RIGHT ANGLE *ENGINEERING*

STRUCTURAL CERTIFICATION REPORT

Roof-mounted Solar Panels

November 15, 2024

To: Kin Home
139 Hunter's Grv Ln #202
Lehi, UT 84043

Re: Andrew Davis
1821 SW Merryman Dr
Lee's Summit, MO 64082
AHJ: **Jackson (County)**, MO

Kin Home proposes to install new roof-mounted solar panels at this residence and asked *Right Angle Engineering* to review the existing structure for suitability. This letter summarizes the methods that were used to survey, evaluate, and certify the existing roof framing and the attachment of the new solar panels to it.

STRUCTURAL DESIGN

Building Code:	International Residential Code 2018
Design Standards:	ASCE 7-16
Snow:	Ground: p_g= 30.0 psf | Flat Roof: p_f= 20.79 psf | Sloped Roof: p_s= 17.33 psf
Wind:	Ultimate Wind Speed = 109.0 mph | Exposure = C
Seismic:	Risk Category = 2 | Seismic Design Category = B | Site Class = D

STRUCTURE

Field Technicians from *Kin Home* visited the site and observed the existing structure :

Array Name	Panel Quantity	Roof Framing	Material	Pitch
Array 1	12	Pre-Manufactured Truss| 24" o.c.	Asphalt Shingles	20°
Array 2	5	Pre-Manufactured Truss| 24" o.c.	Asphalt Shingles	20°
Array 3	3	Pre-Manufactured Truss| 24" o.c.	Asphalt Shingles	20°

ANCHORAGE

The solar panel anchorage shall be installed according to the manufacturer's most current installation manual. The attachment configuration should match the certified building plans. The solar panels should be mounted parallel (max 5 inches) to the roof surface.

Array Name	Connection Type	Fastener	Max Anchorage Spacing
Array 1	Splice Foot XL	(2) #14 wood screws (2.5" embedment) into roof substructure	48"
Array 2	Splice Foot XL	(2) #14 wood screws (2.5" embedment) into roof substructure	48"
Array 3	Splice Foot XL	(2) #14 wood screws (2.5" embedment) into roof substructure	48"

Installation Instructions

Solar panels and the equipment shall be installed per the manufacturer's installation specifications. Improper installation will void this certification. If deviations from the approved structural plans occur, Right Angle Engineering must be notified. Prior to installation, the installer should:

- Confirm that the existing structure matches the information provided in the site survey, the approved installation plans and this certification.
- Identify discrepancies between this certification and the approved installation plans. If found, then this certification shall govern.

- Identify structural elements that are dangerous (cracked, broken, excessive sag, signs of overstress, rot, decay, fire, water). If found, installation shall cease until those elements are adequately abated and made to comply with the referenced building code.
- Verify that both the existing structure and the solar addition has been permitted through the AHJ.

STRUCTURAL CERTIFICATION

I certify the addition of solar panels on the roof of this structure does not cause the structure to become unsafe or make it generally less compliant with the life-safety requirements of the referenced building code. Based on the evaluation methods described below, for the loads that exist at this site, the existing framing will safely support the new solar panels if they are installed and attached correctly.

Array Name	Certification Method	Retrofits
Array 1	Prescriptive method International Existing Building code 806.2	None required
Array 2	Prescriptive method International Existing Building code 806.2	None required
Array 3	Prescriptive method International Existing Building code 806.2	None required

Regards,

11/15/2024

Robert D. Smythe, P.E.
Right Angle Engineering

Job Details

Roof Snow Load - ASCE 7-16	
Ground Snow Load (p_g) *Section 7.2*	30.0 psf
Exposure Factor (C_e) *Table 7.3-1*	0.9
Thermal Factor (C_t) *Table 7.3-2*	1.1
Importance Factor (I_s) *Table 1.5-2*	1
Flat Roof Snow Load (p_f) *Equation 7.3-1*	20.79 psf
Non-Slippery Surface Slope Factor (C_s) *Figure 7.4-1*	1
Slippery Surface Slope Factor (C_s) *Figure 7.4-1*	0.83
Roof Snow Load *Equation 7.4-1*	20.79 psf
Reduced Snow Load (Slippery Surface) *Equation 7.4-1*	17.33 psf

Design Criteria	
Wind Speed (V_{ult}) *Local Design Criteria*	109.0mph
Exposure Category	C
Risk Category	2
Mean Roof Height	20 ft
Roof Type	Gable Roof
Building Type	Enclosed

Roof Live Load	
Existing Roof Live Load *ASCE 7-16 Table 4.3-1*	20 psf

[1]Roof Dead Load			
Asphalt Shingles	2.0 psf	**No Drywall**	0.0 psf
5/8" Plywood Sheathing	2.0 psf	**Solar Panel Array**	2.74 psf
Roof Framing	4 psf	**Dead Load Without Panels**	9.2 psf
Insulation	1.2 psf		

[1]Roof Dead Load is taken from the worst case scenario dead load from all arrays of the job in order to provide a more conservative evaluation.

Array 1

Array Details	
Roof Framing	Pre-Manufactured Truss
Spacing	24.0"
Beam Span	34.0'
Roof Pitch	20°
Panel Quantity	12
Panel Array Area	259.62 ft²
Panel Orientation	Portrait
Lag Screw Embedment	2.5"
Roof Attachment Type	Splice Foot XL (2) #14 wood screws
Shear Capacity *K2 Testing*	216.0 lbs
Pullout Capacity *K2 Testing*	424.0 lbs
Velocity Pressure *Equation 26.10-1 (K_z=0.9, K_{ht}=1, K_d=0.85, K_e=0.96)*	22.48 psf

GCP Zones	1/2e	2n/2r /3e	3r
GC_p *Figure 30.3-(2A-5B)*	-1.93	-2.52	-3.0
Design Pressure Up [psf] *Equation 29.4-7 γ_a=0.53 γ_E=1.0,*	-23.1	-30.2	-35.9
Factored Design Pressure Up [psf] *ASD LC (.6D + .6W)*	-12.3	-16.6	-20.0
Exposed Design Pressure Up [psf] *γ_a=0.53 γ_E=1.5,*	-34.6	-45.3	-53.9
Design Pressure Down [psf]	16	16	16
Tributary Area [ft^2]	31.5	25.6	21.2
Maximum Connection Spacing [in]	121	98	81
Maximum Rail Span [in]	48	48	48
Maximum Rail Cantilever [in]	16	16	16
Design Connection Spacing [in] **Adjusted*	48	48	48
Design Connection Spacing (exposed) [in]	48	48	48

Prescriptive Method: International Existing Building Code 806.2	
Total load on member without solar	2129.29 lbs
Total load on member with solar	2102.16 lbs
Percentage of total design load on member with solar	0.99%

The 2018 International Existing Building section 806.2 indicates that alterations to an existing building that results in less than a 5.0% increase in the total stress may be performed without a structural evaluation of the existing building. As demonstrated in the above calculations, the additional weight of the solar panels will be less than 5.0% increase in the gravity loading and therefore stress on the existing roof framing. Load case before and load case after solar panels have been added have both been considered according to International Building Code 1607.13.5.1.

Array 2

Array Details	
Roof Framing	Pre-Manufactured Truss
Spacing	24.0"
Beam Span	29.0'
Roof Pitch	20°
Panel Quantity	5
Panel Array Area	108.18 ft²
Panel Orientation	Portrait
Lag Screw Embedment	2.5"
Roof Attachment Type	Splice Foot XL (2) #14 wood screws
Shear Capacity *K2 Testing*	216.0 lbs
Pullout Capacity *K2 Testing*	424.0 lbs
Velocity Pressure *Equation 26.10-1 (K_z=0.9, K_{ht}=1, K_d=0.85, K_e=0.96)*	22.48 psf

GCP Zones	1/2e	2n/2r /3e	3r
GC_p *Figure 30.3-(2A-5B)*	-1.93	-2.52	-3.0
Design Pressure Up [psf] *Equation 29.4-7 γ_a=0.53 γ_E=1.0,*	-23.1	-30.2	-35.9
Factored Design Pressure Up [psf] *ASD LC (.6D + .6W)*	-12.3	-16.6	-20.0
Exposed Design Pressure Up [psf] *γ_a=0.53 γ_E=1.5,*	-34.6	-45.3	-53.9
Design Pressure Down [psf]	16	16	16
Tributary Area [ft^2]	31.5	25.6	21.2
Maximum Connection Spacing [in]	121	98	81
Maximum Rail Span [in]	48	48	48
Maximum Rail Cantilever [in]	16	16	16
Design Connection Spacing [in] **Adjusted*	48	48	48
Design Connection Spacing (exposed) [in]	48	48	48

Prescriptive Method: International Existing Building Code 806.2	
Total load on member without solar	1829.39 lbs
Total load on member with solar	1802.26 lbs
Percentage of total design load on member with solar	0.99%

The 2018 International Existing Building section 806.2 indicates that alterations to an existing building that results in less than a 5.0% increase in the total stress may be performed without a structural evaluation of the existing building. As demonstrated in the above calculations, the additional weight of the solar panels will be less than 5.0% increase in the gravity loading and therefore stress on the existing roof framing. Load case before and load case after solar panels have been added have both been considered according to International Building Code 1607.13.5.1.

Array 3

Array Details	
Roof Framing	Pre-Manufactured Truss
Spacing	24.0"
Beam Span	8.0'
Roof Pitch	20°
Panel Quantity	3
Panel Array Area	64.91 ft²
Panel Orientation	Portrait
Lag Screw Embedment	2.5"
Roof Attachment Type	Splice Foot XL (2) #14 wood screws
Shear Capacity *K2 Testing*	216.0 lbs
Pullout Capacity *K2 Testing*	424.0 lbs
Velocity Pressure *Equation 26.10-1 (K_z=0.9, K_{ht}=1, K_d=0.85, K_e=0.96)*	22.48 psf

GCP Zones	1/2e	2n/2r /3e	3r
GC_p *Figure 30.3-(2A-5B)*	-1.93	-2.52	-3.0
Design Pressure Up [psf] *Equation 29.4-7 γ_a=0.53 γ_E=1.0,*	-23.1	-30.2	-35.9
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Design Pressure Down [psf]	16	16	16
Tributary Area [ft^2]	31.5	25.6	21.2
Maximum Connection Spacing [in]	121	98	81
Maximum Rail Span [in]	48	48	48
Maximum Rail Cantilever [in]	16	16	16
Design Connection Spacing [in] **Adjusted*	48	48	48
Design Connection Spacing (exposed) [in]	48	48	48

Prescriptive Method: International Existing Building Code 806.2	
Total load on member without solar	569.81 lbs
Total load on member with solar	560.77 lbs
Percentage of total design load on member with solar	0.98%

The 2018 International Existing Building section 806.2 indicates that alterations to an existing building that results in less than a 5.0% increase in the total stress may be performed without a structural evaluation of the existing building. As demonstrated in the above calculations, the additional weight of the solar panels will be less than 5.0% increase in the gravity loading and therefore stress on the existing roof framing. Load case before and load case after solar panels have been added have both been considered according to International Building Code 1607.13.5.1.

