

1. "Such variance ... will serve not merely as a convenience to the applicant, but [is] necessary to alleviate some demonstrable hardship or difficulty so great as warrant a variance under the circumstances."
 - a. Applicant is seeking to reduce the cost of electricity that his home requires to run in a reasonable fashion. The only way to reduce the size of said power bills is for the applicant to generate power at the location of the residence instead of purchasing it from the local utility company. As such the addition of a power generating system [solar] is required for the applicant to reduce the hardship of the electric bills.
2. The "special circumstances, hardship, or difficulty [do not] arise out of a misunderstanding or mistake..."
 - a. The applicant did not have a misunderstanding or made a mistake regarding the cost of electricity and the power bills associated with it.
3. "Such variance from ... the strict application of the terms of [the Zoning Ordinance] ... are in harmony with its general purposes and intents ..."
 - a. The power generating system [rooftop] solar will be installed in such a way that is both aesthetically appealing and non-disruptive to the overall aesthetic of the area. This is in line with the general purpose and intent of the Zoning Ordinance.
4. "The special circumstances, hardship, or difficulty applicable to the property are [not] self-imposed by the property owner, or predecessor..."
 - a. A certain amount of power is required for a residence to operate in a manner which is considered normal and reasonable. This requirement is by the nature of the residence and not through the intentional actions of the homeowner outside the normal power consumption of living in the residence.
5. "Because of special circumstances applicable to the property, including its size, shape, topography, location, or surroundings, the strict application of the zoning ordinance will deprive such property of privileges enjoyed by other property of the same classification in the same zoning district."
 - a. Other properties within the same zoning classification have been allowed to have solar power systems installed on their rooftops. This was primarily allowed since the profile of the roof allowed for the solar modules to be hidden from view through various means such as an existing parapet wall on a flat roof section of the home.
 - b. The applicant's property does not feature any rooftops that would allow for a similar less-visible installation, so a similar type of installation would not be possible. If such screening methods were used on the available roof surfaces, it would not only significantly impact the aesthetic of the home in an extremely negative way, but would also negatively affect the production of the solar modules to a degree that would make them ineffective at providing sufficient power generation.
 - c. Therefore for the applicant to enjoy the same privilege of a solar power system on their residence, the power generating modules must be placed in a more visible location.
6. The variance would not "Constitute a grant of special privilege inconsistent with the limitations upon other properties in the vicinity and zone in which such property is located"
 - a. This variance would not violate the primary purpose of such ordinance in that it will be installed in such a way to maintain the aesthetic appeal of the property. Therefore this

variance does not allow for a privilege that is inconsistent with the existing Zoning Ordinance's limitation on other properties in the area.

In addition, it is not possible to decrease the size of the array to minimize the visual impact of the system. The applicant is already using a high efficiency panel with a high power density, as such there is no way to decrease the size of the system while maintain the required levels of power generation needed to service the requirements of the residence.

Additionally, the system is designed to be placed on a particular roof surface to optimize power production in a way that is necessary for the electrical needs of the home. To place the modules on a different roof surface would negatively affect the production of the system and require additional modules.

As such, due to the required location of the module's placement, it is not a viable option to screen the modules with either plant life or manmade screens as the screening will cause significant shading to the array. The adjacent lot is at a higher elevation with the lot line relatively close to the roof where the solar modules are being placed. If a screen either man-made or natural (ie trees) they would have to be placed close to the roof in question to remain on the applicant's yard – additionally they would need to be sufficiently high to a point to block their visibility from the adjacent lot, but in turn would also block solar access due to their height and relative proximity to that roof.

Below: Applicant lot is at a lower elevation on the side of the solar array.



Below: If natural/man made barrier were to be high enough to visually screen the modules, it would also shade the modules and significantly reduce production.



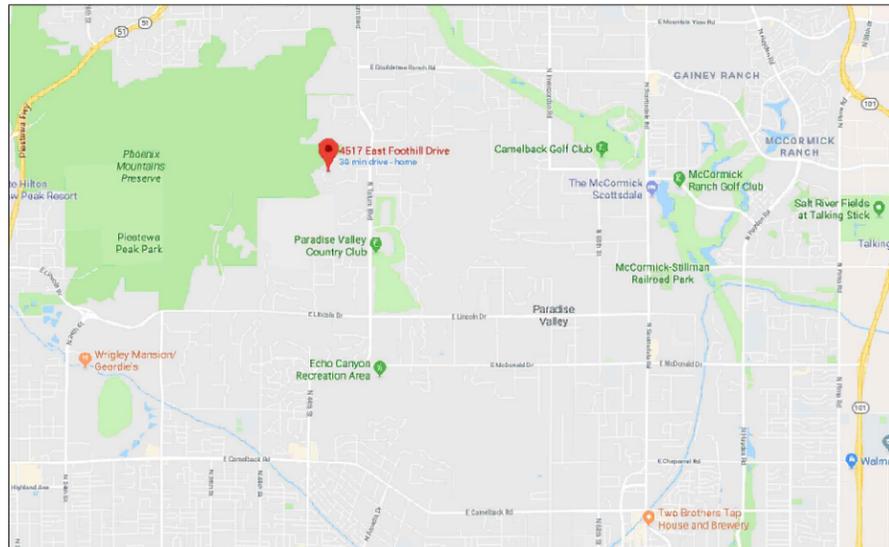
Additionally a ground mounted array is not an option due to the available space and topography of the lot. For one, there is significant tree coverage of the lot which would need to be removed in order to provide acceptable solar access and would significantly impact the natural aesthetic of the lot. Additionally there is only one location that would provide sufficient space for a ground mounted array without being in the front yard or setbacks. However, said area features a natural wash and bridge which cannot be build on or backfilled. Therefor there are no locations in which the array can be constructed on the ground.

Below: Natural wash/bridge in the available ground space.



