

Recreation Project

207 Market St
Saugerties, NY, 12477

5.1 kW DC

Photovoltaic Solar Array

Homeowner	System Owner	AHJ
Recreation 207 Market St Saugerties, NY 12477	Saugerties Parks Recreation	Town of saugerties 4 High Street, Saugerties, NY 12477

DIRECT ENERGY SOLAR
28 Industrial Drive,
Middletown, NY, 10941

October 11, 2016

REVISIONS



Project Scope:
To install 20 Kyocera 255W Modules and 20 Enphase M215 Microinverter Inverter(s)

Governing Codes:
2008 National Electric Code
2010 New York State Residential Building Code
Underwriters Laboratories (UL) Standards
OSHA 29 CFR 1910.269
ASCE-7-10



Index of Pages:
TS Title Sheet
PV-1.1 Attachment Detail
PV-2 Electrical Diagram
PV-3 Electrical Calculations
PV-4 String and Conduit Layout
PV-5 Equipment Ratings & Signage

Recreation PROJECT
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UTILITY ACCT#-

GENERAL NOTES:

PREPARED BY:

TITLE SHEET

TS

ROOF : 1

PITCH : 18°
 AZIMUTH : 258°
 MODULES : 20

Roof Type: Asphalt Shingle

Roof Support: 2x8 Truss

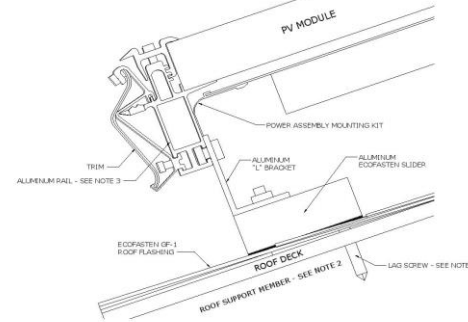
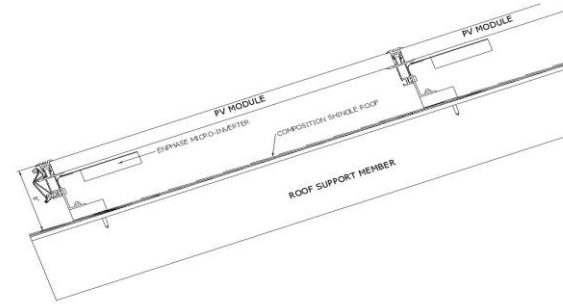
SYSTEM DETAILS

Module Weight	838 lbs
Racking Weight	372 lbs
Micoinverter Weight	88 lbs
System Weight	1298 lbs
System Square Footage	354 sq ft
System Distributed Load	3.66 psf
Racking max attachment span	48 in
Lag Screw Thread Depth	2.25 in
Point Load Max Spacing	48 in
Number of Roof Attachments	59
Max Allowable Rail Overhang	16 in

SYSTEM CONDITIONS

Building Height (h)	18 ft
Building Least Horizontal (H)	ft
Year Building Built	0
Basic Wind Speed (V)	90 mph
Snow Load	40 psf
Roof Zone	3
Effective Roof Area [sq ft] (E)	50

TYPICAL SECTION



Note 1: Use 5/16" x 4" Hex Head Stainless Steel Lag Screws
 Note 2: See Roof Details Table
 Note 3: Unirac SFM Racking