DAVIS RESIDENCE

PHOTOVOLTAIC SYSTEM
1821 SW MERRYMAN DR
LEE'S SUMMIT, MO 64082

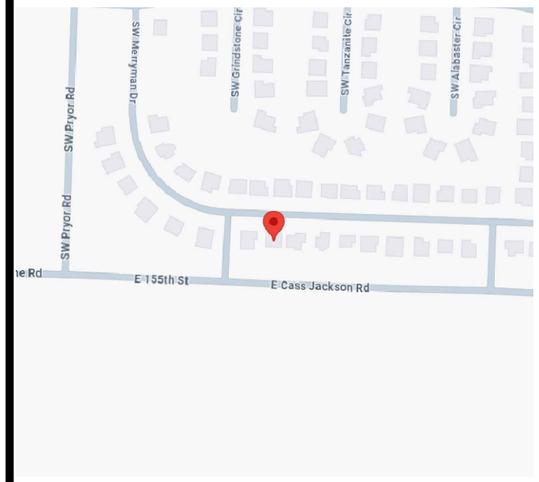
PHOTOVOLTAIC SYSTEM SPECIFICATIONS:

SYSTEM SIZE - 8.000kW DC | 6.500kW AC
MODULE TYPE & AMOUNT - (20) LONGI LR5-54HABB-400M
MODULE DIMENSIONS: 67.83" X 44.61" = 21.02 SF. WEIGHT: 47.84 LBS / 21.7 KG.
INVERTER - (20) ENPHASE IQ8M-72-2-US [240V] MICROINVERTERS
INTERCONNECTION METHOD - LOAD BREAKER

CUSTOMER NAME: DAVIS, ANDREW
UTILITY BILL NAME: DAVIS, ANDREW
1821 SW MERRYMAN DR
LEE'S SUMMIT, MO 64082

LICENSE # MO - 2024017475

STRUCTURAL STAMP



VICINITY MAP

AERIAL MAP

GENERAL

1. UTILITY SHALL BE NOTIFIED BEFORE ACTIVATION OF PHOTOVOLTAIC SYSTEM.
2. 110.2 APPROVAL: ALL ELECTRICAL EQUIPMENT SHALL BE LABELED, LISTED, OR CERTIFIED BY A NATIONALLY RECOGNIZED TESTING LABORATORY ACCREDITED BY THE UNITED STATES OCCUPATIONAL SAFETY HEALTH ADMINISTRATION
3. CONTRACTOR SHALL FIELD VERIFY ALL DIMENSIONS PRIOR TO INITIATING CONSTRUCTION.
4. CONTRACTOR SHALL REVIEW ALL MANUFACTURER INSTALLATION DOCUMENTS PRIOR TO INITIATING CONSTRUCTION.
5. ALL EQUIPMENT AND ASSOCIATED CONNECTIONS, ETC, AND ALL ASSOCIATED WIRING AND INTERCONNECTIONS SHALL BE INSTALLED ONLY BY QUALIFIED PERSONNEL.
6. THE CONTRACTOR OR OWNER MUST PROVIDE ROOF ACCESS (LADDER TO ROOF) FOR ALL THE REQUIRED INSPECTIONS. LADDERS MUST BE OSHA APPROVED, MINIMUM TYPE I WITH A 250LB. RATING, IN GOOD CONDITION AND DESIGNED FOR ITS INTENDED USE.
7. CONTRACTOR SHALL VERIFY THAT THE ROOF STRUCTURE WILL WITHSTAND THE ADDITIONAL LOADS.
8. LAG SCREWS SHALL PENETRATE A MINIMUM 2" INTO SOLID SAWN STRUCTURAL MEMBERS AND SHALL NOT EXCEED MANUFACTURER RECOMMENDATIONS FOR FASTENERS INTO ENGINEERED STRUCTURAL MEMBERS.
9. AN ACCESS POINT SHALL BE PROVIDED THAT DOES NOT PLACE THE GROUND LADDER OVER OPENINGS SUCH AS WINDOWS OR DOORS ARE LOCATED AT STRONG POINTS OF BUILDING CONSTRUCTION AND IN LOCATIONS WHERE THE ACCESS POINT DOES NOT CONFLICT WITH OVERHEAD OBSTRUCTIONS SUCH AS TREE LIMBS, WIRES, OR SIGNS.
10. WHERE DC CONDUCTORS ARE RUN INSIDE BUILDING, THEY SHALL BE CONTAINED IN A METAL RACEWAY; THEY SHALL NOT BE INSTALLED WITHIN 10" OF THE ROOF DECKING OR SHEATHING EXCEPT WHERE COVERED BY THE PV MODULES AND EQUIPMENT.
11. PLUMBING AND MECHANICAL VENTS THROUGH THE ROOF SHALL NOT BE COVERED BY SOLAR MODULES- - NO BUILDING, PLUMBING OR MECHANICAL VENTS TO BE COVERED, CONSTRUCTED OR ROUTED AROUND SOLAR MODULES.
12. ALL FIELD -INSTALLED JUNCTION, PULL AND OUTLET BOXES LOCATED BEHIND MODULES SHALL BE ACCESSIBLE DIRECTLY OR BY DISPLACEMENT OF A MODULE SECURED BY REMOVABLE FASTENERS.

ELECTRICAL

1. WIRING MATERIALS SHALL COMPLY WITH MAXIMUM CONTINUOUS CURRENT OUTPUT AT 25°C AND MAXIMUM VOLTAGE AT 600V; WIRE SHALL BE WET RATED AT 90°C.
2. EXPOSED PHOTOVOLTAIC SYSTEM CONDUCTORS ON THE ROOF WILL BE USE 2 OR PV-TYPE WIRE.
3. PHOTOVOLTAIC SYSTEM CONDUCTORS SHALL BE IDENTIFIED AND GROUPED. THE MEANS OF IDENTIFICATION SHALL BE PERMITTED BY SEPARATE COLOR-CODING, MARKING TAPE, TAGGING OR OTHER APPROVED MEANS.
4. ALL EXTERIOR CONDUIT, FITTINGS, AND BOXES SHALL BE RAIN-TIGHT AND APPROVED FOR USE IN WET LOCATIONS.
5. ALL METALLIC RACEWAYS AND EQUIPMENT SHALL BE BONDED AND ELECTRICALLY CONTINUOUS.
6. WHERE SIZES OF JUNCTION BOXES, RACEWAYS, AND CONDUITS ARE NOT SPECIFIED, CONTRACTOR SHALL SIZE THEM ACCORDING TO APPLICABLE CODES.
7. REMOVAL OF A UTILITY-INTERACTIVE INVERTER OR OTHER EQUIPMENT SHALL NOT DISCONNECT THE BUILDING CONNECTION BETWEEN THE GROUNDING ELECTRODE CONDUCTOR AND THE PV SOURCE AND/OR OUTPUT CIRCUIT GROUNDED CONDUCTOR.
8. FOR GROUNDED SYSTEMS, THE PHOTOVOLTAIC SOURCE AND OUTPUT CIRCUITS SHALL BE PROVIDED WITH A GROUND-FAULT PROTECTION DEVICE OR SYSTEM THAT DETECTS A GROUND FAULT, INDICATES THAT FAULT HAS OCCURED AND AUTOMATICALLY DISCONNECTS ALL CONDUCTORS OR CAUSES THE INVERTER TO AUTOMATICALLY CEASE SUPPLYING POWER TO OUTPUT CIRCUITS.
9. FOR UNGROUNDED SYSTEMS, THE INVERTER IS EQUIPPED WITH GROUND FAULT PROTECTION AND A GFI FUSE PORT FOR GROUND FAULT INDICATION.
10. PV MODULE FRAMES SHALL BE BONDED TO RACKING RAIL OR BARE COPPER GEC/GEC PER THE MODULE MANUFACTURER'S LISTED INSTRUCTION SHEET.
11. PV MODULE RACKING RAIL SHALL BE BONDED TO BARE COPPER GEC VIA WEEB LUG, ILSCO GBL-4DBT LAY-IN LUG, OR EQUIVALENT LISTED LUG.
12. THE PHOTOVOLTAIC INVERTER WILL BE LISTED AS UL 1741 COMPLIANT.
13. RACKING AND BONDING SYSTEM TO BE UL2703 RATED.
14. ANY REQUIRED GROUNDING ELECTRODE CONDUCTOR WILL BE CONTINUOUS, EXCEPT FOR SPLICES OR JOINTS AS BUS BARS WITHIN LISTED EQUIPMENT.
15. WHEN BACKFED BREAKER IS THE METHOD OF UTILITY INTERCONNECTION, THE BREAKERS SHALL NOT READ "LINE AND LOAD".
16. WHEN APPLYING THE 120% RULE, THE SOLAR BREAKER TO BE POSITIONED AT THE OPPOSITE END OF THE BUS BAR FROM THE MAIN BREAKER.
17. THE WORKING CLEARANCE AROUND THE EXISTING ELECTRICAL EQUIPMENT AS WELL AS THE NEW ELECTRICAL EQUIPMENT WILL BE MAINTAINED.

NOTE: VISIBLE, LOCKABLE, LABELED AC DISCONNECT LOCATED WITHIN 10' OF UTILITY METER.