Finally, other solar generating options are not viable for this property. A common suggestion is solar roofing tiles which replace the existing roofing tiles. However these tiles are significantly less production

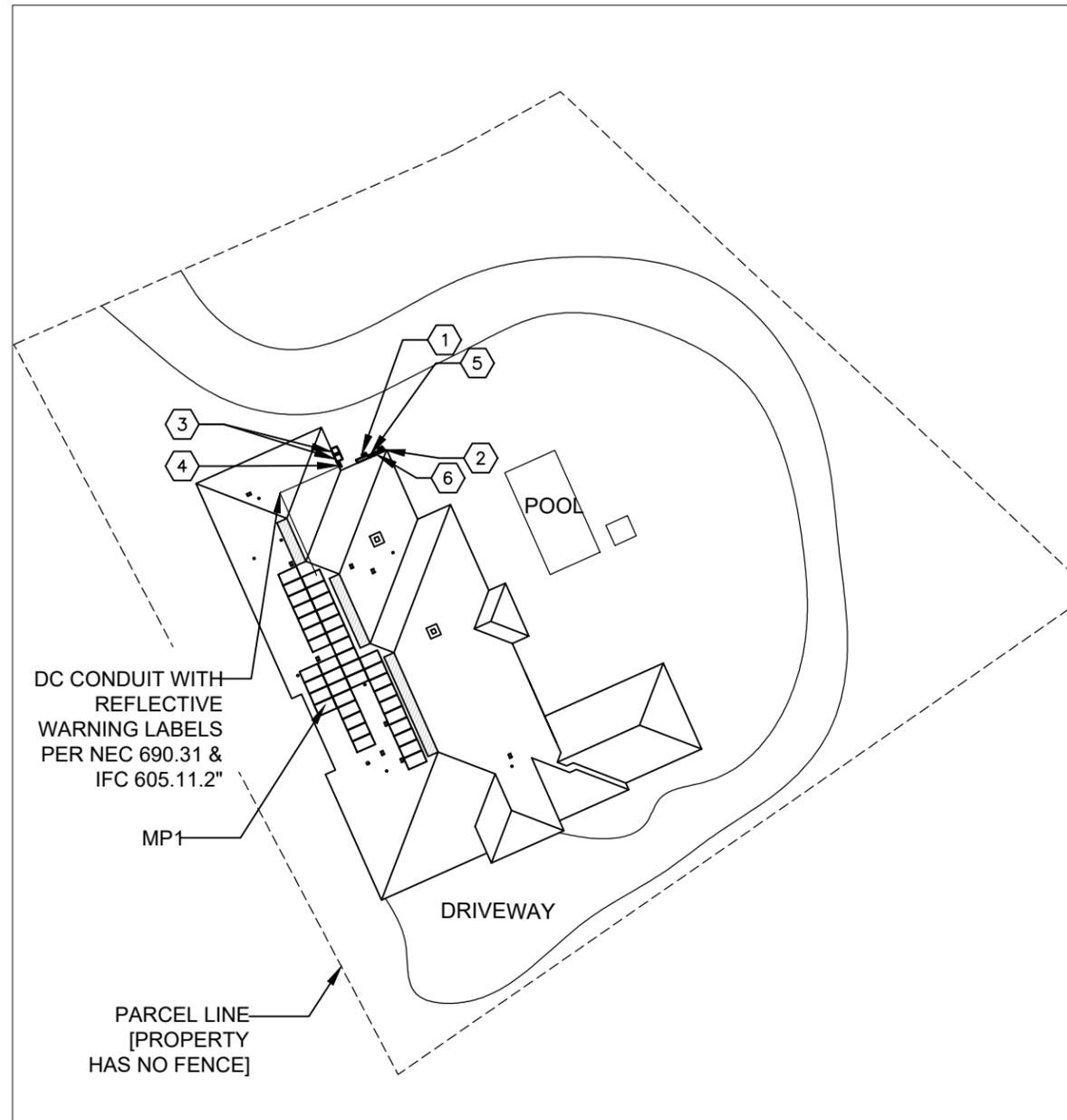
per square foot which would increase the amount of square footage needed to achieve the required system size, thus increasing the visual impact further. Additionally, since there is no air flow between the surface of the roof and the module itself, the modules suffer from overheating, especially in the Arizona desert. Our experience has shown that these overheating issues reduce the production of the system significantly and in many cases can result in an electrical failure which can lead to damage or fire to the home. While these tiles have been popularized by more forward facing companies such as Tesla, many of the above mentioned issues and safety concerns are why these tiles are almost never used in Arizona or have yet to be released.



SITE LOCATION



AERIAL VIEW



SITE PLAN

SCOPE OF WORK

TO INSTALL A PHOTOVOLTAIC (PV) SYSTEM AT THE Nute, Howard Residence

LOCATED AT
4517 E Foothill Drive
Paradise Valley , AZ 85253

THE POWER GENERATED BY THE PV SYSTEM WILL BE INTERCONNECTED WITH THE UTILITY GRID THROUGH THE EXISTING ELECTRICAL SERVICE EQUIPMENT.

SHEET INDEX

- PV1 SITE MAP / SITE PLAN
- PV2 ROOF PLAN
- E1 THREE LINE DIAGRAM
- L1 LABELING
- ATTACHMENTS: CUT-SHEETS

GOVERNING CODES

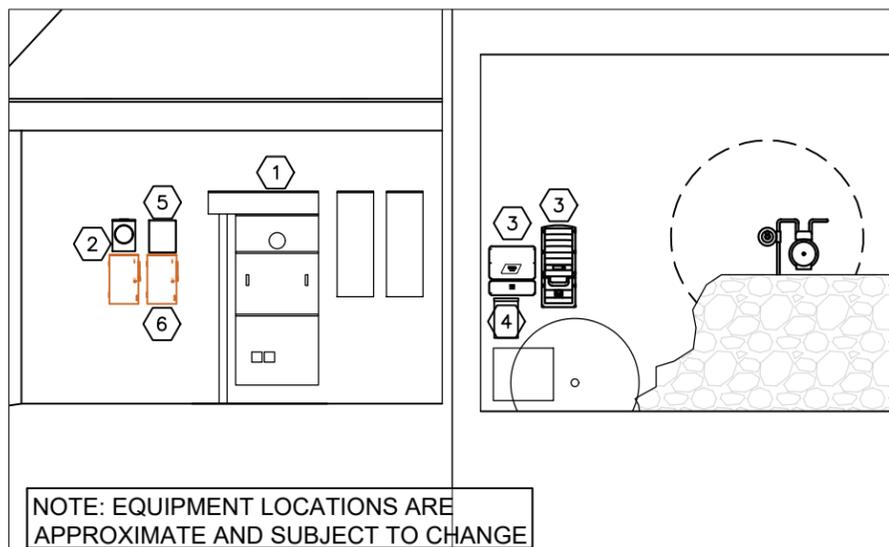
- LOCAL JURISDICTION - Paradise Valley
- UTILITY - APS
- 2014 NATIONAL ELECTRICAL CODE
- 2015 INTERNATIONAL BUILDING CODE
- 2015 INTERNATIONAL RESIDENTIAL CODE
- 2015 INTERNATIONAL FIRE CODE
- CITY AMENDMENTS

