Building Codes: 2017 NEC, 2018 IFC, 2018 IRC, 2018 IBC and AHJ Amendments

JIMENEZ, LUIS PV SYSTEM
415 HIGHGROVE DRIVE .
SPRING LAKE, NC, 28390
APN: 01050401 0177 06
JURISDICTION: HARNETT COUNTY (NC)

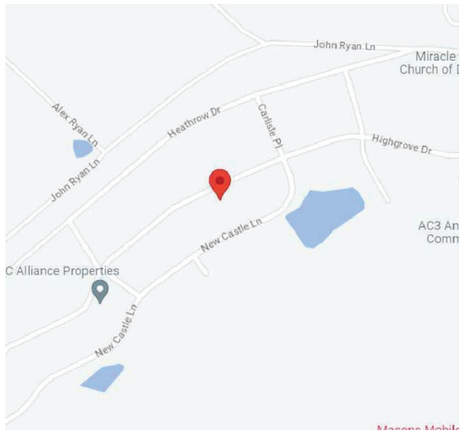
GENERAL INFORMATION

SYSTEM SIZE:	14.400 kW-DC-STC
	11.400 kW-AC
ROOF PITCHED:	45 DEGREES
INVERTER:	(1) SOLAREDGE SE11400H-US W/ S440 OPTIMIZERS
MODULES:	(36) HY-DH108P8-400B
STRINGS:	(1) x 15, (1) x 10, (1) x 11 MODULE SERIES STRINGS
ELECTRICAL SERVICE RATING:	200A (DERATE TO 175A)
PV SYSTEM OVERCURRENT RATING:	60A
PV SYSTEM DISCONNECT SWITCH:	EATON DG222URB (60A / 2P)
ROOF TYPE:	COMP SHINGLE
ROOF FRAMING:	ENGINEERED TRUSS
RACKING/RAILING:	UNIRAC / UNIRAC-NXT

TABLE OF CONTENTS

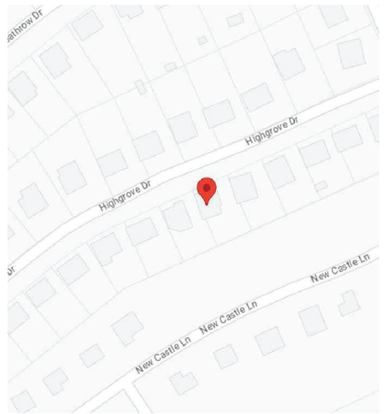
VICINITY MAP

SCALE: NTS



AERIAL MAP

SCALE: NTS



NORTH CAROLINA REGISTERED ENGINEERING COMPANY
CERT. NO. C-3406
STRUCTURAL CAPACITY, PC

ENGINEER SEAL ARE FOR STRUCTURAL ITEMS ONLY

NORTH CAROLINA PROFESSIONAL
SEAL 033700 06/06/2023 ENGINEER
ADRIAN S. DURHAM

NOTES

EQUIPMENT LOCATION

1. ALL EQUIPMENT SHALL MEET MINIMUM SETBACKS AS REQUIRED BY NEC 110.26.
2. WIRING SYSTEMS INSTALLED IN DIRECT SUNLIGHT MUST BE RATED FOR EXPECTED OPERATING TEMPERATURE AS SPECIFIED BY NEC690.31(A),(C) AND NEC TABLES 310.15(B)(2)(A) AND 310.15(B)(3)(C).
3. JUNCTION AND PULL BOXES PERMITTED INSTALLED UNDER PV MODULES ACCORDING TO NEC 690.34.
4. ADDITIONAL AC DISCONNECT(S) SHALL BE PROVIDED WHERE THE INVERTER IS NOT WITHIN SIGHT OF THE AC SERVICING DISCONNECT.
5. ALL EQUIPMENT SHALL BE INSTALLED ACCESSIBLE TO QUALIFIED PERSONNEL ACCORDING TO NEC APPLICABLE CODES.
6. ALL COMPONENTS ARE LISTED FOR THEIR PURPOSE AND RATED FOR OUTDOOR USAGE WHEN APPROPRIATE.

WIRING & CONDUIT NOTES

1. ALL CONDUITS AND WIRE WILL BE LISTED AND APPROVED FOR THEIR PURPOSE. CONDUIT AND WIRE SPECIFICATIONS ARE BASED ON MINIMUM CODE REQUIREMENTS AND ARE NOT MEANT TO LIMIT UP-SIZING.
2. CONDUCTORS SIZED ACCORDING TO NEC 690.8, NEC 690.7.
3. DC WIRING LIMITED TO MODULE FOOTPRINT. MICRO INVERTER WIRING SYSTEMS SHALL BE LOCATED AND SECURED UNDER THE ARRAY WITH SUITABLE WIRING CLIPS.
4. AC CONDUCTORS COLORED OR MARKED AS FOLLOWS: PHASE A OR L1- BLACK, PHASE B OR L-2 RED, OR OTHER CONVENTION IF THREE PHASE, PHASE C OR L3-BLUE, YELLOW, ORANGE, OR OTHER CONVENTION NEUTRAL- WHITE OR GREY IN 4-WIRE DELTA CONNECTED SYSTEMS THE PHASE WITH THE HIGHER VOLTAGE TO BE MARKED ORANGE NEC 110.15.

