMENT INSTALLED IN DIRECT SUNLIGHT MUST BE RATED FOR EXPECTED OPERATING TEMPERATURE AS SPECIFIED BY NEC 690.31(A) AND NEC TABLE 310.15(B).
3. ALL EQUIPMENT SHALL BE INSTALLED ACCESSIBLE TO QUALIFIED PERSONNEL ACCORDING TO NEC APPLICABLE CODES.
4. ALL COMPONENTS ARE LISTED FOR THEIR PURPOSE AND RATED FOR OUTDOOR USAGE WHEN APPROPRIATE.

PROJECT INFORMATION:

NUMBER OF STORIES: 2
CONDUIT RUN: Interior
ECOBEE QTY: 1
LIGHT BULB QTY: 18
PV METER: Not Required

ROOF TYPE (1) INFORMATION:
ROOF TYPE: Comp Shingle
FRAMING TYPE: Rafter
SHEATHING TYPE: OSB
ATTACHMENT: UNIRAC STRONGHOLD ATT
RACKING: NXT Horizon @ 48" OC Portrait / 72" OC Landscape
NUMBER OF ATTACHMENTS: 38

ROOF TYPE (2) INFORMATION *(IF APPLICABLE)*:
SEE PV4.2

SYSTEM TO BE INSTALLED INFORMATION:

DC SYSTEM SIZE: 7.2 kW DC
AC SYSTEM SIZE: 5.22 kW AC
MODULE TYPE: (18) URE FBM400MFG-BB
INVERTER TYPE: Enphase IQ8PLUS-72-2-US
MONITORING: Enphase IQ Combiner 4 X-IQ-AM1-240-4

AERIAL VIEW

DESIGN CRITERIA

WIND SPEED: 115 mph
GROUND SNOW LOAD: 20 lb/ft²
WIND EXPOSURE FACTOR: C
SEISMIC DESIGN CATEGORY: B

SITE SPECIFICATIONS

CONSTRUCTION - V-B
ZONING: RESIDENTIAL

SCOPE OF WORK

INSTALLATION OF UTILITY INTERACTIVE PHOTOVOLTAIC SOLAR SYSTEM AND ANY NECESSARY ADDITIONAL WORK NEEDED FOR INSTALLATION.

SHEET INDEX

8/4/23

STATE OF MISSOURI
JOHN A. CALVERT
NUMBER PE-2021040848
PROFESSIONAL ENGINEER

Digitally signed by John A. Calvert
Date: 2023.08.04 16:45:05 -06'00'

UTILITY COMPANY:

Evergy MO West

PERMIT ISSUER:

City of Lee's Summit

BLUE RAVEN SOLAR
1403 N. Research Way
Orem, UT 84097
800.377.4480
WWW.BLUERAVENSOLAR.COM

NABCEP CERTIFIED
PV INSTALLATION PROFESSIONAL
Scott Gurney
#PV-011719-015866

CONTRACTOR:
BRS FIELD OPS
800-377-4480

CUSTOMER INFORMATION:
Dan Roberts
518 NW Main St
Lee's Summit Missouri 64063

AC SYSTEM SIZE: 5.22 kW AC
DC SYSTEM SIZE: 7.2 kW DC

DRAWING BY:
Brendan Fillmore

PLOT DATE:
August 4, 2023

PROJECT NUMBER:
793875

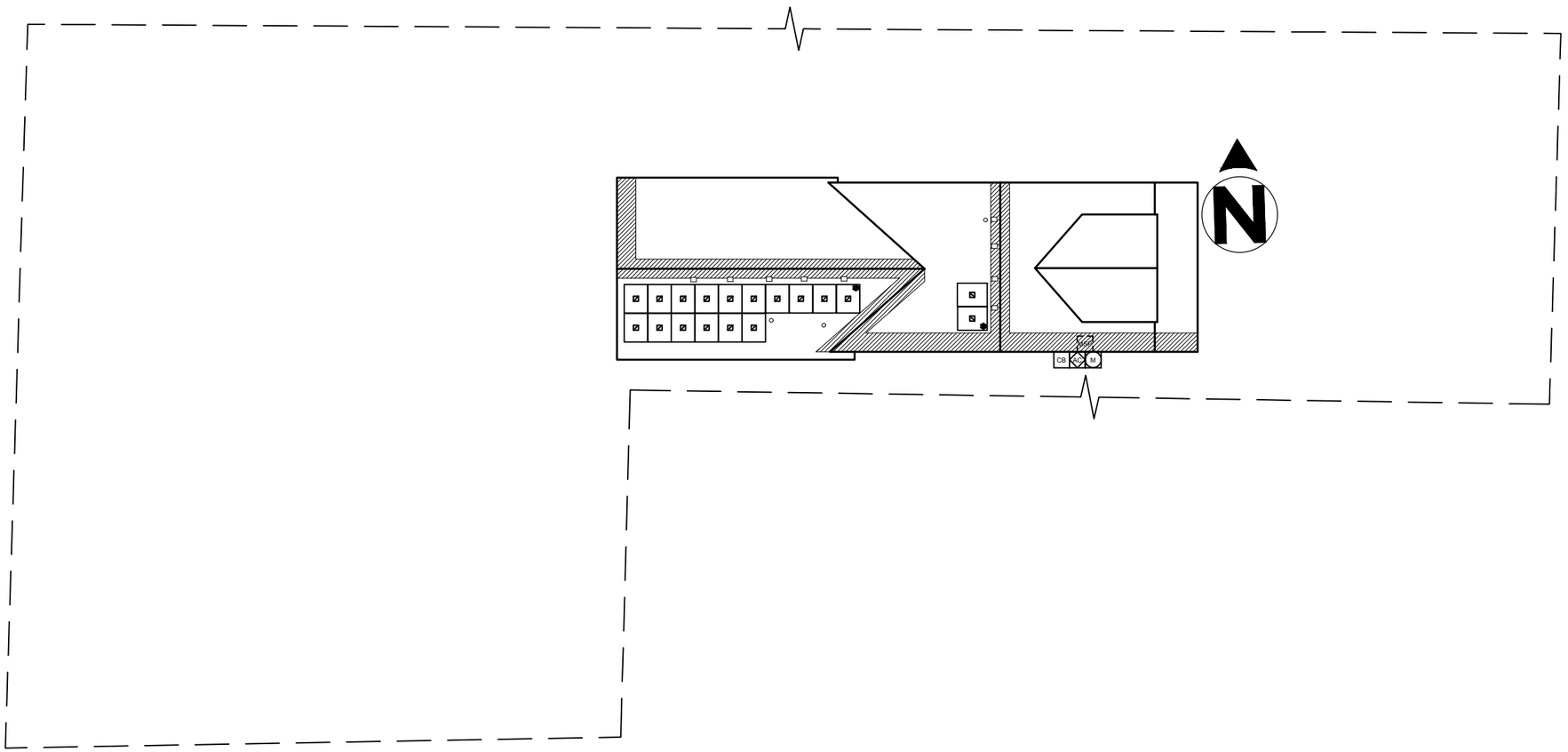
SHEET NAME:
COVER SHEET

REVISION:	PAGE NUMBER:
0	PV1

PV SYSTEM SPECIFICATIONS

TOTAL NUMBER OF MODULES: 18
MODULE MAKE AND MODEL: URE FBM400MFG-BB
MODULE WATTAGE: 400W DC

INVERTER MAKE AND MODEL: Enphase IQ8PLUS-72-2-US
INVERTER TYPE: Microinverter (1 Inverter per PV Module)
INVERTER CURRENT OUTPUT: 1.21A AC
INVERTER NOMINAL VOLTAGE: 240V
INVERTER WATTAGE: 290W AC



LEGEND

- JUNCTION BOX
- M — UTILITY METER
- MSP — MAIN SERVICE PANEL
- AC — AC DISCONNECT
- CB — COMBINER BOX
- LC — LOAD CENTER
- SUB — SUBPANEL
- PV — PV METER
- TS — TRANSFER SWITCH
- ESS — SUNPOWER ESS
- HUB — SUNPOWER HUB+
- RPO — REMOTE POWER OFF
- FIRE SETBACK
- TRENCHING
- PROPERTY LINE

SCALE: 3/64" = 1'-0"

Sealed For
Existing Roof &
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STATE OF MISSOURI
JOHN A. CALVERT
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8/4/23

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CONTRACTOR:
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800-377-4480

CUSTOMER INFORMATION:
Dan Roberts
518 NW Main St
Lee's Summit Missouri 64063

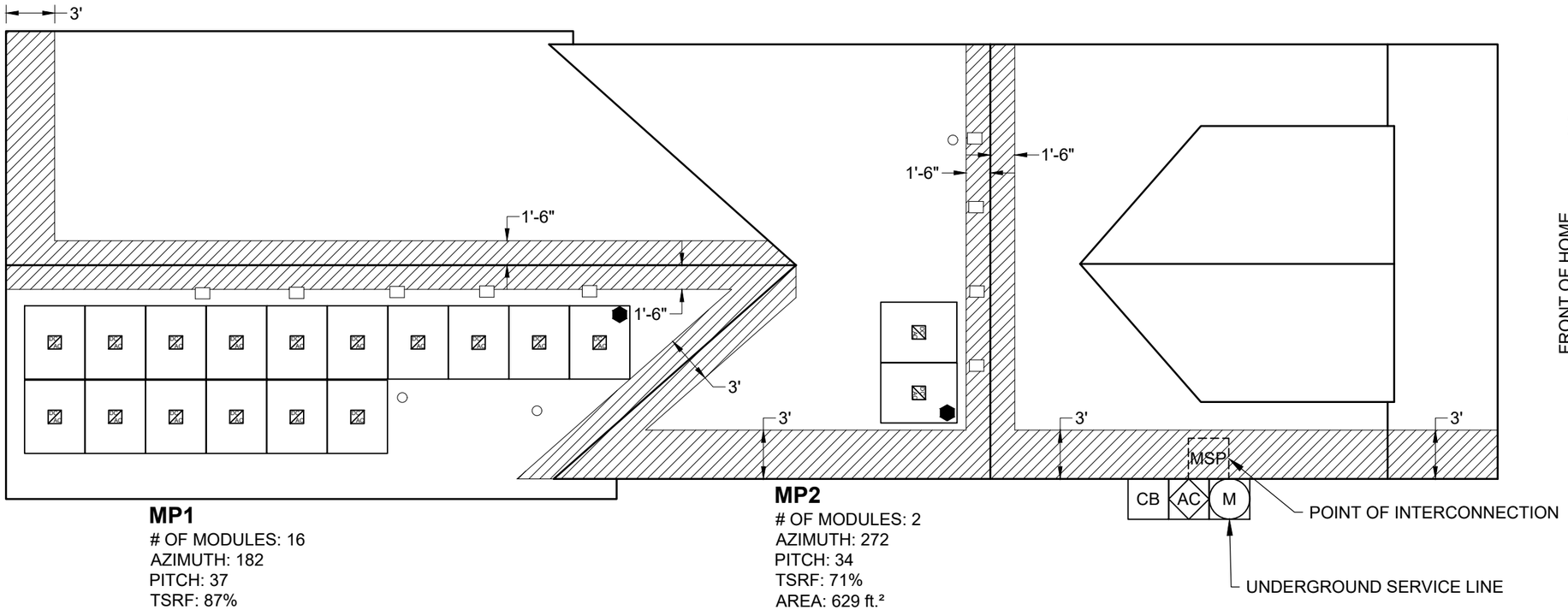
AC SYSTEM SIZE: 5.22 kW AC
DC SYSTEM SIZE: 7.2 kW DC

DRAWING BY: Brendan Fillmore
PLOT DATE: August 4, 2023
PROJECT NUMBER: 793875
SHEET NAME: SITE PLAN
REVISION: 0
PAGE NUMBER: PV2

PV SYSTEM SPECIFICATIONS

TOTAL NUMBER OF MODULES: 18
MODULE MAKE AND MODEL: URE FBM400MFG-BB
MODULE WATTAGE: 400W DC

INVERTER MAKE AND MODEL: Enphase IQ8PLUS-72-2-US
INVERTER TYPE: Microinverter (1 Inverter per PV Module)
INVERTER CURRENT OUTPUT: 1.21A AC
INVERTER NOMINAL VOLTAGE: 240V
INVERTER WATTAGE: 290W AC



MP1
OF MODULES: 16
AZIMUTH: 182
PITCH: 37
TSRF: 87%
AREA: 740 ft.²

MP2
OF MODULES: 2
AZIMUTH: 272
PITCH: 34
TSRF: 71%
AREA: 629 ft.²

LEGEND

- JUNCTION BOX
- M — UTILITY METER
- MSP — MAIN SERVICE PANEL
- AC — AC DISCONNECT
- CB — COMBINER BOX
- LC — LOAD CENTER
- SUB — SUBPANEL
- PV — PV METER
- TS — TRANSFER SWITCH
- ESS — SUNPOWER ESS
- HUB — SUNPOWER HUB+
- RPO — REMOTE POWER OFF
- FIRE SETBACK
- TRENCHING
- PROPERTY LINE

SCALE: 1/8" = 1'-0"

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8/4/23

STATE OF MISSOURI
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CONTRACTOR:
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CUSTOMER INFORMATION:
Dan Roberts
518 NW Main St
Lee's Summit Missouri 64063

AC SYSTEM SIZE: 5.22 kW AC
DC SYSTEM SIZE: 7.2 kW DC

DRAWING BY: Brendan Fillmore
PLOT DATE: August 4, 2023
PROJECT NUMBER: 793875
SHEET NAME: ROOF PLAN
REVISION: 0
PAGE NUMBER: PV3

STRUCTURAL INFORMATION:

ROOF TYPE (1):

ROOF TYPE: Comp Shingle
SHEATHING TYPE: OSB
FRAMING TYPE: Rafter
FRAMING SIZE: 2x4 @ 24" OC
CEILING JOIST SIZE: 2x4 @ 24" OC

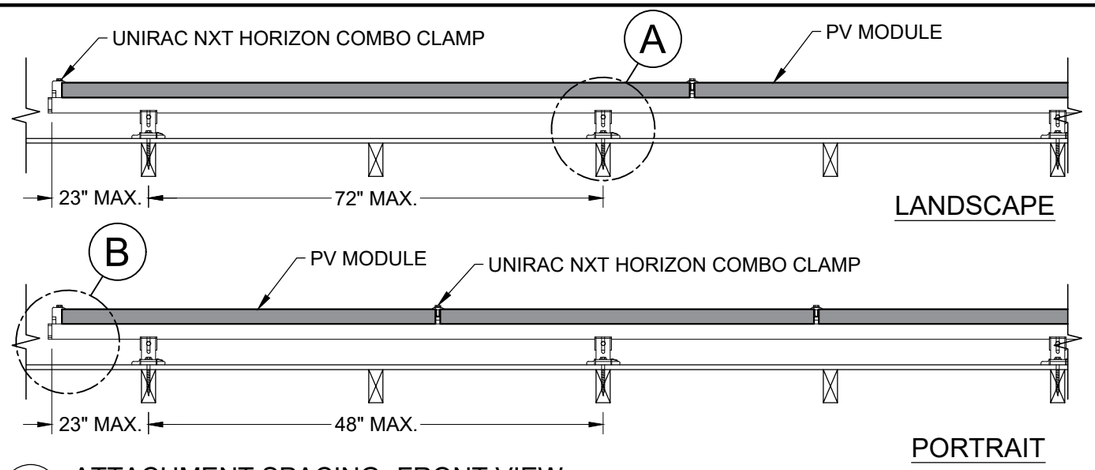
ATTACHMENT: UNIRAC STRONGHOLD ATT
RACKING: NXT Horizon
@ 48" OC Portrait / 72" OC Landscape
NUMBER OF ATTACHMENTS: 38

PV MODULE COUNT: 18 Modules
TOTAL ARRAY AREA: 367.2 ft² (20.4ft²/panel)
TOTAL ROOF AREA: 3074 ft²
ARRAY/ROOF AREA: 11.9%
ARRAY WEIGHT: 900 lbs (50 lbs/panel)
DISTRIBUTED LOAD: 2.45 lbs/ft²
POINT LOAD: 23.68 lbs/attachment

STRUCTURAL NOTES:

MP 1 is rafter framing with 2x6 rafters spaced 19.2 in apart

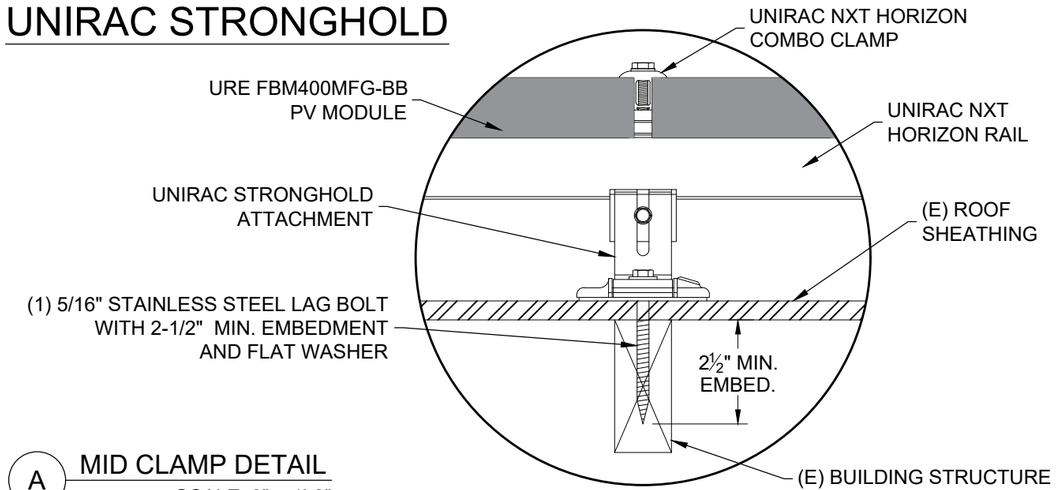
*NOTE: LISTED NUMBER OF ATTACHMENT POINTS ARE AN ESTIMATE ONLY AND MAY VARY BASED ON FIELD CONDITIONS. MAXIMUM ATTACHMENT SPACING TO BE FOLLOWED PER ENGINEER OF RECORD SPECIFICATIONS.