SITE PLAN NOTES

- 1 (EXISTING) ELECTRICAL SERVICE ENTRANCE 400A SPLIT MAIN SERVICE PANEL WITH TWO 200A MCB and UTILITY REVENUE METER
- 2 (NEW) DEDICATED PV SYSTEM KWH METER and UTILITY DISCONNECT SWITCH
- 3 (NEW) INVERTER WITH INTEGRATED DC DISCONNECT
- 4 (NEW) COMBINER PANEL
- 5 (NEW) TAP BOX
- 6 (NEW) FUSED DISCONNECT

EQUIPMENT SUMMARY

- 39 Hanwha Q CELLS Q.PEAK G4.1 305
- 01 SolarEdge SE7600H-US
- 01 SolarEdge SE7600H-US
- 01 Milbank 100A Meter Base
- 39 SolarEdge Power Optimizer P320
- 01 EATON, 100A, DG223URB, 2P
- 01 EATON, 100A, DG223NRB, 2P, Fused
- 01 EATON BR48L125RP (2 BREAKERS)



EQUIPMENT ELEVATION

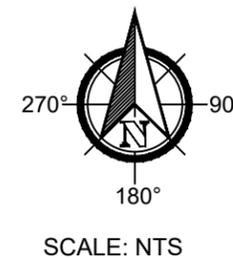
Project Manager:
Kaleina Eden

ONE ARRAY

MP1	PITCH: 18	AZIMUTH: 245
	MATERIAL: Metal Roof	
	MOUNTING: Flush Mounted	
	3FT FIRE CODE ACCESS PATH	

ROOF LEGEND	
	GAS VENT
	T-TOP VENT
	DORMER VENT

PARCEL INFO	
PARCEL #:	169-11-069
SQUARE FOOTAGE:	5,063
CONST. YEAR:	1994



NOTE:

1. UTILITY HAS 24-HR UNRESTRICTED ACCESS TO ALL PHOTOVOLTAIC SYSTEM COMPONENTS LOCATED AT THE SERVICE ENTRANCE.
2. WORKSPACE IN FRONT OF THE AC ELECTRICAL SYSTEM COMPONENTS SHALL BE IN ACCORDANCE WITH APS & NEC REQUIREMENTS. FOR APS REQUIREMENTS, REFERENCE SECTION 300 OF THE APS ESRM & SECTION 8.2 OF THE APS INTERCONNECTION REQUIREMENTS.
3. REFERENCE SECTION 301.15 OF THE APS ESRM FOR ELECTRIC METER SEPARATION BETWEEN WATER & GAS.

SHEET:
PV1

DATE:
9/28/2018

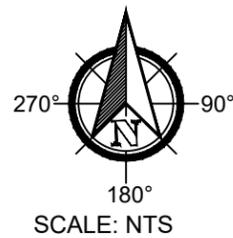
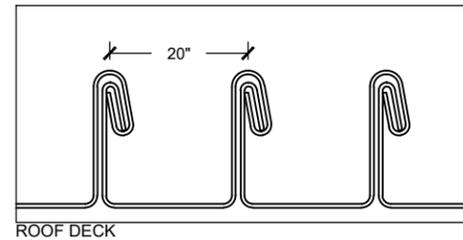
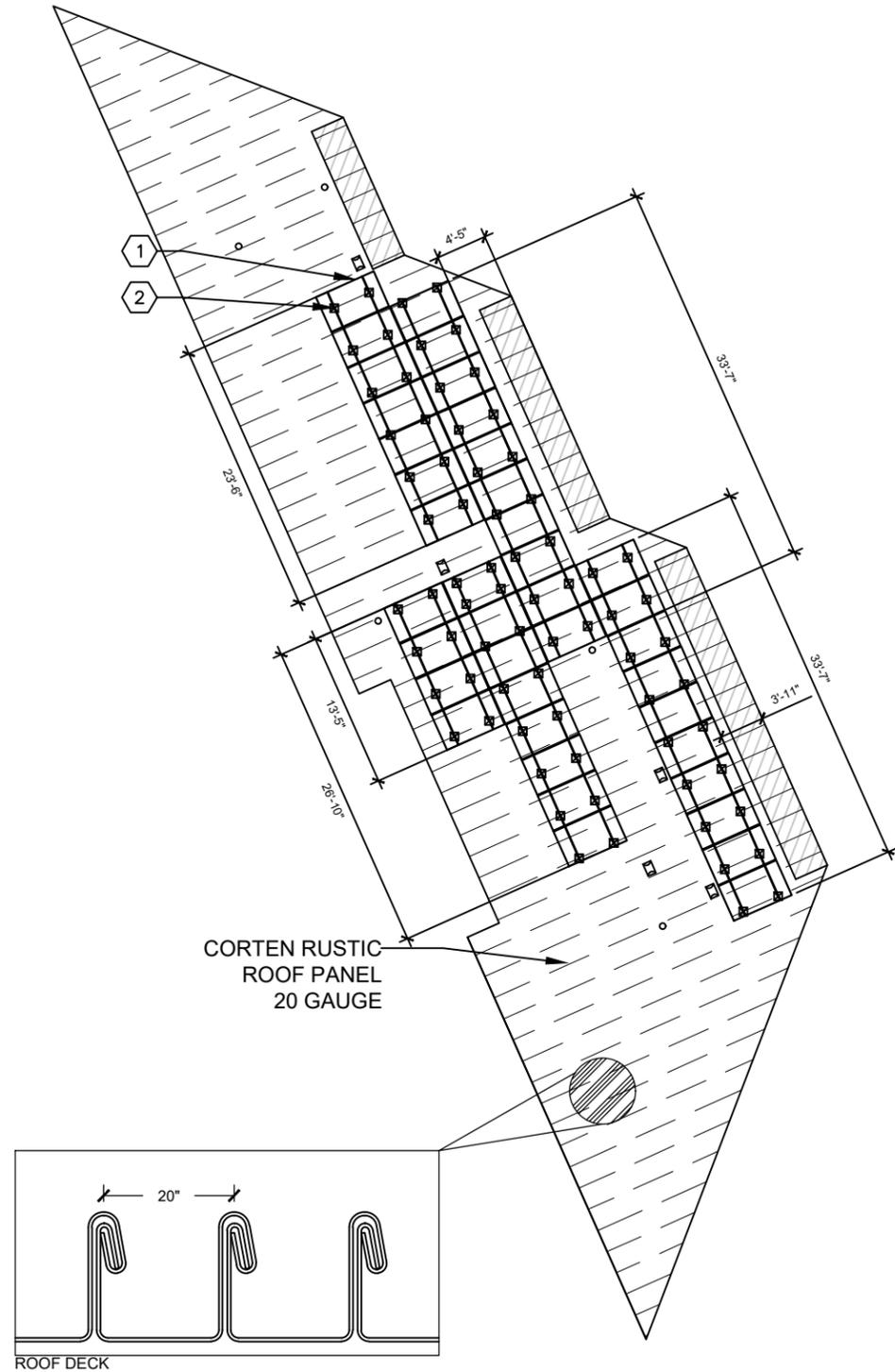
Revision: 0
Designer: Alex Meehl