GENERAL NOTES

1. MODULES ARE LISTED UNDER UL 1703 AND CONFORM TO THE STANDARDS.
2. INVERTERS ARE LISTED UNDER UL 1741 AND CONFORM TO THE STANDARDS.
3. DRAWINGS ARE DIAGRAMMATIC, INDICATING GENERAL ARRANGEMENT OF THE PV SYSTEM AND THE ACTUAL SITE CONDITION MIGHT VARY.
4. WORKING CLEARANCES AROUND THE NEW PV ELECTRICAL EQUIPMENT WILL BE MAINTAINED IN ACCORDANCE WITH NEC 110.26.
5. ALL GROUND WIRING CONNECTED TO THE MAIN SERVICE GROUNDING IN MAIN SERVICE PANEL/SERVICE COMPONENT.
6. ALL CONDUCTORS SHALL BE 600V, 75° C STANDARD COPPER UNLESS OTHERWISE NOTED.
7. WHEN REQUIRED, A LADDER SHALL BE IN PLACE FOR INSPECTION IN COMPLIANCE WITH OSHA REGULATIONS.
8. THE SYSTEM WILL NOT BE INTERCONNECTED BY THE CONTRACTOR UNTIL APPROVAL FROM THE LOCAL JURISDICTION AND/OR THE UTILITY.
9. ROOF ACCESS POINT SHALL BE LOCATED IN AREAS THAT DO NOT REQUIRE THE PLACEMENT OF GROUND LADDERS OVER OPENINGS SUCH AS WINDOWS WHERE THE ACCESS POINT DOES NOT CONFLICT WITH OVERHEAD OBSTRUCTIONS SUCH AS TREES, WIRES OR SIGNS.
10. PV ARRAY COMBINER/JUNCTION BOX PROVIDES TRANSITION FROM ARRAY WIRING TO CONDUIT WIRING.

TITAN SOLAR POWER
525 W BASELINE RD., MESA AZ, 85210
CONTRACTOR LIC# U.34445

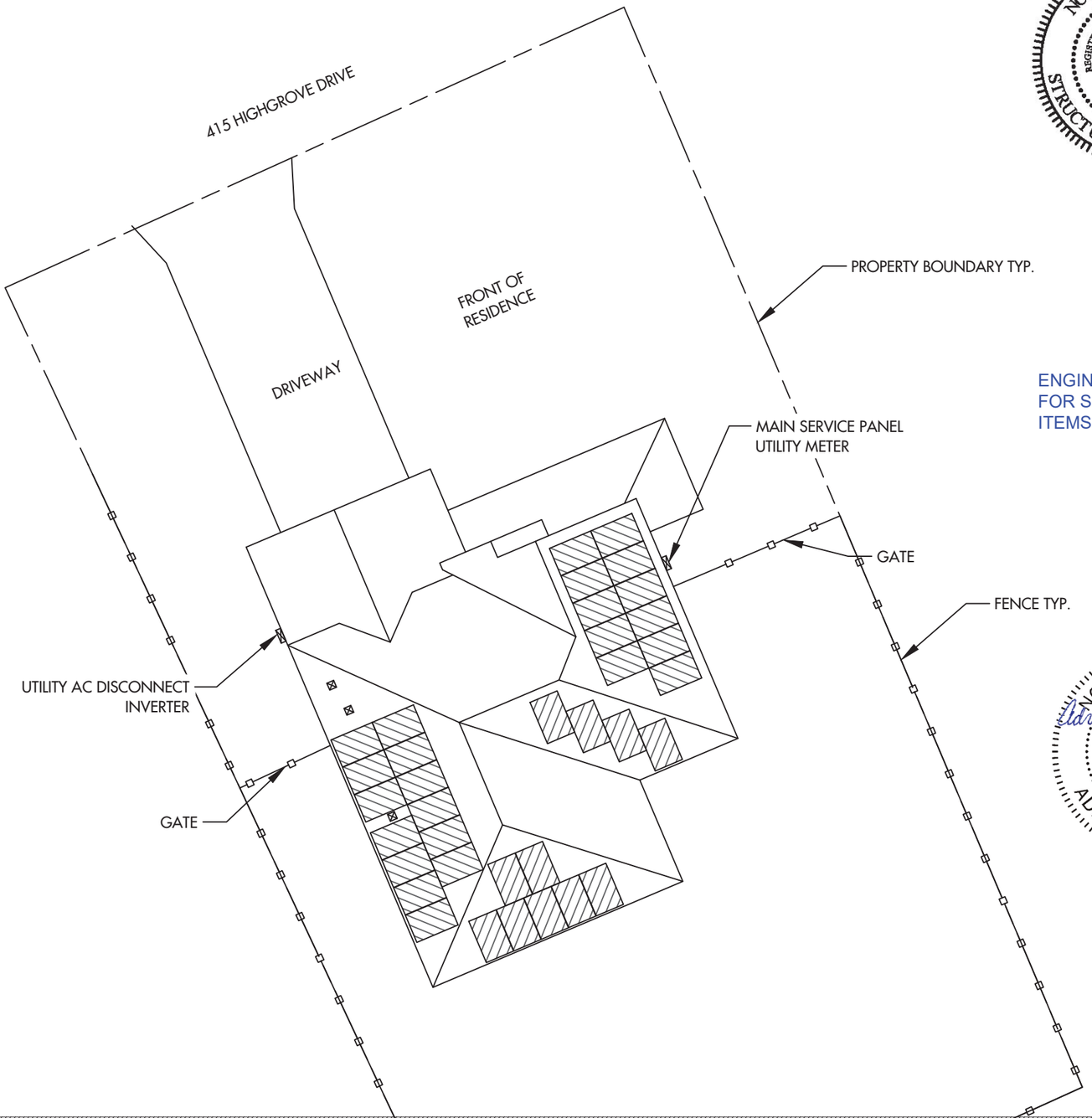
JIMENEZ, LUIS RESIDENCE
415 HIGHGROVE DRIVE , SPRING LAKE, NC, 28390
LAT:35.238534, LON:-78.975111
TSP159468

(36) HY-DH108P8-400B
(1) SOLAREDGE SE11400H-US
14.400 kW DC SYSTEM SIZE
11.400 kW AC SYSTEM SIZE

DATE: 6/1/2023
REV:A
DRAWN BY: HM

SEAL:

COVER PAGE
PV 1



1

NORTH CAROLINA REGISTERED ENGINEERING COMPANY CERT. NO. C-3406 STRUCTURAL CAPACITY, PC

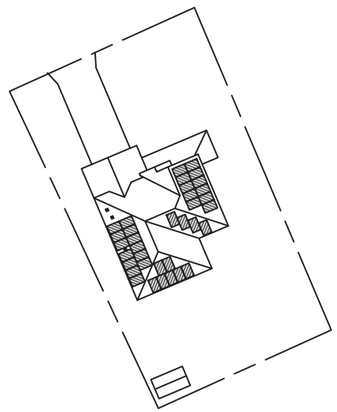
ENGINEER SEAL ARE FOR STRUCTURAL ITEMS ONLY

NORTH CAROLINA PROFESSIONAL SEAL 033700 06/06/2023 ENGINEER ADRIAN S. DURHAM

PROJECT NOTES

1. UTILITY SHALL HAVE 24HR UNRESTRICTED ACCESS TO ALL PHOTOVOLTAIC COMPONENTS LOCATED AT SES EQUIPMENT
2. NO LOCKED GATES, DOGS, ETC SHALL IMPEDE ACCESS TO SES EQUIPMENT
3. WORKSPACE IN FRONT OF AC ELECTRICAL SYSTEM COMPONENTS SHALL BE IN ACCORDANCE WITH SOUTH RIVER ELECTRIC MEMBERSHIP CORPORATION AND NEC REQUIREMENTS.
4.

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



TITAN SOLAR POWER
525 W BASELINE RD., MESA AZ, 85210
CONTRACTOR LIC# U.34445

JIMENEZ, LUIS RESIDENCE
415 HIGHGROVE DRIVE , SPRING LAKE, NC, 28390
LAT:35.238534, LON:-78.975111
TSP159468

(36) HY-DH108P8-400B
(1) SOLAREDGE SE11400H-US
14.400 kW DC SYSTEM SIZE
11.400 kW AC SYSTEM SIZE

SCALE: 1/16" = 1'-0"
DATE: 6/1/2023
REV: A
DRAWN BY: HM

SEAL:

SITE PLAN
PV 2

ARRAY INFORMATION

AR-01
QUANTITY: 14
MOUNTING TYPE: FLUSH
ARRAY TILT: 45°
AZIMUTH: 247°
ATTACHMENT SPACING: 4'
ROOF TYPE: COMP SHINGLE

AR-02
QUANTITY: 7
MOUNTING TYPE: FLUSH
ARRAY TILT: 45°
AZIMUTH: 157°
ATTACHMENT SPACING: 4'
ROOF TYPE: COMP SHINGLE

AR-03
QUANTITY: 4
MOUNTING TYPE: FLUSH
ARRAY TILT: 45°
AZIMUTH: 157°
ATTACHMENT SPACING: 4'
ROOF TYPE: COMP SHINGLE

AR-04
QUANTITY: 11
MOUNTING TYPE: FLUSH
ARRAY TILT: 45°
AZIMUTH: 67°
ATTACHMENT SPACING: 4'
ROOF TYPE: COMP SHINGLE

NOTES

- ROOF VENTS, SKYLIGHTS, WILL NOT BE COVERED UPON PV INSTALLATION
- TOTAL ROOF AREA = 2729.8 SQ-FT
- TOTAL ARRAY AREA = 756.82 SQ-FT
- ARRAY COVERAGE = 27.72%
-
-

NORTH CAROLINA REGISTERED ENGINEERING COMPANY CERT. NO. C-3406 STRUCTURAL CAPACITY, PC

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NORTH CAROLINA PROFESSIONAL SEAL 033700 06/06/2023 ENGINEER: ADRIAN S. DURHAM

Adrian S. Durham

TITAN SOLAR POWER
525 W BASELINE RD., MESA AZ, 85210
CONTRACTOR LIC# U.34445

JIMENEZ, LUIS RESIDENCE
415 HIGHGROVE DRIVE , SPRING LAKE, NC, 28390
LAT:35.238534, LON:-78.975111
TSP159468

(36) HY-DH108P8-400B
(1) SOLAREDGE SE11400H-US
14.400 kW DC SYSTEM SIZE
11.400 kW AC SYSTEM SIZE

SCALE: 31/256" = 1'-0"
DATE: 6/1/2023
REV:A
DRAWN BY: HM

SEAL:

PV LAYOUT
PV 3

MODULE & RACKING INFORMATION
MODULE: HY-DH108P8-400B
MODULE WEIGHT: 49.80 LBS
MODULE DIMENSIONS: 67.8''x 44.65'' x 1.5"
RACKING/RAIL: UNIRAC / UNIRAC-NXT
ROOF FASTENING: (2) #12-14 SCREW, HWH, SS, SELF-DR
W/ #12 EPDM WASHER

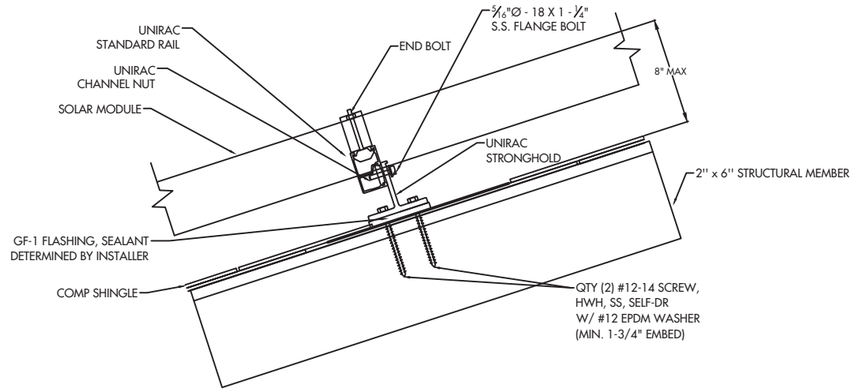
ROOF & FRAMING INFORMATION
MATERIAL: COMP SHINGLE
RAFTER/TRUSS SIZE: 2'' x 6''
RAFTER/TRUSS SPACING: 1'