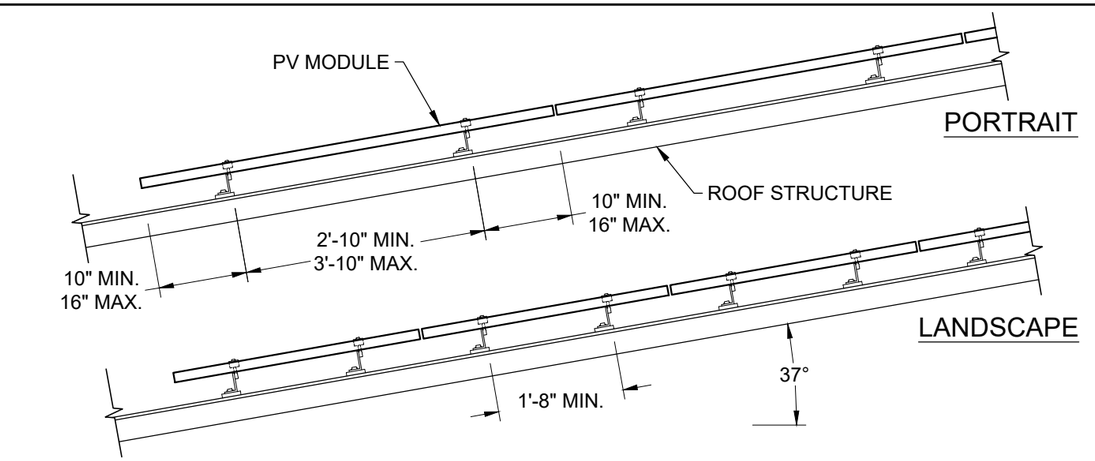
C ATTACHMENT SPACING- FRONT VIEW
SCALE: 3/4" = 1'-0"

-RACKING ATTACHMENTS TO BE STAGGERED

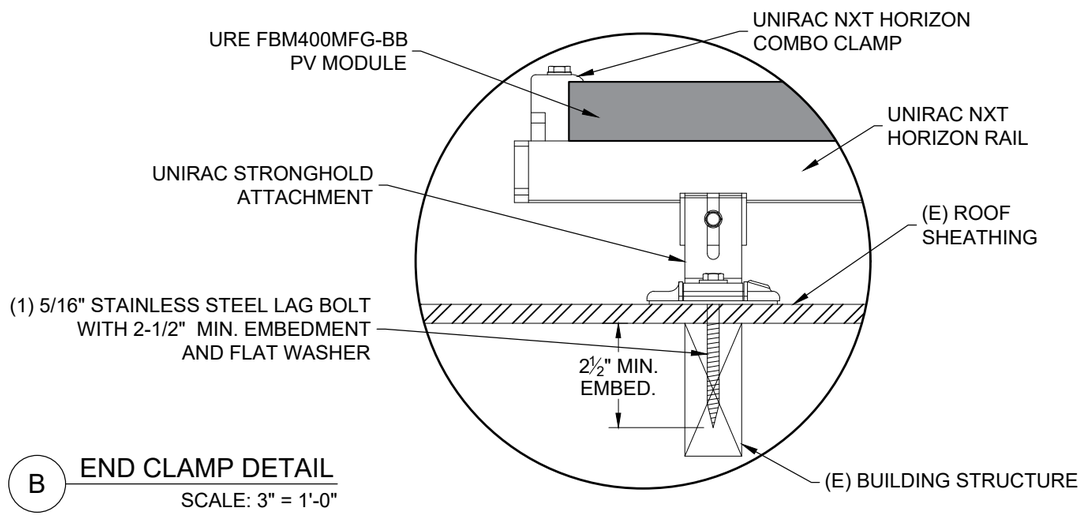
UNIRAC STRONGHOLD



A MID CLAMP DETAIL
SCALE: 3" = 1'-0"



D ATTACHMENT SPACING- SIDE VIEW
SCALE: 1/2" = 1'-0"



B END CLAMP DETAIL
SCALE: 3" = 1'-0"

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8/4/23

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#PV-011719-015866

CONTRACTOR:
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800-377-4480

CUSTOMER INFORMATION:
Dan Roberts
518 NW Main St
Lee's Summit Missouri 64063

AC SYSTEM SIZE: 5.22 kW AC
DC SYSTEM SIZE: 7.2 kW DC

DRAWING BY: Brendan Fillmore
PLOT DATE: August 4, 2023
PROJECT NUMBER: 793875
SHEET NAME: STRUCTURAL
REVISION: 0
PAGE NUMBER: PV4

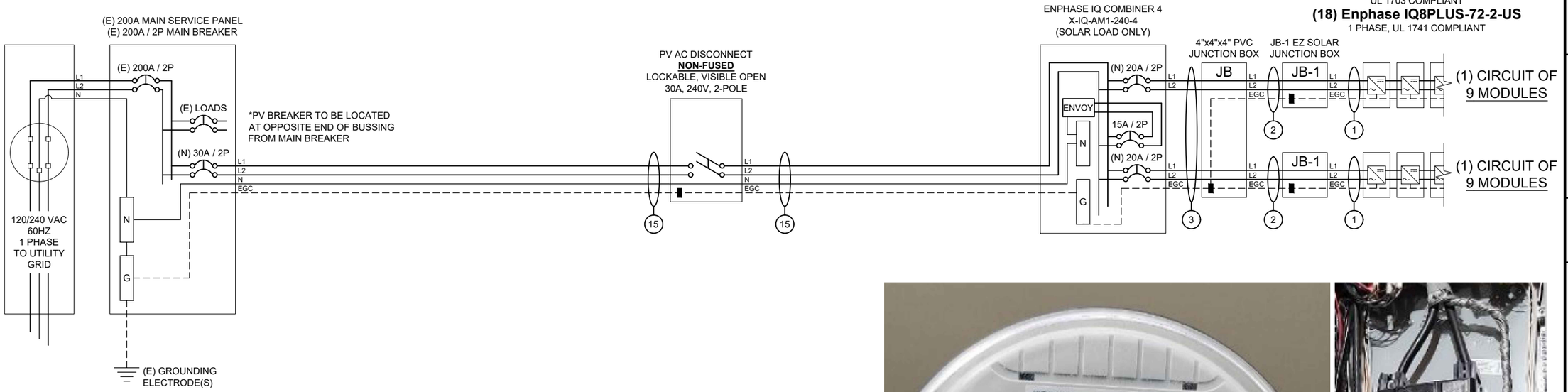
15	(1)	10 AWG THHN/THWN-2, CU., BLACK (L1)	21.8 A AC	3	(2)	10 AWG THHN/THWN-2, CU., BLACK (L1)	MAX 10.9 A AC	2	(1)	10 AWG THHN/THWN-2, CU., BLACK (L1)	MAX 10.9 A AC	1	(1)	12-2 TC-ER,THHN/THWN-2, CU.	MAX 10.9 A AC
	(1)	10 AWG THHN/THWN-2, CU., RED (L2)	240 V AC		(2)	10 AWG THHN/THWN-2, CU., RED (L 2)	240 V AC		(1)	10 AWG THHN/THWN-2, CU., RED (L2)	240 V AC		(1)	6 AWG BARE, CU (EGC)	240 V AC
	(1)	10 AWG THHN/THWN-2, CU., WHITE (N)			(1)	10 AWG THHN/THWN-2, CU., GREEN (EGC)			(1)	10 AWG THHN/THWN-2, CU., GREEN (EGC)					
	(1)	10 AWG THHN/THWN-2, CU., GREEN (EGC)								OR 10- 2 UF-B W/G (OR NM-B), THHN/THWN-2, SOLID CU.					
	(1)	3/4 INCH EMT	EXTERIOR		(1)	3/4 INCH EMT	EXTERIOR		(1)	3/4 INCH EMT (Not Required for UF-B or NM-B Cable)	INTERIOR				EXTERIOR

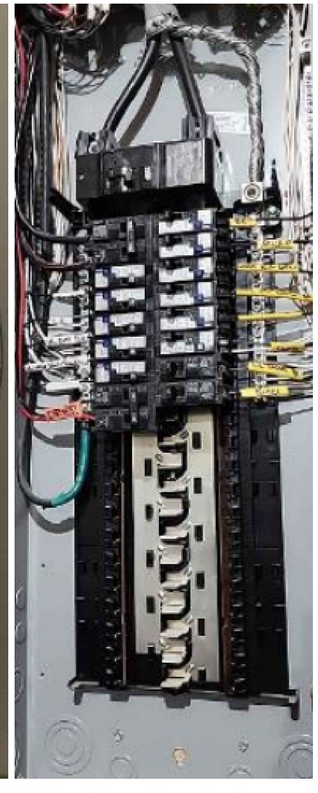
DESIGNER NOTES:

LOAD SIDE BREAKER IN MSP, POI INTERIOR

ELECTRICAL NOTES:

(18) URE FBM400MFG-BB
UL 1703 COMPLIANT
(18) Enphase IQ8PLUS-72-2-US
1 PHASE, UL 1741 COMPLIANT





INTERCONNECTION NOTES

705.12(B)(3) THE FOLLOWING METHOD(S) SHALL BE USED TO DETERMINE THE RATINGS OF BUSBARS: *(2)* WHERE TWO SOURCES, ONE A PRIMARY POWER SOURCE AND THE OTHER ANOTHER POWER SOURCE, ARE LOCATED AT OPPOSITE ENDS OF A BUSBAR THAT CONTAINS LOADS, THE SUM OF 125 PERCENT OF THE POWER-SOURCE(S) OUTPUT CIRCUIT CURRENT AND THE RATING OF THE OVERCURRENT DEVICE PROTECTING THE BUS BAR SHALL NOT EXCEED 12O PERCENT OF THE AMPACITY OF THE BUSBAR.

UTILITY COMPANY: Evergy MO West **PERMIT ISSUER:** City of Lee's Summit

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#PV-011719-015866

CONTRACTOR:
BRS FIELD OPS
800-377-4480

CUSTOMER INFORMATION:
Dan Roberts
518 NW Main St
Lee's Summit Missouri 64063

AC SYSTEM SIZE: 5.22 kW AC
DC SYSTEM SIZE: 7.2 kW DC

DRAWING BY:
Brendan Fillmore

PLOT DATE:
August 4, 2023

PROJECT NUMBER:
793875

SHEET NAME:
ELECTRICAL

REVISION:	PAGE NUMBER:
0	PV5

MODULE SPECIFICATIONS	URE FBM400MFG-BB
RATED POWER (STC)	400 W
MODULE VOC	37.2 V DC
MODULE VMP	31.17 V DC
MODULE IMP	12.84 A DC
MODULE ISC	13.68 A DC
VOC CORRECTION	-0.27 %/°C
VMP CORRECTION	-0.32 %/°C
SERIES FUSE RATING	30 A DC
ADJ. MODULE VOC @ ASHRAE LOW TEMP	41.8 V DC
ADJ. MODULE VMP @ ASHRAE 2% AVG. HIGH TEMP	27.0 V DC

MICROINVERTER SPECIFICATIONS	Enphase IQ8+ Microinverters
POWER POINT TRACKING (MPPT) MIN/MAX	30 - 58 V DC
MAXIMUM INPUT VOLTAGE	60 V DC
MAXIMUM DC SHORT CIRCUIT CURRENT	15 A DC
MAXIMUM USABLE DC INPUT POWER	440 W
MAXIMUM OUTPUT CURRENT	1.21 A AC
AC OVERCURRENT PROTECTION	20 A
MAXIMUM OUTPUT POWER	290 W
CEC WEIGHTED EFFICIENCY	97 %

AC PHOTOVOLATIC MODULE MARKING (NEC 690.52)	
NOMINAL OPERATING AC VOLTAGE	240 V AC
NOMINAL OPERATING AC FREQUENCY	47 - 68 HZ AC
MAXIMUM AC POWER	240 VA AC
MAXIMUM AC CURRENT	1.0 A AC
MAXIMUM OCPD RATING FOR AC MODULE	20 A AC

DESIGN LOCATION AND TEMPERATURES	
TEMPERATURE DATA SOURCE	ASHRAE 2% AVG. HIGH TEMP
STATE	Missouri
CITY	Lee's Summit
WEATHER STATION	KANSAS CITY INTL ARPT
ASHRAE EXTREME LOW TEMP (°C)	-21
ASHRAE 2% AVG. HIGH TEMP (°C)	35

SYSTEM ELECTRICAL SPECIFICATIONS	CIR 1	CIR 2	CIR 3	CIR 4	CIR 5	CIR 6
NUMBER OF MODULES PER MPPT	9	9				
DC POWER RATING PER CIRCUIT (STC)	3600	3600				
TOTAL MODULE NUMBER	18					
STC RATING OF ARRAY	7200					
AC CURRENT @ MAX POWER POINT (IMP)	10.9	10.9				
MAX. CURRENT (IMP X 1.25)	13.6125	13.6125				
OCPD CURRENT RATING PER CIRCUIT	20	20				
MAX. COMB. ARRAY AC CURRENT (IMP)	21.8					
MAX. ARRAY AC POWER	5220W AC					

AC VOLTAGE RISE CALCULATIONS	DIST (FT)	COND.	√RISE(V)	VEND(V)	%VRISE
VRISE SEC. 1 (MICRO TO JBOX)	32.4	12 Cu.	1.18	241.18	0.49%
VRISE SEC. 2 (JBOX TO COMBINER BOX)	55	10 Cu.	1.52	241.52	0.63%
VRISE SEC. 3 (COMBINER BOX TO POI)	5	10 Cu.	0.28	240.28	0.12%
TOTAL VRISE			2.98	242.98	1.24%