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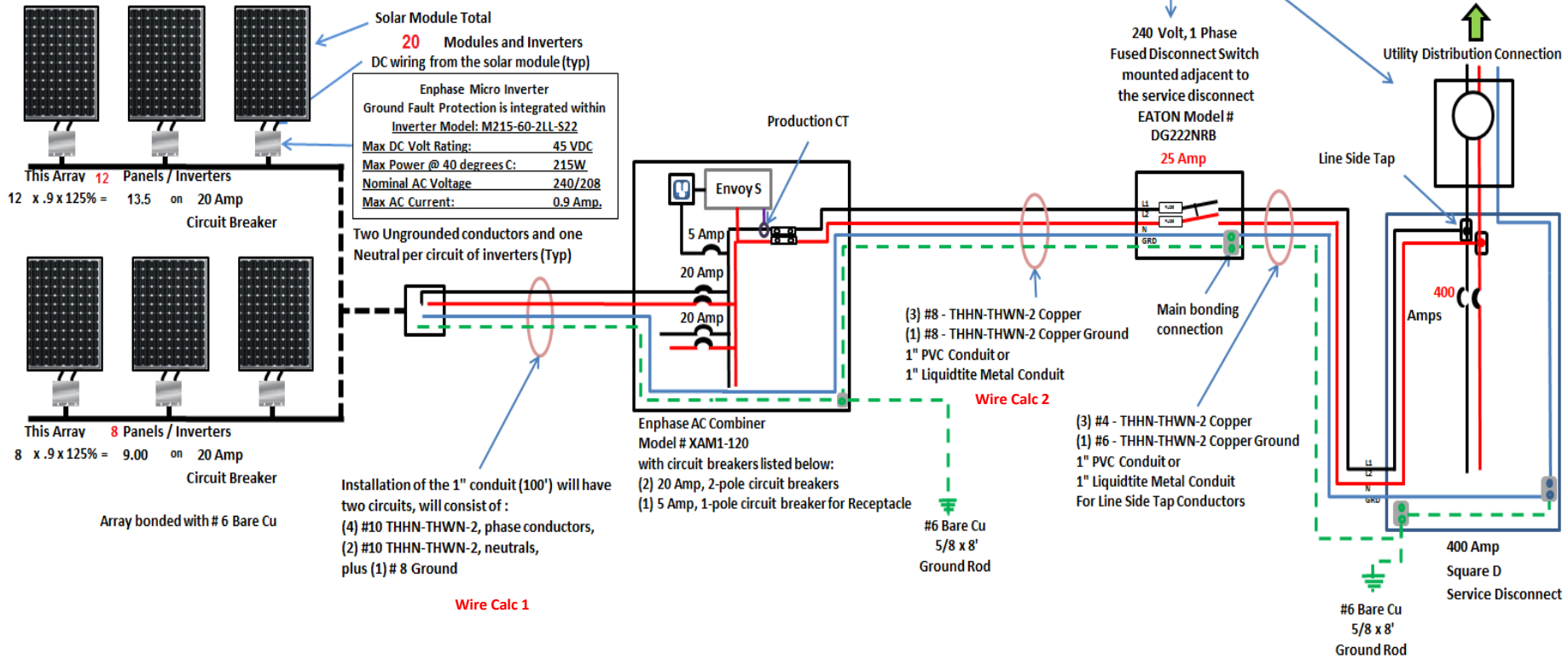
ATTACHMENT
 DETAIL

PV-1.1

Racking and Structural Notes:

Electrical Diagram for Recreation - 5.1 kW DC Photovoltaic Solar Array

Frank Grecco Memorial
207 Market St.
Saugerties, NY 12477



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ELECTRICAL - 3 Line

PV-2

Electrical Diagram for Recreation - 5.1 kW DC Photovoltaic Solar Array

Calculation for PV Breaker				
Calculation for Main PV Breaker & Circuits				
System Current =	0.9	x	20	= 18 A
Design Amperage =	18	x	125%	= 22.5 A
Main Buss Rating =	200	x	120%	= 240 A
Existing Main Breaker =	200 A			
Max Solar Breaker =	240	-	200	= 40 A
Circuit # 1 =	12	X	0.9 x 125% =	13.5 A
Circuit # 2 =	8	X	0.9 x 125% =	9 A

Electrical Notes
1) All equipment to be listed and labeled for its application.
2) All conductors shall be copper, rated for 90C and wet environment, unless otherwise noted.
3) Working clearances around al new and existing electrical equipment shall comply with NEC110.26
4) All wire terminations shall be appropriately labeled and readily visible.
5) Module grounding clips to be installed between module frame and module support rail, per grounding clip manufacturers instruction.
6) Module Support rail to be bonded to continuous copper GEC via WEEB lug per NEC 690.4(C).
7) If used PV power source breaker to be located at bottom of bus per NEC 690.64(B)(7).
8) AC combiner panels shall be labeled as "Inverter AC Combiner Panel".
9) Listing agency name and number to be indicated on inverters and modules per NEC 110.3(B)
10) PV power source breaker to be suitable for backfeed per NEC 690.64(B)(5).

PV Circuit Conductors
AC Combiner Panel to PV Array Wire Calc 1
Minimum #10 AWG Cu
WIRE SIZING CALCULATION
 2011/2014 NEC Article 310
 Full Load Amperage : 10.8
 Source Voltage : 240
 Length of Run (Feet) : 100
 Load Duty : Continuous
 Conductor Type : THWN-2
 Conductor Material : Copper
 Conductor Location : Dry or Wet
 Conductor Insulation Temperature : 90 °C
 Rooftop Installation: NEC 310.15(B)(3)(c)
 Distance Above Roof : Above 13 mm to 90 mm [above 1/2 inch to 3 1/2 inch]
 Average Outside Temp : 90 Deg. F 32.2 Deg. C
 Temperature Adder : 40 Deg. F 22 Deg. C

