GENERAL NOTES

1. *All electrical materials shall be new and listed by recognized electrical testing laboratory*
   Custom made equipment shall have complete test data submitted by the manufacturer attesting to its safety
2. *Outdoor equipment shall be NEMA 3R rated or equivalent*
3. *All metallic equipment shall be grounded*
4. *Contractor shall obtain electrical permits prior to installation and shall coordinate all inspections, testing commissioning and acceptance with the client,*
   utility co. and city inspectors as needed.
5. *The electrical contractor shall verify the exact locations of service points and service sizes with the serving utility company and comply with all utility companies requirements.*
6. *Drawings are diagrammatic only, routing of raceways shall be option of the contractor unless otherwise noted and shall be coordinated with other trades.*
7. *If the roof material or the roof structure not adequate for PV installation, call the engineer of record print to installation. The contractor is responsible to verify that the roof is capable of withstanding the extra weight.*
8. *If the distances for cable runs are different than shown, the contractor shall notify the electrical engineer to validate the wire size. Final drawings will be red-lined and updated as appropriate.*
9. *Whenever a discrepancy in quality of equipment arises on the drawing or specifications, the contractor shall be responsible for providing and installing all materials and services required by the strictest conditions noted on the drawings or in the specifications to ensure complete compliance and longevity of the operable system required by the engineer of record.*

PHOTOVOLTAIC NOTES:

1. *Ground mounted photovoltaic panels and modules shall be tested, listed and identified by recognized testing laboratory*
2. *Solar system shall not cover any plumbing or mechanical vents*
3. *Modules and support structures shall be grounded unless racking has integrated ground.*
4. *Removal of an interactive inverter or other equipment shall not disconnect the bonding connection between the grounding electrode conductor and the photovoltaic source and/or output circuit grounded conductors.*
5. *All PV modules and associated equipment and wiring shall be protected from physical damage.*
6. *Live parts of PV source circuits and PV output circuits over 150v to ground shall not be accessible to other than qualified persons while energized.*
7. *Inverter is equipped with integrated DC disconnect, thus providing ground fault protection*
8. *All conductors shall be copper and 75 deg rated*
9. *A single conductor shall be permitted to be used to perform the multiple functions of dc grounding, AC grounding and bonding between AC and DC systems.*
10. *Non-current carrying metal parts of equipment shall be effectively bonded together. Bond both ends of raceways.*

SHEET INDEX

GOVERNING CODES

THE INSTALLATION OF SOLAR ARRAYS AND PHOTOVOLTAIC POWER SYSTEMS SHALL COMPLY WITH THE FOLLOWING CODES:

- *2020 National Electrical Code*
- *2018 International Building Code*
- *2018 International Residential Code*
- *2020 Minnesota Residential Code*
- *2020 Minnesota Building Code*
- *2020 Minnesota Energy Code*
- *2020 Minnesota Accessibility Code*
- *2020 Minnesota State Fire Code*
- *2018 International Fire Code*
- *2018 International Energy Conservation Code*
- *2018 Mechanical Code*

AS ADOPTED BY THE STATE OF MINNESOTA
ALL OTHER ORDINANCE ADOPTED BY THE LOCAL GOVERNING AGENCIES

SYSTEM RATING

DC 38.40 KW STC
AC 27.84 KW STC

EQUIPMENT SUMMARY

96 HANWHA 400WATT MODULES
WITH IQ8PLUS MICROINVERTERS

ELECTRICAL INFORMATION

EXISTING
MAIN SERVICE PANEL BUS SIZE:**200A**
MAIN SERVICE BREAKER SIZE:**200A**
MOUNTING SYSTEM: SUNMODO GROUND MOUNT

BUILDING INFORMATION

CONSTRUCTION TYPE: V-B
OCCUPANCY: R3

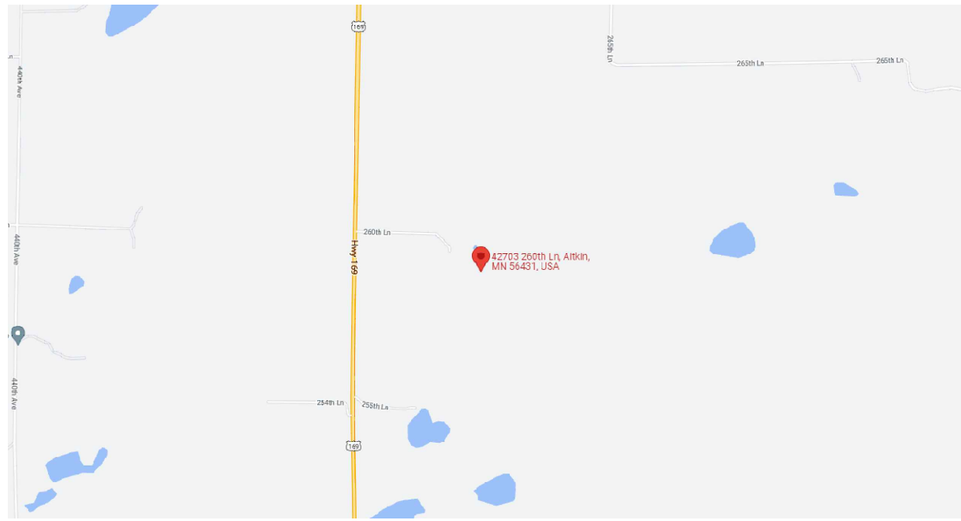
CONTRACTOR

Address:101 Isanti Parkway
NE, Isanti, MN 55040
Phone number: (763) 229-6662
E-mail: contact@wolfriverelectric.com

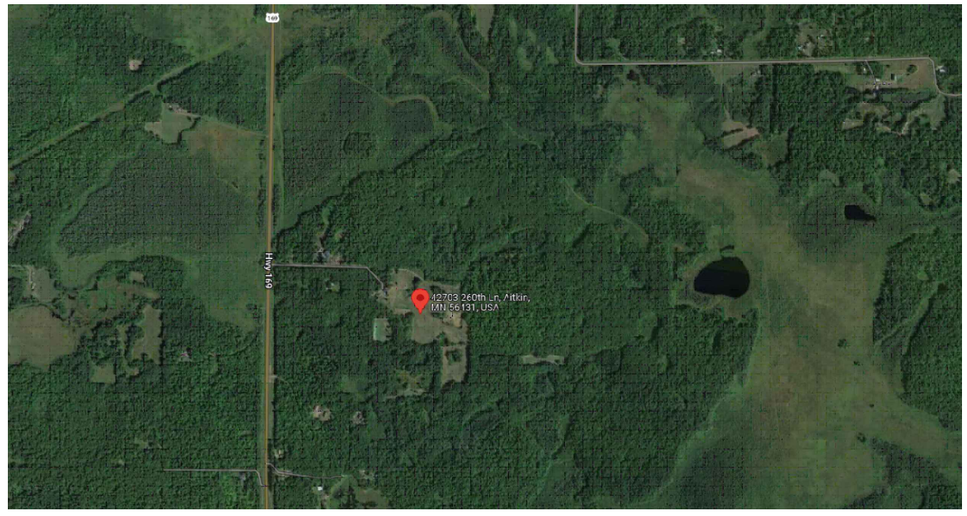
WOLF RIVER ELECTRIC

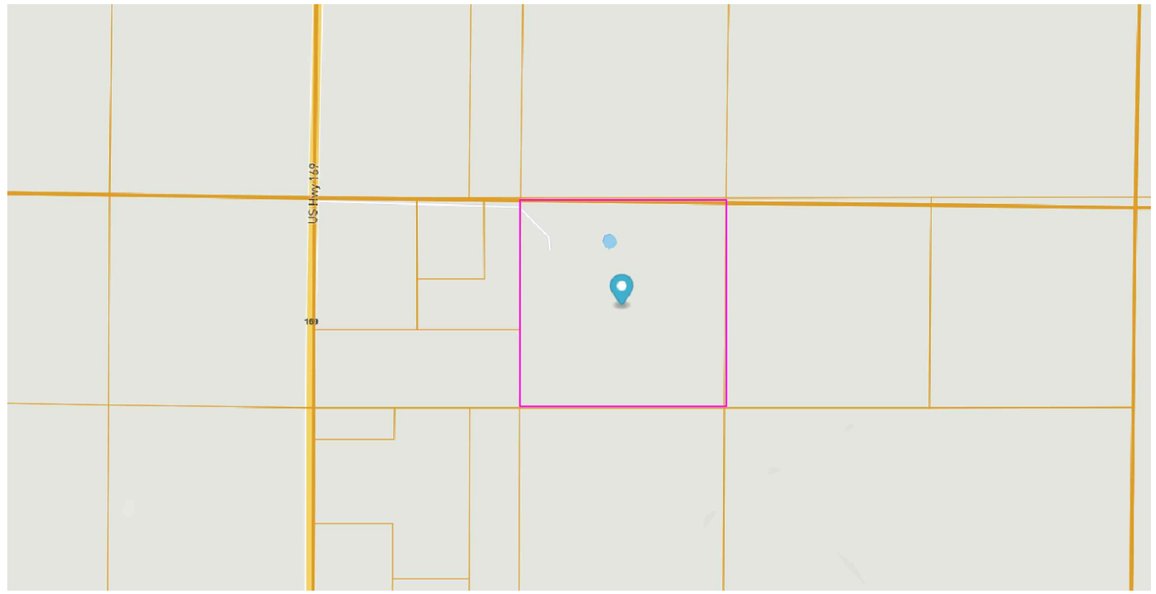
Owner: Susan and Mark Boyd
Property Address: 42703 260th Ln Aitkin, MN 56431
Property Type: Single Family Residence
Drawn by: New@engineerinc.io
Date: *03/24/2022*

VICINITY MAP (SCALE: NTS)

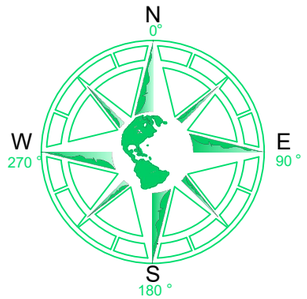


SATELLITE VIEW (SCALE: NTS)



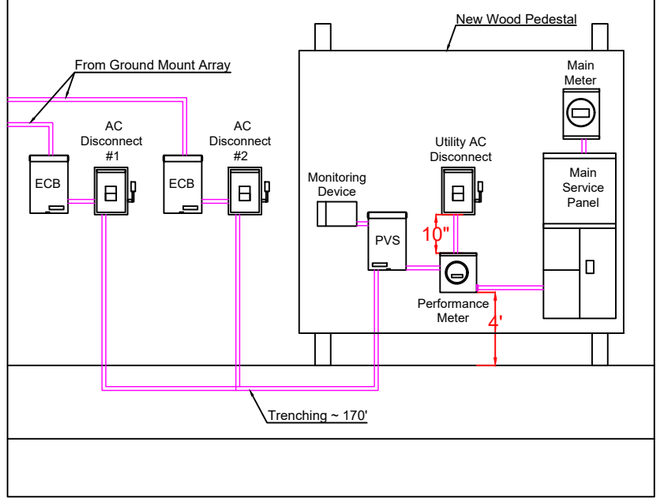


SECONDARY INTERCONNECTION

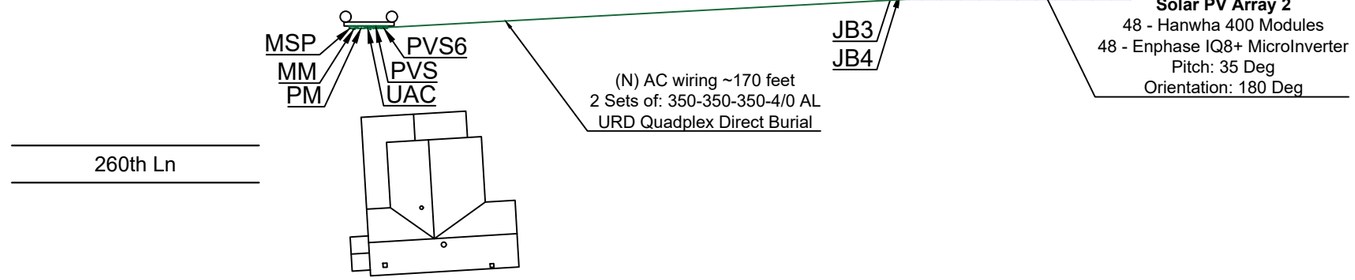


SCALE: 1/64" = 1'-0"