PHOTOVOLTAIC AC DISCONNECT OUTPUT LABEL (NEC 690.54)	
AC OUTPUT CURRENT	21.8 A AC
NOMINAL AC VOLTAGE	240 V AC

CONDUCTOR SIZE CALCULATIONS					
MICROINVERTER TO JUNCTION BOX (1)	MAX. SHORT CIRCUIT CURRRENT (ISC) =	10.9	A AC		
	MAX. CURRENT (ISC X1.25) =	13.6	A AC		
	CONDUCTOR (TC-ER, COPPER (90°C)) =	12	AWG		
	CONDUCTOR RATING =	30	A		
	AMB. TEMP. AMP. CORRECTION =	0.96			
	ADJUSTED AMP. =	28.8	>	13.6	
JUNCTION BOX TO JUNCTION BOX (2)	MAX. SHORT CIRCUIT CURRRENT (ISC) =	10.9	A AC		
	MAX. CURRENT (ISC X1.25) =	13.6	A AC		
	CONDUCTOR (UF-B, COPPER (60°C)) =	10	AWG		
	CONDUCTOR RATING =	30	A		
	CONDUIT FILL DERATE =	1			
	AMB. TEMP. AMP. CORRECTION =	0.96			
	ADJUSTED AMP. =	28.8	>	13.6	
JUNCTION BOX TO COMBINER BOX (3)	MAX. SHORT CIRCUIT CURRRENT (ISC) =	10.9	A AC		
	MAX. CURRENT (ISC X1.25) =	13.6	A AC		
	CONDUCTOR (UF-B, COPPER (60°C)) =	10	AWG		
	CONDUCTOR RATING =	30	A		
	CONDUIT FILL DERATE =	0.8			
	AMB. TEMP. AMP. CORRECTION =	0.96			
	ADJUSTED AMP. =	23.04	>	13.6	
COMBINER BOX TO MAIN PV OCPD (15)	INVERTER RATED AMPS =	21.8	A AC		
	MAX. CURRENT (RATED AMPS X1.25) =	27.23	A AC		
	CONDUCTOR (THWN-2, COPPER (75°C TERM.)) =	10	AWG		
	CONDUCTOR RATING =	35	A		
	CONDUIT FILL DERATE =	1			
	AMB. TEMP. AMP. CORRECTION =	0.96			
	ADJUSTED AMP. =	33.6	>	27.2	

GROUNDING NOTES

1. A GROUNDING ELECTRODE SYSTEM IN ACCORDANCE WITH [NEC 690.47] AND [NEC 250.50-60] SHALL BE PROVIDED. PER [NEC 690.47], THE GROUNDING ELECTRODE SYSTEM OF AN EXISTING BUILDING MAY BE USED AND BE BONDED AT THE SERVICE ENTRANCE. IF EXISTING SYSTEM IS INACCESSIBLE, OR INADEQUATE, OR IS ONLY METALLIC WATER PIPING, A SUPPLEMENTAL GROUNDING ELECTRODE WILL BE USED AT THE INVERTER LOCATION CONSISTING OF A UL LISTED 8 FT GROUND ROD WITH ACORN CLAMP.
2. THE GROUNDING ELECTRODE CONDUCTOR SHALL BE PROTECTED FROM PHYSICAL DAMAGE BETWEEN THE GROUNDING ELECTRODE AND THE PANEL (OR INVERTER) IF SMALLER THAN #6 AWG COPPER WIRE PER [NEC 250.64(B)]. THE GROUNDING ELECTRODE CONDUCTOR WILL BE CONTINUOUS, EXCEPT FOR SPLICES OR JOINTS AT BUSBARS WITHIN LISTED EQUIPMENT PER [NEC 250.64(C)].
3. GROUNDING ELECTRODE CONDUCTORS SHALL BE NO LESS THAN 8 AWG AND NO GREATER THAN 6 AWG COPPER AND BONDED TO THE EXISTING GROUNDING ELECTRODE TO PROVIDE FOR A COMPLETE SYSTEM.
4. PV SYSTEM SHALL BE GROUNDED IN ACCORDANCE TO [NEC 250.21], [NEC TABLE 250.122], AND ALL METAL PARTS OR MODULE FRAMES ACCORDING TO [NEC 690.46].
5. MODULE SOURCE CIRCUITS SHALL BE GROUNDED IN ACCORDANCE TO [NEC 690.42].
6. THE GROUNDING CONNECTION TO A MODULE SHALL BE ARRANGED SUCH THAT THE REMOVAL OF A MODULE DOES NOT INTERRUPT A GROUNDED CONDUCTOR TO ANOTHER MODULE.
7. EACH MODULE WILL BE GROUNDED USING THE SUPPLIED CONNECTION POINTS IDENTIFIED IN THE MANUFACTURER'S INSTALLATION INSTRUCTIONS.
8. ENCLOSURES SHALL BE PROPERLY PREPARED WITH REMOVAL OF PAINT/FINISH AS APPROPRIATE WHEN GROUNDING EQUIPMENT WITH TERMINATION GROUNDING LUGS.
9. GROUNDING SYSTEM COMPONENTS SHALL BE LISTED FOR THEIR PURPOSE, AND GROUNDING DEVISES EXPOSED TO THE ELEMENTS SHALL BE RATED FOR DIRECT BURIAL.
10. GROUNDING AND BONDING CONDUCTORS SHALL BE COPPER, SOLID OR STRANDED, AND BARE WHEN EXPOSED.
11. EQUIPMENT GROUNDING CONDUCTORS SHALL BE SIZED ACCORDING TO [NEC 690.45] AND BE A MINIMUM OF 10 AWG WHEN NOT EXPOSED TO DAMAGE (6 AWG SHALL BE USED WHEN EXPOSED TO DAMAGE).
12. GROUNDING AND BONDING CONDUCTORS, IF INSULATED, SHALL BE COLOR CODED GREEN (OR MARKED GREEN IF 4 AWG OR LARGER).
13. ALL CONDUIT BETWEEN THE UTILITY AC DISCONNECT AND THE POINT OF CONNECTION SHALL HAVE GROUNDED BUSHINGS AT BOTH ENDS.
14. SYSTEM GEC SIZED ACCORDING TO [NEC 690.47], [NEC TABLE 250.66], DC SYSTEM GEC SIZED ACCORDING TO [NEC 250.166], MINIMUM 8 AWG WHEN INSULATED, 6 AWG WHEN EXPOSED TO DAMAGE.
15. EXPOSED NON-CURRENT CARRYING METAL PARTS OF MODULE FRAMES, EQUIPMENTS, AND CONDUCTOR ENCLOSURES SHALL BE GROUNDED IN ACCORDANCE WITH [NEC 250.134] OR [NEC 250.136(A)] REGARDLESS OF VOLTAGE.

WIRING & CONDUIT NOTES

1. ALL CONDUIT SIZES AND TYPES, SHALL BE LISTED FOR ITS PURPOSE AND APPROVED FOR THE SITE APPLICATIONS.
2. BOLTED CONNECTION REQUIRED IN DC DISCONNECTS ON THE WHITE GROUNDED CONDUCTOR (USE POLARIS BLOCK OR NEUTRAL BAR).
3. ANY CONNECTION ABOVE LIVE PARTS MUST BE WATERTIGHT. REDUCING WASHERS DISALLOWED ABOVE LIVE PARTS, MEYERS HUBS RECOMMENDED
4. UV RESISTANT CABLE TIES (NOT ZIP TIES) USED FOR PERMANENT WIRE MANAGEMENT OFF THE ROOF SURFACE IN ACCORDANCE WITH [NEC 110.2,110.3(A-B)].
5. SOLADECK JUNCTION BOXES MOUNTED FLUSH WITH ROOF SURFACE TO BE USED FOR WIRE MANAGEMENT AND AS FLASHED ROOF PENETRATIONS FOR INTERIOR CONDUIT RUNS.
6. ALL PV CABLES AND HOMERUN WIRES BE TYPE USE-2, AND SINGLE-CONDUCTOR CABLE LISTED AND IDENTIFIED AS PV WIRE, TYPE TC-ER, OR EQUIVALENT; ROUTED TO SOURCE CIRCUIT COMBINER BOXES AS REQUIRED.
7. ALL CONDUCTORS AND OCPD SIZES AND TYPES SPECIFIED ACCORDING TO [NEC 690.8] FOR MULTIPLE CONDUCTORS.
8. ALL PV DC CONDUCTORS IN CONDUIT EXPOSED TO SUNLIGHT SHALL BE INSTALLED AT LEAST 7/8" ABOVE THE ROOF SURFACE AND DERATED ACCORDING TO [NEC TABLE 310.15 (B)(2)(A)], [NEC TABLE 310.15(B)(3)(A)],& [NEC 310.15(B)(3)(C)].
9. EXPOSED ROOF PV DC CONDUCTORS SHALL BE USE-2, 90°C RATED, WET AND UV RESISTANT, AND UL LISTED RATED FOR 600V, UV RATED SPIRAL WRAP SHALL BE USED TO PROTECT WIRE FROM SHARP EDGES.
10. PHASE AND NEUTRAL CONDUCTORS SHALL BE DUAL RATED THHN/THWN-2 INSULATED, 90°C RATED, WET AND UV RESISTANT, RATED FOR 600V
11. 4-WIRE DELTA CONNECTED SYSTEMS HAVE THE PHASE WITH THE HIGHER VOLTAGE TO GROUND MARKED ORANGE OR IDENTIFIED BY OTHER EFFECTIVE MEANS.
12. ALL SOURCE CIRCUITS SHALL HAVE INDIVIDUAL SOURCE CIRCUIT PROTECTION
13. VOLTAGE DROP LIMITED TO 2% FOR DC CIRCUITS AND 3% FOR AC CIRCUITS
14. NEGATIVE GROUNDED SYSTEMS DC CONDUCTORS SHALL BE COLOR CODED AS FOLLOWS: DC POSITIVE- RED (OR MARKED RED), DC NEGATIVE- GREY (OR MARKED GREY)
15. POSITIVE GROUNDED SYSTEMS DC CONDUCTORS COLOR CODED:
DC POSITIVE- GREY (OR MARKED GREY), DC NEGATIVE- BLACK (OR MARKED BLACK)
16. AC CONDUCTORS >4AWG COLOR CODED OR MARKED: PHASE A OR L1- BLACK, PHASE B OR L2- RED, PHASE C OR L3- BLUE, NEUTRAL- WHITE/GRAY
* USE-2 IS NOT INDOOR RATED BUT PV CABLE IS RATED THWN/THWN-2 AND MAY BE USED INSIDE
** USE-2 IS AVAILABLE AS UV WHITE
17. RIGID CONDUIT, IF INSTALLED, (AND/OR NIPPLES) MUST HAVE A PULL BUSHING TO PROTECT WIRES.
18. IF CONDUIT DETERMINED TO BE RAN THROUGH ATTIC IN FIELD THEN CONDUIT WILL BE EITHER EMT, FMC, OR MC CABLE IF DC CURRENT COMPLYING WITH [NEC 690.31], [NEC 250.118(10)]. DISCONNECTING MEANS SHALL COMPLY WITH [NEC 690.13] AND [NEC 690.15].
19. CONDUIT RAN THROUGH ATTIC WILL BE AT LEAST 18" BELOW ROOF SURFACE COMPLYING WITH [NEC 230.6(4)] AND SECURED NO GREATER THAN 6' APART PER [NEC 330.30(B)].

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PV INSTALLATION PROFESSIONAL
Scott Gurney
#PV-011719-015866

CONTRACTOR:
BRS FIELD OPS
800-377-4480

CUSTOMER INFORMATION:
Dan Roberts
518 NW Main St
Lee's Summit Missouri 64063

AC SYSTEM SIZE: 5.22 kW AC
DC SYSTEM SIZE: 7.2 kW DC

DRAWING BY: Brendan Fillmore
PLOT DATE: August 4, 2023
PROJECT NUMBER: 793875
SHEET NAME: ELEC CALCS
REVISION: 0
PAGE NUMBER: PV6

STANDARD LABELS

⚠ WARNING
ELECTRIC SHOCK HAZARD
TERMINALS ON THE LINE AND LOAD SIDES MAY BE ENERGIZED IN THE OPEN POSITION

LABEL 1
FOR PV SYSTEM DISCONNECTING MEANS WHERE THE LINE AND LOAD TERMINALS MAY BE ENERGIZED IN THE OPEN POSITION.
[2017 NEC 690.13(B)]
[2020 NEC 690.13(B)]

PHOTOVOLTAIC SYSTEM
⚠ AC DISCONNECT ⚠
RATED AC OUTPUT CURRENT 21.78 A
NOMINAL OPERATING AC VOLTAGE 240 V

LABEL 2
SHALL BE MARKED AT AN ACCESSIBLE LOCATION AT THE DISCONNECTING MEANS AS A POWER SOURCE AND WITH THE RATED AC OUTPUT CURRENT AND THE NOMINAL OPERATING AC VOLTAGE.
[2017 NEC 690.54]
[2020 NEC 690.54]

⚠ WARNING
DUAL POWER SUPPLY
SOURCES: UTILITY GRID AND PV SOLAR ELECTRIC SYSTEM

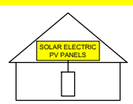
LABEL 3
IF INTERCONNECTING LOAD SIDE, INSTALL THIS LABEL ANYWHERE THAT IS POWERED BY BOTH THE UTILITY AND THE SOLAR PV SYSTEM, IE. MAIN SERVICE PANEL AND SUBPANELS.
[2017 NEC 705.12(B)(3)]
[2020 NEC 705.12(B)(3)]

⚠ WARNING
POWER SOURCE OUTPUT CONNECTION
DO NOT RELOCATE THIS OVERCURRENT DEVICE

LABEL 4
APPLY TO THE DISTRIBUTION EQUIPMENT ADJACENT TO THE BACK-FED BREAKER FROM THE POWER SOURCE.
[2017 NEC 705.12(B)(2)(3)(b)]
[2020 NEC 705.12(B)(3)(2)]

⚠ WARNING
THIS EQUIPMENT FED BY MULTIPLE SOURCES. TOTAL RATING OF ALL OVERCURRENT DEVICES, EXCLUDING MAIN SUPPLY OVERCURRENT DEVICE, SHALL NOT EXCEED AMPACITY OF BUSBAR.