GOVERNING CODES

ALL MATERIALS, EQUIPMENT, INSTALLATION AND WORK SHALL COMPLY WITH THE FOLLOWING APPLICABLE CODES:

- 2018 INTERNATIONAL BUILDING CODE
- 2018 INTERNATIONAL MECHANICAL CODE
- 2018 UNIFORM PLUMBING CODE
- 2018 INTERNATIONAL FUEL GAS CODE
- 2017 INTERNATIONAL ENERGY CODE
- 2018 INTERNATIONAL EXISTING BUILDING CODE
- 2018 NATIONAL ELECTRICAL CODE
- 2018 INTERNATIONAL FIRE CODE

SHEET INDEX:

KIN HOME
139 N HUNTERS GROVE LN, LEHI, UT, 84043

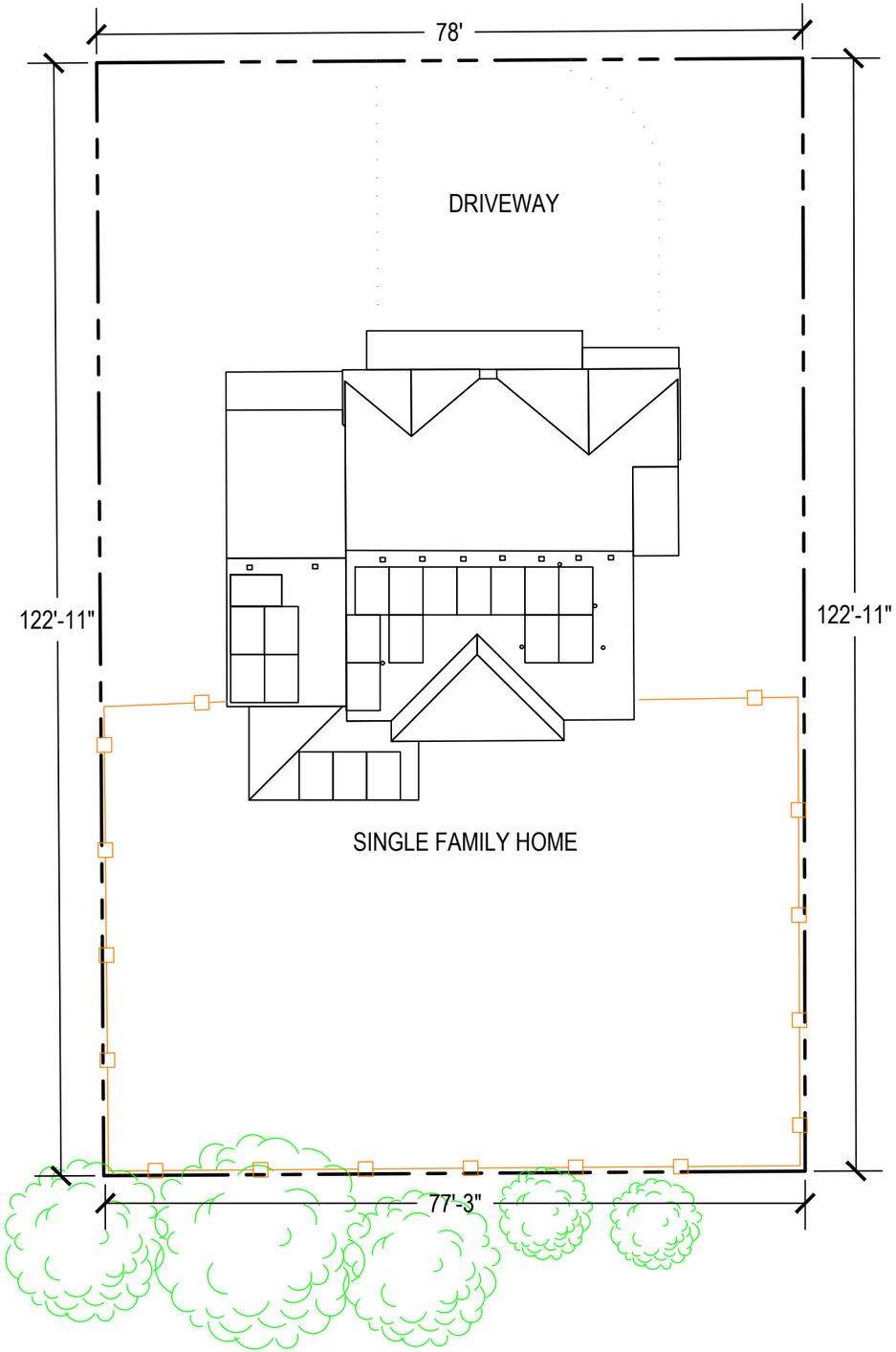
COVER PAGE

JOB #: 7996
DATE: 11/13/2024
DRAWN BY: JN

REV #1:
REV #2:
REV #3:

PV-1

1821 SW MERRYMAN DR



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CUSTOMER NAME: DAVIS, ANDREW
UTILITY BILL NAME: DAVIS, ANDREW
1821 SW MERRYMAN DR
LEE'S SUMMIT, MO 64082

LICENSE # MO - 2024017475

STRUCTURAL STAMP

LEGEND:

PROPERTY LINE:

DRIVEWAY:

FENCE:

APN: 69700101000000000

LOT: 0.208 ACRES

NOTE: VISIBLE, LOCKABLE, LABELED AC DISCONNECT LOCATED WITHIN 10' OF UTILITY METER.

SCALE: 1/16" = 1'-0"

KIN HOME

139 N HUNTERS GROVE LN, LEHI, UT, 84043

PROPERTY PLAN

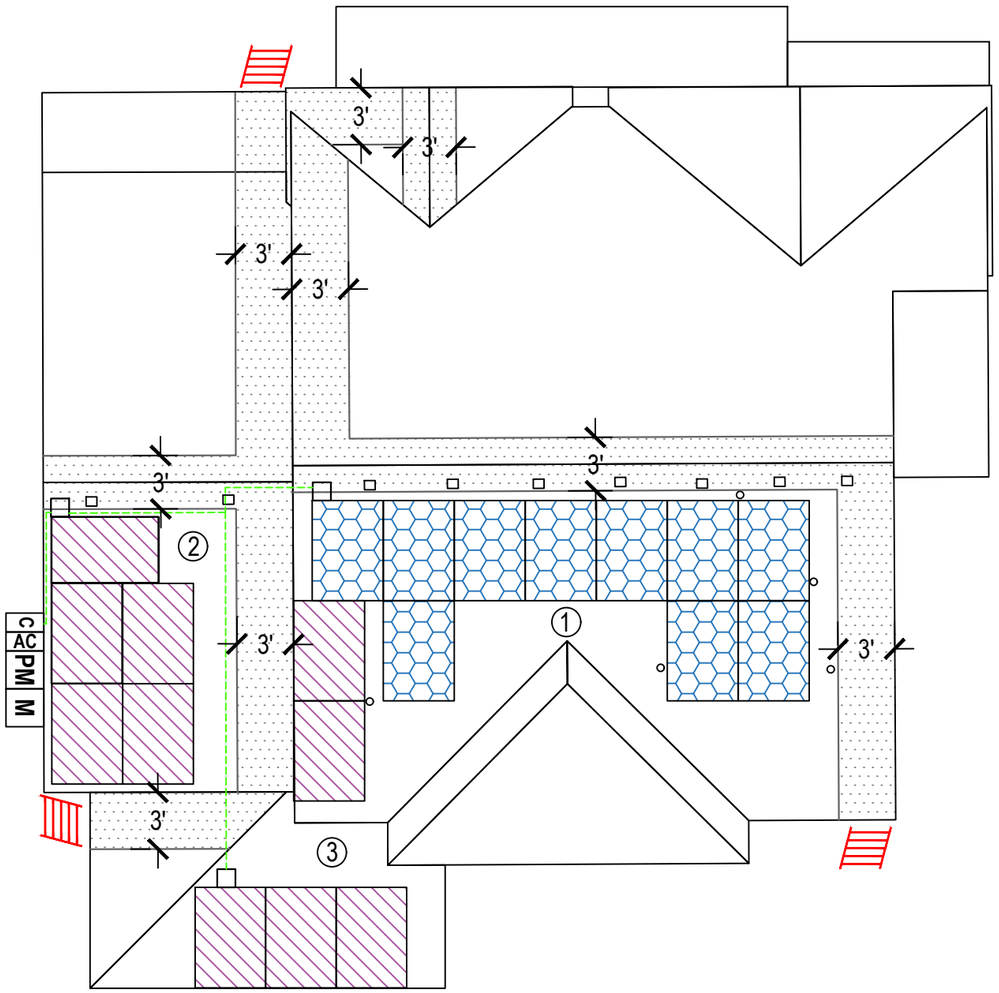
JOB #: 7996
DATE: 11/13/2024
DRAWN BY: JN

PV-2

ROOF DETAIL	
ROOF SECTION 1: COMP SHINGLE AZIMUTH: 182° PITCH: 20° MODULE COUNT: 12	1
ROOF SECTION 2: COMP SHINGLE AZIMUTH: 182° PITCH: 20° MODULE COUNT: 5	2
ROOF SECTION 3: COMP SHINGLE AZIMUTH: 182° PITCH: 20° MODULE COUNT: 3	3

CIRCUIT DETAIL
ENPHASE CIRCUITS
CIRCUIT # 1: 10 MODULES
CIRCUIT # 2: 10 MODULES

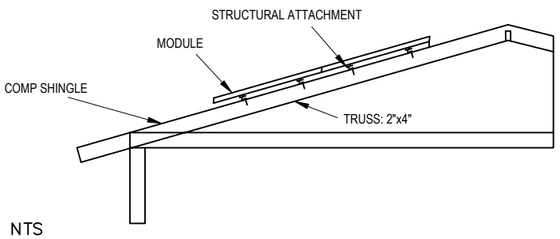
1821 SW MERRYMAN DR



N

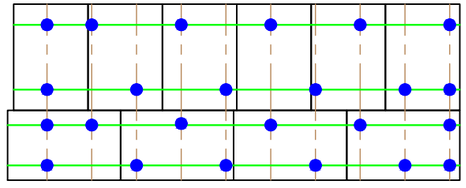
PV MODULE ELECTRICAL SPECIFICATIONS	
MODULE TYPE	LONGI LR5-54HABB-400M
POWER MAX (P_{MAX})	400W
OPEN CIRCUIT VOLTAGE (V_{OC})	37.05V
SHORT CIRCUIT CURRENT (I_{SC})	13.72A
MAX POWER-POINT VOLTAGE (V_{MP})	30.94V
MAX POWER-POINT CURRENT (I_{MP})	12.93A
SERIES FUSE RATING	30A
MODULE MECHANICAL SPECIFICATIONS	
DESIGN WIND SPEED	109 MPH
DESIGN SNOW LOAD	30 PSF
# OF STORIES	1
ROOF PITCH	20°
TOTAL ARRAY AREA (SQ. FT)	416.20
TOTAL ROOF AREA (SQ. FT)	2109
ARRAY SQ. FT / TOTAL ROOF SQ. FT	17.35%

ELEVATION DETAIL



NTS

ELEVATION DETAIL



1. MAX ATTACHMENT SPACING SHALL NOT EXCEED 48" O.C.
2. ATTACHMENTS SHALL BE STAGGERED
3. ROOF SPACING: 24"O.C.

INVERTER ELECTRICAL SPECIFICATIONS	
INVERTER TYPE	ENPHASE IQ8M-72-2-US [240V]
MAX INPUT DC VOLTAGE	60V
MAX DC SHORT CIRCUIT CURRENT	15A
MAXIMUM OUTPUT POWER	325W
MAXIMUM CONT. OUTPUT CURRENT	1.35A
CEC EFFICIENCY	97.6%
MAX UNITS PER 20A CIRCUIT	11

NOTE: VISIBLE, LOCKABLE, LABELED AC DISCONNECT LOCATED WITHIN 10' OF UTILITY METER.

CUSTOMER NAME: DAVIS, ANDREW

UTILITY BILL NAME: DAVIS, ANDREW
1821 SW MERRYMAN DR
LEE'S SUMMIT, MO 64082

LICENSE # MO - 2024017475

STRUCTURAL STAMP

STATE OF MISSOURI ★ PROFESSIONAL ENGINEER ★
ROBERT SMYTHE NUMBER PE-2019032917
11/15/2024

SYSTEM LEGEND

PV SYSTEM SIZE:
NEW 8.000kW DC | 6.500kW AC

M — EXISTING INTERIOR MAIN SERVICE PANEL & POINT OF INTERCONNECTION. TIED TO UTILITY METER 23777350.