ARRAY 01: 14 MODULES
UPLIFT = 8829.54 LBS.
POINT LOAD = 22.61 LBS. PER MOUNTING POINT
PULLOUT STRENGTH = 17325.00 LBS.
DISTRIBUTED LOAD = 2.54 PSF
MODULE & RACKING WEIGHT = 746.20 LBS

ARRAY 04: 11 MODULES
UPLIFT = 6937.49 LBS.
POINT LOAD = 22.55 LBS. PER MOUNTING POINT
PULLOUT STRENGTH = 13650.00 LBS.
DISTRIBUTED LOAD = 2.54 PSF
MODULE & RACKING WEIGHT = 586.30 LBS

ARRAY 02: 7 MODULES
UPLIFT = 4414.77 LBS.
POINT LOAD = 18.66 LBS. PER MOUNTING POINT
PULLOUT STRENGTH = 10500.00 LBS.
DISTRIBUTED LOAD = 2.54 PSF
MODULE & RACKING WEIGHT = 373.10 LBS

ARRAY 03: 4 MODULES
UPLIFT = 2522.73 LBS.
POINT LOAD = 13.33 LBS. PER MOUNTING POINT
PULLOUT STRENGTH = 8400.00 LBS.
DISTRIBUTED LOAD = 2.54 PSF
MODULE & RACKING WEIGHT = 213.20 LBS



ENGINEER SEAL ARE FOR STRUCTURAL ITEMS ONLY

NORTH CAROLINA REGISTERED ENGINEERING COMPANY
CERT. NO. C-3406
STRUCTURAL CAPACITY, PC

NORTH CAROLINA PROFESSIONAL
SEAL
033700
06/06/2023
ENGINEER
ADRIAN S. DURHAM

TITAN SOLAR POWER
525 W BASELINE RD., MESA AZ, 85210
CONTRACTOR LIC# U.34445

JIMENEZ, LUIS RESIDENCE
415 HIGHGROVE DRIVE , SPRING LAKE, NC, 28390
LAT:35.238534, LON:-78.975111
TSP159468

(36) HY-DH108P8-400B
(1) SOLAREDGE SE11400H-US
14.400 kW DC SYSTEM SIZE
11.400 kW AC SYSTEM SIZE

DATE: 6/1/2023
REV:A
DRAWN BY: HM

SEAL:

DETAILS
PV 4

PV MODULE

HY-DH108P8-400B

W	=	400 W
ISC	=	13.79 ADC
VOC	=	37.07 VDC
IMP	=	12.90 ADC
VMP	=	31.21 VDC
TVOC	=	-0.304% / °C

WIRE SCHEDULE

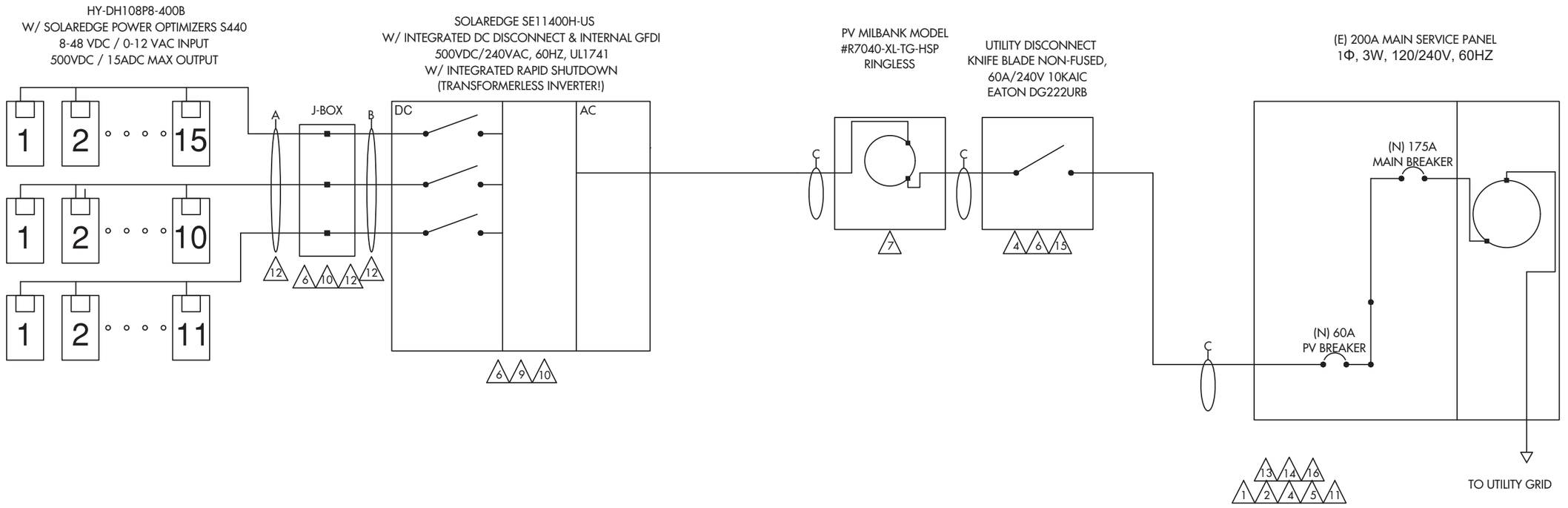
A - (6) #10 AWG-CU PV WIRE (HR)
(1) #10 AWG-CU BARE COPPER WIRE (GND)
1 1/4 PVC TRENCHED TO 18" MINDEPTH

B - (6) #10 AWG-CU THWN-2 WIRE (HR)
(1) #10 AWG-CU THWN-2 WIRE (GND)
3/4'' EMT

C - (3) #6 AWG-CU THWN-2 WIRE (HR)
(1) #8 AWG-CU THWN-2 WIRE (GND)
3/4'' EMT

MAIN SERVICE PANEL

BUS RATING	=	200A
MAX. CURRENT RATING	=	240A (200A X 1.2)
SOLAR BACKFEED	=	59A
MAIN BREAKER	=	175A
TOTAL	=	234A



WIRE SIZE CALCULATIONS

TEMP CORRECTION FACTOR: 0.87 (43° AMBIENT)
ROOFTOP TEMP CORRECTION FACTOR: 1.00 (43° ADJUSTED)
(2" ABOVE ROOFTOP / 0° TEMP ADDERS - AS OCCURS)
(TEMP DATA TAKEN FROM ASHRAE 2% AVG HIGH TEMP)