LABEL 5
APPLY TO THE PV COMBINER BOX
[2017 NEC 705.12(B)(2)(3)(c)]
[2020 NEC 705.12(B)(3)(3)]

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 6
BUILDINGS WITH PV SYSTEMS SHALL HAVE A PERMANENT LABEL LOCATED AT EACH SERVICE EQUIPMENT LOCATION TO WHICH THE PV SYSTEMS ARE CONNECTED OR AT AN APPROVED READILY VISIBLE LOCATION AND SHALL INDICATE THE LOCATION OF RAPID SHUTDOWN INITIATION DEVICES.
[2017 NEC 690.56(C)(1)(a)]
[2020 NEC 690.56(C)]

RAPID SHUTDOWN SWITCH FOR SOLAR PV SYSTEM

LABEL 7
SIGN LOCATED AT RAPID SHUT DOWN DISCONNECT SWITCH
[2017 NEC 690.56(C)(3)]
[2020 NEC 690.56(C)(2)]

LABELING NOTES
1) LABELS CALLED OUT ACCORDING TO ALL COMMON CONFIGURATIONS. ELECTRICIAN TO DETERMINE EXACT REQUIREMENTS IN THE FIELD PER CURRENT NEC AND LOCAL CODES AND MAKE APPROPRIATE ADJUSTMENTS.
2) LABELING REQUIREMENTS BASED ON THE 2017 & 2020 NEC CODE, OSHA STANDARD 19010.145, ANSIZ535.
3) MATERIAL BASED ON THE REQUIREMENTS OF THE AHJ.
4) LABELS TO BE OF SUFFICIENT DURABILITY TO WITHSTAND THE ENVIRONMENT INVOLVED AND SHALL NOT BE HANDWRITTEN [NEC 110.21]

ADDITIONAL LABELS

⚠ WARNING
MAIN DISTRIBUTION UTILITY DISCONNECT(S)
POWER TO THIS BUILDING IS ALSO SUPPLIED FROM A ROOF MOUNTED SOLAR ARRAY WITH A RAPID SHUTDOWN DISCONNECTING MEANS GROUPED AND LABELED WITHIN LINE OF SITE AND 10 FT OF THIS LOCATION

LABEL 8
PERMANENT PLAQUE OR DIRECTORY DENOTING THE LOCATION OF ALL ELECTRIC POWER SOURCE DISCONNECTING MEANS ON OR IN THE PREMISES SHALL BE INSTALLED AT EACH SERVICE EQUIPMENT LOCATION AND AT THE LOCATION(S) OF THE SYSTEM DISCONNECT(S) FOR ALL ELECTRIC POWER PRODUCTION SOURCES CAPABLE OF BEING INTERCONNECTED.
[2017 NEC 705.10]
[2020 NEC 705.10]

⚠ WARNING
POWER TO THIS BUILDING IS ALSO SUPPLIED FROM MAIN DISTRIBUTION UTILITY DISCONNECT LOCATED

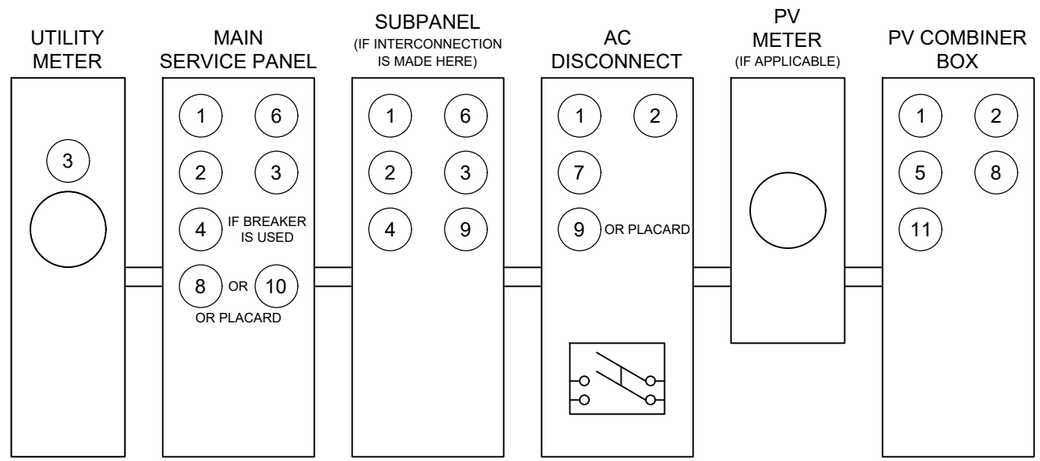
LABEL 9
PERMANENT PLAQUE OR DIRECTORY DENOTING THE LOCATION OF ALL ELECTRIC POWER SOURCE DISCONNECTING MEANS ON OR IN THE PREMISES SHALL BE INSTALLED AT EACH SERVICE EQUIPMENT LOCATION AND AT THE LOCATION(S) OF THE SYSTEM DISCONNECT(S) FOR ALL ELECTRIC POWER PRODUCTION SOURCES CAPABLE OF BEING INTERCONNECTED.
[2017 NEC 705.10]
[2020 NEC 705.10]

⚠ WARNING
POWER TO THIS BUILDING IS ALSO SUPPLIED FROM A ROOF MOUNTED SOLAR ARRAY. SOLAR ARRAY RAPID SHUTDOWN DISCONNECT IS LOCATED OUTSIDE NEXT TO THE UTILITY METER.

LABEL 10
PERMANENT PLAQUE OR DIRECTORY TO BE LOCATED AT MAIN SERVICE EQUIPMENT DENOTING THE LOCATION OF THE RAPID SHUTDOWN SYSTEM DISCONNECTING MEANS IF SOLAR ARRAY RAPID SHUTDOWN DISCONNECTING SWITCH IS NOT GROUPED AND WITHIN LINE OF SITE OF MAIN SERVICE DISCONNECTING MEANS.
[2017 NEC 705.10 AND 690.56(C)(1)(a)]
[2020 NEC 705.10 AND 690.56(C)]

⚠ WARNING
PHOTOVOLTAIC SYSTEM COMBINER PANEL
DO NOT ADD LOADS

LABEL 11
PERMANENT PLAQUE OR DIRECTORY TO BE LOCATED AT AC COMBINER PANEL.
[2017 NEC 110.21(B)]
[2020 NEC 110.21(B)]



*ELECTRICAL DIAGRAM SHOWN ABOVE IS FOR LABELING PURPOSES ONLY. NOT AN ACTUAL REPRESENTATION OF EQUIPMENT AND CONNECTIONS TO BE INSTALLED. LABEL LOCATIONS PRESENTED MAY VARY DEPENDING ON TYPE OF INTERCONNECTION METHOD AND LOCATION PRESENTED ON 3 LINE DIAGRAM. 3 LINE DIAGRAM ON PV5 TO REFLECT ACTUAL REPRESENTATION OF PROPOSED SCOPE OF WORK.

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DC SYSTEM SIZE: 7.2 kW DC

DRAWING BY:
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PLOT DATE:
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PROJECT NUMBER:
793875

SHEET NAME:
LABELS

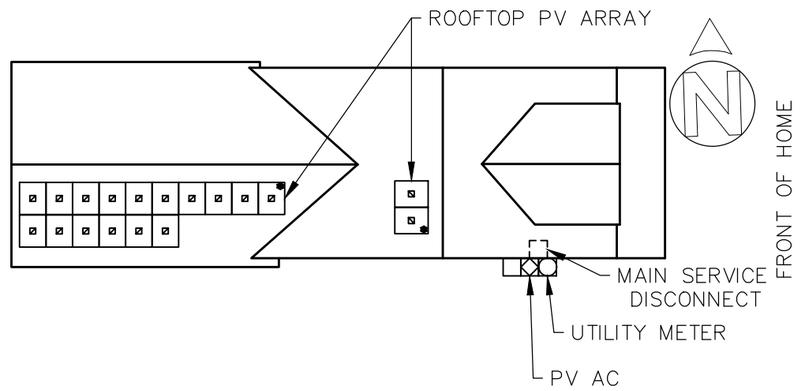
REVISION: 0

PAGE NUMBER: PV7

CAUTION

MULTIPLE SOURCES OF POWER

POWER TO THIS BUILDING IS ALSO SUPPLIED FROM THE FOLLOWING SOURCES WITH DISCONNECTS LOCATED AS SHOWN:



518 NW MAIN ST,
LEE'S SUMMIT MISSOURI 64063

DIRECTORY PLACARD NOTES

[NEC 705.10] A PERMANENT PLAQUE OR DIRECTORY DENOTING THE LOCATION OF ALL ELECTRIC POWER SOURCE DISCONNECTING MEANS ON OR IN THE PREMISES SHALL BE INSTALLED AT EACH SERVICE EQUIPMENT LOCATION AND AT THE LOCATION(S) OF THE SYSTEM DISCONNECT(S) FOR ALL ELECTRIC POWER PRODUCTION SOURCES CAPABLE OF BEING INTERCONNECTED. THE MARKING SHALL COMPLY WITH *[110.21(B)]*.

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PLACARD

REVISION: 0

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URECO
United Renewable Energy Co., Ltd.

EN

PEACH

FBM_MFG-BB / 108 cells
390W - 405 W
Mono-Crystalline PV Module

URE Peach module uses URE state-of -the art cell cutting technology, and advanced module manufacturing experiences.

UL 61730, CE-compliant
Quality Controlled PV-TÜV SUD
IEC 61215:2016, IEC 61730:2016

Key Features

- Positive power tolerance
  +0 ~ +5 watt
- 100% EL inline inspection
  Better module reliability
- Withstand heavy loading
  Front load 5400 Pa & rear load 2400 Pa
- Design for 1000 VDC
  Reduce the system BOS effectively
- Excellent low light performance
  3.5% relative eff. Reduction at low (200W/m²)
- Fire resistance
  Class of reaction to Type 1/ Class C

URECO
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United Renewable Energy Co., Ltd.

EN

Electrical Data

Model - STC		FBM390MFG-BB	FBM395MFG-BB	FBM400MFG-BB	FBM405MFG-BB
Maximum Rating Power (Pmax)	[W]	390	395	400	405
Module Efficiency	[%]	19.98	20.23	20.49	20.75
Open Circuit Voltage (Voc)	[V]	36.84	37.03	37.20	37.36
Maximum Power Voltage	[V]	30.82	31.00	31.17	31.36
Short Circuit Current (Isc)	[A]	13.50	13.59	13.68	13.78
Maximum Power Current	[A]	12.66	12.75	12.84	12.92

*Standard Test Condition (STC): Cell Temperature 25 °C, Irradiance 1000 W/m², AM 1.5
*Values without tolerance are typical numbers.Measurement tolerance: ± 3%

Mechanical Data

Item	Specification
Dimensions	1723 mm (L)[1] x 1133 mm (W)[1] x 35 mm (D)[2] / 67.83" (L)[1] x 44.61" (W)[1] x 1.38" (D)[2]
Weight	21.7 kg / 47.84 lbs
Solar Cell	12x9 pieces monocrystalline solar cells series strings
Front Glass	White toughened safety glass, 3.2mm thickness
Cell Encapsulation	EVA (Ethylene-Viny-Acetate)
Frame	Black anodized aluminum profile
Junction Box	IP≥ 68, 3 diodes
Cable	1200 mm (cable length can be customized), 4mm²
Connector Type	MC4 / MC4 Compatible
Package Configuration	31 pcs Per Pallet, 806 pcs per 40' HQ container

[1] : With assembly tolerance of ± 2 mm [± 0.08˝]
[2] : With assembly tolerance of ± 0.8 mm [± 0.03˝]

Operating Conditions

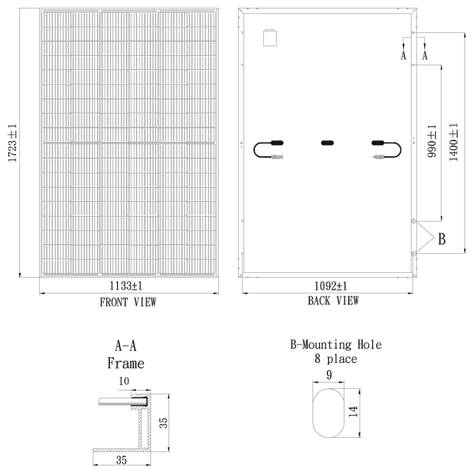
Item	Specification
Mechanical Load	5400 Pa
Maximum System Voltage	1000V
Series Fuse Rating	30 A
Operating Temperature	-40 to 85 °C

Temperature Characteristics

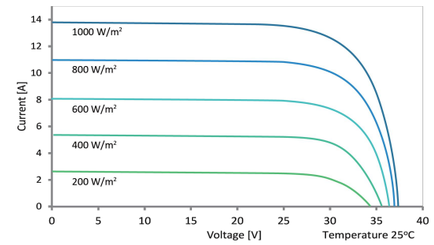
Item	Specification
Nominal Module Operating Temperature	45°C ± 2°C
Temperature Coefficient of Isc	0.048 % / °C
Temperature Coefficient of Voc	-0.27 % / °C
Temperature Coefficient of Pmax	-0.32 % / °C

*Nominal module operating temperature (NMOT): Air mass AM 1.5, irradiance 800W/m², temperature 20°C, windspeed 1 m/s.
*Reduction in efficiency from 1000W/m² to 200W/m² at 25°C: 3.5 ± 2%.

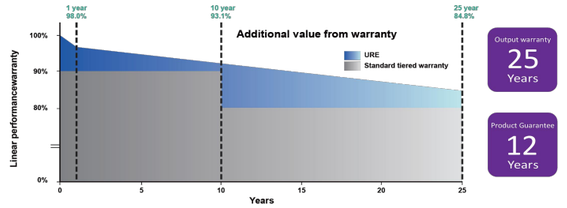
Engineering Drawing (mm)



Dependence on Irradiance



Reliability with Warranty



For more information, please visit us at ***www.urecorp.com***

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URECO_US_Peach_FBM_MFG-BB_V1_3.2_35mm_BS_EN_220602

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SPEC SHEETS

REVISION: 0

PAGE NUMBER: SS

ENPHASE

DATA SHEET

IQ8 and IQ8+ 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.

Enphase 25 year limited warranty

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.

UL CERTIFIED SAFETY

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

IQ8SP-DS-0002-01-EN-US-2022-03-17

Easy to install

- Lightweight and compact with plug-n-play connectors
- Power Line Communication (PLC) between components
- Faster installation with simple two-wire cabling

High productivity and reliability

- Produce power even when the grid is down*
- More than one million cumulative hours of testing
- Class II double-insulated enclosure
- Optimized for the latest high-powered PV modules

Microgrid-forming

- Complies with the latest advanced grid support**
- Remote automatic updates for the latest grid requirements
- Configurable to support a wide range of grid profiles
- Meets CA Rule 21 (UL 1741-SA) requirements

* Only when installed with IQ System Controller 2, meets UL 1741.
** IQ8 and IQ8Plus supports split phase, 240V installations only.

IQ8 and IQ8+ Microinverters

INPUT DATA (DC)		IQ8-60-2-US	IQ8PLUS-72-2-US
Commonly used module pairings[1]	W	235 – 350	235 – 440
Module compatibility		60-cell/120 half-cell	60-cell/120 half-cell, 66-cell/132 half-cell and 72-cell/144 half-cell
MPPT voltage range	V	27 – 37	29 – 45
Operating range	V	25 – 48	25 – 58
Min/max start voltage	V	30 / 48	30 / 58
Max input DC voltage	V	50	60
Max DC current[2] [module Isc]	A	15	
Overvoltage 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)		**IQ8-60-2-US**	**IQ8PLUS-72-2-US**
Peak output power	VA	245	300
Max continuous output power	VA	240	290
Nominal (L-L) voltage/range[3]	V	240 / 211 – 264	
Max continuous output current	A	1.0	1.21
Nominal frequency	Hz	60	
Extended frequency range	Hz	50 – 68	
AC short circuit fault current over 3 cycles	Arms	2	
Max units per 20 A (L-L) branch circuit[4]		16	13
Total harmonic distortion		<5%	
Overvoltage 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	%	97.5	97.6
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	
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) No enforced DC/AC ratio. See the compatibility calculator at https://link.enphase.com/module-compatibility
(2) Maximum continuous input DC current is 10.6A (3) Nominal voltage range can be extended beyond nominal if required by the utility. (4) Limits may vary. Refer to local requirements to define the number of microinverters per branch in your area.

IQ8SP-DS-0002-01-EN-US-2022-03-17

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Data Sheet
Enphase Q Cable Accessories
REGION: Americas

Enphase Q Cable Accessories

The **Enphase Q Cable™** and accessories are part of the latest generation Enphase IQ System™. These accessories provide simplicity, reliability, and faster installation times.

Enphase Q Cable

- Two-wire, double-insulated Enphase Q Cable is 50% lighter than the previous generation Enphase cable
- New cable numbering and plug and play connectors speed up installation and simplify wire management
- Link connectors eliminate cable waste

Field-Wireable Connectors

- Easily connect Q cables on the roof without complex wiring
- Make connections from any open connector and center feed any section of cable within branch limits
- Available in male and female connector types

Enphase Q Cable Accessories

CONDUCTOR SPECIFICATIONS	
Certification	UL3003 (raw cable), UL 9703 (cable assemblies), DG cable
Flame test rating	FT4
Compliance	RoHS, OIL RES I, CE, UV Resistant, combined UL for Canada and United States
Conductor type	THHN/THWN-2 dry/wet
Disconnecting means	The AC and DC bulkhead connectors have been evaluated and approved by UL for use as the load-break disconnect required by NEC 690.