PM — PRODUCTION METERING EQUIPMENT

AC — NEW PV SYSTEM AC DISCONNECT(RSD). LOCATED WITHIN 10' OF MSP.

C — NEW DEDICATED PV SYSTEM COMBINER PANEL.

20 NEW LONGI LR5-54HABB-400M MODULES
20 NEW ENPHASE IQ8M-72-2-US MICROINVERTERS, MOUNTED ON THE BACK OF EACH MODULE.

NEW PV CONDUIT RUN.*SEE E1.0 CONDUIT SCHEDULE*
= EXTERIOR RUN = ATTIC RUN

NEW JUNCTION BOX. (EZ SOLAR JB-1.2)

36" FIRECODE PATHWAY LADDER ACCESS LOCATION.

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

KIN HOME

139 N HUNTERS GROVE LN, LEHI, UT, 84043

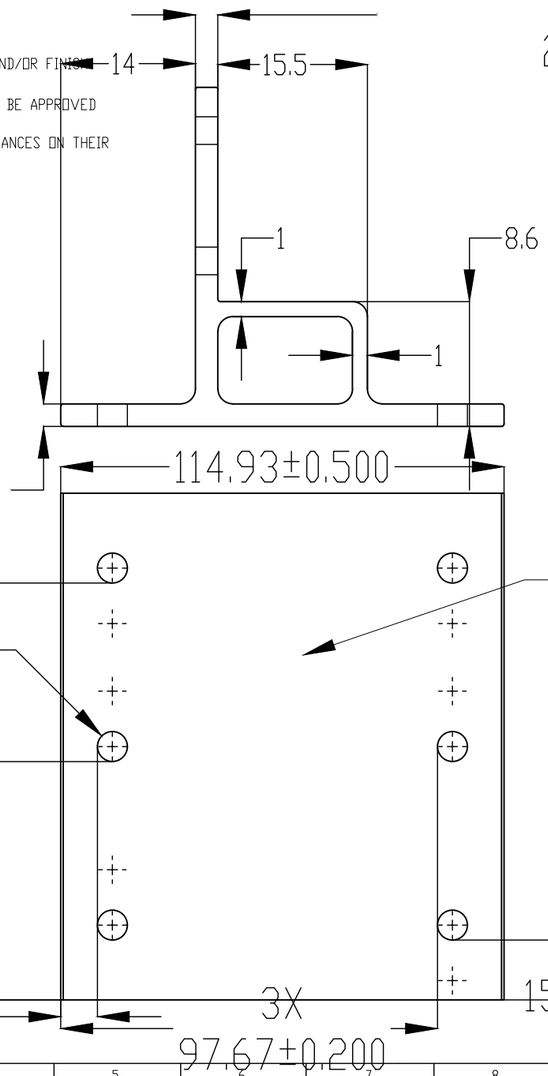
SITE PLAN

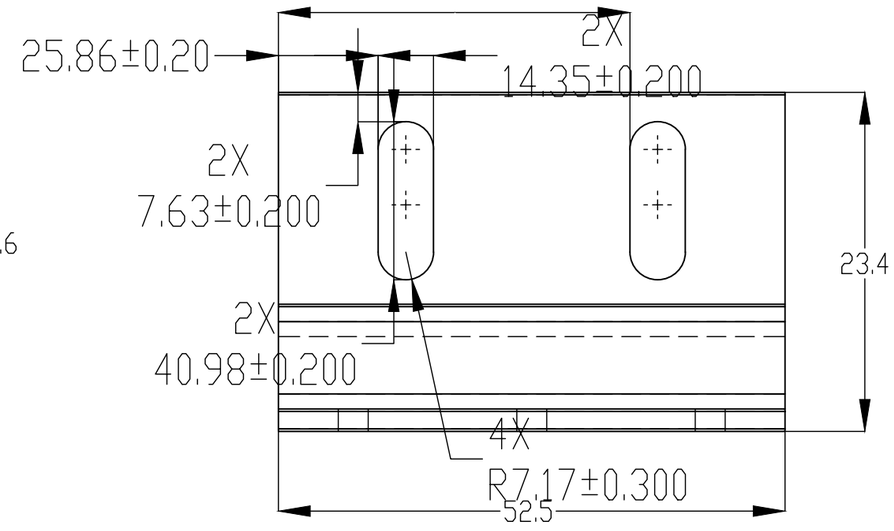
JOB #: 7996
DATE: 11/13/2024
DRAWN BY: JN

PV-3

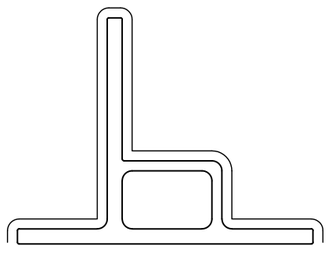
NOTES:

ALL DIMENSIONS ARE mm UNLESS OTHERWISE SPECIFIED.
DIMENSIONS AND TOLERANCE SHOWN ARE AFTER PLATING AND/OR FINISH.
PART IS TO BE FREE OF BURRS AND SHARP EDGES.
ANY MATERIAL DEVIATION FROM SPECIFIED MATERIAL MUST BE APPROVED BY EVEREST/K2.
PARTS SHALL NOT HAVE OILS, RESIDUES, OR OTHER SUBSTANCES ON THEIR SURFACE.

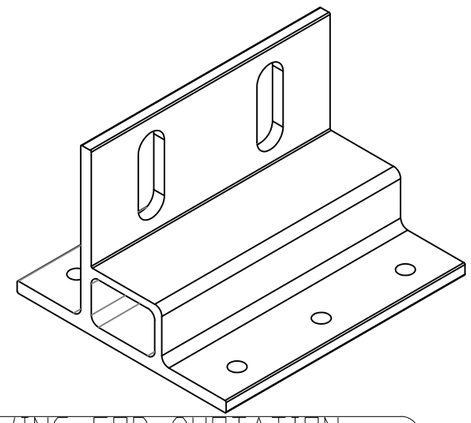




HIDDEN LINES OMITTED FOR SIMPLICITY.



EXPOSED SURFACE



DRAWING FOR QUOTATION

QUOTATION PORPUSES ONLY, NOT FOR MANUFACTURING

CUSTOMER NAME: DAVIS, ANDREW

UTILITY BILL NAME: DAVIS, ANDREW
1821 SW MERRYMAN DR
LEE'S SUMMIT, MO 64082

LICENSE # MO - 2024017475

STRUCTURAL STAMP

11/15/2024

MOUNTING LEGEND

MOUNT DETAILS

SCALE: NOT TO SCALE

KIN HOME

139 N HUNTERS GROVE LN, LEHI, UT, 84043

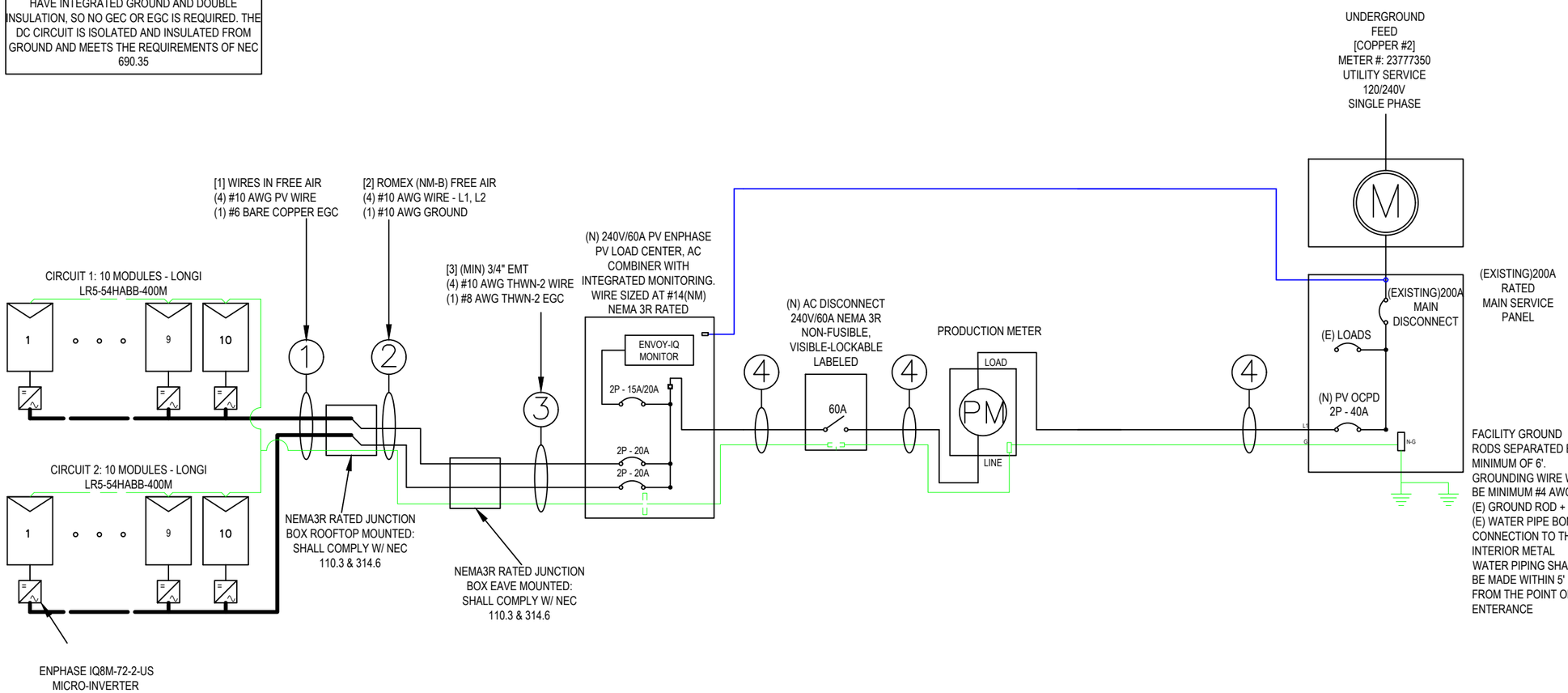
MOUNTING DETAILS

JOB #: 7996
DATE: 11/13/2024
DRAWN BY: JN

S-1

CONDUCTOR AND CONDUIT SCHEDULE					
TAG	WIRE TYPE	WIRE SIZE	# OF CONDUCTORS	CONDUIT TYPE	MIN. CONDUIT SIZE
1	Q-CABLE	#10	2 - L1 L2	FREE AIR	N/A
1	BARE COPPER	#6	1 - BARE	FREE AIR	N/A
2	ROMEX (NM-B)	#10/2	2 - L1 L2 GND	ROMEX FREE AIR (IN ATTIC)	N/A
3	THWN-2	#10	2 - L1 L2	PVC	3/4"
3	THWN-2 EGC	#8	1 - GND	PVC	3/4"
4	THWN-2	#8	3 - L1 L2 N	PVC	3/4"
4	THWN-2 EGC	#8	1 - GND	PVC	3/4"