 Adjusted Ambient Temperature : 130.0 Deg. F 54.2 Deg. C
 Terminal Temperature Rating : 60 °C
 Circuit Type : Single Phase 3 Wire (2 phase conductors & neutral)
 Qty. of Circuit Current-Carrying Conductors : 2
 Additional Current-Carrying Conductors : 2

 Total Qty. Current-Carrying Conductors : 4
 Conductor Requirement:
 Full Load Amps : 10.8
 Load Duty Multiplier : 1.25
 Ambient Temp. Multiplier . : 1.32
 Qty. Conductors Multiplier : 1.25

 Required Conductor Ampacity: 22.28
 Terminal Requirement:
 Full Load Amps : 10.8
 Load Duty Multiplier : 1.25

 Required Terminal Ampacity : 13.5
 Selected Conductor:
 Conductor Ampacity : 40.0
 Ambient Temp. Derate : 0.76
 Qty. Conductors Derate : 0.8

 Adjusted Ampacity : 24.32
SELECTED CONDUCTOR SIZE : 10 Awg
 2 x Ohms/MilFt x Length x Amps 2 x 1.24 x 100 x 22.28
 VD = = 2.68
 1000 x Qty Wires per Phase 1000 x 1
 Volts At Load Terminals..... : 237.32
Actual Percent Voltage Drop . : 1.12

PV Circuit Conductors
Interconnection: LST Wire Calc 2
Minimum #8 AWG
#4 AWG for 60 degree rating to first disconnect
WIRE SIZING CALCULATION
 2011/2014 NEC Article 310
 Full Load Amperage : 18
 Source Voltage : 240
 Length of Run (Feet) : 30
 Load Duty : Continuous
 Conductor Type : THWN-2
 Conductor Material : Copper
 Conductor Location : Dry or Wet
 Conductor Insulation Temperature : 90 °C
 Ambient Temperature : 26-30 °C = 78-86 °F
 Terminal Temperature Rating : 60 °C
 Circuit Type : Single Phase 3 Wire (2 phase conductors & neutral)
 Qty. of Circuit Current-Carrying Conductors : 2
 Conductor Requirement:
 Full Load Amps : 18.0
 Load Duty Multiplier : 1.25
 Ambient Temp. Multiplier . : 1.15
 Qty. Conductors Multiplier : 1.0

 Required Conductor Ampacity: 25.88
 Terminal Requirement:
 Full Load Amps : 18.0
 Load Duty Multiplier : 1.25

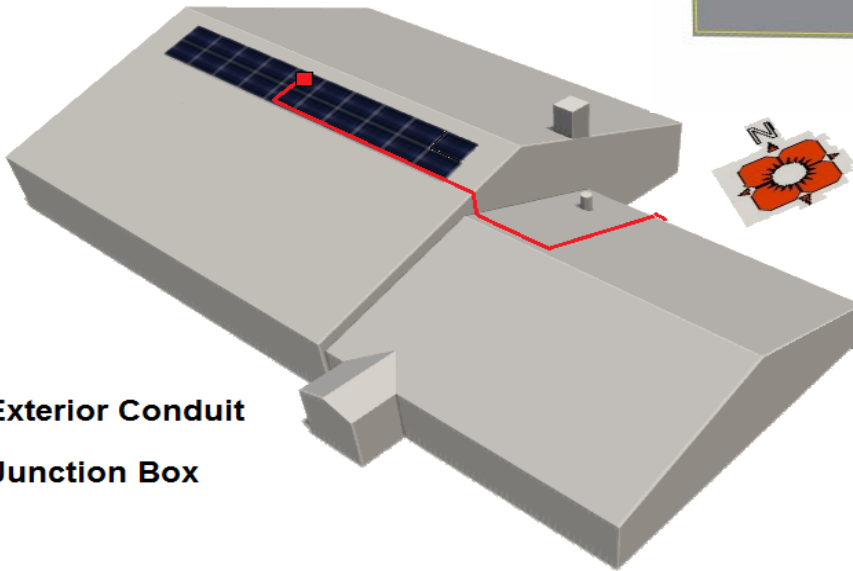
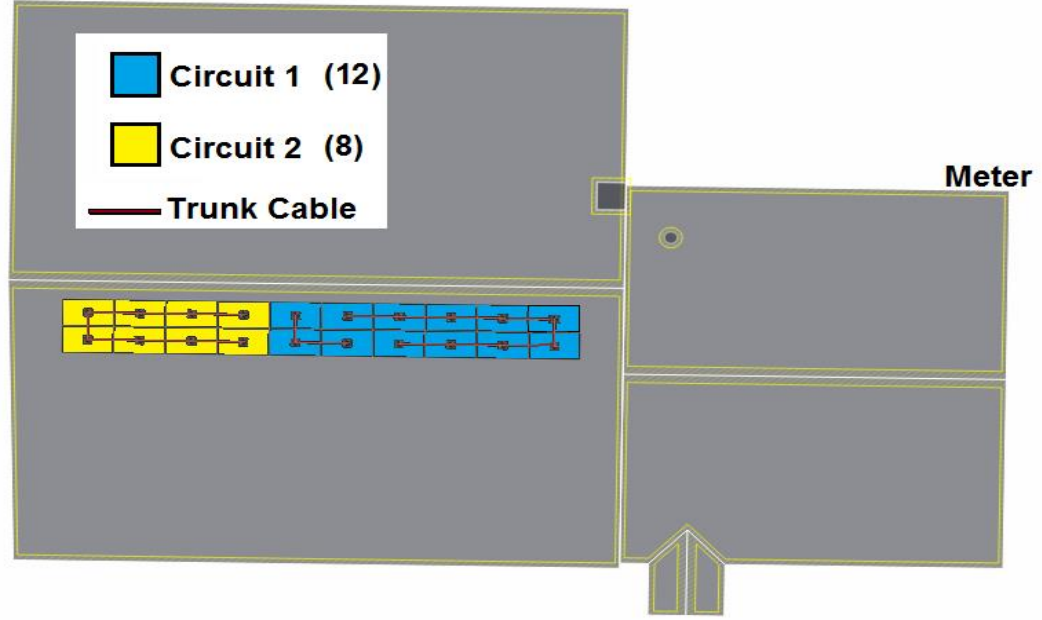
 Required Terminal Ampacity : 22.5
 Selected Conductor:
 Conductor Ampacity : 55.0
 Ambient Temp. Derate : 0.87
 Qty. Conductors Derate : 1.0