TITLE: SITE PLAN 15.200 kW-AC
Nute, Howard Residence 11,895 W-DC
4517 E Foothill Drive, Paradise Valley , AZ 85253

Sun Valley Solar Solutions LLC
3225 N Colorado St. Chandler, AZ 85225
T: (480) 689-5000 / F: (480) 659-3429
www.sunvalleysolar.com



ROOF PLAN



NOTE: EXPOSED PV ROOFTOP CONDUCTORS THAT ARE NOT LOCATED UNDER THE ARRAY MODULES, SHALL BE INSTALLED IN A LISTED RACEWAY, AND SHALL INCLUDE LISTED JUNCTION BOXES AT BOTH ENDS OF THE RACEWAY TO TRANSITION FROM EXPOSED CONDUCTORS TO THE LISTED RACEWAYS. 2011 NEC ARTICLE 690.31(A) AND (B) EXCEPTION

PITCH: 18 AZIMUTH: 245
 MP1 MATERIAL: Metal Roof
 MOUNTING: Flush Mounted

ROOF LEGEND	
	GAS VENT
	T-TOP VENT
	DORMER VENT

ROOF PLAN NOTES:

- ① (NEW) PHOTOVOLTAIC PANEL ARRAY MOUNTED FLUSH TO ROOF WITH 18DEG PITCH
- ② RACKING INFORMATION
 - EVEREST MOUNTING RAIL
 - S-5! | S-5-S
 - TRUSS SPACING = 20" O.C.
 - PENETRATION POINTS = 4' SPACING
 - MOUNTING DETAIL

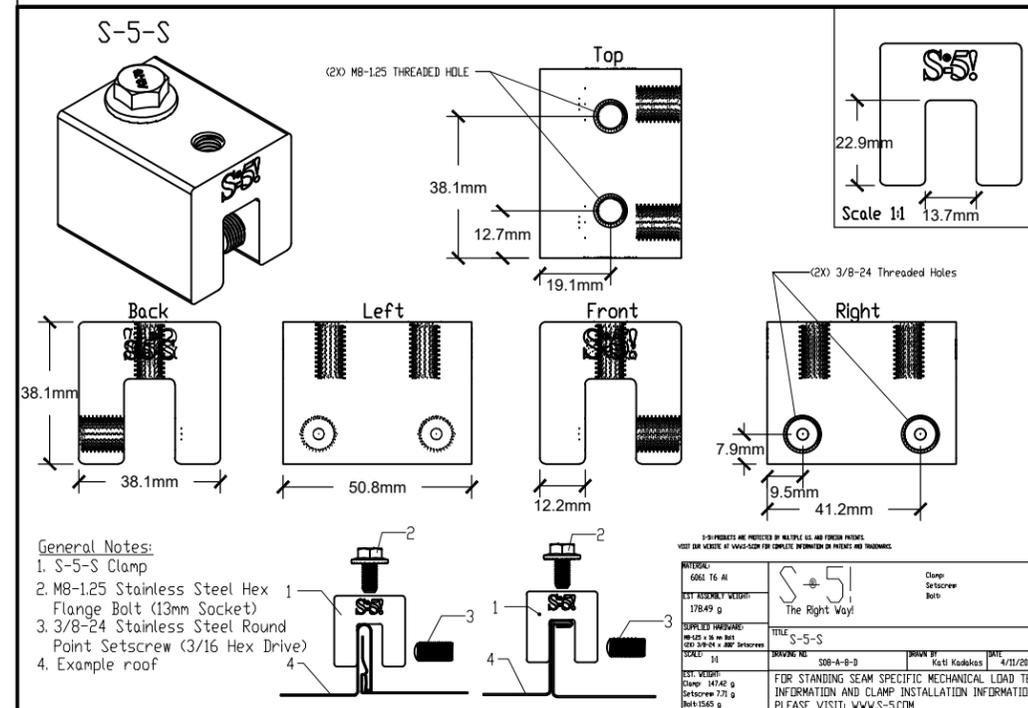
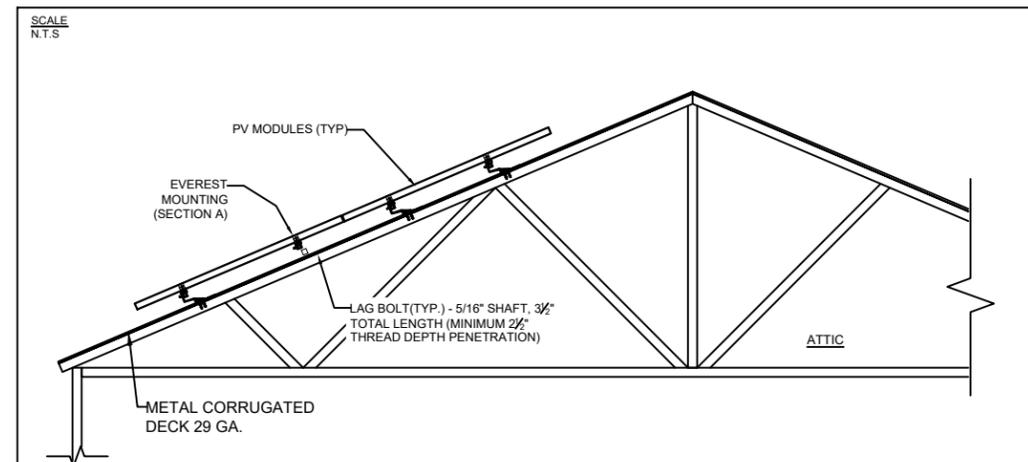
ROOF 1 CALCULATIONS:

DESIGN PER ASCE 7-10 2.4.1 & IBC 2015
 SOLAR MODULE WEIGHT = 41.45 LBS.
 EXPOSURE CATEGORY = B
 BASIC WIND SPEED = 115 MPH

STRUCTURAL NOTES:

- 1) TOTAL ASSEMBLY WEIGHT: 1880.5 LBS
- 2) TOTAL AREA COVERED BY MODULES: 735.6 FT2
- 3) DEAD LOAD = 1880.5 / 735.6 = 2.6 LBS/FT2
- 4) POINT LOAD CALCULATIONS [# OF POINTS (72)] - 26.1 lb/point
- 5) TOTAL DESIGN LOAD (DOWNFORCE) = 14.0 psf
- 6) TOTAL DESIGN LOAD (UPFORCE) = -28.6 psf

RAILS TO BE BONDED TO GROUND (EGC) - 690.4 (C)
 RAIL SPLICES TO BE ELECTRICALLY BONDED
 FLASHING REQUIRED FOR STANDOFF PENETRATIONS
 FOLLOW MODULE INSTRUCTION ON FRAME MOUNTING POINT



SHEET:
PV2

DATE:
10/10/2018

Revision: 0
 Designer: Alex Meehl

TITLE: ROOF PLAN 15.200 kW-AC
 Nute, Howard Residence 11,895 W-DC
 4517 E Foothill Drive, Paradise Valley, AZ 85253

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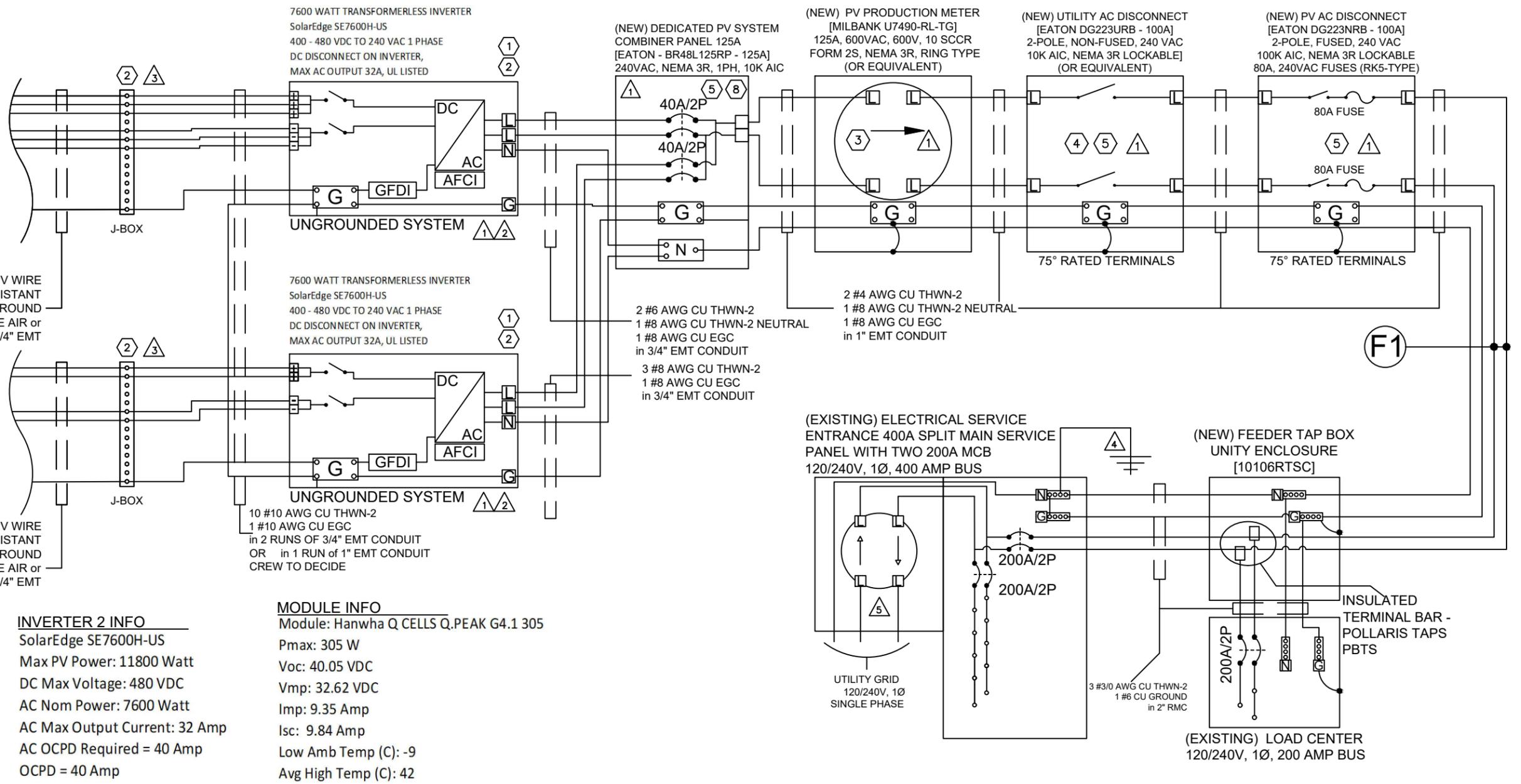
One Array

(SEE ARRAY PAGE)
 PV MODULE = 305 WATTS
 21 MODULES = 6405 WATTS
 1 STRING OF 11 PV MODULES
 1 STRING OF 10 PV MODULES
 ROOF TOP CONDUIT MIN. INSTALL
 1/2" FROM ROOF SURFACE

6 #10 CU PV WIRE
 SUNLIGHT RESISTANT
 1 #10 GROUND
 PV WIRE IN FREE AIR or
 PV WIRE IN 3/4" EMT

(SEE ARRAY PAGE)
 PV MODULE = 305 WATTS
 18 MODULES = 5490 WATTS
 1 STRING OF 18 PV MODULES
 ROOF TOP CONDUIT MIN. INSTALL
 1/2" FROM ROOF SURFACE