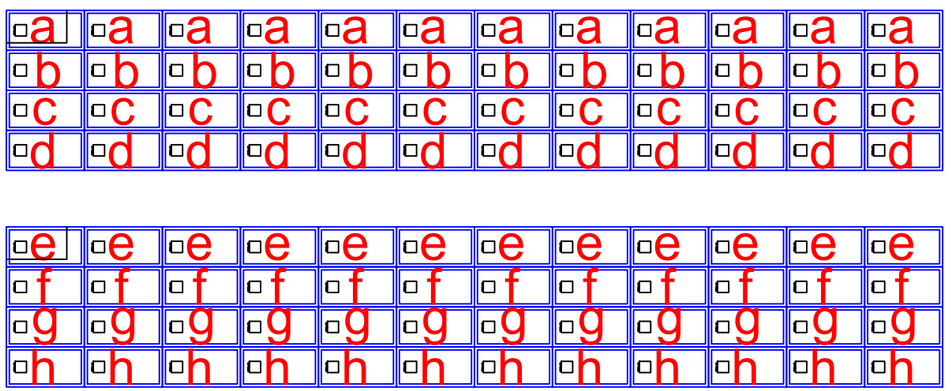
EQUIPMENT ELEVATION



NOTE: No clearance issue
Distance between all equipments is maximum 10"
MILLE LACS ENERGY COOP
Note: 24/ 7 Unescorted keyless access is to be provided for ALL UTILITY EQUIPMENT



BRANCH CONFIGURATION



INDEX

MSP (E) **200A** Main Service Panel
MM ..... (E) Main Meter
PVS..... (N) 200A PV Sub Panel
MD..... (N) Monitoring Device
ECB.(N)2x Enphase Combiner Box
PM ..... (N) Performance Meter
UAC..... (N) 200A Utility AC
AC#1..... (N) 100A AC Disconnect
AC#2..... (N) 100A AC Disconnect
JB ..... (N) Junction Box
..... (N) Microinverter
..... Solar Module
..... EMT type Conduit
..... Fire Setback Line
..... FMT type Conduit
..... PVC type Conduit

SOLAR MODULES

96 HANWHA 400 Watt
Model #Q.PEAK DUO BLK ML-G10+

INVERTER

INVERTER TYPE: Micro:
96 Enphase IQ8PLUS
Model # IQ8PLUS-72-2-US(240V)

CONTRACTOR

WOLF RIVER ELECTRIC

Wolf RIver Electirc
Address:101 Isanti Parkway NE, Isanti, MN 55040
Phone number: (763) 229-6662
E-mail: contact@wolfriverelectric.com

SITE MAP & PV LAYOUT

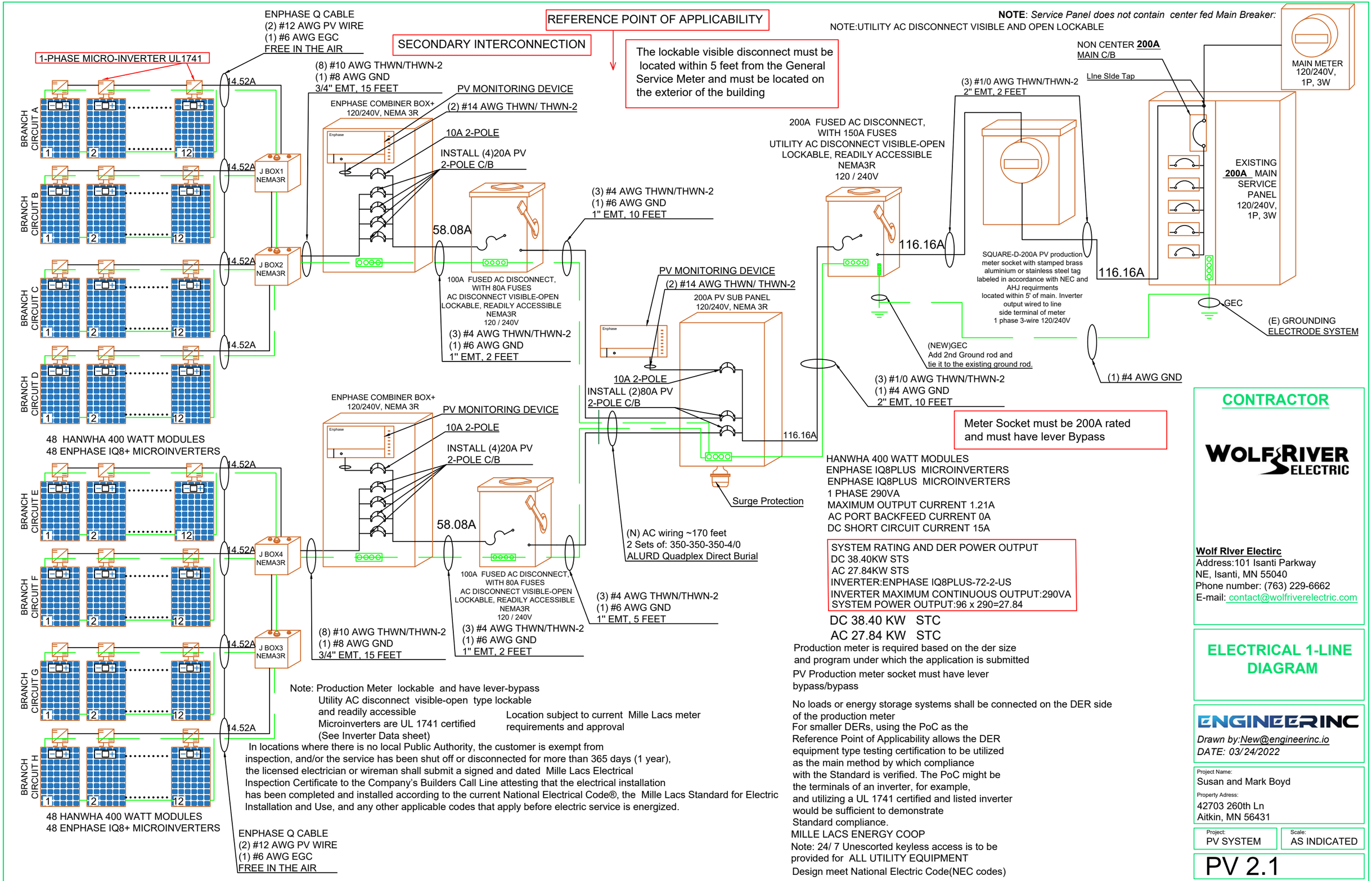
ENGINEERINC

Drawn by:New@engineerinc.io
DATE: 03/24/2022

Project Name:
Susan and Mark Boyd
Property Adress:
42703 260th Ln
Aitkin, MN 56431

Project: PV SYSTEM
Scale: AS INDICATED

PV 1.0



NOTE: *Service Panel does not contain center fed Main Breaker:*

CONTRACTOR

WOLF RIVER ELECTRIC

Wolf RIver Electirc
Address:101 Isanti Parkway
NE, Isanti, MN 55040
Phone number: (763) 229-6662
E-mail: contact@wolfriverelectric.com

ELECTRICAL 1-LINE DIAGRAM

ENGINEERINC

Drawn by:New@engineerinc.io
DATE: 03/24/2022

Project Name:
Susan and Mark Boyd
Property Adress:
42703 260th Ln
Aitkin, MN 56431

Project: PV SYSTEM
Scale: AS INDICATED

PV 2.1

PV ARRAY RATING

BRANCH CIRCUIT -A						
Number Modules	12	Type	Q.PEAK DUO BLK ML-G10+		Hanwha 400 Watt	
Number MicroInverters	12	Type	Enphase IQ7+ Microinverters		IQ7PLUS-72-2-US(240V)	
Total DC Wattage (Watts)	Watts STC, (Watts/Module) 12*400=4800					
Array Currents	I-SC	11.14	A	I-MP	10.77	A
Module Voltage	V-OC	45.3	V	V-MP	37.13	V
BRANCH CIRCUIT - B						
Number Modules	12	Type	Q.PEAK DUO BLK ML-G10+		Hanwha 400 Watt	
Number MicroInverters	12	Type	Enphase IQ7+ Microinverters		IQ7PLUS-72-2-US(240V)	
Total DC Wattage (Watts)	Watts STC, (Watts/Module) 12*400=4800					
Array Currents	I-SC	11.14	A	I-MP	10.77	A
Module Voltage	V-OC	45.3	V	V-MP	37.13	V
BRANCH CIRCUIT - C						
Number Modules	12	Type	Q.PEAK DUO BLK ML-G10+		Hanwha 400 Watt	
Number MicroInverters	12	Type	Enphase IQ7+ Microinverters		IQ7PLUS-72-2-US(240V)	
Total DC Wattage (Watts)	Watts STC, (Watts/Module) 12*400=4800					
Array Currents	I-SC	11.14	A	I-MP	10.77	A
Module Voltage	V-OC	45.3	V	V-MP	37.13	V
BRANCH CIRCUIT - D						
Number Modules	12	Type	Q.PEAK DUO BLK ML-G10+		Hanwha 400 Watt	
Number MicroInverters	12	Type	Enphase IQ7+ Microinverters		IQ7PLUS-72-2-US(240V)	
Total DC Wattage (Watts)	Watts STC, (Watts/Module) 12*400=4800					
Array Currents	I-SC	11.14	A	I-MP	10.77	A
Module Voltage	V-OC	45.3	V	V-MP	37.13	V
BRANCH CIRCUIT -E						
Number Modules	12	Type	Q.PEAK DUO BLK ML-G10+		Hanwha 400 Watt	
Number MicroInverters	12	Type	Enphase IQ7+ Microinverters		IQ7PLUS-72-2-US(240V)	
Total DC Wattage (Watts)	Watts STC, (Watts/Module) 12*400=4800					
Array Currents	I-SC	11.14	A	I-MP	10.77	A
Module Voltage	V-OC	45.3	V	V-MP	37.13	V
BRANCH CIRCUIT - F						
Number Modules	12	Type	Q.PEAK DUO BLK ML-G10+		Hanwha 400 Watt	
Number MicroInverters	12	Type	Enphase IQ7+ Microinverters		IQ7PLUS-72-2-US(240V)	
Total DC Wattage (Watts)	Watts STC, (Watts/Module) 12*400=4800					
Array Currents	I-SC	11.14	A	I-MP	10.77	A
Module Voltage	V-OC	45.3	V	V-MP	37.13	V
BRANCH CIRCUIT -G						
Number Modules	12	Type	Q.PEAK DUO BLK ML-G10+		Hanwha 400 Watt	
Number MicroInverters	12	Type	Enphase IQ7+ Microinverters		IQ7PLUS-72-2-US(240V)	
Total DC Wattage (Watts)	Watts STC, (Watts/Module) 12*400=4800					
Array Currents	I-SC	11.14	A	I-MP	10.77	A
Module Voltage	V-OC	45.3	V	V-MP	37.13	V
BRANCH CIRCUIT - H						
Number Modules	12	Type	Q.PEAK DUO BLK ML-G10+		Hanwha 400 Watt	
Number MicroInverters	12	Type	Enphase IQ7+ Microinverters		IQ7PLUS-72-2-US(240V)	
Total DC Wattage (Watts)	Watts STC, (Watts/Module) 12*400=4800					
Array Currents	I-SC	11.14	A	I-MP	10.77	A
Module Voltage	V-OC	45.3	V	V-MP	37.13	V