DC WIRING

CONDUIT FILL FACTOR	=	0.80
OPTIMIZER MAX. CURRENT	=	18.75A DC (15.00A X 1 X 1.25)
#10- AWG CU. AMPACITY FREE AIR	=	47.85A (55A X 0.87)
#10 - AWG CU. AMPACITY ROOFTOP CONDUIT	=	27.84A (40A X 0.87 X 0.80)

AC WIRING

CONDUIT FILL FACTOR	=	1 (3) CONDUCTORS
MAX. INVERTER CURRENT	=	47.5A (PER INVERTER SPECS)
MIN. INVERTER OCP	=	59.375A (47.5A X 1.25)
INVERTER OCP	=	60A
#6 - AWG CU AMPACITY	=	65.25A (75A X 1 X 0.87)

TITAN SOLAR POWER
525 W BASELINE RD., MESA AZ, 85210
CONTRACTOR LIC# U.34445

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LAT:35.238534, LON:-78.975111
TSP159468

(36) HY-DH108P8-400B
(1) SOLAREDGE SE11400H-US
14.400 kW DC SYSTEM SIZE
11.400 kW AC SYSTEM SIZE

DATE: 6/1/2023
REV:A
DRAWN BY: HM

SEAL:

ONE LINE

PV 5

PV MODULE

HY-DH108P8-400B

W	=	400 W
ISC	=	13.79 ADC
VOC	=	37.07 VDC
IMP	=	12.90 ADC
VMP	=	31.21 VDC
TVOC	=	-0.304% / °C

WIRE SCHEDULE

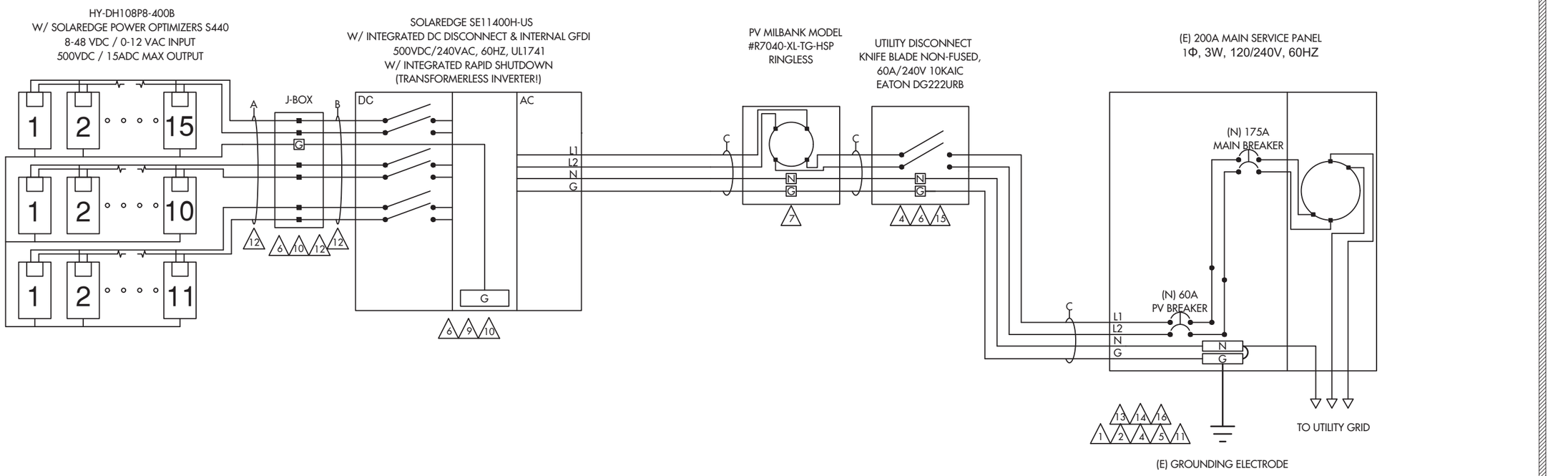
A - (6) #10 AWG-CU PV WIRE (HR)
(1) #10 AWG-CU BARE COPPER WIRE (GND)
1 1/4 PVC TRENCHED TO 18" MINDEPTH

B - (6) #10 AWG-CU THWN-2 WIRE (HR)
(1) #10 AWG-CU THWN-2 WIRE (GND)
3/4'' EMT

C - (3) #6 AWG-CU THWN-2 WIRE (HR)
(1) #8 AWG-CU THWN-2 WIRE (GND)
3/4'' EMT

MAIN SERVICE PANEL

BUS RATING	=	200A
MAX. CURRENT RATING	=	240A (200A X 1.2)
SOLAR BACKFEED	=	59A
MAIN BREAKER	=	175A
TOTAL	=	234A



WIRE SIZE CALCULATIONS

TEMP CORRECTION FACTOR: 0.87 (43° AMBIENT)
ROOFTOP TEMP CORRECTION FACTOR: 1.00 (43° ADJUSTED)
(2" ABOVE ROOFTOP / 0° TEMP ADDERS - AS OCCURS)
(TEMP DATA TAKEN FROM ASHRAE 2% AVG HIGH TEMP)

DC WIRING

CONDUIT FILL FACTOR	=	0.80
OPTIMIZER MAX. CURRENT	=	18.75A DC (15.00A X 1 X 1.25)
#10- AWG CU. AMPACITY FREE AIR	=	47.85A (55A X 0.87)
#10 - AWG CU. AMPACITY ROOFTOP CONDUIT	=	27.84A (40A X 0.87 X 0.80)