 Adjusted Ampacity : 47.85
SELECTED CONDUCTOR SIZE : 8 Awg
 2 x Ohms/MilFt x Length x Amps 2 x 0.778 x 30 x 25.88
 VD = = 0.84
 1000 x Qty Wires per Phase 1000 x 1
 Volts At Load Terminals..... : 239.16
Actual Percent Voltage Drop . : 0.35

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ELECTRICAL	
PV-3	

String and Conduit Layout

Reviewed by: Seth Cisco (610) 283-3112



— Exterior Conduit

■ Junction Box

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ELECTRICAL

PV-4

PV Module Ratings @ STC	
Module Make	Kyocera
Module Model	KD255GX-LFB2
Max Power-Point Current (Imp)	8.39
Max Power-Point Voltage (Vmp)	30.40
Open-Circuit Voltage (Voc)	37.60
Short-Circuit Current (Isc)	9.09
Max Series Fuse (OCPD)	15.00
Maximum Power (Pmax)	255.00
Max Voltage	600.00
Voc Temp Coeff (%Voc/C)	-0.36

Inverter Ratings	
Inverter Make	Enphase
Inverter Model	M215-60-2LL-S22
Max DC Voltage Rating	45
Max Power @ 40 Degrees C	215
Nominal AC Voltage	240/208
Max AC Current	1
Max OCPD Rating	20

Signage Requirements

- 1) Red Background
- 2) White Lettering
- 3) Min 3/8" Letter Height
- 4) All Capital Letters
- 5) Arial or Similar Font
- 6) Suitable for environment installed

**WARNING: PHOTOVOLTAIC
POWER SOURCE**

**SOLAR CIRCUITS ONLY DO NOT
ADD CIRCUITS TO THIS PANEL**

**PHOTOVOLTAIC SYSTEM EQUIPPED WITH
RAPID SHUTDOWN**

WARNING
INVERTER OUTPUT CONNECTION. DO NOT RELOCATE
THIS OVERCURRENT DEVICE

WARNING
DUAL POWER SOURCE SECOND SOURCE
IS PHOTOVOLTAIC SYSTEM

SOLAR PV LOADCENTER
5.1 kW DC Solar Array
240 VOLT AC SYSTEM
INSTALLED COMPONENTS
20 Kyocera 255W Modules
20 Enphase M215 Microinverter Inverters
CIRCUIT CALCULATIONS
System Current = 0.9 X 20 = 18 Amps
Design Amperage = 18 X 125% = 22.5 Amps
Circuit # 1 = 12 Inverters 0.9 x 1.25 13.5
Circuit # 2 = 8 Inverters 0.9 x 1.25 9

Installed By: Direct Energy Solar October, 2016

WARNING
ELECTRICAL SHOCK HAZARD
**DO NOT TOUCH TERMINALS!
TERMINALS ON BOTH LINE AND
LOAD SIDES MAY BE ENERGIZED
IN THE OPEN POSITION**

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EQUIPMENT
RATINGs AND
SIGNAGE

PV-5