FROM JBOX TOPV SUB PANEL							
Maximum Continius Current (A)	18.15	More Than 3 CCC Adjist. Factor		0.5		Adjusted Conductor Ampacity(A)	18.15 / 0.5 = 36.3
way Height From Roof (Temp 39+22=61C)		3 1/2"	# of wire(# BC *2)	12		Ambiend Tem Factor Per NEC Table 310.15(b)(2)(a)	0.71
Temp. Derate Factor (max. continous current divided ambient tem. Factor (A)				36.3 * 0.71 = 51.13		Wire Size from NEC Table 310.15(b)16	10 AWG
FROM PV SUB PANEL TO MAIN PANEL							
Total Number Of Microinverters	96	Total Amps From All Microinverters (A)		96 * 1.21 = 116.16		Consider Continuous (A)	116.16 * 1.25 = 145.2
Temp. Derate Factor(0.91 at wall of the Building) (A)				145.2 / 0.91 = 159.56		Wire Size from NEC Table 310.15(b)16	1/0 AWG
Ambiend Tem Factor Per NEC Table 310.15(b)(2)(a)				0.91			

WIRE SIZE CALCULATION

BRANCH CIRCUIT - A	
Number OF Microinverters in Circuit	12
Microinverter Maximum Output Current (A)	1.21
Branch Circuit Total Current (A)	12 * 1.21 * 1.25 = 18.15
Breaker Size Per Branch Circuit (A)	20
BRANCH CIRCUIT - B	
Number OF Microinverters in Circuit	12
Microinverter Maximum Output Current (A)	1.21
Branch Circuit Total Current (A)	12 * 1.21 * 1.25 = 18.15
Breaker Size Per Branch Circuit (A)	20
BRANCH CIRCUIT - C	
Number OF Microinverters in Circuit	12
Microinverter Maximum Output Current (A)	1.21
Branch Circuit Total Current (A)	12 * 1.21 * 1.25 = 18.15
Breaker Size Per Branch Circuit (A)	20
BRANCH CIRCUIT - D	
Number OF Microinverters in Circuit	12
Microinverter Maximum Output Current (A)	1.21
Branch Circuit Total Current (A)	12 * 1.21 * 1.25 = 18.15
Breaker Size Per Branch Circuit (A)	20
BRANCH CIRCUIT - E	
Number OF Microinverters in Circuit	12
Microinverter Maximum Output Current (A)	1.21
Branch Circuit Total Current (A)	12 * 1.21 * 1.25 = 18.15
Breaker Size Per Branch Circuit (A)	20
BRANCH CIRCUIT -F	
Number OF Microinverters in Circuit	12
Microinverter Maximum Output Current (A)	1.21
Branch Circuit Total Current (A)	12 * 1.21 * 1.25 = 18.15
Breaker Size Per Branch Circuit (A)	20
BRANCH CIRCUIT - G	
Number OF Microinverters in Circuit	12
Microinverter Maximum Output Current (A)	1.21
Branch Circuit Total Current (A)	12 * 1.21 * 1.25 = 18.15
Breaker Size Per Branch Circuit (A)	20
BRANCH CIRCUIT - H	
Number OF Microinverters in Circuit	12
Microinverter Maximum Output Current (A)	1.21
Branch Circuit Total Current (A)	12 * 1.21 * 1.25 = 18.15
Breaker Size Per Branch Circuit (A)	20

CONTRACTOR

WOLF RIVER ELECTRIC

Wolf RIver Electirc
Address:101 Isanti Parkway
NE, Isanti, MN 55040
Phone number: (763) 229-6662
E-mail: contact@wolfriverelectric.com

WIRE SIZE CALCULATION

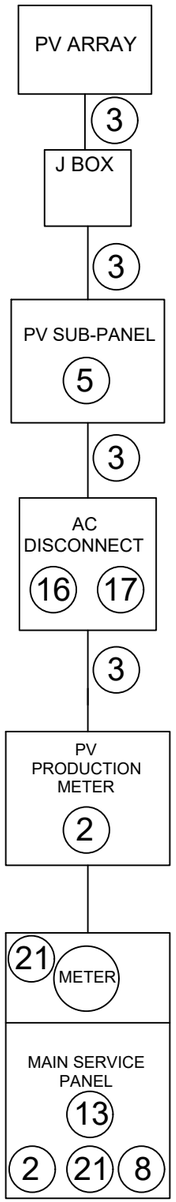
ENGINEERINC

Drawn by:New@engineerinc.io
DATE: 03/24/2022

Project Name:
Susan and Mark Boyd
Property Adress:
42703 260th Ln
Aitkin, MN 56431

Project: PV SYSTEM
Scale: AS INDICATED

PV 2.2



LABEL 1

Production Meter

LABEL 2

Photovoltaic Power Source

LABEL 3

CAUTION: SOLAR CIRCUIT

LABEL 4

WARNING

ELECTRIC SHOCK HAZARD

THE DC CONDUCTORS OF THIS PHOTOVOLTAIC SYSTEM ARE UNDERGROUND AND MAY BE ENERGIZED

LABEL 5

WARNING

ELECTRIC SHOCK HAZARD

IF GROUND FAULT IS INDICATED NORMALLY GROUNDED CONDUCTORS MAY BE UNDERGROUND AND ENERGIZED

LABEL 6

WARNING

ELECTRIC SHOCK HAZARD

DO NOT TOUCH TERMINALS TERMINALS ON BOTH LINE AND LOAD SIDES MAY BE ENERGIZED IN THE OPEN POSITION

LABEL 7

WARNING

ELECTRIC SHOCK HAZARD

DO NOT TOUCH TERMINALS 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

LABEL 8

WARNING

TURN OF PHOTOVOLTAIC AC DISCONNECT PRIOR TO WORKING INSIDE PANEL

LABEL 9

DO NOT DISCONNECT UNDER LOAD

LABEL 10

MAIN PV SYSTEM DISCONNECT

LABEL 11

MAIN PV SYSTEM AC DISCONNECT

LABEL 12

SOLAR DISCONNECT

LABEL 13

CAUTION

SOLAR ELECTRIC SYSTEM CONNECTED

LABEL 14

WARNING- DUAL POWER SOURCE SECOND SOURCE IS PV SYSTEM

LABEL 15

CAUTION

PHOTOVOLTAIC SYSTEM CIRCUIT IS BACKFED

LABEL 16

PHOTOVOLTAIC AC DISCONNECT

MAXIMUM AC OPERATING CURRENT 116.16A

MAXIMUM AC OPERATING CURRENT 240V

LABEL 17

PHOTOVOLTAIC

UTILITY AC DISCONNECT

LABEL 18

PHOTOVOLTAIC

DC DISCONNECT

LABEL 19

NOMINAL OPERATING AC VOLTAGE

NOMINAL OPERATING AC FREQUANCY

MAXIMUM AC POWER

MAXIMUM AC CURRENT

MAX OCERCURRENT DEVICE RATING FOR AC MODULE PROTECTION

LABEL 20

PV SYSTEM DC DISCONNECT

OPERATING CURRENT

OPERATING VOLTAGE

MAXIMUM SYSTEM VOLTAGE

SHORT CIRCUIT CURRENT

LABEL 21

RATED MAX POWER-FONT CURRENT

RATED MAX POWER-FONT VOLTAGE

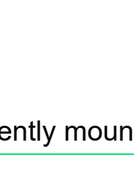
MAXIMUM SYSTEM VOLTAGE

SHORT CIRCUIT CURRENT

MAX RATED OUTPUT CURRENT OF THE CHARGE CONTROLLER IF INSTALLED

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.



Note: LABELS SHALL COMPLY WITH NEC 690

"Labels shall be weatherproof, durable and permanently mounted"

*** ALL LABELS = RED THERMOPLASTIC/REFLECTIVE , Permanently mounted

CONTRACTOR

WOLF RIVER ELECTRIC

Wolf River Electirc
Address:101 Isanti Parkway
NE, Isanti, MN 55040
Phone number: (763) 229-6662
E-mail: contact@wolfriverelectric.com

SYSTEM LABELING DETAIL

ENGINEERINC

Drawn by:New@engineerinc.io
DATE: 03/24/2022

Susan and Mark Boyd

Property Adress:
42703 260th Ln
Aitkin, MN 56431

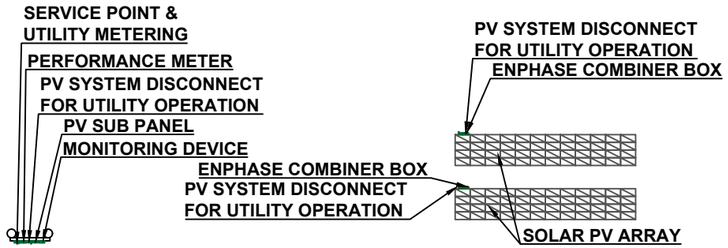
PV SYSTEM

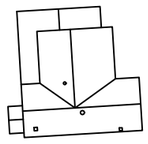
Scale: AS INDICATED

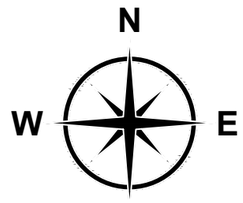
PV 3.1

CAUTION

POWER TO THIS BUILDING IS ALSO SUPPLIED
FROM THE FOLLOWING SOURCES WITH
DISCONNECTS LOCATED AS SHOWN:
SERVICE 1 OF 2



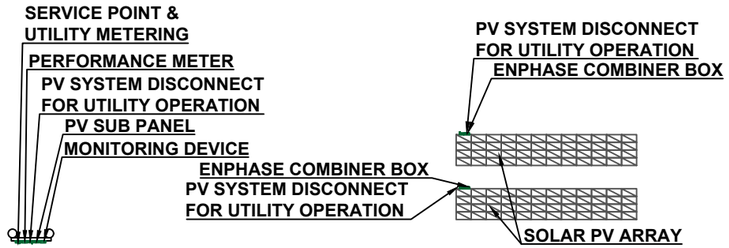


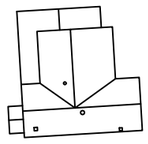


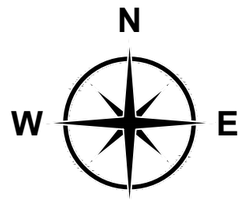
42703 260th Ln Aitkin, MN 56431

CAUTION

POWER TO THIS BUILDING IS ALSO SUPPLIED
FROM THE FOLLOWING SOURCES WITH
DISCONNECTS LOCATED AS SHOWN:
SERVICE 2 OF 2







42703 260th Ln Aitkin, MN 56431

CONTRACTOR

WOLF RIVER ELECTRIC

Wolf RIver Electirc
Address:101 Isanti Parkway
NE, Isanti, MN 55040
Phone number: (763) 229-6662
E-mail: contact@wolfriverelectric.com