Q CABLE TYPES / ORDERING OPTIONS

Connectorized Models	Size / Max Nominal Voltage	Connector Spacing	PV Module Orientation	Connector Count per Box
Q-12-10-240	12 AWG / 277 VAC	1.3 m (4.2 ft)	Portrait	240
Q-12-17-240	12 AWG / 277 VAC	2.0 m (6.5 ft)	Landscape (60-cell)	240
Q-12-20-200	12 AWG / 277 VAC	2.3 m (7.5 ft)	Landscape (72-cell)	200

ENPHASE Q CABLE ACCESSORIES

Name	Model Number	Description
Raw Q Cable	Q-12-RAW-300	300 meters of 12 AWG cable with no connectors
Field-wireable connector (male)	Q-CONN-10M	Make connections from any open connector
Field-wireable connector (female)	Q-CONN-10F	Make connections from any Q Cable open connector
Cable Clip	Q-CLIP-100	Used to fasten cabling to the racking or to secure looped cabling
Disconnect tool	Q-DISC-10	Disconnect tool for Q Cable connectors, DC connectors, and AC module mount
Q Cable sealing caps (female)	Q-SEAL-10	One needed to cover each unused connector on the cabling
Terminator	Q-TERM-10	Terminator cap for unused cable ends
Enphase EN4 to MC4 adaptor[1]	ECA-EN4-S22	Connect PV module using MC4 connectors to IQ micros with EN4 (TE PV4-S SOLARLOK). 150mm/5.9" to MC4.
Enphase EN4 non-terminated adaptor[1]	ECA-EN4-FW	For field wiring of UL certified DC connectors. EN4 (TE PV4-S SOLARLOK) to non-terminated cable. 150mm/5.9"
Enphase EN4 to MC4 adaptor (long)[1]	ECA-EN4-S22-L	Longer adapter cable for EN4 (TE PV4-S SOLARLOK) to MC4. Use with split cell modules or PV modules with short DC cable. 600mm/23.6"
Replacement DC Adaptor (MC4)	Q-DCC-2	DC adaptor to MC4 (max voltage 100 VDC)
Replacement DC Adaptor (UTX)	Q-DCC-5	DC adaptor to UTX (max voltage 100 VDC)

1. Qualified per UL subject 9703.

TERMINATOR
Terminator cap for unused cable ends, sold in packs of ten (Q-TERM-10)

SEALING CAPS
Sealing caps for unused aggregator and cable connections (Q-BA-CAP-10 and Q-SEAL-10)

DISCONNECT TOOL
Plan to use at least one per installation, sold in packs of ten (Q-DISC-10)

CABLE CLIP
Used to fasten cabling to the racking or to secure looped cabling, sold in packs of one hundred (Q-CLIP-100)

To learn more about Enphase offerings, visit **enphase.com**

2020-06-26

To learn more about Enphase offerings, visit **enphase.com**

BLUE RAVEN SOLAR

DRAWING NUMBER:
SS

Data Sheet
Enphase Networking

IQ Combiner 4/4C

X-IQ-AM1-240-4C
X2-IQ-AM1-240-4C (IEEE 1547:2018)

X-IQ-AM1-240-4
X2-IQ-AM1-240-4 (IEEE 1547:2018)

The **IQ Combiner 4/4C** with IQ Gateway and integrated LTE-M1 cell modem (included only with IQ Combiner 4C) consolidates interconnection equipment into a single enclosure. It streamlines IQ Microinverters and storage installations by providing a consistent, pre-wired solution for residential applications. It offers up to four 2-pole input circuits and Eaton BR series busbar assembly.

Smart

- Includes IQ Gateway for communication and control
- Includes Mobile Connect cellular modem (CELLMODEM-M1-06-SP-05), included only with IQ Combiner 4C
- Includes solar shield to match Enphase IQ Battery aesthetics and deflect heat
- Supports Wi-Fi, Ethernet, or cellular connectivity
- Optional AC receptacle available for PLC bridge
- Provides production metering and consumption monitoring

Simple

- Mounts on single stud with centered brackets
- Supports bottom, back and side conduit entry
- Allows up to four 2-pole branch circuits for 240VAC plug-in breakers (not included)
- 80A total PV or storage branch circuits

Reliable

- Durable NRTL-certified NEMA type 3R enclosure
- Five-year limited warranty
- Two years labor reimbursement program coverage included for both the IQ Combiner SKU's
- UL listed
- X2-IQ-AM1-240-4 and X2-IQ-AM1-240-4C comply with IEEE 1547:2018 (UL 1741-SB, 3rd Ed.)

To learn more about Enphase offerings, visit **enphase.com**
IQ-C-4-4C-DS-0103-EN-US-12-29-2022

IQ Combiner 4/4C

MODEL NUMBER	
IQ Combiner 4 X-IQ-AM1-240-4 X2-IQ-AM1-240-4 (IEEE 1547:2018)	IQ Combiner 4 with IQ Gateway printed circuit board for integrated revenue grade PV production metering (ANSI C12.20 ± 0.5%) and consumption monitoring (± 2.5%). Includes a silver solar shield to match the IQ Battery and IQ System Controller 2 and to deflect heat.
IQ Combiner 4C X-IQ-AM1-240-4C X2-IQ-AM1-240-4C (IEEE 1547:2018)	IQ Combiner 4C with IQ Gateway printed circuit board for integrated revenue grade PV production metering (ANSI C12.20 ± 0.5%) and consumption monitoring (± 2.5%). Includes Mobile Connect cellular modem (CELLMODEM-M1-06-SP-05), a plug-and-play industrial-grade cell modem for systems up to 60 microinverters. (Available in the US, Canada, Mexico, Puerto Rico, and the US Virgin Islands, where there is adequate cellular service in the installation area.) Includes a silver solar shield to match the IQ Battery and IQ System Controller and to deflect heat.
ACCESSORIES AND REPLACEMENT PARTS	(not included, order separately)
Supported microinverters	IQ6, IQ7, and IQ8. (Do not mix IQ6/7 Microinverters with IQ8)
Communications Kit COMMS-CELLMODEM-M1-06 CELLMODEM-M1-06-SP-05 CELLMODEM-M1-06-AT-05	 - Includes COMMS-KIT-01 and CELLMODEM-M1-06-SP-05 with 5-year Sprint data plan - 4G based LTE-M1 cellular modem with 5-year Sprint data plan - 4G based LTE-M1 cellular modem with 5-year AT&T data plan
Circuit Breakers BRK-10A-2-240V BRK-15A-2-240V BRK-20A-2P-240V BRK-15A-2P-240V-B BRK-20A-2P-240V-B	Supports Eaton BR210, BR215, BR220, BR230, BR240, BR250, and BR260 circuit breakers. Circuit breaker, 2 pole, 10A, Eaton BR210 Circuit breaker, 2 pole, 15A, Eaton BR215 Circuit breaker, 2 pole, 20A, Eaton BR220 Circuit breaker, 2 pole, 15A, Eaton BR215B with hold down kit support Circuit breaker, 2 pole, 20A, Eaton BR220B with hold down kit support
XA-SOLARSHIELD-ES	Replacement solar shield for IQ Combiner 4/4C
XA-PLUG-120-3	Accessory receptacle for Power Line Carrier in IQ Combiner 4/4C (required for EPLC-01)
X-IQ-NA-HD-125A	Hold-down kit for Eaton circuit breaker with screws
Consumption monitoring CT (CT-200-SPLIT/CT-200-CLAMP)	A pair of 200A split core current transformers
ELECTRICAL SPECIFICATIONS	
Rating	Continuous duty
System voltage	120/240VAC, 60 Hz
Eaton BR series busbar rating	125A
Max. continuous current rating	65A
Max. continuous current rating (input from PV/storage)	64A
Max. fuse/circuit rating (output)	90A
Branch circuits (solar and/or storage)	Up to four 2-pole Eaton BR series Distributed Generation (DG) breakers only (not included)
Max. total branch circuit breaker rating (input)	80A of distributed generation/95A with IQ Gateway breaker included
IQ Gateway breaker	10A or 15A rating GE/Siemens/Eaton included
Production metering CT	200A solid core pre-installed and wired to IQ Gateway
MECHANICAL DATA	
Dimensions (WxHxD)	37.5 cm x 49.5 cm x 16.8 cm (14.75 in x 19.5 in x 6.63 in). Height is 53.5 cm (21.06 in) with mounting brackets.
Weight	7.5 kg (16.5 lbs)
Ambient temperature range	-40°C to +46°C (-40°F to 115°F)
Cooling	Natural convection, plus heat shield
Enclosure environmental rating	Outdoor, NRTL-certified, NEMA type 3R, polycarbonate construction
Wire sizes	• 20A to 50A breaker inputs: 14 to 4 AWG copper conductors • 60A breaker branch input: 4 to 1/0 AWG copper conductors • Main lug combined output: 10 to 2/0 AWG copper conductors • Neutral and ground: 14 to 1/0 copper conductors • Always follow local code requirements for conductor sizing.
Altitude	Up to 3,000 meters (9,842 feet)
INTERNET CONNECTION OPTIONS	
Integrated Wi-Fi	IEEE 802.11b/g/n
Cellular	CELLMODEM-M1-06-SP-05, CELLMODEM-M1-06-AT-05 (4G based LTE-M1 cellular modem). Note that an Mobile Connect cellular modem is required for all Enphase Energy System installations.
Ethernet	Optional, IEEE 802.3, Cat5E (or Cat6) UTP Ethernet cable (not included)
COMPLIANCE	
Compliance, IQ Combiner	CA Rule 21 (UL 1741-SA) IEEE 1547:2018 - UL 1741-SB, 3rd Ed. (X2-IQ-AM1-240-4 and X2-IQ-AM1-240-4C) CAN/CSA C22.2 No. 107.1, Title 47 CFR, Part 15, Class B, ICES 003 Production metering: ANSI C12.20 accuracy class 0.5 (PV production) Consumption metering: accuracy class 2.5
Compliance, IQ Gateway	UL 60601-1/CANCSA 22.2 No. 61010-1

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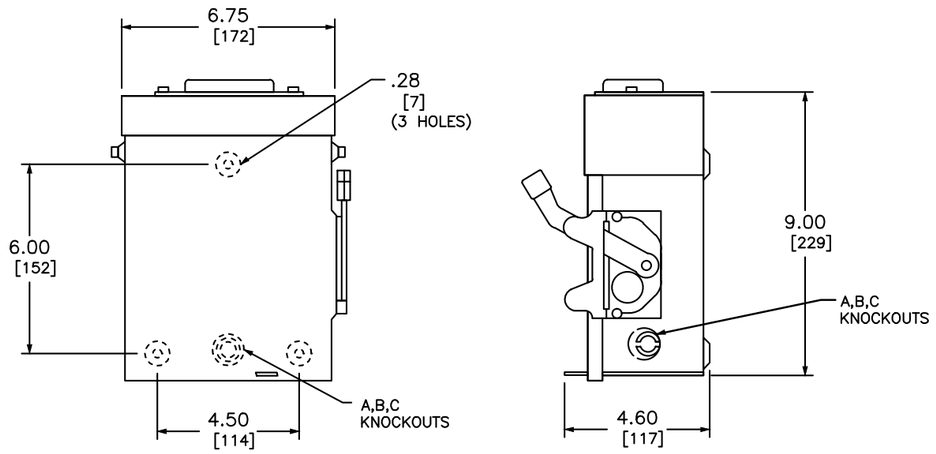
NABCEP CERTIFIED
PV INSTALLATION PROFESSIONAL
Scott Gurney
#PV-011719-015866

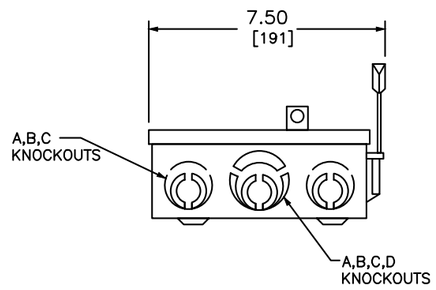
CONTRACTOR:
BRS FIELD OPS
385-498-6700

SHEET NAME:
SPEC SHEETS

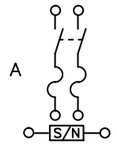
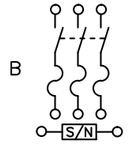
REVISION: 0

PAGE NUMBER: SS





NEMA TYPE 3R
ILLUSTRATED

WIRING DIAGRAMS	
FUSIBLE	NOT FUSIBLE
A 	C 
B 	D 

TERMINAL LUGS ‡			
AMPERES	MAX. WIRE	MIN. WIRE	TYPE
30	# 6 AWG	# 12 AWG	AL
	# 6 AWG	# 14 AWG	CU

KNOCKOUTS				
SYMBOL	A	B	C	D
CONDUIT SIZE	.50	.75	1	1.25

DUAL DIMENSIONS: INCHES / MILLIMETERS

CATALOG NUMBER	VOTAGE RATINGS	WIRING DIAG.	HORSEPOWER RATINGS					
			120VAC		240VAC			
			STD.	MAX.	STD.		MAX.	
			1 Ø	1 Ø	1 Ø	3 Ø	1 Ø	3 Ø
D211NRB●■	240VAC	A	1/2	2	1 1/2	–	3	–
D221NRB	240VAC	A	–	–	1 1/2	3*	3	7 1/2*
D321NRB	240VAC	B	–	–	1 1/2	3	3	7 1/2
DU221RB	240VAC	C	–	–	–	–	3	–
DU321RB	240VAC	D	–	–	–	–	3	7 1/2

NOTES:
FINISH – GRAY BAKED ENAMEL ELECTRODEPOSITIED OVER CLEANED PHOSPHATIZED STEEL.
UL LISTED – FILE E–2875
ALL NEUTRALS – INSULATED GROUNDABLE
SUITABLE FOR USE AS SERVICE EQUIPMENT
TOP OF NEMA TYPE 3R SWITCHES HAVE PROVISIONS FOR MAXIMUM 2 1/2" BOLT–ON HUB.
SHORT CIRCUIT CURRENT RATINGS:
● 10,000 AMPERES.
10,000 AMPERES WHEN USED WITH OR PROTECTED BY CLASS H OR K FUSES.
100,000 AMPERES WITH CLASS R FUSES.
* FOR CORNER GROUNDED DELTA SYSTEMS.
■ PLUG FUSES
‡ LUGS SUITABLE FOR 60°C OR 75° CONDUCTORS.

GENERAL DUTY SAFETY SWITCHES
VISIBLE BLADE TYPE
30 AMPERE
ENCLOSURE – NEMA TYPE 3R RAINPROOF

SQUARE D
by Schneider Electric

DWG# NO. 1852

FEBRUARY 2014

REF DWG #1852

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#PV-011719-015866

CONTRACTOR:
BRS FIELD OPS
385-498-6700

DRAWING BY:

PLOT DATE:

PROJECT NUMBER:

SHEET NAME:
SPEC SHEET

REVISION: ----

PAGE NUMBER: SS

EZ SOLAR
making solar simple.

JB-1.2
Specification Sheet
PV Junction Box for Composition/Asphalt Shingle Roofs

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WWW.EZSOLARPRODUCTS.COM

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A. System Specifications and Ratings

- Maximum Voltage: 1,000 Volts
- Maximum Current: 80 Amps
- Allowable Wire: 14 AWG – 6 AWG
- Spacing: Please maintain a spacing of at least ½" between uninsulated live parts and fittings for conduit, armored cable, and uninsulated live parts of opposite polarity.
- Enclosure Rating: Type 3R
- Roof Slope Range: 2.5 – 12:12
- Max Side Wall Fitting Size: 1"
- Max Floor Pass-Through Fitting Size: 1"
- Ambient Operating Conditions: (-35°C) - (+75°C)
- Compliance:
  - JB-1.2: UL1741
  - Approved wire connectors: must conform to UL1741
- System Marking: **Interek Symbol and File #5019942**
- Periodic Re-inspections: If re-inspections yield loose components, loose fasteners, or any corrosion between components, components that are found to be affected are to be replaced immediately.