AC WIRING

CONDUIT FILL FACTOR	=	1 (3) CONDUCTORS
MAX. INVERTER CURRENT	=	47.5A (PER INVERTER SPECS)
MIN. INVERTER OCP	=	59.375A (47.5A X 1.25)
INVERTER OCP	=	60A
#6 - AWG CU AMPACITY	=	65.25A (75A X 1 X 0.87)

TITAN SOLAR POWER
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CONTRACTOR LIC# U.34445

JIMENEZ, LUIS RESIDENCE
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LAT:35.238534, LON:-78.975111
TSP159468

(36) HY-DH108P8-400B
(1) SOLAREDGE SE11400H-US
14.400 kW DC SYSTEM SIZE
11.400 kW AC SYSTEM SIZE

DATE: 6/1/2023
REV:A
DRAWN BY: HM

SEAL:

THREE LINE

PV 6

1

⚠ CAUTION
PHOTOVOLTAIC SYSTEM CIRCUIT IS BACKFED

LOCATION: BACKFED BREAKER
CODE REF: NEC 705.12(4)

2

⚠ WARNING
INVERTER OUTPUT CONNECTION:
DO NOT RELOCATE THIS
OVERCURRENT DEVICE

LOCATION: BACKFED BREAKER
CODE REF: 2017 NEC 705.12(2)(3)(b)

3

WARNING
A GENERATION SCOURCE IS CONNECTED TO THE SUPPLY (UTILITY) SIDE OF THE MAIN SERVICE DISCONNECT. FOLLOW THE PROPER LOCK-OUT/TAG-OUT PROCEDURES TO ENSURE THE PHOTOVOLTAIC SYSTEM UTILITY DISCONNECT SWITCH IS OPENED PRIOR TO PERFORMING WORK ON THIS DEVICE

LOCATION: (IF APPLICABLE) SUPPLY SIDE TAP LOAD PANEL
CODE REF: UTILITY

4

PHOTOVOLTAIC AC DISCONNECT
RATED AC OPERATING CURRENT: 47.5A
NOMINAL OPERATING AC VOLTAGE: 240VAC

LOCATION: MAIN PANEL AC DISCONNECT(S)
CODE REF: NEC 690.54

5

RAPID SHUTDOWN SWITCH FOR SOLAR PV SYSTEM

LOCATION: MAIN PANEL (EXTERIOR) PV BREAKER (INTERIOR)
CODE REF: NEC 690.56(C)(3)

6

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

LOCATION: COMBINER PANEL AC DISCONNECT JUNCTION BOX INVERTER(S)
CODE REF: NEC 690.13(B)

7

PHOTOVOLTAIC
SYSTEM METER

LOCATION: DEDICATED KWH METER
CODE REF: NEC 690.4(B) UTILITY

8

⚠ WARNING
PHOTOVOLTAIC SYSTEM COMBINER PANEL
DO NOT ADD LOADS

LOCATION: AC COMBINER PANEL
CODE REF: NEC 690.13(B)

9

PHOTOVOLTAIC SYSTEM DC DISCONNECT
MAXIMUM VOLTAGE: 480VDC
MAXIMUM CIRCUIT CURRENT: 15.0ADC
MAX. RATED OUTPUT CURRENT OF THE CHARGE CONTROLLER OR DC-TO-DC- CONVERTER (IF INSTALLED) 15.0ADC

LOCATION: DC DISCONNECT INVERTER
CODE REF: UTILITY

10

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

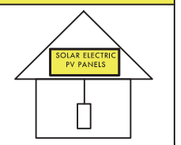
DC VOLTAGE IS ALWAYS PRESENT WHEN SOLAR MODULES ARE EXPOSED TO SUNLIGHT

LOCATION: DC DISCONNECT, COMBINE BOX
CODE REF: NEC 690.13(B)

11

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.



LOCATION: MAIN SERVICE (OUTSIDE COVER)
CODE REF: NEC 690.12
NEC 690.56(C)(1)(a)
YELLOW STICKER

12

WARNING PHOTOVOLTAIC POWER SOURCE

LOCATION: DC CONDUIT JUNCTION BOX NO MORE THAN 10FT
CODE REF: NEC 690.31(G)(3) NEC 690.31(G)(4)
REFLECTIVE AND WEATHER RESISTANT

LABEL REQUIRES CAPITALIZED LETTERS WITH A MINIMUM HEIGHT OF 3/8 INCH, WHITE LETTERS ON RED BACKGROUND
LABELS SHALL BE PLACED ON INTERIOR AND EXTERIOR DC CONDUIT, RACEWAYS, ENCLOSURES, AND CABLE ASSEMBLIES EVERY 10 FEET, WITHIN 1 FOOT OF TURNS OR BENDS AND WITHIN 1 FOOT ABOVE AND BELOW PENETRATIONS OF ROOF/CEILING ASSEMBLIES, WALLS OR BARRIERS.

13

⚠ CAUTION
DUAL POWER SOURCE
SECOND SOURCE IS PHOTOVOLTAIC

LOCATION: SERVICE METER MAIN PANEL

14

⚠ WARNING
INVERTER OUTPUT CONNECTION
DO NOT RELOCATE THIS OVERCURRENT DEVICE

LOCATION: (IF APPLICABLE) SERVICE PANEL
CODE REF: NEC 705.12(7)

15

PHOTOVOLTAIC SYSTEM UTILITY DISCONNECT SYSTEM

LOCATION: AC DISCONNECT
CODE REF: UTILITY

16

PV SOLAR BREAKER
DO NOT RELOCATE THIS OVERCURRENT DEVICE

LOCATION: MAIN PANEL:(EXTERIOR) PV BREAKER: (INTERIOR)
CODE REF: NEC 705.12(B)(2)(3)(B)

THIS MAIN BREAKER HAS BEEN DERATED TO 175A
DO NOT INSTALL A LARGER BREAKER

LOCATION: MAIN SERVICE PANEL ONLY WHEN MAIN BREAKER IS DERATED

TITAN SOLAR POWER
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CONTRACTOR LIC# U.34445