PLACARD

ENGINEERINC

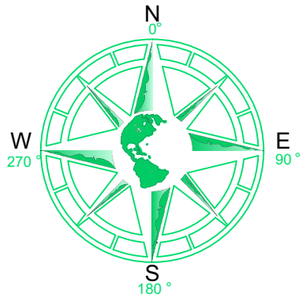
Drawn by:New@engineerinc.io
DATE: 03/24/2022

Project Name:
Susan and Mark Boyd
Property Adress:
42703 260th Ln
Aitkin, MN 56431

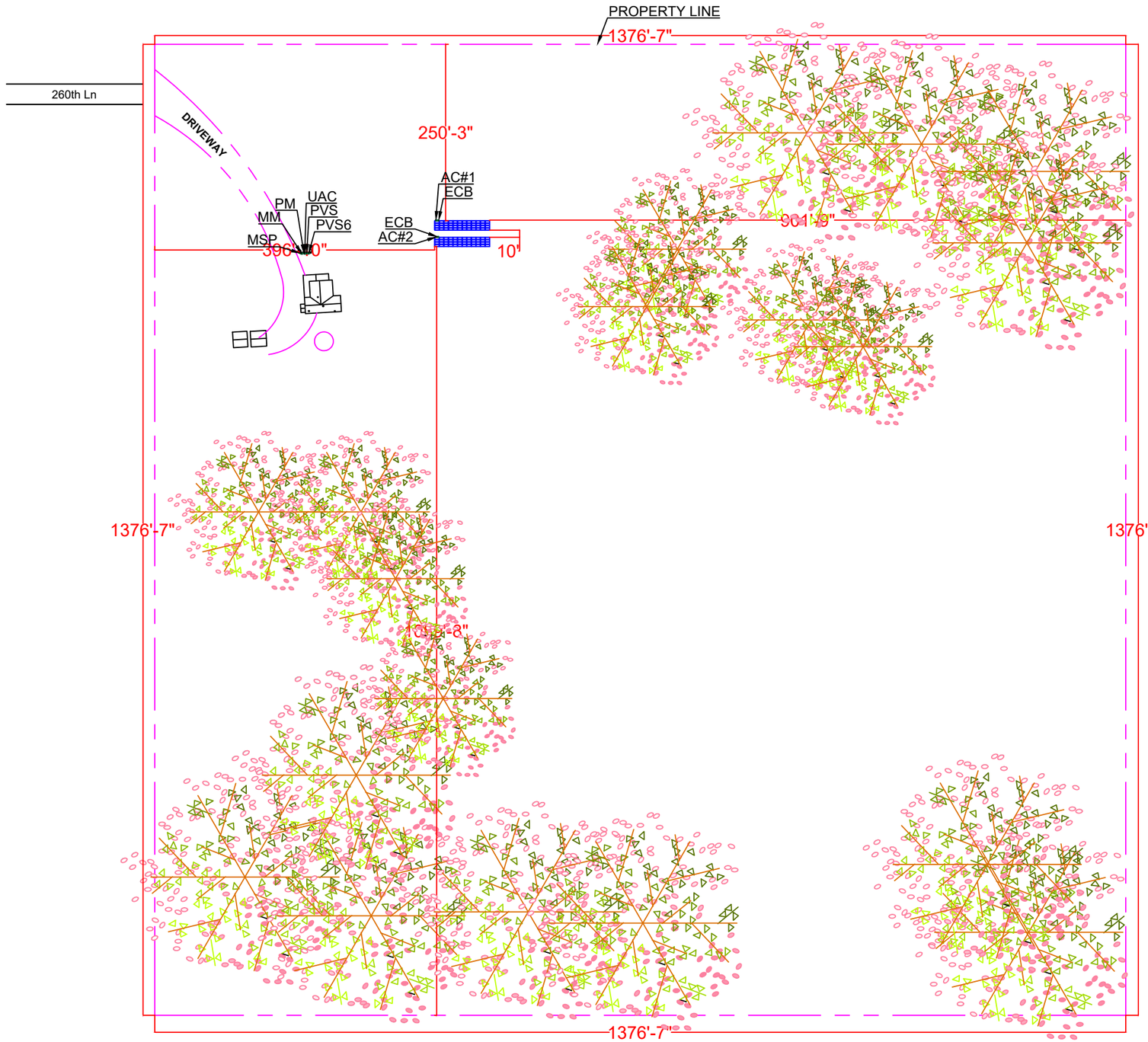
Project:
PV SYSTEM

Scale:
AS INDICATED

PV 3.2



SCALE: 1/128" = 1'-0"



MILLE LACS ENERGY COOP
Note: 24/ 7 Unescorted keyless access is to be provided for ALL UTILITY EQUIPMENT

LEGEND

MSP..... Main Service Panel
MM ..... Main Meter
UAC..... Utility AC Disconnect
AC#1..... AC Disconnect
AC#2..... AC Disconnect
PVS..... PV Sub Panel
MD ..... Monitoring Device
PM .....Perfromance Meter
ECB..... Enphase Combiner Box

CONTRACTOR

Wolf RIver Electirc
Address:101 Isanti Parkway
NE, Isanti, MN 55040
Phone number: (763) 229-6662
E-mail: contact@wolfriverelectric.com

PROPERTY PLAN

ENGINEERINC
Drawn by:New@engineerinc.io
DATE: 03/24/2022

Project Name:
Susan and Mark Boyd

Property Adress:
42703 260th Ln
Aitkin, MN 56431

Project:
PV SYSTEM

Scale:
AS INDICATED

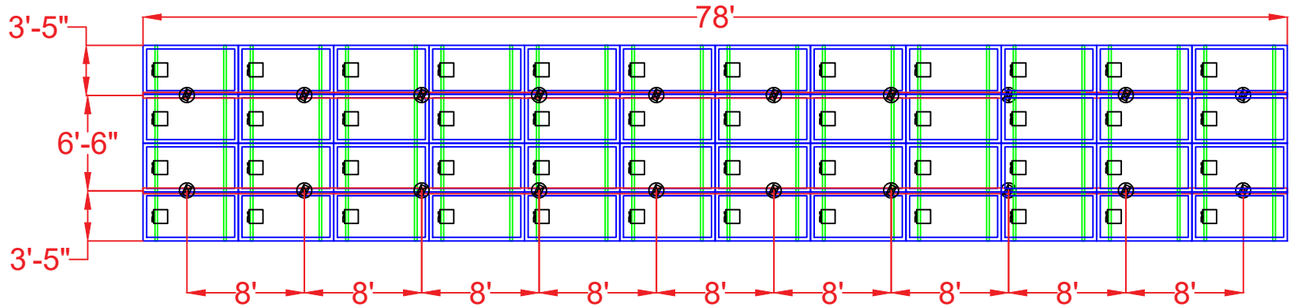
PV 4.0

ATTACHMENT

RAIL

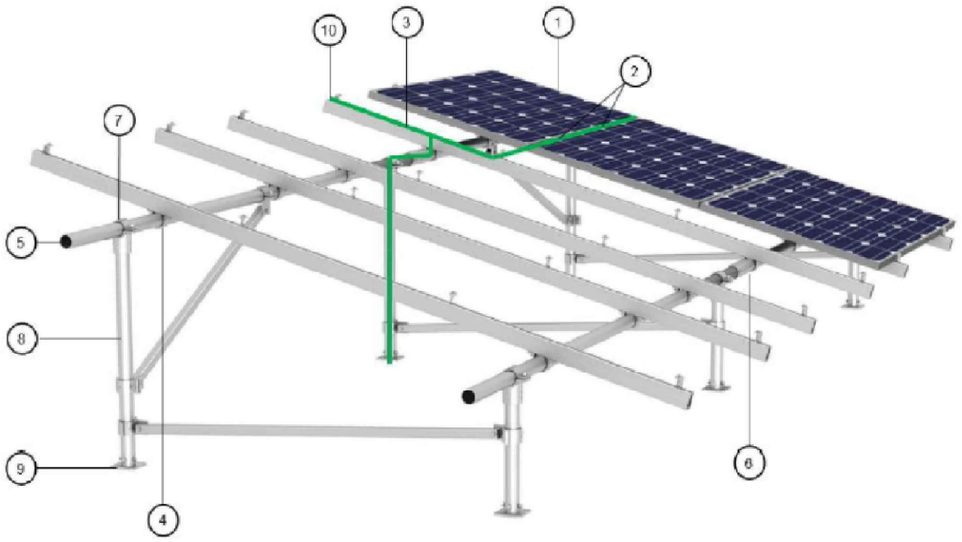
2" HORIZONTAL PIPE

POINT LOAD CALCULATION PER ARRAY	
Module Weight (lbs)	48.5
# Of Modules	96
Total Module Weight (lbs)	4656
Rack Weight (lbs)	931.2
MicroInverters Weight (lbs)	228.48
Total System Weight (lbs)	5815.68
# Of Standoffs	20
Max Span Between Standoffs (in)	96
Loading Per Standoff (lbs)	290.78
Total Area (sq.ft.)	2112
Loading (PSF)	2.75



MILLE LACS ENERGY COOP
Note: 24/ 7 Unescorted keyless access is to be provided for ALL UTILITY EQUIPMENT

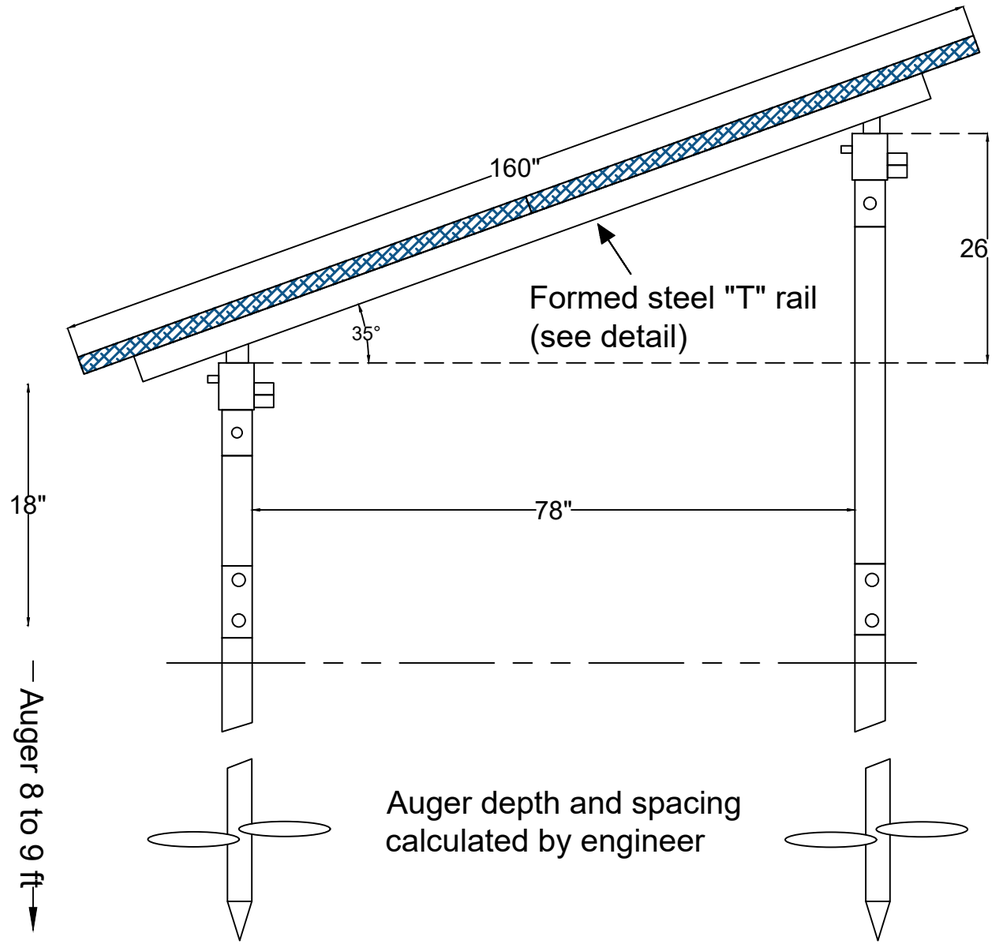
Fault Current Path Diagram



Items are listed in the fault current path in order from the PV Panel to the Post Base

1. PV Panel
2. Grounding Mid Clamp Kit
3. Helio Rail
4. 2" Aluminium Pipe Clamp Kit with PVC insulator
5. Horizontal Steel Post
6. 2" Pipr Splice Kit (configuration dependent)
7. 2" T Pipe Cap Kit
8. Vertical Post
9. 2" Post Base Kit
10. Grounding Lug

Fault Current Path



CONTRACTOR

WOLF RIVER ELECTRIC

Wolf RIver Electirc
Address:101 Isanti Parkway
NE, Isanti, MN 55040
Phone number: (763) 229-6662
E-mail: contact@wolfriverelectric.com

ATTACHMENT LAYOUT

ENGINEERINC

Drawn by:New@engineerinc.io
DATE: 03/24/2022

Project Name:
Susan and Mark Boyd
Property Adress:
42703 260th Ln
Aitkin, MN 56431

Project:
PV SYSTEM

Scale:
AS INDICATED

PV 5.0

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.