THE ENPHASE IQ8M-72-2-USMICRO-INVERTERS HAVE INTEGRATED GROUND AND DOUBLE INSULATION, SO NO GEC OR EGC IS REQUIRED. THE DC CIRCUIT IS ISOLATED AND INSULATED FROM GROUND AND MEETS THE REQUIREMENTS OF NEC 690.35



PV MODULE ELECTRICAL SPECIFICATIONS	
MODULE TYPE	LONGI LR5-54HABB-400M
POWER MAX (P_{MAX})	400W
OPEN CIRCUIT VOLTAGE (V_{OC})	37.05V
SHORT CIRCUIT CURRENT (I_{SC})	13.72A
MAX POWER-POINT VOLTAGE (V_{MP})	30.94V
MAX POWER-POINT CURRENT (I_{MP})	12.93A
SERIES FUSE RATING	30A

INVERTER ELECTRICAL SPECIFICATIONS	
INVERTER TYPE	ENPHASE IQ8M-72-2-US [240V]
MAX INPUT DC VOLTAGE	60V
MAX DC SHORT CIRCUIT CURRENT	15A
MAXIMUM OUTPUT POWER	325W
MAXIMUM CONT. OUTPUT CURRENT	1.35A
CEC EFFICIENCY	97.6%
MAX UNITS PER 20A CIRCUIT	11

SYSTEM OVER-CURRENT PROTECTION DEVICE (OCPD) CALCULATIONS	
INVERTER TYPE	ENPHASE IQ8M-72-2-US [240V]
# OF INVERTERS	20
MAX CONTINUOUS OUTPUT CURRENT	1.35
(# OF INVERTERS) X (MAX CONT. OUTPUT CURRENT) X 125% <= OCPD RATING	
(20 x 1.35A x 1.25)= 33.75A <= 40A, OK	

BUSBAR CALCULATIONS - PV BREAKER - 120% RULE	
MAIN BUS RATING	200
MAIN DISCONNECT RATING	200
PV BREAKER RATING	40
(MAIN BUS RATING x 1.2) - MAIN DISCONNECT RATING >= OCPD RATING	
(200A x 1.2) - 200A >= 40A, OK	

CUSTOMER NAME: DAVIS, ANDREW
UTILITY BILL NAME: DAVIS, ANDREW
1821 SW MERRYMAN DR
LEE'S SUMMIT, MO 64082

LICENSE # MO - 2024017475

ELECTRICAL STAMP

STATE OF MISSOURI ★ PROFESSIONAL ENGINEER ★
ROBERT SMYTHE NUMBER PE-2019032917
11/15/2024

ELECTRICAL DIAGRAM NOTES

PV SYSTEM SIZE:
NEW 8.000kW DC | 6.500kW AC

MODULE TYPE & AMOUNT - (20) LONGI LR5-54HABB-400M
INVERTER - (20) ENPHASE IQ8M-72-2-US

NOTES:
1. MODULES ARE BONDED TO RAIL USING UL 2703 RATED BONDING SYSTEM - INTEGRATED BONDING MID-CLAMPS + DIRECT-BURIAL LAY-IN-LUGS; SEE ATTACHED FOR SPECIFICATIONS IF APPLICABLE
2. PV DC SYSTEM IS UNGROUNDED
3. PV ARRAY WILL HAVE A GROUNDING ELECTRODE SYSTEM IN COMPLIANCE WITH NEC 250.58 AND 690.47(A)
4. PV SOURCE, OUTPUT, AND INVERTER INPUT CIRCUIT WIRING METHODS SHALL COMPLY WITH NEC 690.1(G)
5. BACKFED PV BREAKER WILL BE INSTALLED AT OPPOSITE END OF THE BUS BAR FROM THE MAIN BREAKER. A PERMANENT WARNING LABEL TO BE INSTALLED PER SYSTEM SIGNAGE, PAGE
6. BARE COPPER IS TRANSITIONED TO THWN-2 VIA IRREVERSIBLE CRIMP; WHEN PRESENT, THE GEC TO BE CONTINUOUS
7. INVERTER(S) TO BE COMPLIANT WITH UL 1741 SUPPLEMENT A
8. CONDUIT AND CONDUCTOR SPECIFICATIONS ARE BASED ON MINIMUM CODE REQUIREMENTS AND ARE NOT MEANT TO LIMIT UP-SIZING AS REQUIRED BY FIELD CONDITIONS
9. CONDUIT AND CONDUCTOR SPECIFICATIONS ARE BASED ON MINIMUM CODE REQUIREMENTS AND ARE NOT MEANT TO LIMIT UPSIZING AS REQUIRED BY FIELD CONDITIONS.

NOTE: VISIBLE, LOCKABLE, LABELED AC DISCONNECT LOCATED WITHIN 10' OF UTILITY METER.

KIN HOME

139 N HUNTERS GROVE LN, LEHI, UT, 84043

ELECTRICAL DIAGRAM

JOB #: 7996
DATE: 11/13/2024
DRAWN BY: JN

EE-1

AC CONDUCTOR AMPACITY CALCULATIONS: FROM ROOF TOP JUNCTION BOX TO COMBINER BOX

AMBIENT TEMPERATURE ADJUSTMENT FOR EXPOSED CONDUIT
PER NEC 310.15(b)(2)(C): + 22°
EXPECTED WIRE TEMP (°C): 37° + 22° = 59°
TEMP CORRECTION PER TABLE 310.16: 0.71
OF CURRENT CARRYING CONDUCTORS: 4
CONDUIT FILL CORRECTION PER NEC 310.15(B)(2)(a): 0.80
CIRCUIT CONDUCTOR SIZE: 10 AWG
CIRCUIT CONDUCTOR AMPACITY: 40 A

REQUIRED CIRCUIT CONDUCTOR AMPACITY PER NEC 690.8(A&B):
1.25 X MAX AC OUTPUT CURRENT X #OF INVERTERS PER STRING
CIRCUIT 1 = 10 X 1.35 X 1.25 = 16.88 A
CIRCUIT 2 = 10 X 1.35 X 1.25 = 16.88 A

DERATED AMPACITY OF CIRCUIT CONDUCTOR PER NEC TABLE 310.16
TEMP CORR. PER NEC TABLE 310.16 X CONDUIT FILL CORR. PER NEC 310.15(B)(2)(a) X
CIRCUIT CONDUCTOR AMPACITY = 0.71 X 0.8 X 20 = 11.36 A

AC CONDUCTOR AMPACITY CALCULATIONS: FROM COMBINER BOX TO POI

EXPECTED WIRE TEMP (°C): 37°
TEMP CORRECTION PER NEC TABLE 31.16: 0.91
CIRCUIT CONDUCTOR SIZE: 8 AWG
CIRCUIT CONDUCTOR AMPACITY: 55A
OF CURRENT CARRYING CONDUCTORS: 3
CONDUIT FILL PER NEC 310.15(b)(2)(a): 1
REQUIRED CIRCUIT CONDUCTOR AMPACITY PER NEC 690.8(B):
1.35 X MAX AC OUTPUT CURRENT X # OF INVERTERS
1.25 X 1.35 X 20 = 33.75 A

DERATED AMPACITY OF CIRCUIT CONDUCTORS PER NEC TABLE 310.16:
TEMP CORR. PER NEC 310.16 X CONDUIT FILL CORR. PER NEC 310.15(B)(2)(a) X
CIRCUIT CONDUCTOR AMPACITY: = .65 X 1 X 55 = 35.75A

ELECTRICAL NOTES:

1.) ALL EQUIPMENT TO BE LISTED BY UL OR ANOTHER NRTL, AND LABELED FOR ITS APPLICATION.
2.) ALL CONDUCTORS SHALL BE COPPER, RATED FOR 600V AND 90 DEGREE C WET ENVIRONMENT
3.) WIRING, CONDUIT, AND RACEWAYS MOUNTED ON ROOFTOPS 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.) DRAWING 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.) THE POLARITY OF THE GROUNDED CONDUCTORS IS NEGATIVE.

MICRO-INVERTER SPECIFICATIONS	
MANUFACTURER / MODEL #	ENPHASE IQ8M-72-2-US
AC MAX CONTINUOUS OUTPUT	1.35A
AC MAX. CONT. OUTPUT POWER	325W
CEC WEIGHTED EFFICIENCY	97.6%

PERCENT OF VALUES	NUMBER OF CURRENT CARRYING CONDUCTORS IN EMT
.80	4-6
.70	7-9
.50	10-20

AMBIENT TEMPERATURE SPECS	
RECORD LOW TEMP	-10°
AMBIENT TEMP (HIGH TEMP 2%)	40°
CONDUIT HEIGHT	0.5"
ROOF TOP TEMP	56°
CONDUCTOR TEMPERATURE RATE	90°
MODULE TEMPERATURE COEFFICIENT OF Voc	-0.26%/°C

CUSTOMER NAME: DAVIS, ANDREW
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ELECTRICAL STAMP

STATE OF MISSOURI ★ PROFESSIONAL ENGINEER ★
ROBERT SMYTHE
NUMBER PE-2019032917
11/15/2024

ELECTRICAL CALCULATIONS

NOTE: VISIBLE, LOCKABLE, LABELED AC DISCONNECT LOCATED WITHIN 10' OF UTILITY METER.

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139 N HUNTERS GROVE LN, LEHI, UT, 84043

ELECTRICAL CALCULATION

JOB #: 7996
DATE: 11/13/2024
DRAWN BY: JN

EE-2

DC LABELS

⚠ WARNING

TURN OFF PHOTOVOLTAIC AC
DISCONNECT PRIOR TO WORKING
INSIDE PANEL

LOCATION:
- COMBINER / JUNCTION BOX

CODE REF:
2020 NEC 690.13(B), 706.15(C)(4),
110.27(C)
OSHA 1910.145(F)(7)

⚠ WARNING

ELECTRICAL SHOCK HAZARD
TERMINALS ON BOTH LINE AND
LOAD SIDES MAY BE ENERGIZED
IN THE OPEN POSITION

DC VOLTAGE IS ALWAYS PRESENT
WHEN SOLAR MODULES ARE
EXPOSED TO SUNLIGHT

LOCATION:
- DC DISCONNECT
- COMBINER BOX
- DC ENCLOSURES

CODE REF:
2020 NEC 690.13(B)

MAXIMUM DC VOLTAGE
OF THE PV SYSTEM:
480VDC

LOCATION:
- DC DISCONNECT OR POWER CONVERSION UNIT OR PV DISTRIBUTION EQUIPMENT

CODE REF:
2020 NEC 690.53
WHITE TEXT, RED BACKGROUND

PHOTOVOLTAIC
DC DISCONNECT

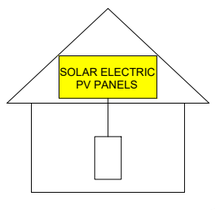
LOCATION:
- DC DISCONNECT

CODE REF:
2020 NEC 690.13(B)
WHITE TEXT, RED BACKGROUND

RAPID SHUTDOWN

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 ARRAY.