ITEM NO.	PART NUMBER	DESCRIPTION	QTY
1	JB-1.2 BODY	POLYCARBONATE WITH UV INHIBITORS	1
2	JB-1.2 LID	POLYCARBONATE WITH UV INHIBITORS	1
3	#10 X 1-1/4" PHILLIPS PAN HEAD SCREW		6
4	#8 X 3/4" PHILLIPS PAN HEAD SCREW		6

SIZE	DWG. NO.	REV
B	JB-1.2	
SCALE: 1:2	WEIGHT: 1.45 LBS	SHEET 1 OF 3

TORQUE SPECIFICATION:	15-20 LBS
CERTIFICATION:	UL STANDARD 1741, NEMA 3R
WEIGHT:	1.45 LBS

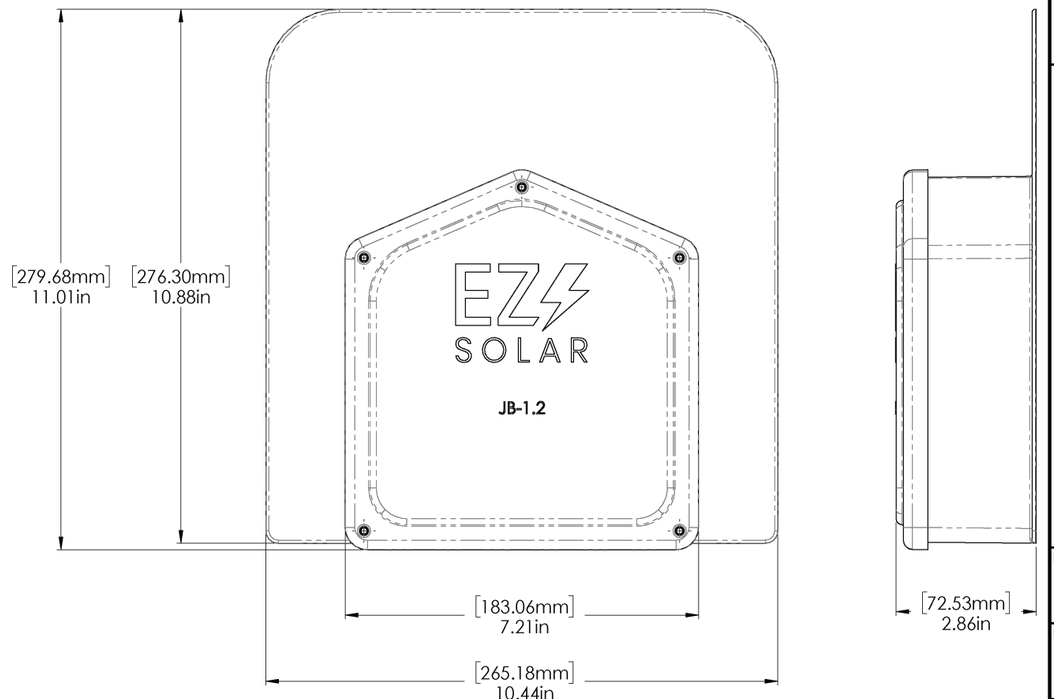

Table 1: Typical Wire Size, Torque Loads and Ratings

	1 Conductor	2 Conductor	Torque				
			Type	NM	Inch Lbs	Voltage	Current
ABB ZS6 terminal block	10-24 awg	16-24 awg	Sol/Str	0.5-0.7	6.2-8.85	600V	30 amp
ABB ZS10 terminal block	6-24 awg	12-20 awg	Sol/Str	1.0-1.6	8.85-14.16	600V	40 amp
ABB ZS16 terminal bock	4-24 awg	10-20 awg	Sol/Str	1.6-2.4	14.6-21.24	600V	60 amp
ABB M6/8 terminal block	8-22 awg		Sol/Str	.08-1	8.85	600V	50 amp
Ideal 452 Red WING-NUT Wire Connector	8-18 awg		Sol/Str	Self Torque	Self Torque	600V	
Ideal 451 Yellow WING-NUT Wire Connector	10-18 awg		Sol/Str	Self Torque	Self Torque	600V	
Ideal, In-Sure Push-In Connector Part #39	10-14 awg		Sol/Str	Self Torque	Self Torque	600V	
WAGO, 2204-1201	10-20 awg	16-24 awg	Sol/Str	Self Torque	Self Torque	600V	30 amp
WAGO, 221-612	10-20 awg	10-24 awg	Sol/Str	Self Torque	Self Torque	600V	30 amp
Dottie DRC75	6-12 awg		Sol/Str	Snap-In	Snap-In		
ESP NG-53	4-6 awg		Sol/Str		45	2000V	
	10-14 awg		Sol/Str		35		
ESP NG-717	4-6 awg		Sol/Str		45	2000V	
	10-14 awg		Sol/Str		35		
Brumall 4-5,3	4-6 awg		Sol/Str		45	2000V	
	10-14 awg		Sol/Str		35		

Table 2: Minimum wire-bending space for conductors through a wall opposite terminals in mm (inches)

Wire size, AWG or		Wires per terminal (pole)							
		1		2		3		4 or More	
kcmil	(mm2)	mm	(inch)	mm	(inch)	mm	(inch)	mm	(inch)
14-10	(2.1-5.3)	Not specified		-		-		-	
8	(8.4)	38.1	(1-1/2)	-		-		-	
6	(13.3)	50.8	(2)	-		-		-	

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SHEET NAME: SPEC SHEET
REVISION: ----
PAGE NUMBER: SS

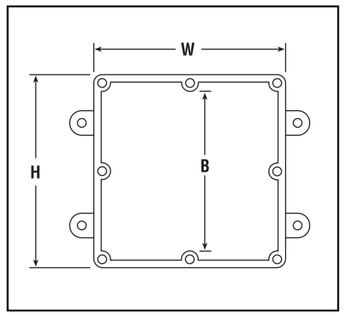
Molded Nonmetallic Junction Boxes 6P Rated

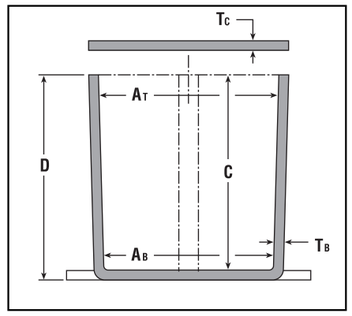
Except where noted by †

UL LISTED E42728

It's another first from Carlon® - the first nonmetallic junction boxes UL Listed with a NEMA 6P rating per Section 314.29, Exception of the National Electrical Code. Manufactured from PVC or PPO thermoplastic molding compound and featuring foam-in-place gasketed lids attached with stainless steel screws, these rugged enclosures offer all the corrosion resistance and physical properties you need for direct burial applications.

Type 6P enclosures are intended for indoor or outdoor use, primarily to provide a degree of protection against contact with enclosed equipment, falling dirt, hose-directed water, entry of water during prolonged submersion at a limited depth, and external ice formation.

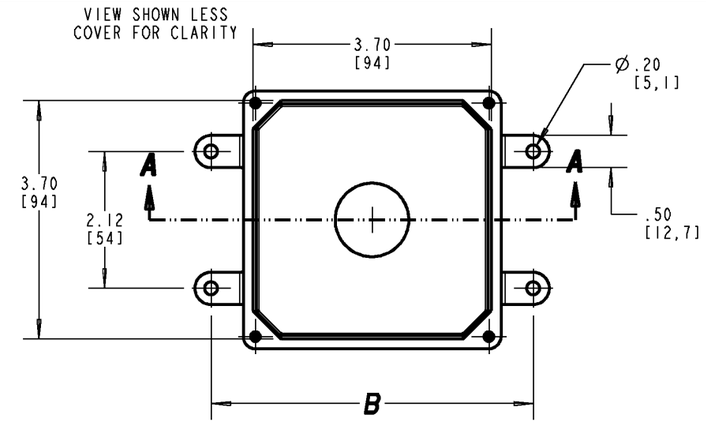


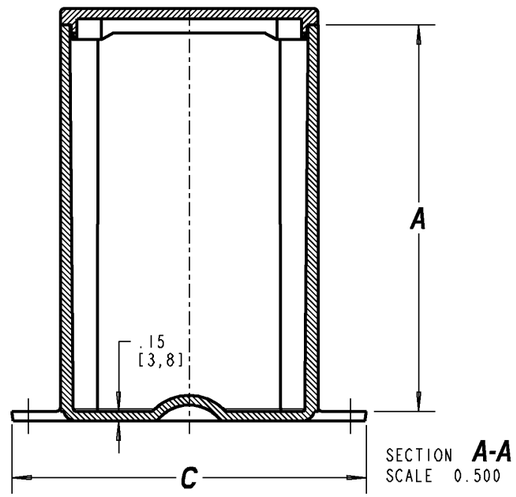


- All Carlon Junction Boxes are UL Listed and maintain a minimum of a NEMA Type 4/4x Rating.
- Parts numbers with an asterisk (*) are UL Listed and maintain a NEMA Type 6P Rating and Type 4/4X Rating.

Part No.	Size in Inches H x W x D	Std. Ctn. Qty.	Min AT	Min. AB	Min. B	Min. C	Ta Typical	Tc Typical	Material PVC	Material Thermo-plastic	Std. Ctn. Wt. (Lbs.)
E989NNJ-CAR*	4 x 4 x 2	5	3 11/16	3 5/8	N/A	2	.160	.155	X		3
E987N-CAR*	4 x 4 x 4	5	3 11/16	3 1/2	N/A	4	.160	.155	X		4
†E989NNR-CAR*	4 x 4 x 6	4	3 11/16	3 3/8	N/A	6	.160	.200	X		5
E989PPJ-CAR*	5 x 5 x 2	4	4 11/16	4 1/2	N/A	2	.110	.150		X	3
E987R-CAR*	6 x 6 x 4	2	6	5 5/8	N/A	4	.190	.190		X	3
E989RRR-UPC*	6 x 6 x 6	8	5 5/8	5 3/8	N/A	6	.160	.150		X	14
E989N-CAR	8 x 8 x 4	1	8	8	N/A	4	.185	.190		X	2
E989SSX-UPC	8 x 8 x 7	2	7 21/32	7 5/16	N/A	7	.160	.150		X	6
E989UUN	12 x 12 x 4	3	11 5/8	11 1/2	11 1/8	4	.160	.150		X	12
E989R-UPC	12 x 12 x 6	2	11 15/16	11 7/8	11 7/16	6	.265	.185		X	10

Carlon®





SECTION A-A
SCALE 0.500

SIZE	A	B	C
E989NNJ E989NNJB E989NNJ-CAR E989NNJCL E989NNJL (4X4X2)	2.00 (50,8)	4.63 (117,6)	5.13 (130,2)
E989NNR E989NNR-CAR (4X4X6)	6.00 (152.4)	5.00 (127,0)	5.50 (139,7)

NOTES:
1. MATERIAL: PVC
2. NEMA TYPES: 4/4X, 6P

GENERAL NOTES

1. ALL DIMENSIONS ARE FOR REFERENCE ONLY.
2. DIMENSIONS IN BRACKETS [ ] ARE IN METRIC UNITS.

REVISIONS

F SEE ERN 2016195 FOR APPROVAL SIGNATURES & RELEASE DATE. PROJECT NO: 5AM000006

Thomas&Betts www.tnb.com

DESCRIPTION: MOLDED NON-METALLIC ENCLOSURE

ORIGINAL PROJECT NO / (ERN NO)	SHEET NO:	REV. NO:	DRAWING NO:
/ ( )	2 OF 2	F	WSD-AC01977

BLUE RAVEN SOLAR

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NABCEP CERTIFIED
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385-498-6700

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SHEET NAME:
SPEC SHEET

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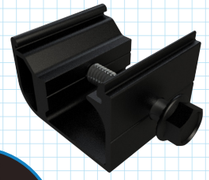
NXT HORIZON®

UNIRAC®
BETTER SOLAR STARTS HERE

UNIRAC 25 YEAR FULL-SYSTEM WARRANTY

DISCOVER YOUR **NXT** HORIZON®

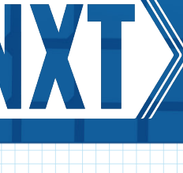
The culmination of over two decades of experience. Thoughtful design, rigorous engineering, world-class support, and a reliable supply chain are the foundation of what makes us confident that NXT HORIZON® is the NXT Level of DESIGN, SIMPLICITY, and VALUE.



STRONGHOLD™ RAIL CLAMP

DARK: SHCLMPD1
MILL: SHCLMPM1

Adaptable rail connection to attachments allows click-in feature compatibility with almost all of Unirac's attachments.

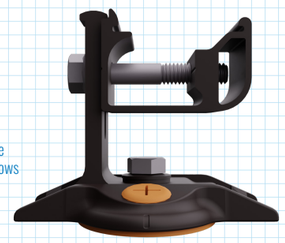


FlashLoc technology combined with new features: click-in rail & open slot L-Foot for the best flash-less install experience.

STRONGHOLD™ ATTACHMENT KIT

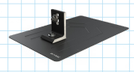
DARK: SHCPKTD1
MILL: SHCPKTM1

Rail clicks into the clamps attached to the Stronghold™ base. Open slot in L-foot allows drop-in rail clamp.



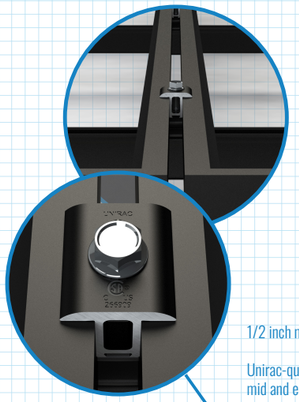
Alternative attachment options:

SOLARHOOKS
All varieties



FLASHKIT PRO
DARK: 004055D
MILL: 004055M

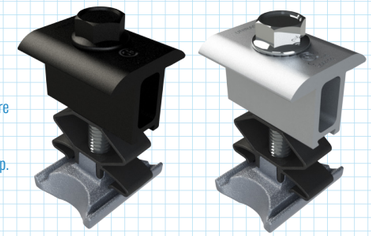
FLASHLOC™ DUO
DARK: 004275D
MILL: 004275M



NXT HORIZON® COMBO CLAMP

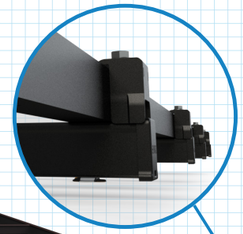
DARK: CCLAMPD1
MILL: CCLAMPM1

Clicks into rail anywhere (even where there are cables!)
Self-standing clamp with spring combines as both mid and end clamp.
Clamps 30-40 mm modules



1/2 inch module spacing for efficiency.

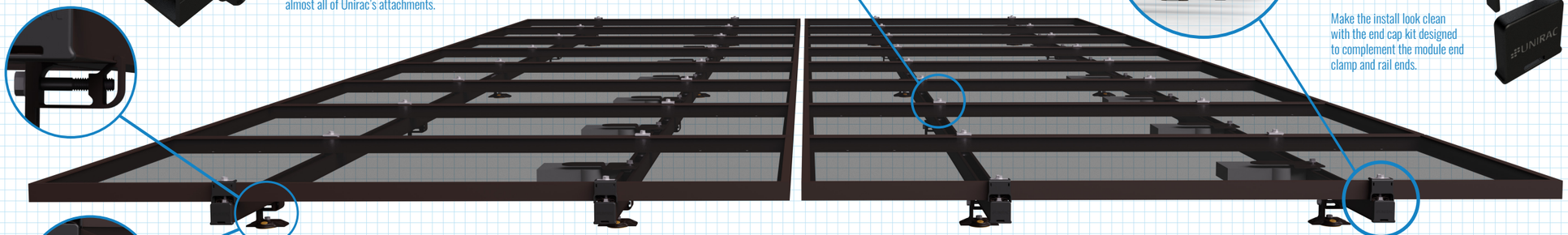
Unirac-quality bonding that works both as mid and end clamps.



NXT HORIZON® CAP KIT

ENDCAPD1

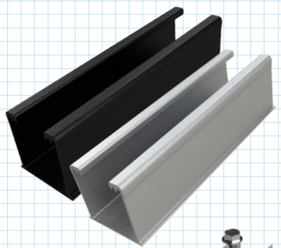
Make the install look clean with the end cap kit designed to complement the module end clamp and rail ends.