© 2021 Enphase Energy. All rights reserved. Enphase, the Enphase logo, IQ8 microinverters, and other names are trademarks of Enphase Energy, Inc. Data subject to change.

IQ8SP-DS-0002-01-EN-US-2021-10-19

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

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 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	
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	
Acoustic noise at 1 m		<60 dBA	
Pollution degree		PD3	
Enclosure		Class II double-insulated, corrosion resistant polymeric enclosure	
Environ. category / UV exposure rating		NEMA Type 6 / outdoor	
COMPLIANCE			
Certifications		CA Rule 21 (UL 1741-SA), UL 62109-1, UL1741/IEEE1547, FCC Part 15 Class B, ICES-0003 Class B, CAN/CSA-C22.2 NO. 107.1-01 This product is UL Listed as PV Rapid Shut Down Equipment and conforms with NEC 2014, NEC 2017, and NEC 2020 section 690.12 and C22.1-2018 Rule 64-218 Rapid Shutdown of PV Systems, for AC and DC conductors, when installed according to manufacturer's instructions.	

(1) 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-2021-10-19

CONTRACTOR

WOLF RIVER ELECTRIC

Wolf RIver Electirc
Address:101 Isanti Parkway
NE, Isanti, MN 55040
Phone number: (763) 229-6662
E-mail: contact@wolfriverelectric.com

INVERTER DATA SHEET

ENGINEERINC

Drawn by:New@engineerinc.io
DATE: 03/24/2022

Project Name:
Susan and Mark Boyd
Property Adress:
42703 260th Ln
Aitkin, MN 56431

Project:
PV SYSTEM

Scale:
AS INDICATED

D 6.0

Enphase® Energy // Rapid Shutdown

Rapid shutdown is built-in

The 2014 edition of the National Electrical Code (NEC 2014) added new rapid shutdown requirements for PV systems installed on buildings. Enphase Microinverters fully meet rapid shutdown requirements in the new code without the need to install any additional electrical equipment.

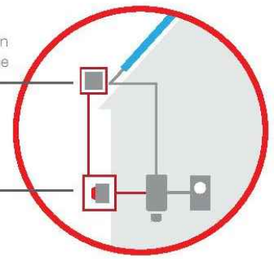
What's new in NEC 2014?
NEC 2014, Section 690.12 applies to PV conductors over 10 feet from the PV array and requires that the conductors power down to 30 volts and 240 volt-amperes within 10 seconds of rapid shutdown initiation.

String inverters require work arounds for rapid shutdown

Work around.
Specialized Rapid Shutdown electrical box installed on the roof within 10 feet of array.

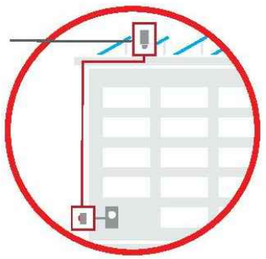
Work around.
Shutoff switch that is easily accessible to first responders on the ground.

Work around.
Extra conduit in installation.



Residential String Inverter

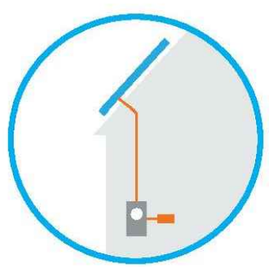
Work around.
String inverter installed on roof, a hostile environment that string inverters are not built to live in.



Commercial String Inverter

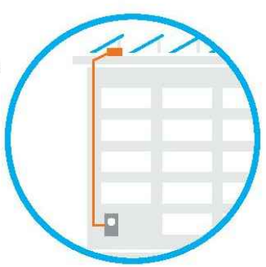
Enphase comes standard with rapid shutdown capability

All Enphase microinverters, even those that were previously installed, inherently meet rapid shutdown requirements, no additional equipment or workarounds needed



Residential Microinverter

Enphase microinverters can safely shut down automatically, leaving only low-voltage DC electricity isolated to the PV module



Commercial Microinverter

To learn more, visit enphase.com

[e] enphase ENERGY

QUICK **INSTALL** GUIDE

ENPHASE.

Install the **Enphase IQ8 Series** Microinverter

To install Enphase IQ8 Series Microinverters, read and follow all warnings and instructions in this guide and in the *Enphase IQ8 Series Microinverter Installation and Operation Manual* at enphase.com/support. Safety warnings are listed on the back page of this guide.

The Enphase Microinverter models listed in this guide do not require grounding electrode conductors (GEC), equipment grounding conductors (EGC), or grounded conductor (neutral). The microinverter has a Class II double-insulated rating, which includes ground fault protection (GFP). To support GFP, use only PV modules equipped with DC cables labeled ***PV Wire*** or ***PV Cable***.

IMPORTANT: Enphase IQ8 Series Microinverters require the IQ Cable. An IQ Gateway is required to monitor performance of the IQ Microinverters. The Q Accessories work only with Enphase IQ8 Series Microinverters.

Note: After you log in to your Enphase Installer Platform account from Enphase Installer app, Scan the microinverter QR code and connect to the Enphase IQ Gateway to track the system installation progress.

PREPARATION

A) Download the Enphase Installer App and open it to log in to your Enphase Installer Platform account. With this app, **scan the microinverter QR code** and connect to the Enphase IQ Gateway to track system installation progress. To download, go to enphase.com/toolkit or scan the QR code at right.

B) Refer to the following table and check PV module electrical compatibility at: enphase.com/en-us/support/module-compatibility.

Model	DC connector	Typical PV module* cell count
IQ8-60-2-US	MC-4 locking type	Pair with 60 cell /120-half-cell modules
IQ8PLUS-72-2-US IQ8M-72-2-US IQ8A-72-2-US	MC-4 locking type	Pair with 60 cell / 120-half-cell, 66 cell, or 72 cell / 144-half-cell
IQ8H-240-72-2-US IQ8H-208-72-2-US	MC-4 locking type	Pair with 60 cell /120-half-cell, 66 cell, or 72 cell / 144-half-cell

* Enphase IQ8 Series Microinverters are compatible with bi-facial PV modules if the temperature adjusted electrical parameters (maximum power, voltage and current) of the modules, considering the front side electrical parameters (i.e., 0% back side gain), are within the allowable microinverter input parameters range.

C) In addition to the Enphase Microinverters, PV modules and racking, you will need these **Enphase IQ8 Series Microinverters**:

- Enphase IQ Gateway (model ENV-IQ-AM1-240) communications gateway or Enphase IQ Combiner (check enphase.com for models): is required to monitor solar production.
- Tie wraps or cable clips (Q-CLIP-100)
- Enphase Sealing Caps (Q-SEAL-10): for any unused connectors on the Enphase IQ Cable
- Enphase Terminator (Q-TERM-10): one needed at the end of each AC cable segment
- Enphase Disconnect Tool (Q-DISC-10)
- Enphase IQ Cable:

Cable model	Connector spacing*	PV module orientation	Connectors per box
Q-12-10-240	1.3m	Portrait (all)	240
Q-12-17-240	2.0m	Landscape (60- and 66-cell)	240
Q-12-20-200	2.3m	Landscape (72-cell)	200

*Allows for 30cm of cable slack

D) Check that you have these other items:
- AC junction box.
- Tools: screwdrivers, wire cutter, voltmeter, torque wrench, sockets, and wrenches for mounting hardware

E) Protect your system with lightning and/or surge suppression devices. It is also important to have insurance that protects against lightning and electrical surges.

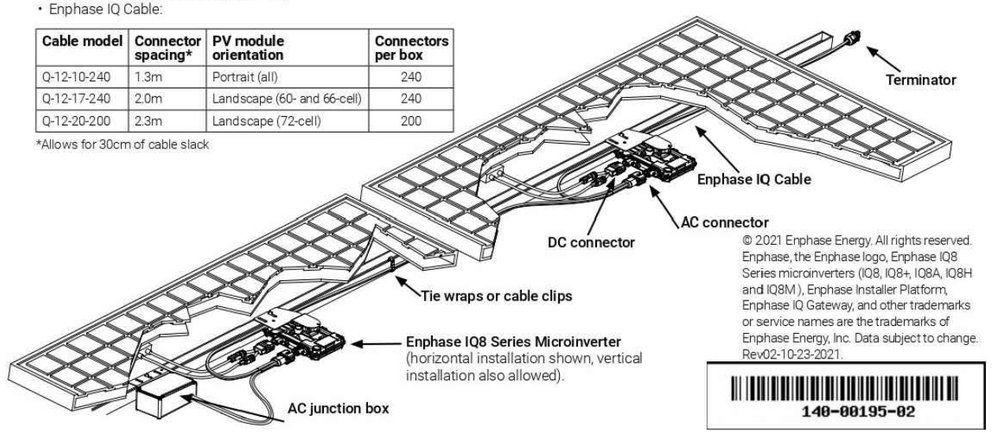
F) Plan your AC branch circuits to meet the following limits for maximum number of microinverters per branch when protected with a 20-amp over-current protection device (OCPD).

Maximum* IQ8 Series Microinverters per AC branch circuit (single-phase)		
IQ8 (240V)	IQ8+ (240V)	IQ8M (240V)
16	**13**	**11**
IQ8A (240V)	IQ8H (240V)	IQ8H (208V)
11	**10**	**9**

* Limits may vary. Refer to local requirements to define the number of microinverters per branch in your area.

G) Size the AC wire gauge to account for voltage rise. Select the correct wire size based on the distance from the beginning of the Enphase IQ Cable to the breaker in the load center. Design for a voltage rise total of less than 2% for these sections. Refer to the Voltage Rise Technical Brief at enphase.com/support for more information.

Best practice: Center-feed the branch circuit to minimize voltage rise in a fully-populated branch.



© 2021 Enphase Energy. All rights reserved. Enphase, the Enphase logo, Enphase IQ8 Series microinverters (IQ8, IQ8+, IQ8A, IQ8H and IQ8M), Enphase Installer Platform, Enphase IQ Gateway, and other trademarks or service names are the trademarks of Enphase Energy, Inc. Data subject to change.
Rev02-10-23-2021.