NOTES REGARDING RAPID SHUTDOWN LABELS:
- TITLE TEXT MUST BE 3/8" HEIGHT MINIMUM
- BODY TEXT MUST BE HEIGHT MINIMUM
- COLORATION: TITLE TEXT AND 'SOLAR ELECTRIC PV PANELS' TO HAVE YELLOW BACKGROUND

CODE REF:
2020 NEC 690.56(C)

RAPID SHUTDOWN FOR
SOLAR PV SYSTEM

LOCATION:
- MAIN SERVICE DISCONNECT

CODE REF:
2020 NEC 690.56(C)(2)
WHITE TEXT, RED BACKGROUND

AC LABELS

PHOTOVOLTAIC
AC DISCONNECT

LOCATION:
- PV AC DISCONNECT(S)
- PV INTERCONNECTION BREAKER

CODE REF:
2020 NEC 690.13(B)
WHITE TEXT, RED BACKGROUND

⚠ WARNING

ELECTRICAL SHOCK HAZARD
TERMINALS ON BOTH LINE AND
LOAD SIDES MAY BE ENERGIZED
IN THE OPEN POSITION

LOCATION:
- AC DISCONNECT(S)
- BREAKER PANEL (EXTERIOR)

CODE REF:
2020 NEC 690.13(B)
2020 NEC 706.15(C)(4)

⚠ WARNING

THIS EQUIPMENT FED BY
MULTIPLE SOURCES:
TOTAL RATING OF ALL OVERCURRENT
DEVICES EXCLUDING MAIN POWER
SUPPLY SHALL NOT EXCEED
AMPACITY OF BUSBAR

LOCATION:
- AC DISCONNECT(S)

CODE REF:
2020 NEC 705.12(B)(3)(3)

⚠ WARNING

TURN OFF PHOTOVOLTAIC AC
DISCONNECT PRIOR TO WORKING
INSIDE PANEL

LOCATION:
- MAIN SERVICE DISCONNECT

CODE REF:
2020 NEC 690.13(B), 706.15(C)(4),
110.27(C)
OSHA 1910.145(F)(7)

MAIN PHOTOVOLTAIC
SYSTEM DISCONNECT

LOCATION:
- MAIN SERVICE DISCONNECT

CODE REF:
2020 NEC 690.13(B)
WHITE TEXT, RED BACKGROUND

PHOTOVOLTAIC AC DISCONNECT
RATED AC OUTPUT CURRENT: 40AAC
NOMINAL OPERATING AC VOLTAGE: 240VAC

LOCATION:
- AC DISCONNECT(S)
- PV INTERCONNECTION BREAKER
- POINT OF INTERCONNECTION

CODE REF:
2020 NEC 690.54
WHITE TEXT, RED BACKGROUND

EMT CONDUIT/RACEWAYS/PULL BOXES

WARNING: PHOTOVOLTAIC POWER SOURCE

LOCATION, AT 10' SPACING:
- DC CONDUIT
- JUNCTION BOX

CODE REF:
2020 NEC 690.31(G)(3)(4)

AC LABELS (CONT.)

⚠ WARNING

POWER SOURCE OUTPUT
CONNECTION. DO NOT
RELOCATE THIS
OVERCURRENT DEVICE

LOCATION:
- BREAKER PANEL (INTERIOR), NEXT TO PV BREAKER

CODE REF:
2020 NEC 705.12(B)(3)(2)
BLACK TEXT, ORANGE BACKGROUND

⚠ WARNING DUAL POWER SOURCE
SECOND SOURCE IS PHOTOVOLTAIC SYSTEM

LOCATION:
- BREAKER PANEL (EXTERIOR)

CODE REF:
2020 NEC 705.12(C) & NEC 690.59
BLACK TEXT, ORANGE BACKGROUND

GENERAL LABEL COLORING NOTES:
ALL LABELS MARKED 'WARNING' TO HAVE ORANGE TITLE BACKGROUND,
WHITE TEXT BACKGROUND, BLACK TEXT, REFLECTIVE MATERIAL
ALL OTHER LABELS COLORED AS INDICATED

⚠ CAUTION

PHOTOVOLTAIC SYSTEM CIRCUIT IS BACKFED

LOCATION:
BACKFED BREAKER
CODE REF:
2020 NEC 705.12(D) & NEC 690.59
BLACK TEXT, YELLOW BACKGROUND

PV METER (IF APPLICABLE)

PHOTOVOLTAIC SYSTEM
KWh METER

LOCATION:
- PV METER (WHERE APPLICABLE)

WHITE TEXT, RED BACKGROUND

ENERGY STORAGE SYSTEMS (IF APPLICABLE)

NOMINAL ESS AC VOLTAGE: 000VDC
MAXIMUM ESS DC VOLTAGE: _____
AVAILABLE FAULT CURRENCT
DERIVED FROM THE ESS: _____
DATE CALCULATION PERFORMED: _____

LOCATION:
- BATTERY UNIT(S)

CODE REF:
2020 NEC 706.15(C)
WHITE TEXT, RED BACKGROUND

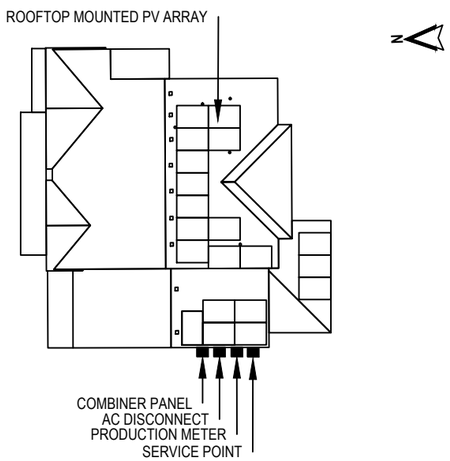
ENERGY
STORAGE
SYSTEM
DISCONNECT

LOCATION:
- BATTERY SYSTEM DISCONNECT

CODE REF:
2020 NEC 706.15(C)
WHITE TEXT, RED BACKGROUND

CAUTION

POWER TO THIS BUILDING IS SUPPLIED FROM THE FOLLOWING SOURCES WITH
DISCONNECTS LOCATED AS SHOWN
COMPANY NAME: KINHOME
COMPANY PHONE NUMBER: (855)264-0363



PV SOLAR SYSTEM(S) ARE EQUIPPED
WITH RAPID SHUTDOWN DEVICE(S)

CUSTOMER NAME: DAVIS, ANDREW
UTILITY BILL NAME: DAVIS, ANDREW
1821 SW MERRYMAN DR
LEE'S SUMMIT, MO 64082

LICENSE # MO - 2024017475

ELECTRICAL STAMP

11/15/2024

ELECTRICAL DIAGRAM NOTES

ALL SIGNAGE MUST BE PERMANENTLY ATTACHED AND BE WEATHER RESISTANT/SUNLIGHT RESISTANT AND CANNOT BE HAND-WRITTEN PER NEC 110.21(B)

PERMANENT PLAQUE OR DIRECTORY PROVIDING THE LOCATION OF THE SERVICE DISCONNECTING MEANS AND THE PHOTOVOLTAIC SYSTEM DISCONNECTING MEANS IF NOT IN THE SAME LOCATION
[NEC 690.56(B)]

WHERE THE PV SYSTEMS ARE REMOTELY LOCATED FROM EACH OTHER, A DIRECTORY IN ACCORDANCE WITH 705.10 SHALL BE PROVIDED AT EACH PV SYSTEM DISCONNECTING MEANS.
PV SYSTEM EQUIPMENT AND DISCONNECTING MEANS SHALL NOT BE INSTALLED IN BATHROOMS
[NEC 690.4(D),(E)]

LABELING NOTES
1.1 LABELING REQUIREMENTS BASED ON THE 2017 NATIONAL ELECTRICAL CODE, INTERNATIONAL FIRE CODE 605.11, OSHA STANDARD 1910.145, ANSI Z535
1.2 MATERIAL BASED ON THE REQUIREMENTS OF THE AUTHORITY HAVING JURISDICTION.
1.3 LABELS TO BE OF SUFFICIENT DURABILITY TO WITHSTAND THE ENVIRONMENT INVOLVED.
1.4 LABELS TO BE A MINIMUM LETTER HEIGHT OF 3/8" AND PERMANENTLY AFFIXED.
1.5 ALERTING WORDS TO BE COLOR CODED. "DANGER" WILL HAVE RED BACKGROUND; "WARNING" WILL HAVE ORANGE BACKGROUND; "CAUTION" WILL HAVE YELLOW BACKGROUND. [ANSI Z535]