NXT HORIZON® RAIL

DARK: 168RLD1
MILL: 168RLM1

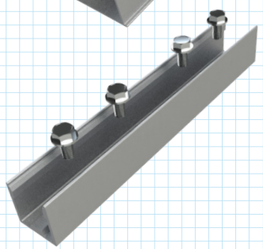
Strong, lightweight open channel rail with invisible, easy, unfailing and integrated wire management system.



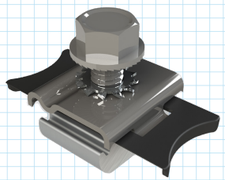
NXT HORIZON® RAIL SPLICE

RLSPLCM1

Structural internal splice that does not interfere with roof connection nor module connection.
Pre-assembled thread cutting bolts.



WIRE MANAGEMENT OPTONS



NXT HORIZON® MLPE & LUG CLAMP

LUGMLPE1

Works as either MLPE Mount or Grounding Lug connection to the rail. Why source two parts when one can do the job?

NXT HORIZON® WIRE MANAGEMENT CLIP

WRMCLPD1

Aesthetic, yet functional accessory that works to help installers keep wires inside the rail.
No zip-ties required. Optional zip tie loop for extra wire management capabilities!

NXT HORIZON® NORTH/SOUTH WIRE MANAGEMENT CLIP

WRMCNSD1

An elegant solution to help installers get to the home run. The same hardware works to provide both easy entry to rail and adjustability for cable thickness.

ALL NXT HORIZON® SYSTEMS INCLUDE A FREE PERMITTING PLANSET DESIGN - FOR QUESTIONS OR CUSTOMER SERVICE VISIT UNIRAC.COM OR EMAIL NXTPERMITS@UNIRAC.COM

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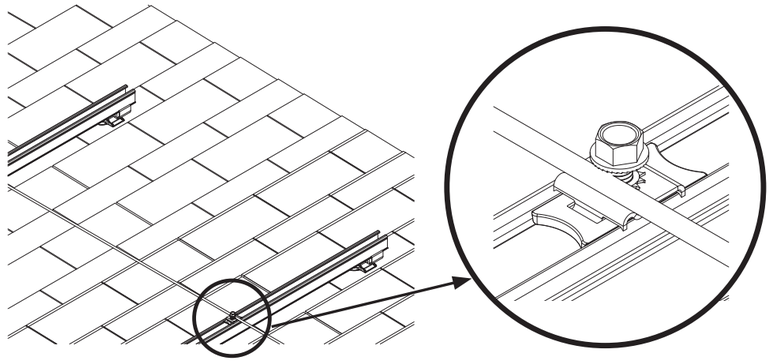
NXT HORIZON®

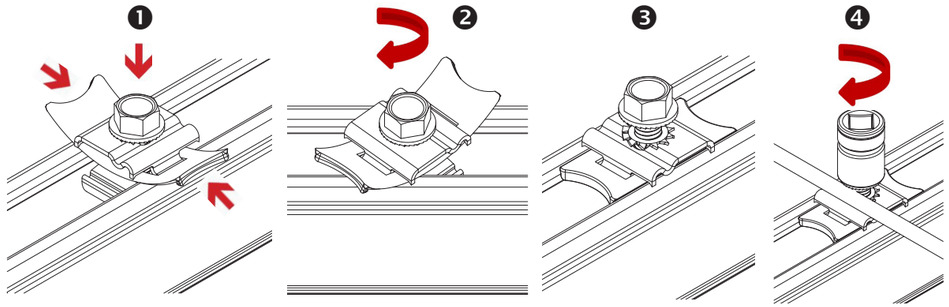
SYSTEM GROUNDING INSTALLATION GUIDE

K PAGE



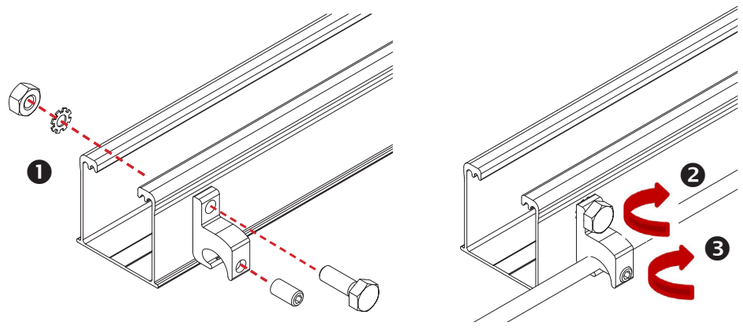
SYSTEM GROUNDING: Rails can be bonded using an NXT Horizon MLPE & Lug Clamp, GROUND WEEBLUG #1 or ILSCO LAY IN LUG (GBL4DBT). At least one rail per row of modules in an array must be bonded to electrical ground. Each additional row of modules must be grounded with at least one rail lug per row or with a row-to-row bonding devise listed here.

Note: See Page F for additional lugs required for expansion joints.



SYSTEM GROUNDING WITH MLPE & LUG CLAMP: Insert the rail nut profile in the opening by lifting the flaps of the plastic clip. Rotate the clamp 90 deg and release the flaps to get flush with rail. Ensure that the rail nut is engaged in the rail profile. Align the ground wire in the depression of the washer. Tighten bolt.

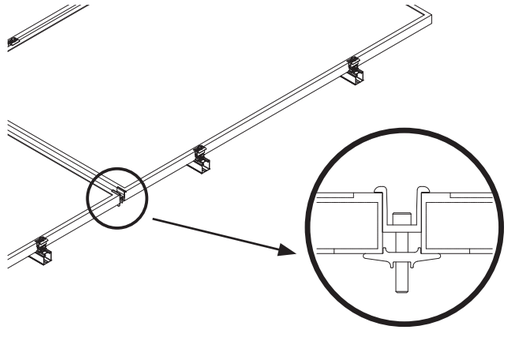
TORQUE VALUE: 6-8 AWG: 12 ft lbs.
CAUTION: MLPE & Lug Clamp cannot be used to simultaneously mount a MLPE and ground wire.



ALTERNATE SYSTEM GROUNDING WITH ILSCO LAY-IN LUG - UNIRAC P/N 008009P:
Alternate Grounding Lug. Drill hole in rail 7/32" in diameter, deburr hole and bolt thru one wall of rail.

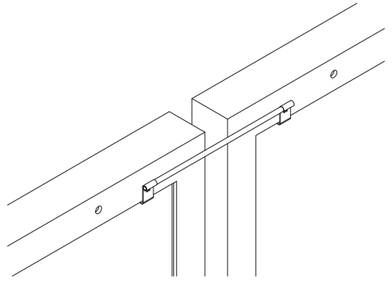
BOLT TORQUE VALUE: 5 ft lbs.
TERMINAL TORQUE: 4-6 AWG: 35in-lbs, 8 AWG: 25 in-lbs.

WARNING: ISOLATE COPPER FROM ALUMINUM CONTACT TO PREVENT CORROSION



ALTERNATE ROW GROUNDING WITH NXT HORIZON ROW BONDING CLAMP:
Insert clamp between module rows and tighten bolt.

TORQUE VALUE: 20 ft-lbs



ALTERNATE ROW GROUNDING WITH N/S BONDING CLIP:
Fully seat bonding clip on each module flange to provide bond across N/S module gap.

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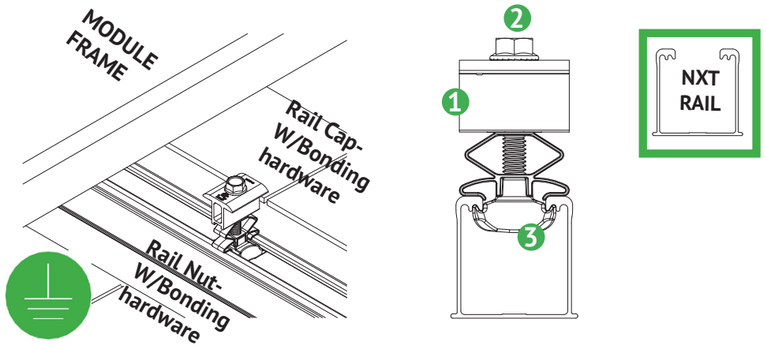
NXT HORIZON®

APPENDIX 1 PAGE

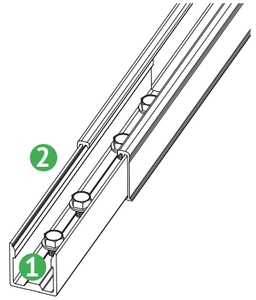
BONDING CONNECTION GROUND PATHS

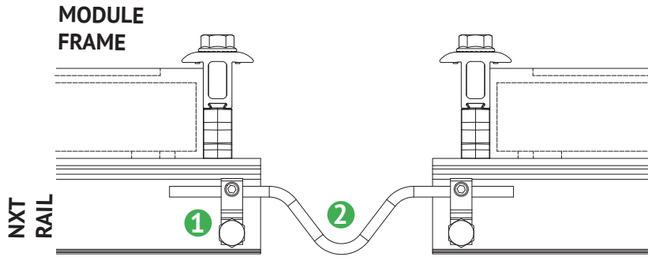


BONDING COMBO MID-END CLAMP ASSEMBLY

1. Aluminum combo mid-end clamp cap with stainless steel bonding pins that pierce module frame anodization to bond module to module through clamp
2. Stainless steel bolt bonds aluminum clamp to stainless steel Hex bolt
3. Aluminum combo mid-end clamp rail nut with stainless steel bonding pins that pierce rail anodization to bond module to module through clamp

NOTE: See page M for installation details





BONDING RAIL SPLICE

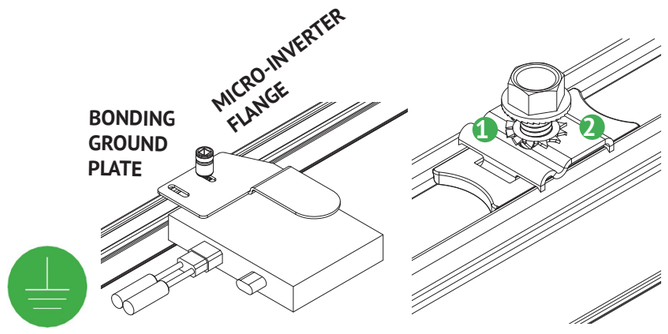
1. Bonding Hardware creates bond between Splice bar and each rail section
2. Aluminum splice bar spans across rail gap to create rail to rail bond. Rail on at least one side of splice will be grounded.

NOTE: See page I for installation details
Splice certified for single-use only

BONDING BETWEEN THERMAL BREAKS

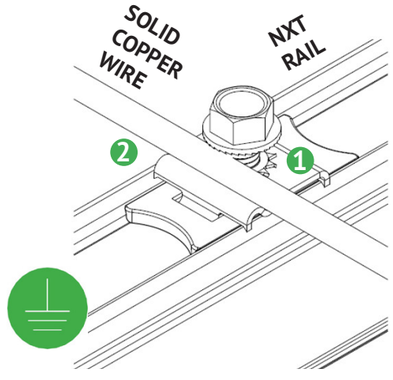
1. Lug is connected at the end of each thermal break to the rail
2. Solid copper wire is connected across the gap to bond the two ends

NOTE: See page D for installation details



BONDING MICROINVERTER MOUNT

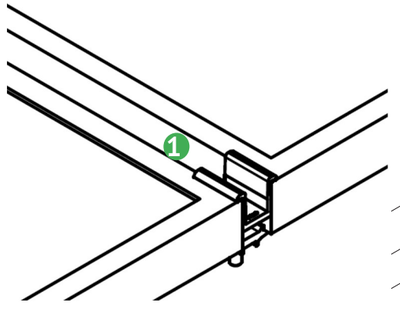
1. Stainless steel Tooth lock washer beneath the MLPE flange remove anodization on the mlpe and bonds.
2. Tabs on the stainless-steel washer remove anodization on the rail and bonds.
   NOTE: See page K for installation details

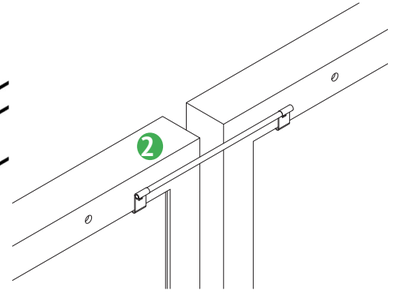


RACK SYSTEM GROUND

1. Tabs on the stainless-steel washer pierce anodization on the rail to bond rail to ground wire.
2. Solid copper wire connected to lug is routed to provide final system ground connection.

NOTE: See page J for installation details and alternate racking system grounding methods.





ALTERNATE ROW-TO-ROW BONDING PATHS

1. Row-to-row module bonding is accomplished with bonding clamp with 2 integral bonding pins.
2. Alternate method by connecting clips on either module to complete the bonding path.

NOTE: See page J for installation details
Row-to-row module bonding certified for single-use only

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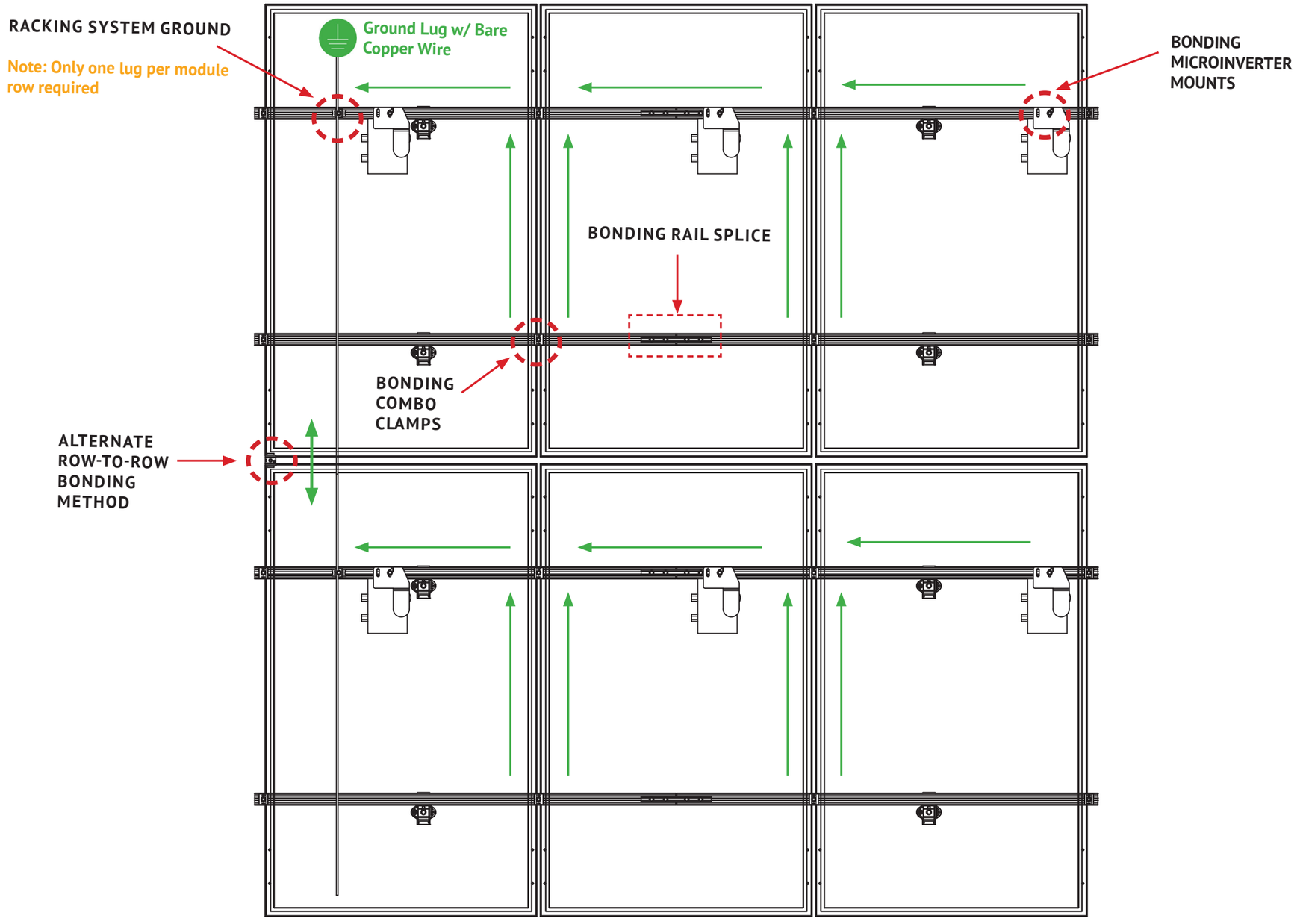
APPENDIX 2 PAGE

BONDING CONNECTION GROUND PATHS



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APPENDIX 3 PAGE
SYSTEM CERTIFICATION

The NXT Horizon system has been certified and listed to the UL 2703 standard (Rack Mounting Systems and Clamping Devices for Flat-Plate Photovoltaic Modules and Panels). This standard included electrical grounding, electrical bonding, mechanical load and fire resistance testing.