140-00195-02

CONTRACTOR

WOLF RIVER ELECTRIC

Wolf RIver Electirc
Address:101 Isanti Parkway
NE, Isanti, MN 55040
Phone number: (763) 229-6662
E-mail: contact@wolfriverelectric.com

ENPHASE RAPID SHUTDOWN, COMPATIBILITY WITH PV

ENGINEERINC
Drawn by:New@engineerinc.io
DATE: 03/24/2022

Project Name:
Susan and Mark Boyd
Property Adress:
42703 260th Ln
Aitkin, MN 56431

Project:
PV SYSTEM
Scale:
AS INDICATED

D 7.0

Q.PEAK DUO BLK ML-G10+

385-405

ENDURING HIGH PERFORMANCE

25 YR Warranty Product & Performance

EUPD RESEARCH TOP BRAND PV MODULES EUROPE 2021

Q CELLS Yield Security

BREAKING THE 20% EFFICIENCY BARRIER

Q.ANTUM DUO Z Technology with zero gap cell layout boosts module efficiency up to 20.9%.

THE MOST THOROUGH TESTING PROGRAMME IN THE INDUSTRY

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

INNOVATIVE ALL-WEATHER TECHNOLOGY

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

ENDURING HIGH PERFORMANCE

Long-term yield security with Anti LID Technology, Anti PID Technology[1], Hot-Spot Protect and Traceable Quality Tra.Q™.

EXTREME WEATHER RATING

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

A RELIABLE INVESTMENT

Inclusive 25-year product warranty and 25-year linear performance warranty[2].

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

THE IDEAL SOLUTION FOR:

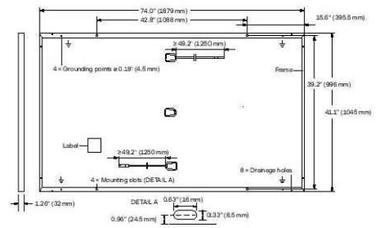
Rooftop arrays on residential buildings

Engineered in Germany

Q CELLS

MECHANICAL SPECIFICATION

Format	74.0 in × 41.1 in × 1.26 in (including frame) (1879 mm × 1045 mm × 32 mm)
Weight	48.5 lbs (22.0 kg)
Front Cover	0.13 in (3.2 mm) thermally pre-stressed glass with anti-reflection technology
Back Cover	Composite film
Frame	Black anodized aluminum
Cell	6 × 22 monocrystalline Q.ANTUM solar half cells
Junction Box	2.09-3.98 in × 1.26-2.36 in × 0.59-0.71 in (53-101 mm × 32-60 mm × 15-18 mm), IP67, with bypass diodes
Cable	4 mm² Solar cable; (+) ≥49.2 in (1250 mm), (−) ≥49.2 in (1250 mm)
Connector	Stäubli MC4; IP68

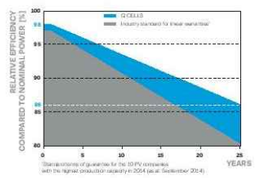


ELECTRICAL CHARACTERISTICS

POWER CLASS				385	390	395	400	405
MINIMUM PERFORMANCE AT STANDARD TEST CONDITIONS, STC[1] (POWER TOLERANCE +5 W / −0 W)								
Minimum	Power at MPP[1]	P_{MPP}	[W]	385	390	395	400	405
Minimum	Short Circuit Current[1]	I_{SC}	[A]	11.04	11.07	11.10	11.14	11.17
Minimum	Open Circuit Voltage[1]	V_{OC}	[V]	45.19	45.23	45.27	45.30	45.34
Minimum	Current at MPP	I_{MPP}	[A]	10.59	10.65	10.71	10.77	10.83
Minimum	Voltage at MPP	V_{MPP}	[V]	36.36	36.62	36.88	37.13	37.39
Minimum	Efficiency[1]	η	[%]	≥19.6	≥19.9	≥20.1	≥20.4	≥20.6
MINIMUM PERFORMANCE AT NORMAL OPERATING CONDITIONS, NMOT[2]								
Minimum	Power at MPP	P_{MPP}	[W]	288.8	292.6	296.3	300.1	303.8
Minimum	Short Circuit Current	I_{SC}	[A]	8.90	8.92	8.95	8.97	9.00
Minimum	Open Circuit Voltage	V_{OC}	[V]	42.62	42.65	42.69	42.72	42.76
Minimum	Current at MPP	I_{MPP}	[A]	8.35	8.41	8.46	8.51	8.57
Minimum	Voltage at MPP	V_{MPP}	[V]	34.59	34.81	35.03	35.25	35.46

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

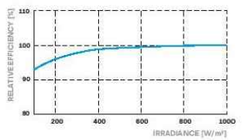
Q CELLS PERFORMANCE WARRANTY



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

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

PERFORMANCE AT LOW IRRADIANCE



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

TEMPERATURE COEFFICIENTS

Temperature Coefficient of I_{SC}	α	[%/K]	+0.04	Temperature Coefficient of V_{OC}	β	[%/K]	−0.27
Temperature Coefficient of P_{MPP}	γ	[%/K]	−0.34	Nominal Module Operating Temperature	NMOT	[°F]	109 ± 5.4 (43 ± 3 °C)

PROPERTIES FOR SYSTEM DESIGN

Maximum System Voltage V_{SYS}	[V]	1000 (IEC) / 1000 (UL)	PV module classification	Class II
Maximum Series Fuse Rating	[A DC]	20	Fire Rating based on ANSI / UL 61730	TYPE 2
Max. Design Load, Push / Pull[3]	[lbs/ft²]	75 (3600 Pa) / 55 (2660 Pa)	Permitted Module Temperature on Continuous Duty	−40 °F up to +185 °F (−40 °C up to +85 °C)
Max. Test Load, Push / Pull[3]	[lbs/ft²]	113 (5400 Pa) / 84 (4000 Pa)		

[3] See Installation Manual

QUALIFICATIONS AND CERTIFICATES

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

PACKAGING INFORMATION

Horizontal packaging	76.4 in 1940 mm	43.3 in 1100 mm	48.0 in 1220 mm	1656 lbs 751 kg	24 pallets	24 pallets	32 modules

Note: Installation instructions must be followed. See the installation and operating manual or contact our technical service department for further information on approved installation and use of this product.

Hanwha Q CELLS America Inc.
400 Spectrum Center Drive, Suite 1400, Irvine, CA 92618, USA | **TEL** +1 949 748 59 96 | **EMAIL** inquiry@us.q-cells.com | **WEB** www.q-cells.us

Specifications subject to technical changes © Q CELLS Q.PEAK DUO BLK ML-G10+_385-405_2021-05_Rev01_NA

CONTRACTOR

WOLF RIVER ELECTRIC

Wolf River Electirc
Address:101 Isanti Parkway NE, Isanti, MN 55040
Phone number: (763) 229-6662
E-mail: contact@wolfriverelectric.com

MODULE DATA SHEET

ENGINEERINC

Drawn by:New@engineerinc.io
DATE: 03/24/2022

Project Name:
Susan and Mark Boyd

Property Adress:
42703 260th Ln
Aitkin, MN 56431

Project:
PV SYSTEM

Scale:
AS INDICATED

D 8.0

SUNMODO

GO BIG ON TURF

SunTurf™ Ground Mount System

SunModo offers the next generation Ground Mount System with SunTurf™. The streamlined design combines the strength of Helio Rails with steel pipes to create the perfect ground mount solution.

SurTurf™ is ideal for solar installers looking for a durable and cost-effective system that can accommodate a wide variety of soil conditions.

The SunTurf™ Ground Mount Advantage

- ✓ Easily scalable from kilowatts to multimegawatts PV Arrays.
- ✓ Foundation design solution for every soil condition.
- ✓ Online configuration tool available to streamline design process.
- ✓ Components optimized for strength, durability and fast installation.
- ✓ UL 2703 Listed by Intertek.

Key Features of SunTurf™ Ground Mount System

SUNMODO
We've Got Your Rack!

SunTurf™ Ground Mount System easily integrate Helio Rails with Schedule 40 steel pipes. No drilling is required to attach the aluminum rails to the horizontal pipe. Optional bracing can provide additional structural rigidity for sites with high snow or wind load conditions. Anchor any ground mount installation using one of our fountain types including helical piles, precast ballasts and concrete piers.

Augers and Ground Screws

Our augers are suitable for use in weak to moderate strength soils and areas with a high-water table. Our ground screws are ideal for use in hard packed earth or soils with large amounts of cobble and gravel.

Ground Screw

Earth Auger

Technical Data

Application	Ground Mount
Material	High grade aluminum, galvanized steel and 304 stainless steel hardware
Module Orientation	Portrait and Landscape
Tilt Angle	Range between 10 to 50 degrees
Foundation Types	Post in concrete, helical earth auger, ground screw anchor and ballast
Structural Integrity	Stamped engineering letters available
Certificate	UL2703 listed by ETL
Warranty	25 years

SunModo, Corp. Vancouver, WA., USA • www.sunmodo.com • 360.844.0048 • info@sunmodo.com

CONTRACTOR

WOLF RIVER ELECTRIC

Wolf River Electirc
Address:101 Isanti Parkway
NE, Isanti, MN 55040
Phone number: (763) 229-6662
E-mail: contact@wolfriverelectric.com

RACKING DATA SHEET

ENGINEERINC
Drawn by:New@engineerinc.io
DATE: 03/24/2022

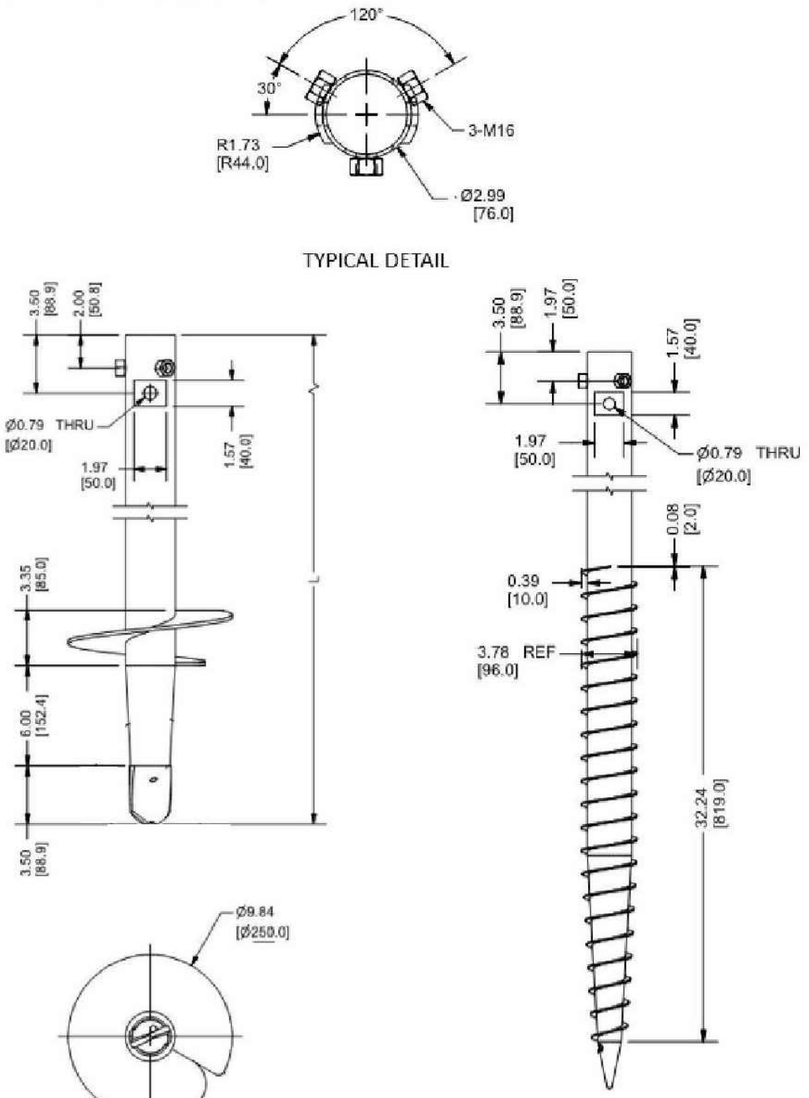
Project Name:
Susan and Mark Boyd
Property Adress:
42703 260th Ln
Aitkin, MN 56431

Project: PV SYSTEM
Scale: AS INDICATED

D 9.0

Basic Information	
Part Number	A21146-XXX
Description	10” Helix Blade Auger
Lengths (-063 | -080)	63 inches | 80 inches
Auger Outside Diameter	76mm
Attachment Hardware	3X M16 Set Screws
Material	#45 Structural Carbon Steel
Finish	Hot Dip Galvanized
Approximate Weight	8,2 kg | 10,5 kg

Basic Information	
Part Number	A21147-XXX
Description	Screw Anchor
Lengths (-063 | -080)	63 inches | 80 inches
Auger Outside Diameter	76mm
Attachment Hardware	3X M16 Set Screws
Material	#45 Structural Carbon Steel
Finish	Hot Dip Galvanized
Approximate Weight	8,2 kg | 10,5 kg



A21146-XXX

A21147-XXX

SunModo Corp | 14800 NE 65th Street | Vancouver, WA 98682 | 360-844-0048
Document Number D10162-V001 | ©2018 – SunModo Corp.