4 #10 CU PV WIRE
 SUNLIGHT RESISTANT
 1 #10 GROUND
 PV WIRE IN FREE AIR or
 PV WIRE IN 3/4" EMT



INVERTER 1 INFO
 SolarEdge SE7600H-US
 Max PV Power: 11800 Watt
 DC Max Voltage: 480 VDC
 AC Nom Power: 7600 Watt
 AC Max Output Current: 32 Amp
 AC OCPD Required = 40 Amp
 OCPD = 40 Amp

INVERTER 2 INFO
 SolarEdge SE7600H-US
 Max PV Power: 11800 Watt
 DC Max Voltage: 480 VDC
 AC Nom Power: 7600 Watt
 AC Max Output Current: 32 Amp
 AC OCPD Required = 40 Amp
 OCPD = 40 Amp

MODULE INFO
 Module: Hanwha Q CELLS Q.PEAK G4.1 305
 Pmax: 305 W
 Voc: 40.05 VDC
 Vmp: 32.62 VDC
 Imp: 9.35 Amp
 Isc: 9.84 Amp
 Low Amb Temp (C): -9
 Avg High Temp (C): 42

LABEL REQUIREMENTS

- 1 -LABEL "PHOTOVOLTAIC ARRAY DC DISCONNECT SWITCH" PER NEC 690.14(C)(2). LABEL WITH OPERATING CURRENT, OPERATING VOLTAGE, MAX SYSTEM VOLTAGE AND SHORT CIRCUIT CURRENT PER NEC 690.53.
- 2 -LABEL WARNING SIGN PER NEC 690.35 READING "WARNING - ELECTRIC SHOCK HAZARD - THE DC CONDUCTORS OF THIS PHOTOVOLTAIC SYSTEM ARE UNGROUNDED AND MAY BE ENERGIZED"
- 3 -LABEL "PHOTOVOLTAIC POWER SYSTEM DEDICATED KWH METER"
- 4 -LABEL "PHOTOVOLTAIC SYSTEM AC UTILITY DISCONNECT SWITCH". SWITCH COVER TO BE LOCKABLE. SWITCH TO BE VISIBLE BLADE AND ACCESSIBLE PER UTILITY REQUIREMENTS AND CONFORM TO NEC 705.22.
- 5 -LABEL WARNING SIGN PER NEC 690.17 READING "WARNING - ELECTRIC SHOCK HAZARD - DO NOT TOUCH TERMINALS. TERMINAL ON BOTH THE LINE AND LOAD SIDE MAY BE ENERGIZED IN THE OPEN POSITION".
- 6 -LABEL WARNING SIGN PER NEC 705.12(D)(7) READING "WARNING INVERTER OUTPUT CONNECTION DO NOT RELOCATE THIS OVERCORRECT PROTECTION DEVICE". LOCATE AT OPPOSITE END OF BUS FROM MAIN BREAKER LOCATION
- 7 -LABEL BREAKER "PHOTOVOLTAIC ELECTRIC POWER SOURCE" PER NEC 705.10, AND "BREAKERS ARE BACKFED" PER NEC 705.12 (D)(5). LABELED WITH THE MAX AC OUTPUT OPERATION CURRENT AND THE OPERATING VOLTAGE PER NEC 690.54.
- 8 -LABEL COMBINER PANEL "DEDICATED PHOTOVOLTAIC SYSTEM COMBINER PANEL" AND "LOADS NOT TO BE ADDED TO THIS PANEL"
- 9 -LABEL "BREAKER HAS BEEN DE-RATED PER NEC 705.12 (D)(2)"

SYSTEM REQUIREMENTS

- 1 -EQUIPMENT SHALL BE INSTALLED IN ACCORDANCE WITH THE NEC 2011 690 AND ALL APPLICABLE REQUIREMENTS OF THE SERVING ELECTRIC UTILITY COMPANY AND OF THE LOCAL AUTHORITY HAVING JURISDICTION
- 2 -LISTING AGENCY NAME AND NUMBERS TO BE INDICATED ON POWER INVERTER AND SOLAR MODULES PER NEC 110.3(B).
- 3 -METALLIC CONDUIT SHALL BE USED WITHIN BUILDINGS PER NEC 690.31(E). EMT BONDED PER NEC 110.3(B).
- 4 -GEC TO BE INSTALLED AS REQUIRED BY MANUFACTURER AND NEC 690.47
- 5 -BI-DIRECTIONAL UTILITY METER TO BE INSTALLED BY UTILITY COMPANY

NOTE: SYSTEM DESIGN IN ACCORDANCE WITH THE 2014 N.E.C.

NEUTRAL IS USED EXCLUSIVELY FOR PHASE AND VOLTAGE DETECTION PER NEC 705.95 (B)

SOLAREEDGE OPTIMIZERS FUNCTION AS DISCONNECTING CONDUCTORS TO DE-ENERGIZE PV SOURCE CIRCUITS IN COMPLIANCE WITH NEC SECTION 690.12 (RAPID SHUTDOWN)

FAULT CALCULATIONS	
F1	AVAILABLE = 9,879 AIC
	D = 25'
	F = 1.121
	M = .471
	Isc = 20,955 AIC
	#4 AWG CU CONDUCTORS
CALCULATIONS IN ACCORDANCE WITH NEC 110.9 & 110.10	
*CURRENT LIMITED BY FUSE	