SYSTEM LEVEL FIRE CLASSIFICATION

The system fire class rating requires installation in the manner specified in the NXT HORIZON Installation Guide. NXT HORIZON has been classified to the system level fire portion of UL 2703. NXT HORIZON has achieved system level performance for steep sloped roofs. System level fire performance is inherent in the NXT HORIZON design, and no additional mitigation measures are required. The fire classification rating is only valid on roof pitches greater than 2:12 (slopes ≥ 2 inches per foot, or 9.5 degrees). The system is to be mounted over fire resistant roof covering rated for the application. There is no required minimum or maximum height limitation above the roof deck to maintain the system fire rating for NXT HORIZON. Approved Module Types & System Level Fire Ratings are listed below:

Module Type	System Level Fire Rating	Rail Direction	Module Orientation
Type 1, 2, 3 with metal frame, 10 with metal frame, 19, 22, 25, 29, & 30	Class A, Class B & Class C	Parallel OR Perpendicular to Ridge	Landscape OR Portrait

MECHANICAL LOAD TEST MODULES

The modules selected for UL 2703 mechanical load testing were selected to represent the broadest range possible for modules on the market. The tests performed covers module frame thicknesses greater than or equal to 1.0 mm, single and double wall frame profiles (some complex frame profiles could require further analysis to determine applicability), and clear and dark anodized aluminum frames. PV modules may have a reduced load rating, independent of the NXT Horizon rating. Please consult the PV module manufacturer's installation guide for more information.

Tested Module	UL2703 Certification Load Ratings	Tested Loads	Tested Module Area
SunPower SPR-A440 -COM	Down: 113 psf, Up: 50 psf , Slope: 15 psf	Down: 170 psf, Up: 75 psf , Slope: 23 psf	21.86 sq ft
Jinko JKM-xxxM 72HL4-V	Down: 50.12 psf, Up: 22.28 psf, Slope: 8 psf	Down: 75.19 psf, Up: 33.42 psf, Slope: 12 psf	27.76 sq ft

UL2703 CERTIFICATION MARKING:

Unirac NXT HORIZON is listed to UL 2703. Certification marking is embossed on all Combo Clamps as shown. Labels with additional certification information are provided with clamps and must be applied to the NXT Horizon Rail at the edge of the array.

Note: This racking system may be used to ground and/or mount a PV module complying with UL1703/UL61730 only when the specific module has been evaluated for grounding and/or mounting in compliance with the included instructions.

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APPENDIX 4
SYSTEM CERTIFICATION PAGE

Electrical Bonding and Grounding Test Modules

The list below is not exhaustive of compliant modules but shows those that have been evaluated and found to be electrically compatible with the NXT Horizon system.

Manufacture	Module Model / Series
Aionrise	AION60G1, AION72G1
Aleo	P-Series & S-Series
Aptos Solar	DNA-120-MF10 DNA-120-(MF/BF)23 DNA-144-(MF/BF)23 DNA-120-(MF/BF)26 DNA-144-(MF/BF)26
Astronergy	CHSM6612 M, M/HV CHSM6612P Series CHSM6612P/HV Series CHSM72M-HC CHSM72M(DG)/F-BH
Auxin	AXN6M610T AXN6P610T AXN6M612T AXN6P612T
Axitec	AC-xxx(M/P)/60S, AC-xxx(M/P)/72S AC-xxxP/156-60S AC-xxxMH/120(S/V/SB/VB) AC-xxxMH/144(S/V/SB/VB)
Boviet	BVM6610, BVM6612
BYD	P6K & MHK-36 Series
Canadian Solar	CS1(H/K/U/Y)-MS CS3K-(MB/MB-AG/MS/P/P HE/PB-AG) CS3L-(MS/P) CS3N-MS CS3U-(MB/MB-AG/MS/P/P HE/PB/PB-AG) CS3W-(MB-AG/MS/P/P-PB-AG) CS3Y-MB-AG CS5A-M CS6K-(M/MS/MS AllBlack/P/P HE)

Manufacture	Module Model / Series
Canadian Solar (cont.)	CS6P-(M/P) CS6R-MS CS6U-(M/P/P HE) CS6W-(MB-AG/MS) CS6X-P, CSX-P CS7L-MB-AG ELPS CS6(A/P)-MM
Centrosolar America	C-Series & E-Series
CertainTeed	CT2xxMxx-01, CT2xxPxx-01, CTxxxMxx-01 CTxxxPxx-01, CTxxxMxx-02, CTxxxMxx-03 CTxxxMxx-04, CTxxxHC11-04
Eco Solargy	Orion 1000 & Apollo 1000
ET Solar	ET AC Module, ET Module ET-M772BH520-550WW/WB
First Solar	FS-6XXX(A) FS-6XXX(A)-P, FS-6XXX(A)-P-I
Flextronics	FXS-xxxBB
FreeVolt	PVGraf
GCL	GCL-P6 & GCL-M6 Series
Hanwha SolarOne	HSL 60
Hansol	TD-AN3, TD-AN4 UB-AN1, UD-AN1
Heliene	36M, 36P 60M, 60P, 72M & 72P Series 144HC M6
H-SAAE	HT60-156M-C HT60-156M(V)-C HT72-156(M/P) HT72-156P-C, HT72-156P(V)-C HT72-156M(PDV)-BF, HT72-156M(PD)-BF HT72-166M, HT72-18X

Manufacture	Module Model / Series
Hyundai	KG, MG, RW, TG, RI, RG, TI, KI, HI Series HiA-SxxxHG, HiD-SxxxRG(BK), HiS-S400PI
ITEK	iT-SE Series
Japan Solar	JPS-60 & JPS-72 Series
JA Solar	JAM72D30MB, JAM78D10MB JAM72S30 /MR JAP6 60-xxx JAM6(K)-60/xxx, JAP6(k)-72-xxx/4BB JAP72S##-xxx/** JAP6(k)-60-xxx/4BB, JAP60S##-xxx/** JAM6(k)-72-xxx/**, JAM72S##-xxx/** JAM6(k)-60-xxx/**, JAM60S##-xxx/** i. ##: 01, 02, 03, 09, 10 ii. **: SC, PR, BP, HiT, IB, MW, MR ** = Backsheet, ## Cell technology
Jinko	JKM & JKMS Series JKMxxxM-72HL-V JKMxxxM-72HLM-TV JKMxxxM-72HL4-(T)V JKMxxxM-7RL3-V
Kyocera	KD-F & KU Series
LA Solar	LSxxxHC(166)
LG Electronics	LGxxx(E1C/E1K/N1C/N1K/N2T/N2W/S1C/S2W/Q1C/Q1K)-A5 LGxxx(A1C/M1C/M1K/N1C/N1K/Q1C/Q1K/QAC/QAK)-A6 LGxxxN2W-B3 LGxxxN2T-B5 LGxxxN1K-B6 LGxxx(N1C/N1K/N2T/N2W)-E6 LGxxx(N1C/N1K/N2W/S1C/S2W)-G4 LGxxxN2T-J5

- The frame profile must not have any feature that might interfere with the bonding devices that are integrated into the racking system
- Use with a maximum over current protection device OCPD of 30A
- **Listed models can be used to achieve a Class A fire system rating, for steep slope applications, only when modules fire typed 1, 2, 3 with metal frame, 10 with metal frame, 19, 22, 25, 29, or 30. See Appendix page 3**

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APPENDIX 5
SYSTEM CERTIFICATION PAGE

Electrical Bonding and Grounding Test Modules

The list below is not exhaustive of compliant modules but shows those that have been evaluated and found to be electrically compatible with the NXT Horizon system.

Manufacture	Module Model / Series
LG Electronics (cont.)	LGxxx(N1K/N1W/N2T/N2W)-L5 LGxxx(M1C/N1C/Q1C/Q1K)-N5 LGxxx(N1C/N1K/N2W/Q1C/Q1K)-V5 LGxxxN3K-V6
LONGi	LR4-60(HPB/HPH) LR4-72(HPH) LR6-60 LR6-60(BK/HPB/HPH/HV/PB/PE/PH) LR6-72 LR6-72(BK/HV/PB/PE/PH) RealBlack LR4-60HPB RealBlack LR6-60HPB
Mission Solar Energy	MSE Mono, MSE Perc MSExxx(SR8T/SR8K/SR9S/SX5T) MSExxx(SX5K/SX6W)
Mitsubishi	MJE & MLE Series
NE Solar	NESE xxx-72MHB-M10
Neo Solar Power Co.	D6M Series
Panasonic	VBHNxxxSA06/SA06B/SA11/SA11B VBHNxxxSA15/SA15B/SA16/SA16B, VBHNxxxKA, VBHNxxxKA03/04, VBHNxxxSA17/SA17G/SA17E/SA18/SA18E, VBHNxxxZA01/ZA02/ZA03/VBHNxxxZA04 EVPVxxx EVPVxxx(H/K/PK)
Peimar	SGxxxM (FB/BF) SMxxxM
Phono Solar	PSxxxM1-20/U PSxxxM1H-20/U PSxxxM1-20UH PSxxxM1H-20UH
Phono Solar (cont.)	PSxxxM1-20/UH PSxxxM1H-20/UH PSxxxM-24/T PSxxxMH-24/T PSxxxM-24/TH PSxxxMH-24/TH
Prism Solar	P72 Series
Q.Cells	Plus, Pro, Peak, G3, G4, Peak G5(SC) , G6(+)(SC)(AC), G7, G8(+), Plus, Pro, Peak L-G2, L-G4, L-G5 Peak L-G5, L-G6, L-G7, L-G8(BFF) Q.PEAK DUO(BLK)-G6+ Q.PEAK DUO BLK-G6+/TS Q.PEAK DUO (BLK)-G7 Q.PEAK DUO L-(G7/G7.1/G7.2/G7.3/G7.7) Q.PEAK DUO (BLK) G8(+) Q.PEAK DUO L-(G8/G8.1/G8.2/G8.3) Q.PEAK DUO L-G8.3 (BFF/BFG/BGT) Q.PEAK DUO (BLK) ML-G9(+) Q.PEAK DUO XL-(G9/G9.2/G9.3) Q.PEAK DUO XL-G9.3/BFG Q.PEAK DUO-G10+ Q.PEAK DUO BLK G10(+) Q.PEAK DUO BLK G10+ /AC Q.PEAK DUO (BLK) ML-G10(a)(+) Q.PEAK DUO XL-(G10/G10.2/G10.3/G10.c/G10.d) Q.PEAK DUO XL-G10.3/BFG Q.PEAK DUO XL-G10.d/BFG Q.PEAK DUO XL-(G11.2/G11.3) Q.PEAK DUO XL-G11.3/BFG
REC	RECxxxAA (BLK/Pure) RECxxxNP (N-PEAK) RECxxxNP2 (Black) RECxxxPE, RECxxxPE72 RECxxxTP, RECxxxTP72 RECxxxTP2(M/BLK2) RECxxxTP2S(M)72 RECxxxTP3M (Black) RECxxxTP4 (Black)
Renesola	All 60-cell modules
Risen	RSM Series, RSM110-8-xxxBMDG
S-Energy	SN72 & SN60 Series
SEG Solar	SEG-xxx-BMD-HV
Seraphim	SEG-(6PA/6PB/6MA/6MA-HV/6MB/E01/E11) SRP-(6QA/6QB) SRP-xxx-6MB-HV, SRP-320-375-BMB-HV, SRP-xxx-BMC-HV, SRP-390-450-BMA-HV, SRP-xxx-BMZ-HV, SRP-390-405-BMD-HV
Sharp	NU-SA & NU-SC Series
Silfab	SLA-M, SLA-P, SLG-M, SLG-P & BC Series SILxxx(BK/BL/HC/HL/HN/ML/NL/NT/NX/NU)
SolarEver USA	SE-166*83-xxxM-120N
Solaria	PowerXT-xxxR-(AC/PD/BD) PowerXT-xxxC-PD PowerXT-xxxR-PM (AC)
Solartech	STU HJT, STU PERC & Quantum PERC
SolarWorld	Sunmodule Protect, Sunmodule Plus/Pro

- The frame profile must not have any feature that might interfere with the bonding devices that are integrated into the racking system
- Use with a maximum over current protection device OCPD of 30A
- **Listed models can be used to achieve a Class A fire system rating, for steep slope applications, only when modules fire typed 1, 2, 3 with metal frame, 10 with metal frame, 19, 22, 25, 29, or 30. See Appendix page 3**

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DRAWING BY:

PLOT DATE:

PROJECT NUMBER:

SHEET NAME:
SPEC SHEET

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Electrical Bonding and Grounding Test Modules

The list below is not exhaustive of compliant modules but shows those that have been evaluated and found to be electrically compatible with the NXT Horizon system.

Manufacture	Module Model / Series
Sonali	SS-M-360 to 390 Series SS-M-390 to 400 Series SS-M-440 to 460 Series SS-M-430 to 460 BiFacial Series
Suniva	MV Series & Optimus Series (35mm)
SunPower	AC, X-Series, E-Series & P-Series SPR E20 435 COM (G4 Frame) Axxx-BLK-G-AC, SPR-Mxxx-H-AC
SunTech	STP, STPXXXS - B60/Wnhb
Sun Edison	F-Series, R-Series
Talesun	TP572, TP596, TP654, TP660 TP672, Hipor M, Smart
Tesla	SC, SC B, SC B1, SC B2, TxxxS, TxxxH
Trina	PA05, PD05, DD05, DD06, DE06, DE09.05 PD14, PE14, DD14, DE14, DE15, DE15V(II) DEG15HC.20(II), DEG15MC.20(II) DEG15VC.20(II), DE18M(II), DEG18MC.20(II) DE19, DEG19C.20
TSMC	TS-150C2 CIGSw
Upsolar	UP-MxxxP, UP-MxxxM(-B)
URECO	D7Kxxx(H7A/H8A), D7Mxxx(H7A/H8A) FAKxxx(C8G/E8G), FAMxxxE7G-BB FAMxxxE8G(-BB), FBKxxxM8G
Vikram	Eldora, Somera, Ultima PREXOS VSMDHT.60.AAA.05 PREXOS VSMDHT.72.AAA.05
VSUN	VSUNxxx-60M-BB, VSUNxxx-72MH VSUN4xx-144BMH

Manufacture	Module Model / Series
Vina	VNS-72M1-5-xxxW-1.5, VNS-72M3-5-xxxW-1.5, VNS-144M1-5-xxxW-1.5, VNS-144M3-5-xxxW-1.5, VNS-120M3-5-xxxW-1.0
Winaico	WST & WSP Series
Yingli	YGE & YLM Series
ZNShine Solar	ZXM6-72 Series, ZXM6-NH144 ZXM6-NHLDD144

- The frame profile must not have any feature that might interfere with the bonding devices that are integrated into the racking system
- Use with a maximum over current protection device OCPD of 30A
- **Listed models can be used to achieve a Class A fire system rating, for steep slope applications, only when modules fire typed 1, 2, 3 with metal frame, 10 with metal frame, 19, 22, 25, 29, or 30. See Appendix page 3**

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