JIMENEZ, LUIS RESIDENCE
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LAT:35.238534, LON:-78.975111
TSP159468

(36) HY-DH108P8-400B
(1) SOLAREDGE SE11400H-US
14.400 kW DC SYSTEM SIZE
11.400 kW AC SYSTEM SIZE

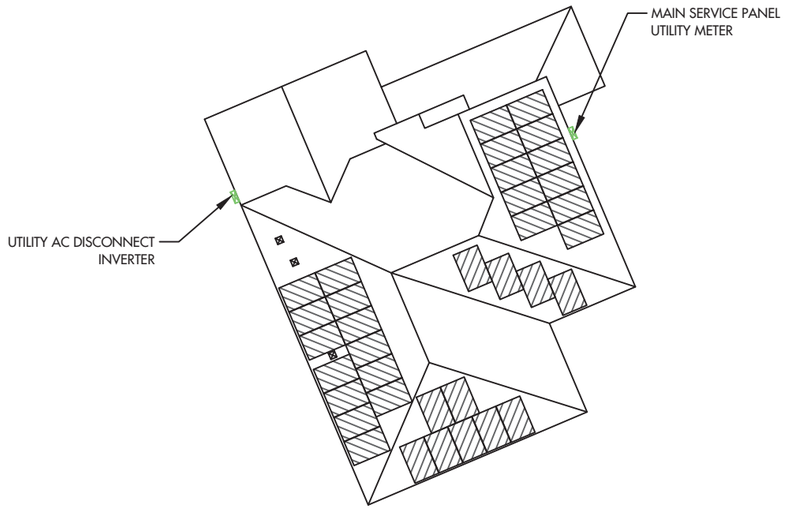
DATE: 6/1/2023
REV: A
DRAWN BY: HM

SEAL:

LABELS
PV 7

CAUTION

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



DIRECTORY PLAQUE IN ACCORDANCE WITH NEC690.56(A)(B), 705.10

TITAN SOLAR POWER
525 W BASELINE RD., MESA AZ, 85210
CONTRACTOR LIC# U.34445

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LAT:35.238534, LON:-78.975111
TSP159468

(36) HY-DH108P8-400B
(1) SOLAREDGE SE11400H-US
14.400 kW DC SYSTEM SIZE
11.400 kW AC SYSTEM SIZE

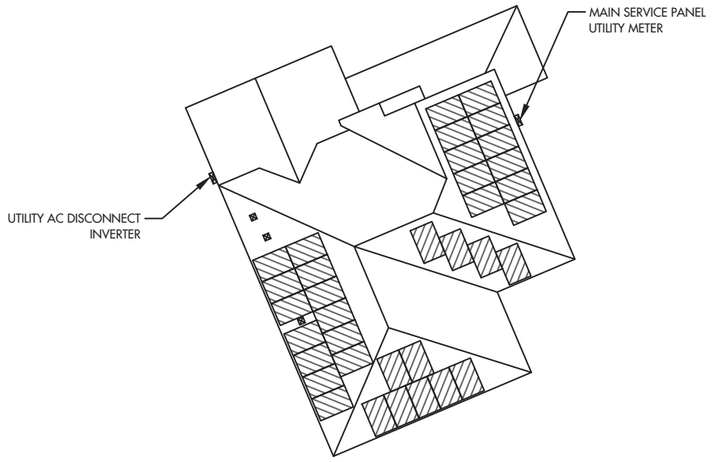
DATE: 6/1/2023
REV: A
DRAWN BY: HM

SEAL:

PLACARD

PV 8

JOB SAFETY PLAN



LOCATION OF NEAREST URGENT CARE FACILITY
NAME:
ADDRESS:
PHONE NUMBER:

NOTES:

- INSTALLER SHALL DRAW IN DESIGNATED SAFETY AREA AROUND HOME
- INSTALLER SHALL UPDATE NAME, ADDRESS, AND PHONE NUMBER OF NEAREST URGENT CARE FACILITY RELATIVE TO THE JOB SITE BEFORE STARTING WORK.

PRINT NAME	INITIAL	YES	NO

TITAN SOLAR POWER
525 W BASELINE RD., MESA AZ, 85210
CONTRACTOR LIC# U.34445

JIMENEZ, LUIS RESIDENCE
415 HIGHGROVE DRIVE , SPRING LAKE, NC, 28390
LAT:35.238534, LON:-78.975111
TSP159468

(36) HY-DH108P8-400B
(1) SOLAREDGE SE11400H-US
14.400 kW DC SYSTEM SIZE
11.400 kW AC SYSTEM SIZE

DATE: 6/1/2023
REV: A
DRAWN BY: HM

SEAL:

SAFETY PLAN
PV 9

Single Phase Inverter with HD-Wave Technology

for North America

SE3000H-US / SE3800H-US / SE5000H-US / SE6000H-US /
SE7600H-US / SE10000H-US / SE11400H-US

INVERTERS

12-25 YEAR WARRANTY

Optimized installation with HD-Wave technology

- Specifically designed to work with power optimizers
- Record-breaking 99% weighted efficiency
- Quick and easy inverter commissioning directly from a smartphone using the SolarEdge SetApp
- Fixed voltage inverter for longer strings
- Integrated arc fault protection and rapid shutdown for NEC 2014, NEC 2017 and NEC 2020 per article 690.11 and 690.12
- UL1741 SA certified, for CPUC Rule 21 grid compliance
- Small, lightweight, and easy to install both outdoors or indoors
- Built-in module-level monitoring
- Optional: Faster installations with built-in consumption metering (1% accuracy) and production revenue grade metering (0.5% accuracy, ANSI C12.20)

solaredge.com

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Single Phase Inverter with HD-Wave Technology