CONTRACTOR

Wolf RIver Electirc
Address:101 Isanti Parkway
NE, Isanti, MN 55040
Phone number: (763) 229-6662
E-mail: contact@wolfriverelectric.com

ATTACHMENT DATA SHEET

ENGINEERINC

Drawn by:New@engineerinc.io
DATE: 03/24/2022

Project Name:
Susan and Mark Boyd
Property Adress:
42703 260th Ln
Aitkin, MN 56431

Project:
PV SYSTEM

Scale:
AS INDICATED

D 10.0

Data Sheet
Enphase Networking

Enphase IQ Envoy

The **Enphase IQ Envoy**™ communications gateway delivers solar production and energy consumption data to Enphase Enlighten™ monitoring and analysis software for comprehensive, remote maintenance and management of the Enphase IQ System.

With integrated revenue grade production metering and optional consumption monitoring, the Envoy IQ is the platform for total energy management and integrates with the Enphase IQ Battery™.

Smart

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

Simple

- Easy system configuration using Enphase Installer Toolkit™ mobile app
- Flexible networking with Wi-Fi, Ethernet, or cellular

Reliable

- Designed for installation indoors or outdoors
- Five-year warranty

UL LISTED

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

ENPHASE.

Enphase IQ Envoy

MODEL NUMBERS	
Enphase IQ Envoy™ ENV-IQ-AM1-240	Enphase IQ Envoy communications gateway with integrated revenue grade PV production metering (ANSI C12.20 +/- 0.5%) and optional consumption monitoring (+/- 2.5%). Includes one 200A continuous rated **production** CT.
ACCESSORIES (order separately)	
Enphase Mobile Connect™ CELLMODEM-03 (4G / 12-year data plan) CELLMODEM-01 (3G / 5-year data plan) CELLMODEM-M1 (4G based LTE-M / 5-year data plan)	Plug and play industrial grade cellular modem with data plan 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.)
Consumption Monitoring CT CT-200-SPLIT	Split-core current transformers enable whole home metering.
POWER REQUIREMENTS	
Power requirements	120/240 VAC split-phase. Max 20 A overcurrent protection required.
CAPACITY	
Number of microinverters polled	Up to 600
MECHANICAL DATA	
Dimensions (WxHxD)	21.3 x 12.6 x 4.5 cm (8.4" x 5" x 1.8")
Weight	17.6 oz (498 g)
Ambient temperature range	-40° to 65° C (-40° to 149° F) -40° to 46° C (-40° to 115° F) if installed in an enclosure
Environmental rating	IP30. For installation indoors or in an NRTL-certified, NEMA type 3R enclosure.
Altitude	To 2000 meters (6,560 feet)
Production CT	- Is limited to 200A of continuous current / 250A OCPD – 72kW AC - Internal aperture measures 19.36mm to support 250MCM THWN conductors (max)
Consumption CT	- For electrical services to 250A with parallel runs up to 500A - Internal aperture measures 0.84" x 0.96" (21.33mm x 24.38mm) to support 3/0 THWN conductor - CT wire insulation rating of 600V
INTERNET CONNECTION OPTIONS	
Integrated Wi-Fi	802.11b/g/n
Ethernet	802.3, Cat5E (or Cat 6) UTP Ethernet cable, not included
Mobile	Optional, CELLMODEM-01 (3G) or CELLMODEM-03 (4G), not included
COMPLIANCE	
Compliance	UL 916 CAN/CSA C22.2 No. 61010-1 47 CFR, Part 15, Class B, ICES 003 IEC/EN 61010-1:2010, EN50065-1, EN61000-4-5, EN61000-6-1, EN61000-6-2 Metering: ANSI C12.20 accuracy class 0.5

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

© 2018 Enphase Energy. All rights reserved. All trademarks or brands used are the property of Enphase Energy, Inc.
2018-12-10

ENPHASE.

CONTRACTOR

WOLF RIVER ELECTRIC

Wolf RIver Electirc
Address:101 Isanti Parkway
NE, Isanti, MN 55040
Phone number: (763) 229-6662
E-mail: contact@wolfriverelectric.com

MONITORING DEVICE DATASHEET

ENGINEERINC

Drawn by:New@engineerinc.io
DATE: 03/24/2022

Project Name:
Susan and Mark Boyd
Property Adress:
42703 260th Ln
Aitkin, MN 56431

Project:
PV SYSTEM

Scale:
AS INDICATED

D 11.0

Data Sheet
Enphase Networking

Enphase IQ Combiner+

(X-IQ-AM1-240-2)

The **Enphase IQ Combiner+**™ with Enphase IQ Envoy™ consolidates interconnection equipment into a single enclosure and streamlines PV 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 Envoy for communication and control
- Flexible networking supports Wi-Fi, Ethernet, or cellular
- Provides production metering and optional consumption monitoring
- Supports installation of the Enphase Q Aggregator™

Simple

- Eaton BR series panelboard interior
- Up to four 2-pole branch circuits for 240 VAC plug-in breakers (not included)
- 80 A total PV or storage branch circuits

Reliable

- Durable NRTL-certified NEMA type 3R enclosure
- Five-year warranty
- UL listed

LISTED

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

ENPHASE.

Enphase IQ Combiner+

MODEL NUMBER	
IQ Combiner+ X-IQ-AM1-240-2	IQ Combiner+ with Enphase IQ Envoy™ for integrated revenue grade PV production metering (ANSI C12.20 +/- 0.5%) and optional* consumption monitoring (+/- 2.5%).
ACCESSORIES (order separately)	
Enphase Mobile Connect™ CELLMODEM-03 (4G / 12-year data plan) CELLMODEM-01 (3G / 5-year data plan) CELLMODEM-M1 (4G LTE CAT-M1 / 5-year data plan)	Plug and play industrial grade cellular modem with data plan 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.)
Consumption Monitoring CT CT-200-SPLIT	Split core current transformers enable whole home consumption metering* (+/- 2.5%).
Circuit Breakers BRK-15A-2-240 BRK-20A-2-240	 Breaker, 2 pole, 15A, Eaton BR215 Breaker, 2 pole, 20A, Eaton BR220
ELECTRICAL SPECIFICATIONS	
Rating	Continuous duty
System voltage	240 VAC, 60 HZ
Eaton BR series busbar rating	125 A
Max. continuous current rating (output to grid)	65 A
Max. fuse/circuit rating (output)	90 A
Branch circuits (solar and/or storage)	Up to four 2-pole Eaton BR series Distributed Generation (DG) breakers only (not included)
Max. continuous current rating (input from PV)	64 A
Max. total branch circuit breaker rating (input)	80 A (any combination)
Production Metering CT	200 A solid core pre-installed and wired to IQ Envoy
MECHANICAL DATA	
Dimensions (WxHxD)	49.3 x 46.5 x 16.0 cm (19.4" x 18.3" x 6.3")
Weight	7.5 kg (16.5 lbs)
Ambient temperature range	-40° C to +46° C (-40° to 115° F)
Cooling	Natural convection, plus heat shield
Enclosure environmental rating	Outdoor, NRTL-certified, NEMA type 3R, polycarbonate construction
Wire sizes	• 20 A to 50 A breaker inputs: 14 to 4 AWG copper conductors • 60 A breaker branch input: 3 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	To 2000 meters (6,560 feet)
INTERNET CONNECTION OPTIONS	
Integrated Wi-Fi	802.11b/g/n
Ethernet	802.3, Cat5E (or Cat 6) UTP Ethernet cable - not included
Cellular	Optional, CELLMODEM-01 (3G) or CELLMODEM-03 (4G) (not included)
COMPLIANCE	
Compliance, Combiner	UL 1741 CAN/CSA C22.2 No. 107.1 47 CFR, Part 15, Class B, ICES 003 Production metering: ANSI C12.20 accuracy class 0.5 (PV production)
Compliance, IQ Envoy	UL 916 CAN/CSA C22.2 No. 61010-1

* Consumption monitoring is required for Enphase Storage Systems.

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

© 2018 Enphase Energy. All rights reserved. All trademarks or brands in this document are registered by their respective owner.
2018-05-02

ENPHASE.

CONTRACTOR

WOLF RIVER ELECTRIC

Wolf RIver Electirc
Address:101 Isanti Parkway
NE, Isanti, MN 55040
Phone number: (763) 229-6662
E-mail: contact@wolfriverelectric.com

ECB
DATA SHEET

ENGINEERINC
Drawn by:New@engineerinc.io
DATE: 03/24/2022

Project Name:
Susan and Mark Boyd
Property Adress:
42703 260th Ln
Aitkin, MN 56431

Project:
PV SYSTEM

Scale:
AS INDICATED

D 12.0

MIDNITE SOLAR INC.

Surge Protection

Surge Protection You Can Count On!

MidNite Solar Surge Protection Devices are type 1 devices, designed for indoor and outdoor applications. Engineered for both AC and PV DC electrical systems, they provide protection to service panels, load centers or electronic devices that are directly connected to a MidNite Surge Protection Device (SPD).

MidNite's SPDs are offered in four models to protect a variety of different voltage ranges. They achieve this protection by clamping surge voltage to a level that your system can sustain without damaging the components of the system.

Compare our SPDs against other surge protection devices. You will see there is no comparison in both our price and features. All our SPDs are made in the USA and have a 5 year warranty.