INVERTER 1

PV MODULE = 305 WATTS
 21 MODULES = 6405 WATTS
 1 STRING OF 11 PV MODULES
 1 STRING OF 10 PV MODULES

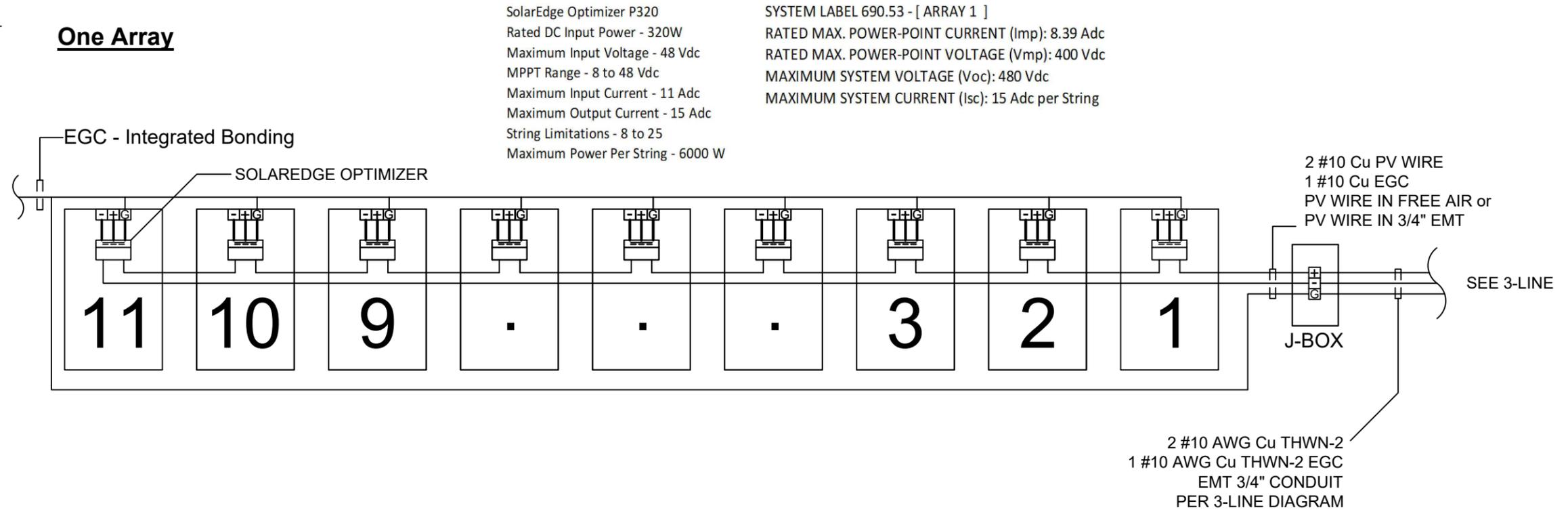
MODULE INFO

Module: Hanwha Q CELLS Q.PEAK G4.1 305
 Pmax: 305 W
 Voc: 40.05 VDC
 Vmp: 32.62 VDC
 Imp: 9.35 Amp
 Isc: 9.84 Amp
 Low Amb Temp (C): -9
 Avg High Temp (C): 42

INVERTER 1 INFO

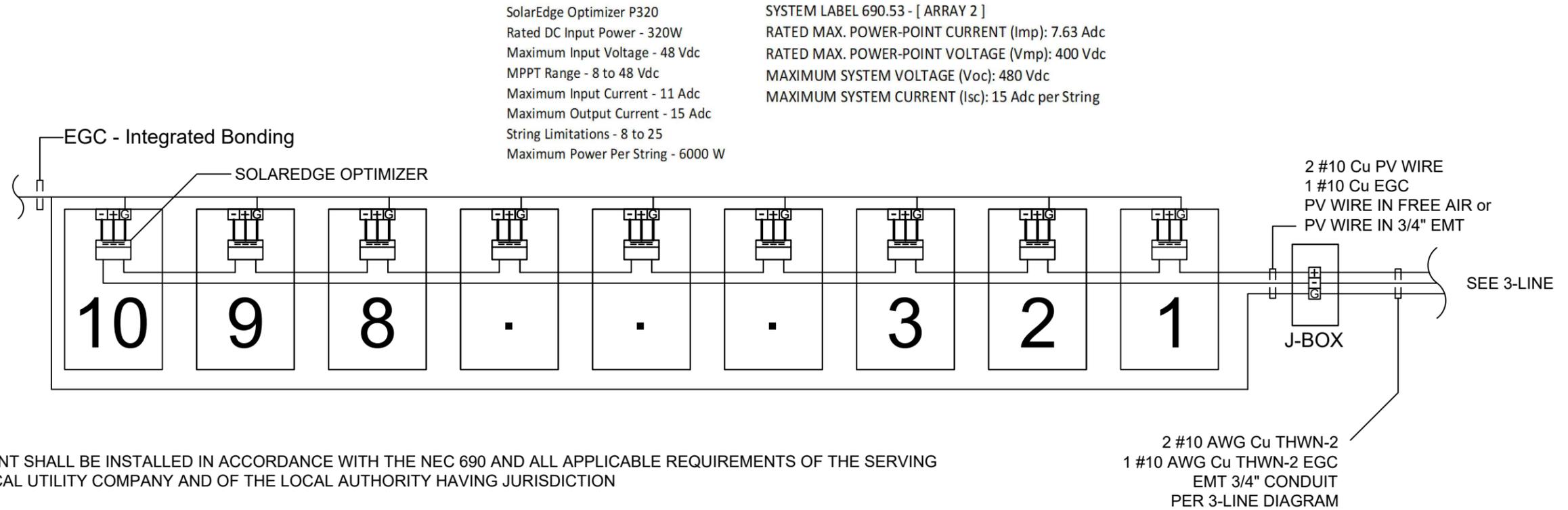
SolarEdge SE7600H-US
 Max PV Power: 11800 Watt
 DC Max Voltage: 480 VDC
 AC Nom Power: 7600 Watt
 AC Max Output Current: 32 Amp
 AC OCPD Required = 40 Amp
 OCPD = 40 Amp

One Array



SolarEdge Optimizer P320
 Rated DC Input Power - 320W
 Maximum Input Voltage - 48 Vdc
 MPPT Range - 8 to 48 Vdc
 Maximum Input Current - 11 Adc
 Maximum Output Current - 15 Adc
 String Limitations - 8 to 25
 Maximum Power Per String - 6000 W

SYSTEM LABEL 690.53 - [ARRAY 1]
 RATED MAX. POWER-POINT CURRENT (Imp): 8.39 Adc
 RATED MAX. POWER-POINT VOLTAGE (Vmp): 400 Vdc
 MAXIMUM SYSTEM VOLTAGE (Voc): 480 Vdc
 MAXIMUM SYSTEM CURRENT (Isc): 15 Adc per String



SolarEdge Optimizer P320
 Rated DC Input Power - 320W
 Maximum Input Voltage - 48 Vdc
 MPPT Range - 8 to 48 Vdc
 Maximum Input Current - 11 Adc
 Maximum Output Current - 15 Adc
 String Limitations - 8 to 25
 Maximum Power Per String - 6000 W