LABELS ARE NOT DRAWN TO SCALE

KINHOME

139 N HUNTERS GROVE LN, LEHI, UT, 84043

WARNING LABELS

JOB #: 7996
DATE: 11/13/2024
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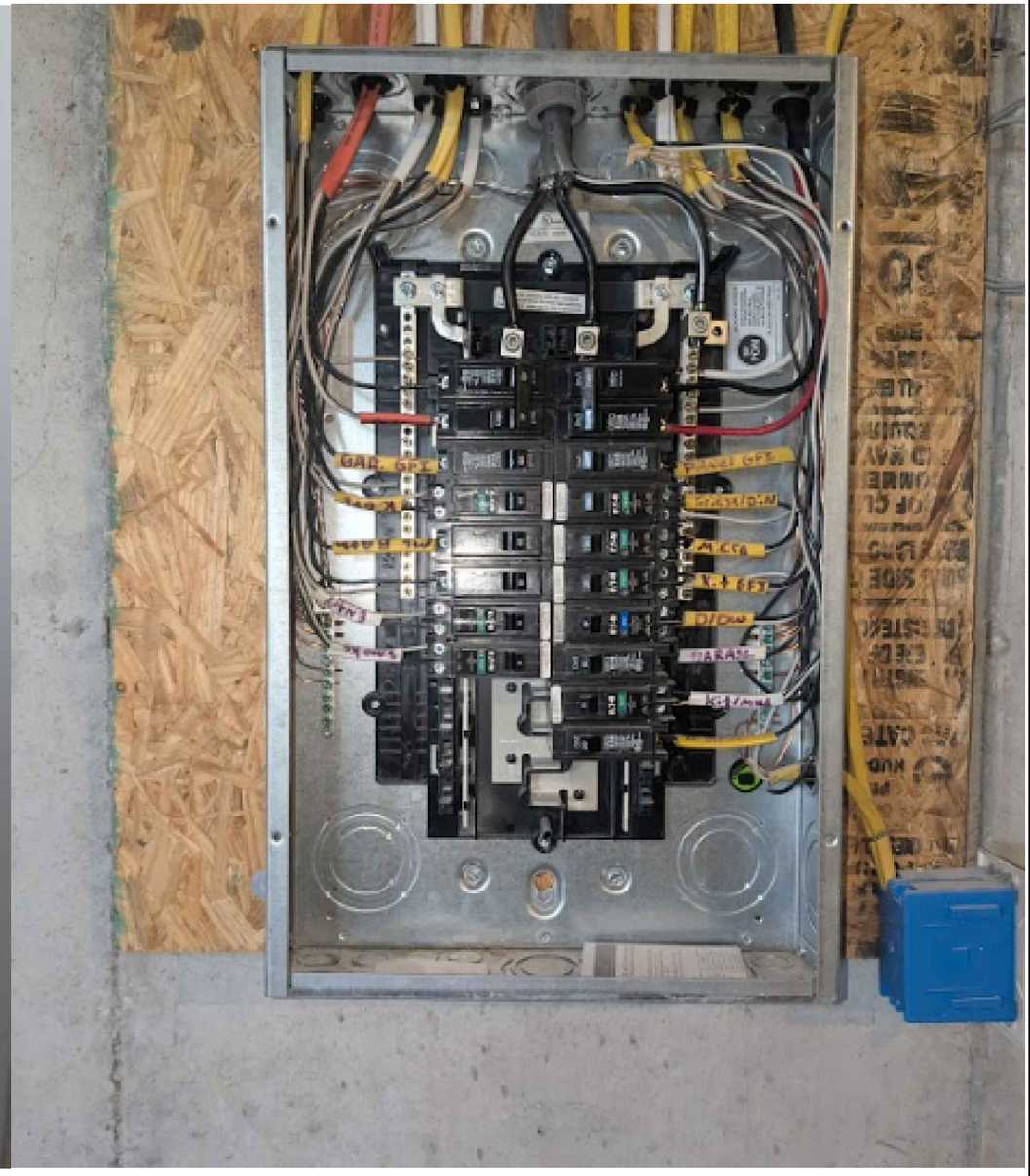
EE-3



CUSTOMER NAME: DAVIS, ANDREW

UTILITY BILL NAME: DAVIS, ANDREW
1821 SW MERRYMAN DR
LEE'S SUMMIT, MO 64082

LICENSE # MO - 2024017475

STRUCTURAL STAMP

ELECTRICAL PHOTOS

KIN HOME

139 N HUNTERS GROVE LN, LEHI, UT, 84043

ELECTRICAL PHOTOS

JOB #: 7996
DATE: 11/13/2024
DRAWN BY: JN

EE-4

Hi-MO 5
(V5)

LR5-54HABB
390~415M

- Suitable for distributed projects
- Advanced module technology delivers superior module efficiency
- Globally validated bifacial energy yield
- High module quality ensures long-term reliability

25 25-year Warranty for Materials and Processing

30 30-year Warranty for Extra Linear Power Output

Complete System and Product Certifications

IEC 61215, IEC 61730, UL61730

ISO9001:2015: ISO Quality Management System

ISO14001: 2015: ISO Environment Management System

ISO45001: 2018: Occupational Health and Safety

IEC62941: Guideline for module design qualification and type approval

LONGi

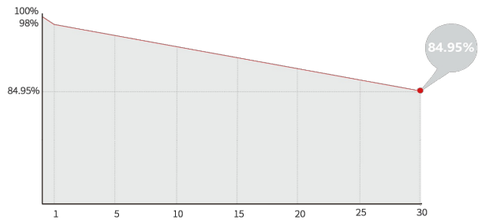
Hi-MO 5

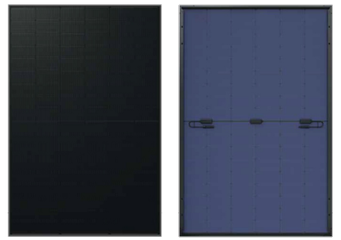
LR5-54HABB 390~415M

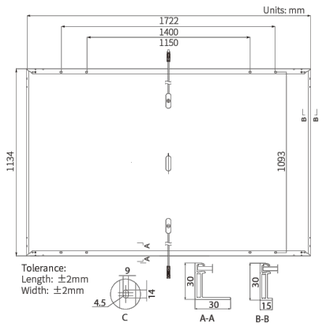
21.3%	0~3%	<2%	0.45%	HALF-CELL
MAX MODULE EFFICIENCY	POWER TOLERANCE	FIRST YEAR POWER DEGRADATION	YEAR 2-30 POWER DEGRADATION	Lower operating temperature

Additional Value

30-Year Power Warranty







Mechanical Parameters

Cell Orientation	108 (6×18)
Junction Box	IP68
Connector Type	EVO2
Output Cable	4mm², ±1200mm, length can be customized
Glass	Dual glass, 2.0+2.0mm Semi-tempered glass
Frame	Anodized aluminum alloy frame
Weight	24.5kg
Dimension	1722×1134×30mm
Packaging	36pcs per pallet / 216pcs per 20' GP 936pcs per 40' HC 720pcs(only for USA)

Electrical Characteristics

STC : AM1.5 1000W/m² 25°C NOCT : AM1.5 800W/m² 20°C 1m/s Test uncertainty for Pmax: ±3%

Module Type	LR5-54HABB-390M		LR5-54HABB-395M		LR5-54HABB-400M		LR5-54HABB-405M		LR5-54HABB-410M		LR5-54HABB-415M	
Testing Condition	STC	NOCT	STC	NOCT	STC	NOCT	STC	NOCT	STC	NOCT	STC	NOCT
Maximum Power (Pmax/W)	390	291.5	395	295.2	400	299.0	405	302.7	410	306.5	415	310.2
Open Circuit Voltage (Voc/V)	36.58	34.39	36.81	34.61	37.05	34.84	37.29	35.06	37.53	35.29	37.77	35.51
Short Circuit Current (Isc/A)	13.57	10.95	13.65	11.01	13.72	11.07	13.79	11.13	13.87	11.19	13.94	11.25
Voltage at Maximum Power (Vmp/V)	30.47	28.43	30.70	28.64	30.94	28.86	31.18	29.09	31.42	29.31	31.66	29.54
Current at Maximum Power (Imp/A)	12.80	10.26	12.87	10.31	12.93	10.36	12.99	10.41	13.05	10.45	13.11	10.50
Module Efficiency(%)	20.0		20.2		20.5		20.7		21.0		21.3	

Electrical characteristics with different rear side power gain (reference to 405W front)

Pmax /W	Voc/V	Isc /A	Vmp/V	Imp /A	Pmax gain
425	37.29	14.48	31.18	13.64	5%
446	37.29	15.17	31.18	14.29	10%
466	37.39	15.86	31.28	14.94	15%
486	37.39	16.55	31.28	15.59	20%
506	37.39	17.24	31.28	16.24	25%

Operating Parameters

Operational Temperature	-40°C ~ +85°C
Power Output Tolerance	0 ~ 3%
Maximum System Voltage	DC1500V (IEC/UL)
Maximum Series Fuse Rating	30A
Nominal Operating Cell Temperature	45±2°C
Protection Class	Class II
Bifaciality	70±5%
Fire Rating	UL type 29 IEC Class C

Mechanical Loading

Front Side Maximum Static Loading	5400Pa
Rear Side Maximum Static Loading	2400Pa
Hailstone Test	25mm Hailstone at the speed of 23m/s

Temperature Ratings (STC)

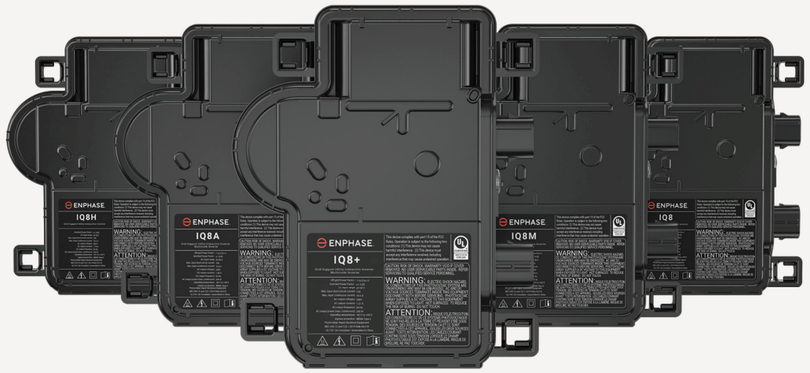
Temperature Coefficient of Isc	+0.050%/°C
Temperature Coefficient of Voc	-0.265%/°C
Temperature Coefficient of Pmax	-0.340%/°C

LONGi

Specifications included in this datasheet are subject to change without notice. LONGi reserves the right of final interpretation. (20240305 V18) DG

ENPHASE.

DATA SHEET



IQ8 Series 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.

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

IQ8SE-DS-0001-01-EN-US-2022-03-17

* Only when installed with IQ System Controller 2, meets UL 1741. IQ8H-208V operates only in grid-tied mode.
** IQ8 Series Microinverters supports split phase, 240V. IQ8H-208 supports split phase, 208V only.

IQ8 Series Microinverters

INPUT DATA (DC)		IQ8-60-2-US	IQ8PLUS-72-2-US	IQ8M-72-2-US	IQ8A-72-2-US	IQ8H-240-72-2-US	IQ8H-208-72-2-US[1]
Commonly used module pairings[2]	W	235 – 350	235 – 440	260 – 460	295 – 500	320 – 540+	295 – 500+
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	33 – 45	36 – 45	38 – 45	38 – 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[3] [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**	**IQ8M-72-2-US**	**IQ8A-72-2-US**	**IQ8H-240-72-2-US**	**IQ8H-208-72-2-US[1]**
Peak output power	VA	245	300	330	366	384	366
Max continuous output power	VA	240	290	325	349	380	360
Nominal (L-L) voltage/range[4]	V			240 / 211 – 264			208 / 183 – 250
Max continuous output current	A	1.0	1.21	1.35	1.45	1.58	1.73
Nominal frequency	Hz	60					
Extended frequency range	Hz	50 – 68					
AC short circuit fault current over 3 cycles	Arms	2					4.4
Max units per 20 A (L-L) branch circuit[5]		16	13	11	11	10	9
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	97.6	97.6	97.6	97.4
CEC weighted efficiency	%	97	97	97	97.5	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) 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.

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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.)

UL LISTED

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

ENPHASE.

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

Product Data Sheet

DU222RB

Safety Switch , 60A, 240VAC, Non-Fusible, General Duty, 2-Pole

SQUARE D

List Price $353.00 USD

Availability Stock Item: This item is normally stocked in our distribution facility.