With lightning you only get one chance, so get the best!

www.midnitesolar.com/spd
17722 67th Ave. NE., Arlington, WA. 360-403-7207 FAX: 360-691-6862

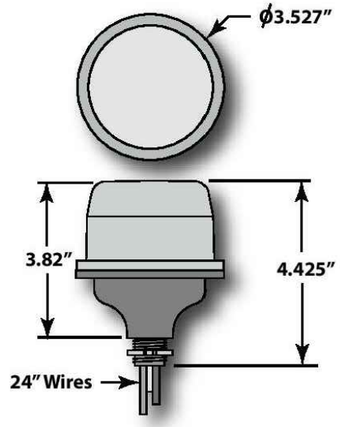
MNSPD300ACFM (Cut-in box)
(MNSPD-300-AC included)

Four Models:

MNSPD-115
MNSPD-300-AC
MNSPD-300-DC
MNSPD-600

MidNite Surge Protection Devices

PART NUMBER	MNSPD-115	MNSPD-300-AC	MNSPD-300-DC	MNSPD-600
Nominal Voltage	0 to 90 VAC 0 to 115 VDC	0 to 250 VAC	0 to 300 VDC	0 to 480 VAC 0 to 600 VDC
MCOV	180V	470V	470V	780V
VPR Line to Ground	600V	1200V	1200V	1800V
Suggested Placement	Up to 90VAC circuits, 12V, 24V, 48VDC battery circuits	120/240 VAC circuits	Off-grid PV combiners Charge controller inputs up to 300VDC	316V/480 VAC circuits Grid-tie PV combiners Grid-tie inverter input Non-Isolated Inverters
Type	UL1449 4th Ed. Type 1	UL1449 4th Ed. Type 1	UL1449 4th Ed. Type 1	UL1449 4th Ed. Type 1
Diagnostic Blue LED	MNSPD-300-AC LED indicates when voltage is present between L1 + ground and L2 + ground MNSPD-115, MNSPD-300-DC and MNSPD-600: LED indicates when voltage is present between L1 + L2 (PV+ PV-)			
Thermal Disconnector	Internal Fuse			
Response Time	<1 micro sec.			



Performance	
Surge Current Rating per Phase	80kA
Short Circuit Current Rating	10kA
Fusing	Individually fused MOVs
Thermal Fusing	Yes
Over current Fusing	Yes
Operating Frequency	0 to 500 Hz
Mechanical Description	
Enclosure	Polycarbonate UL94V-0
Environmental Rating	Type 4X
Connection Method	#12 AWG
Weight	1 lb.
Mounting Method	1/2" Conduit Knockout
Operating Altitude	Sea Level – 12,000' (3,658 Meters)
Storage Temp	-40° F to +185° F (-40° C to +85° C)
Operating Temp	-40° F to +185° F (-40° C to +85° C)
Diagnostics	
Blue status LED, one per leg	
Listings and Performance	
UL Standard for Safety, UL 1449 Surge Protective Devices-Fourth Edition	
CSA C22.2 No. 8-M1986 Electromangetic Interference (EMI) Filters, Fourth Edition	

Model No.	Max Operating Voltage	Surge Current per Phase	Configuration	MCOV	SCCR	VPR 600V/3kA L_G
MNSPD-115	100 VAC/150VDC	80kA	1Ø, 3-wire (2 Legs)	180V L-N	10kA	600V
MNSPD-300-AC	300VAC	80kA	1Ø, 3-wire (2 Legs)	470V L-N	10kA	1200V
MNSPD-300-DC	385VDC	80kA	1Ø, 3-wire (2 Legs)	470V L-N	10kA	1200V
MNSPD-600	480VAC/600VDC	80kA	1Ø, 3-wire (2 Legs)	780V L-N	10kA	1800V

www.midnitesolar.com/spd
17722 - 67th Ave NE, Arlington, WA 98223 PH. 360-403-7207 FAX 360-691-6862

CONTRACTOR

WOLF RIVER ELECTRIC

Wolf RIver Electirc
Address:101 Isanti Parkway
NE, Isanti, MN 55040
Phone number: (763) 229-6662
E-mail: contact@wolfriverelectric.com

SURGE PROTECTION

ENGINEERINC

Drawn by:New@engineerinc.io
DATE: 03/24/2022

Project Name:
Susan and Mark Boyd
Property Adress:
42703 260th Ln
Aitkin, MN 56431

Project:
PV SYSTEM

Scale:
AS INDICATED

D 13.0

CERTIFICATE OF COMPLIANCE

Certificate Number	20180530-E341165
Report Reference	E341165-20171030
Issue Date	2018-MAY-30

Issued to: ENPHASE ENERGY INC
1420 N McDowell Blvd
Petaluma CA 94954-6515

This is to certify that representative samples of STATIC INVERTERS, CONVERTERS AND ACCESSORIES FOR USE IN INDEPENDENT POWER SYSTEMS; PHOTOVOLTAIC RAPID SHUTDOWN SYSTEM EQUIPMENT
See Addendum

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

Standard(s) for Safety: See Addendum

Additional Information: See the UL Online Certifications Directory at www.ul.com/database for additional information

Only those products bearing the UL Certification Mark should be considered as being covered by UL's Certification and Follow-Up Service.

Look for the UL Certification Mark on the product.

Bruce Mahrenholz, Director North American Certification Program
UL LLC

Any information and documentation involving UL Mark services are provided on behalf of UL LLC (UL) or any authorized licensee of UL. For questions, please contact a local UL Customer Service Representative at http://ul.com/aboutul/locations/

Created by UL Document Assembler 2018-07-05 15:07:07 -05:00

CERTIFICATE OF COMPLIANCE

Certificate Number	20180530-E341165
Report Reference	E341165-20171030
Issue Date	2018-MAY-30

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

Permanently-connected, Grid Support utility Interactive, 208V single-phase, 240V single phase evaluated for use on a split phase system, distributed resource power system.

Models IQ7-60, IQ7PLUS-72, and IQ7X-96, followed by -2, -5, -B, or -ACM, followed by -US+. Models IQ7PD-72-2-US and IQ7PD-84-2-US.

USL/CNL – Photovoltaic Rapid Shutdown Equipment.

Models IQ7-60, IQ7PLUS-72, and IQ7X-96, followed by -2, -5, -B, or -ACM, followed by -US+. Models IQ7PD-72-2-US and IQ7PD-84-2-US.

+ may be followed by additional characters not affecting safety

Standard(s) for Safety:

UL 62109-1, SAFETY OF POWER CONVERTERS FOR USE IN PHOTOVOLTAIC POWER SYSTEMS - PART 1: GENERAL REQUIREMENTS

CSA C22.2 NO. 107.1-01, GENERAL USE POWER SUPPLIES

IEEE 1547 INTERCONNECTING DISTRIBUTED RESOURCES WITH ELECTRIC POWER SYSTEMS

IEEE 1547.1 IEEE STANDARD CONFORMANCE TEST PROCEDURES FOR EQUIPMENT INTERCONNECTING DISTRIBUTED RESOURCES WITH ELECTRIC POWER SYSTEMS

UL 1741, INVERTERS, CONVERTERS, CONTROLLERS AND INTERCONNECTION SYSTEM EQUIPMENT FOR USE WITH DISTRIBUTED ENERGY RESOURCES

CEC-300-2011-005,-CMF GUIDELINES FOR CALIFORNIA'S SOLAR ELECTRIC INCENTIVE PROGRAMS PURSUANT TO SENATE BILL 1

Bruce Mahrenholz, Director North American Certification Program
UL LLC

Any information and documentation involving UL Mark services are provided on behalf of UL LLC (UL) or any authorized licensee of UL. For questions, please contact a local UL Customer Service Representative at http://ul.com/aboutul/locations/

Created by UL Document Assembler 2018-07-05 15:07:07 -05:00

CONTRACTOR

WOLF RIVER ELECTRIC

Wolf RIver Electirc
Address:101 Isanti Parkway
NE, Isanti, MN 55040
Phone number: (763) 229-6662
E-mail: contact@wolfriverelectric.com

INVERTER CERTIFICATION

ENGINEERINC

Drawn by:New@engineerinc.io
DATE: 03/24/2022

Project Name:
Susan and Mark Boyd
Property Adress:
42703 260th Ln
Aitkin, MN 56431

Project: PV SYSTEM
Scale: AS INDICATED

D 14.0

DEPARTMENT OF LABOR AND INDUSTRY

Solar PV Inspection Checklist

Solar PV Inspection Checklist for REI #ELE- _____ Installer Wolf RIver Electric
Job Address 42703 260th Ln _____ City/Township Aitkin, MN 56431

Required Documentation
- Manufacturer's specifications for the inverter
- Manufacturer's specifications for the module
- Manufacturer's specifications for the optimizer (if used)
- Verification that the racking system grounding and bonding is listed

PV Inverter

- [ ] Is the PV system utility-interactive, stand alone or multimode? 690.2
- [ ] Is all the equipment listed for PV application? 690.4
- [ ] Is the system grounded, ungrounded or (functionally grounded)? 690.2 and 690.41
- [ ] Has DC Ground-Fault Protection been provided and properly labeled? 690.41(B)?
- [ ] What is the maximum PV system voltage? 690.7
- [ ] Is all listed equipment rated for the maximum voltage? 690.7
- [ ] Determine the maximum circuit current for the PV Source and Output Circuit; Inverter Output Circuit; Inverter Input Circuit; and DC to DC Converter Output (refer to inverter documentation). 690.8

System Grounding

- [ ] Are all exposed non-current carrying metal parts of the PV system grounded? 690.43 and 690.47
- [ ] Are the mounting structures or systems used for equipment grounding? 690.43
- [ ] Are the interconnecting devices used for equipment grounding listed and identified? 690.43
- [ ] Are the EGC properly sized and protected if exposed and not smaller than #6? 690.45, 690.46, 690.50, 250.122, 250.120(C)
- [ ] Has the grounding electrode system been installed? 690.47
- [ ] If both are present, has the DC grounding electrode system been bonded to the AC GES? 690.47(A)

Wiring Methods and Disconnecting Means

- [ ] Are the conductor and cable ampacities determined at 125% before adjustment factors? 690.8 (B)
- [ ] How are the PV Source and Output Circuit protected from overcurrent? 690.9
- [ ] Do AC or DC OCPD's have the appropriate voltage, current and interrupt ratings? 690.9
- [ ] Has arc-fault circuit protection been provided for DC source and/or output circuits? 690.11
- [ ] Is a rapid shutdown required and if so, how is it accomplished and identified? 690.12 & 690.56(C)
- [ ] Is the PV disconnect permanently marked and installed in a readily accessible location? 690.13
- [ ] Are the Isolating devices or equipment disconnecting means installed in circuits connected to equipment at a location within the equipment, or within sight and 10 feet of the equipment? (Where the maximum circuit current is greater than 30 amperes an equipment disconnecting means shall be provided for isolation.) 690.15
- [ ] Has the fuse disconnecting means, if required, been installed? 690.15 and 240.40
- [ ] Are PV source or output circuits > 30 volts in a raceway or guarded if readily accessible? 690.31
- [ ] Is single conductor cable used outdoors Type USE-2 or listed & labeled PV wire? 690.31
- [ ] Are PV source or output circuits on or inside a building in a metal raceway and marked? 690.31

Interconnection

- [ ] Has a plaque or directory been installed at each disconnecting means (capable of interconnection) denoting all electric power sources & power production sources? 705.10
- [ ] Has the point of connection to other sources been installed per 705.12?
- [ ] Is the supply side disconnect readily accessible and within 10' of the connection point? 705.11
- [ ] Are the utility interactive inverters connected to the system through a dedicated circuit breaker or fusible disconnecting means? 705.12
- [ ] Does the bus or conductor ampacity comply with 705.12?
- [ ] Have all the required labels been applied? (See separate label list.)

CONTRACTOR

WOLF RIVER ELECTRIC

Wolf RIver Electirc
Address:101 Isanti Parkway
NE, Isanti, MN 55040
Phone number: (763) 229-6662
E-mail: contact@wolfriverelectric.com

PV INSPECTION CHECKLIST

ENGINEERINC
Drawn by:New@engineerinc.io
DATE: 03/24/2022

Project Name:
Susan and Mark Boyd
Property Adress:
42703 260th Ln
Aitkin, MN 56431

Project: PV SYSTEM
Scale: AS INDICATED

D 15.0