SYSTEM LABEL 690.53 - [ARRAY 2]
 RATED MAX. POWER-POINT CURRENT (Imp): 7.63 Adc
 RATED MAX. POWER-POINT VOLTAGE (Vmp): 400 Vdc
 MAXIMUM SYSTEM VOLTAGE (Voc): 480 Vdc
 MAXIMUM SYSTEM CURRENT (Isc): 15 Adc per String

NOTES

- EQUIPMENT SHALL BE INSTALLED IN ACCORDANCE WITH THE NEC 690 AND ALL APPLICABLE REQUIREMENTS OF THE SERVING ELECTRICAL UTILITY COMPANY AND OF THE LOCAL AUTHORITY HAVING JURISDICTION
- EGC WIRE MUST BE CONTINUOUS AND INSTALLED TO ALLOW PANEL REMOVAL WITHOUT DISRUPTING CONTINUITY. ALL MODULE EGC CONNECTIONS SHALL BE MADE IN ACCORDANCE WITH NEC 690.4(C)
- FOLLOW MANUFACTURER'S SUGGESTED INSTALLATION PRACTICES AND WIRING SPECIFICATIONS.
- CONDUCTORS SHALL BE RATED AND LABELED
- LISTING AGENCY NAME AND NUMBERS TO BE INDICATED ON POWER INVERTER AND SOLAR MODULES PER NEC 110.3(B)
- METALLIC CONDUIT TO BE USED WITHIN BUILDINGS PER NEC 690.31(E). EMT BONDED PER NEC 250.97

SHEET:
E2.1

DATE:
10/10/2018

Revision: 0
 Designer: Alex Meehl

TITLE: ARRAY
 15.200 kW-AC
 Nute, Howard Residence 11,895 W-DC
 4517 E Foothill Drive, Paradise Valley, AZ 85253

Sun Valley Solar Solutions LLC
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 T: (480) 689-5000 / F: (480) 659-3429
 www.sunvalleysolar.com



INVERTER 2

PV MODULE = 305 WATTS
 18 MODULES = 5490 WATTS
 1 STRING OF 18 PV MODULES

MODULE INFO

Module: Hanwha Q CELLS Q.PEAK G4.1 305

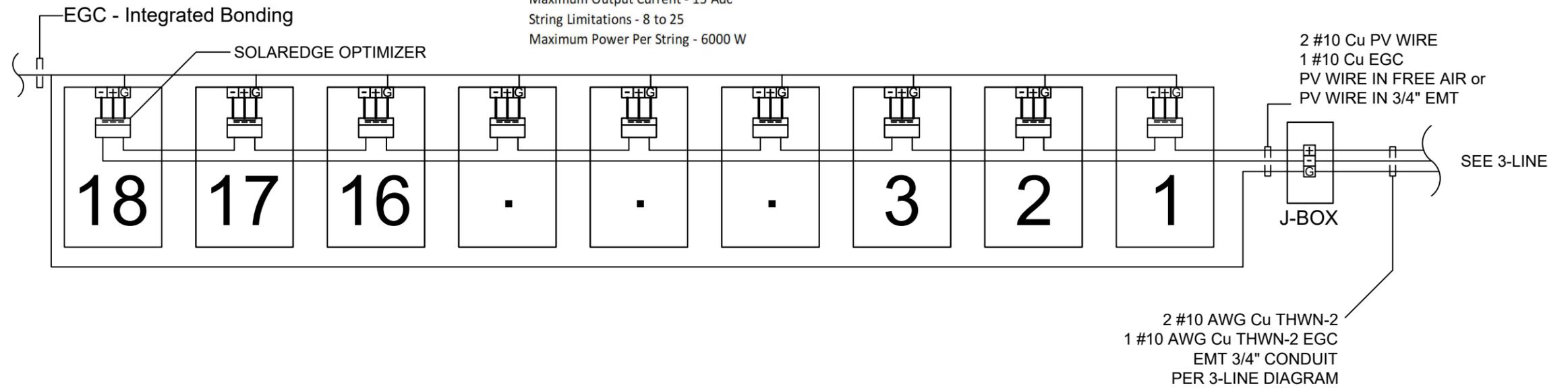
Pmax: 305 W
 Voc: 40.05 VDC
 Vmp: 32.62 VDC
 Imp: 9.35 Amp
 Isc: 9.84 Amp
 Low Amb Temp (C): -9
 Avg High Temp (C): 42

INVERTER 2 INFO

SolarEdge SE7600H-US
 Max PV Power: 11800 Watt
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 AC Nom Power: 7600 Watt
 AC Max Output Current: 32 Amp
 AC OCPD Required = 40 Amp
 OCPD = 40 Amp

SolarEdge Optimizer P320
 Rated DC Input Power - 320W
 Maximum Input Voltage - 48 Vdc
 MPPT Range - 8 to 48 Vdc
 Maximum Input Current - 11 Adc
 Maximum Output Current - 15 Adc
 String Limitations - 8 to 25
 Maximum Power Per String - 6000 W

SYSTEM LABEL 690.53 - [ARRAY 1]
 RATED MAX. POWER-POINT CURRENT (Imp): 13.73 Adc
 RATED MAX. POWER-POINT VOLTAGE (Vmp): 400 Vdc
 MAXIMUM SYSTEM VOLTAGE (Voc): 480 Vdc
 MAXIMUM SYSTEM CURRENT (Isc): 15 Adc per String



NOTES

- EQUIPMENT SHALL BE INSTALLED IN ACCORDANCE WITH THE NEC 690 AND ALL APPLICABLE REQUIREMENTS OF THE SERVING ELECTRICAL UTILITY COMPANY AND OF THE LOCAL AUTHORITY HAVING JURISDICTION
- EGC WIRE MUST BE CONTINUOUS AND INSTALLED TO ALLOW PANEL REMOVAL WITHOUT DISRUPTING CONTINUITY. ALL MODULE EGC CONNECTIONS SHALL BE MADE IN ACCORDANCE WITH NEC 690.4(C)
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- METALLIC CONDUIT TO BE USED WITHIN BUILDINGS PER NEC 690.31(E). EMT BONDED PER NEC 250.97

SHEET:
E2

DATE:
10/10/2018

Revision: 0
 Designer: Alex Meehl

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