Technical Characteristics

Wire Size	#10 to #2 AWG(Al) - #14 to #2 AWG(Cu)
Action	Single Throw
Ampere Rating	60A
Approvals	UL Listed File Number E2875
Enclosure Type	Rainproof and Sleet/Ice proof (Indoor/Outdoor)
Enclosure Rating	NEMA 3R
Factory Installed Neutral	No
Maximum Voltage Rating	240VAC
Disconnect Type	Non-Fusible
Terminal Type	Lugs
Mounting Type	Surface
Type of Duty	General Duty
Number of Poles	2-Pole

Shipping and Ordering

Category	00106 - Safety Switch, General Duty, 30 - 200 Amp, NEMA3R
Discount Schedule	DE1A
GTIN	00785901491491
Package Quantity	1
Weight	4.7 lbs.
Availability Code	Stock Item: This item is normally stocked in our distribution facility.
Returnability	Y
Country of Origin	MX

As standards, specifications, and designs change from time to time, please ask for confirmation of the information given in this document.

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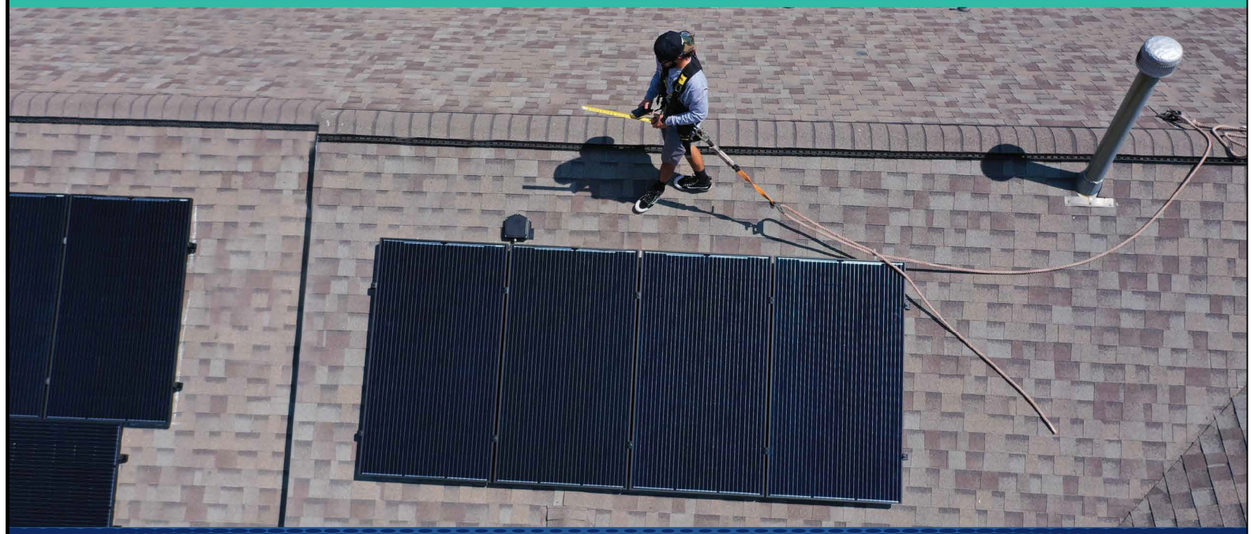
EZ SOLAR
making solar simple.

JB-1.2



THE ULTIMATE ROOFTOP JUNCTION BOX

EZ Solar believes innovation is key to making Solar Simple! The most revolutionary junction box on the market just got better! Designed with the installer in mind, the **JB-1.2** makes installation fast and easy!

SIMPLE TO INSTALL

- Minimal Shingle Cutting
- Enter Through 3 Sidewalls
- Wider and Taller Sidewalls

HIGH QUALITY

- Made from advanced durable polycarbonate + superior components, UL1741, Type 3R
- 3 patented layers of water protection
- 2 Weep Holes for breathability

LOWER PRICE

- We believe that EVERYONE should have access to affordable renewable energy
- With the same great features as the JB-1, the JB-1.2 is now available with updates to make installation even easier.

MADE IN USA

Intertek 5019942

ezsolarproducts.com | info@ezsolarproducts.com | 385.202.4150

making solar simple.

EZ SOLAR
making solar simple.

JB-1.2, JB-1.XL
Specification Sheet
PV Junction Box for Composition/Asphalt Shingle Roofs

A. System Specifications and Ratings

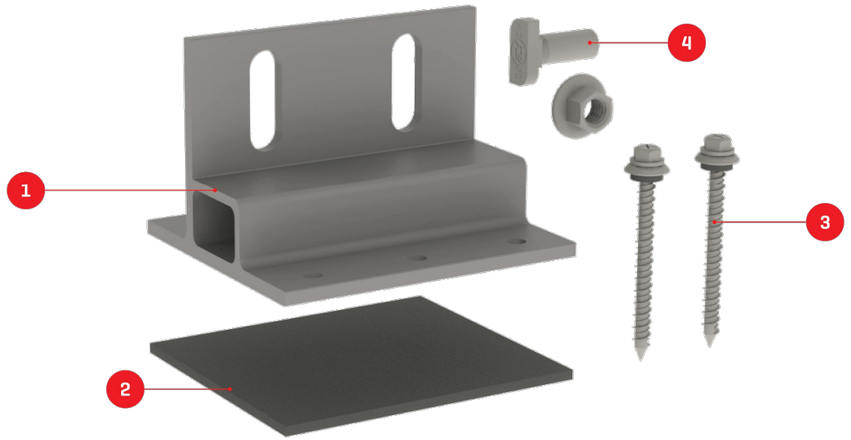
- Maximum Voltage: 1,000 Volts
- Maximum Current: **JB-1.2:** 80 Amps; **JB-1.XL:** 120 Amps
- Allowable Wire: 14 AWG – 6 AWG
- Spacing: Please maintain a spacing of at least ½" between uninsulated live parts and fittings for conduit, armored cable, and uninsulated live parts of opposite polarity.
- 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, CSA C22.2 No. 290; **JB-1.XL:** UL1741, CSA C22.2 No. 290
  - Approved wire connectors: must conform to UL1741, CSA C22.2 No. 290
- 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.

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 block	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 kcmil (mm2)	Wires per terminal (pole)							
	1		2		3		4 or More	
	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)	-		-		-	



Splice Foot XL

Patent Pending

TECHNICAL SHEET

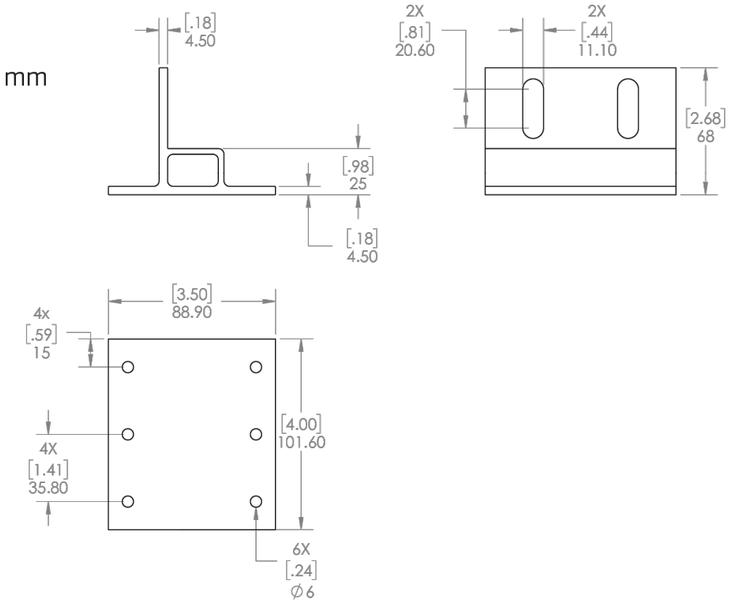
Item Number	Description	Part Number
1	Splice Foot XL	4000162 | Splice Foot XL Kit, Mill
2	K2 EverSeal	
3	Splice Foot Screw, M5x60	
4	T-Bolt & Hex Nut Set	

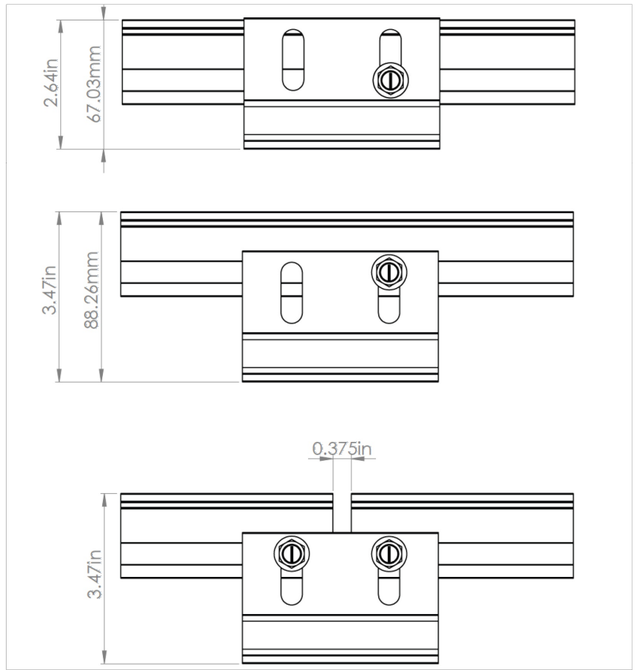
Technical Data

	Splice Foot XL
Roof Type	Composition shingle, EPDM, TPO, Bitumen, Asphalt
Material	Aluminum with stainless steel hardware
Finish	Mill
Roof Connection	M5 x 60 lag screws
Code Compliance	UL 2703
Compatibility	CrossRail 44-X, 48-X, 48-XL, 80

We support PV systems
Formerly Everest Solar Systems

Units: [in] mm





k2-systems.com

Product data sheet
Characteristics

1004162A
METER SOCKET 100AMP OH+UG +OPTIONS

Main

Product or component type	Meter Socket
Meter socket type	Ringless
Hub type	A ACP closing plate

Complementary

Meter socket rated current	100 A
Number of jaws	4 without jaw release
Bypass type	No bypass
Phase	1 phase
[Ue] rated operational voltage	<= 600 V AC
Enclosure material	Steel
Box number	1R
Electrical connection	Lugs slotted
Service feed location	UG OH
Wiring configuration	3-wire
Device mounting	Surface
AWG gauge	AWG 8...AWG 2/0 aluminium/copper)line side AWG 14...AWG 2 aluminium/copper)service ground

Environment

Product certifications	ANSI UL Listed
Enclosure Rating	NEMA 3R

Ordering and shipping details

Category	00039 - METER SOCKETS & HUBS
Discount Schedule	DE4
GTIN	00785901868491
Package weight(Lbs)	6.91 lb(US) (3.13 kg)
Returnability	Yes
Country of origin	US

Offer Sustainability

California proposition 65	WARNING: This product can expose you to chemicals including: Nickel (Metallic), which is known to the State of California to cause cancer, and Toluene, which is known to the State of California to cause birth defects or other reproductive harm. For more information go to www.P65Warnings.ca.gov
EU RoHS Directive	Under investigation

Contractual warranty

Warranty	18 months