for North America

SE3000H-US / SE3800H-US / SE5000H-US / SE6000H-US/
SE7600H-US / SE10000H-US / SE11400H-US

MODEL NUMBER	SE3000H-US	SE3800H-US	SE5000H-US	SE6000H-US	SE7600H-US	SE10000H-US	SE11400H-US	
APPLICABLE TO INVERTERS WITH PART NUMBER	SEXXXXH-XXXXXBXX4							
OUTPUT								
Rated AC Power Output	3000	3800 @ 240V 3300 @ 208V	5000	6000 @ 240V 5000 @ 208V	7600	10000	11400 @ 240V 10000 @ 208V	VA
Maximum AC Power Output	3000	3800 @ 240V 3300 @ 208V	5000	6000 @ 240V 5000 @ 208V	7600	10000	11400 @ 240V 10000 @ 208V	VA
AC Output Voltage Min.-Nom.-Max. (211 - 240 - 264)	✓	✓	✓	✓	✓	✓	✓	Vac
AC Output Voltage Min.-Nom.-Max. (183 - 208 - 229)	-	✓	-	✓	-	-	✓	Vac
AC Frequency (Nominal)	59.3 - 60 - 60.5[1]							Hz
Maximum Continuous Output Current @240V	12.5	16	21	25	32	42	47.5	A
Maximum Continuous Output Current @208V	-	16	-	24	-	-	48.5	A
Power Factor	1, Adjustable - 0.85 to 0.85							
GFDI Threshold	1							A
Utility Monitoring, Islanding Protection, Country Configurable Thresholds	Yes							
INPUT								
Maximum DC Power @240V	4650	5900	7750	9300	11800	15500	17650	W
Maximum DC Power @208V	-	5100	-	7750	-	-	15500	W
Transformer-less, Ungrounded	Yes							
Maximum Input Voltage	480							Vdc
Nominal DC Input Voltage	380				400			Vdc
Maximum Input Current @240V[2]	8.5	10.5	13.5	16.5	20	27	30.5	Adc
Maximum Input Current @208V[2]	-	9	-	13.5	-	-	27	Adc
Max. Input Short Circuit Current	45							Adc
Reverse-Polarity Protection	Yes							
Ground-Fault Isolation Detection	600kΩ Sensitivity							
Maximum Inverter Efficiency	99	99.2						%
CEC Weighted Efficiency	99						99 @ 240V 98.5 @ 208V	%
Nighttime Power Consumption	< 2.5							W

(1) For other regional settings please contact SolarEdge support
(2) A higher current source may be used; the inverter will limit its input current to the values stated

Single Phase Inverter with HD-Wave Technology

for North America

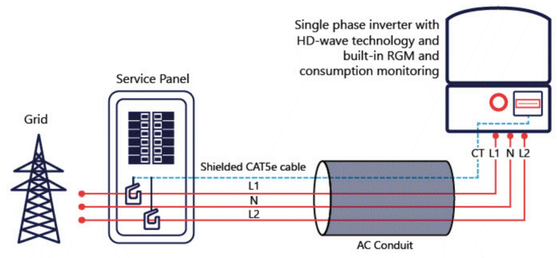
SE3000H-US / SE3800H-US / SE5000H-US / SE6000H-US/
SE7600H-US / SE10000H-US / SE11400H-US

MODEL NUMBER	SE3000H-US	SE3800H-US	SE5000H-US	SE6000H-US	SE7600H-US	SE10000H-US	SE11400H-US	
ADDITIONAL FEATURES								
Supported Communication Interfaces	RS485, Ethernet, ZigBee (optional), Cellular (optional)							
Revenue Grade Metering, ANSI C12.20	Optional[3]							
Consumption metering								
Inverter Commissioning	With the SetApp mobile application using Built-in Wi-Fi Access Point for Local Connection							
Rapid Shutdown - NEC 2014, NEC 2017 and NEC 2020, 690.12	Automatic Rapid Shutdown upon AC Grid Disconnect							
STANDARD COMPLIANCE								
Safety	UL1741, UL1741 SA, UL1699B, CSA C22.2, Canadian AFCI according to T.I.L. M-07							
Grid Connection Standards	IEEE1547, Rule 21, Rule 14 (HI)							
Emissions	FCC Part 15 Class B							
INSTALLATION SPECIFICATIONS								
AC Output Conduit Size / AWG Range	1" Maximum / 14-6 AWG					1" Maximum /14-4 AWG		
DC Input Conduit Size / # of Strings / AWG Range	1" Maximum / 1-2 strings / 14-6 AWG					1" Maximum / 1-3 strings / 14-6 AWG		
Dimensions with Safety Switch (HxWxD)	17.7 x 14.6 x 6.8 / 450 x 370 x 174					21.3 x 14.6 x 7.3 / 540 x 370 x 185		in / mm
Weight with Safety Switch	22 / 10		25.1 / 11.4		26.2 / 11.9	38.8 / 17.6		lb / kg
Noise	< 25					<50		dBA
Cooling	Natural Convection							
Operating Temperature Range	-40 to +140 / -40 to +60[4]							°F / °C
Protection Rating	NEMA 4X (Inverter with Safety Switch)							

(3) Inverter with Revenue Grade Meter P/N: SExxxxH-US000BNC4; Inverter with Revenue Grade Production and Consumption Meter P/N: SExxxxH-US000BNI4 . For consumption metering, current transformers should be ordered separately: SEACT0750-200NA-20 or SEACT0750-400NA-20. 20 units per box
(4) Full power up to at least 50°C / 122°F; for power de-rating information refer to: https://www.solaredge.com/sites/default/files/se-temperature-derating-note-na.pdf

How to Enable Consumption Monitoring

By simply wiring current transformers through the inverter's existing AC conduits and connecting them to the service panel, homeowners will gain full insight into their household energy usage helping them to avoid high electricity bills



RoHS

TITAN SOLAR POWER
525 W BASELINE RD., MESA AZ, 85210
CONTRACTOR LIC# U.34445

JIMENEZ, LUIS RESIDENCE
415 HIGHGROVE DRIVE , SPRING LAKE, NC, 28390
LAT:35.238534, LON:-78.975111
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(36) HY-DH108P8-400B
(1) SOLAREDGE SE11400H-US
14.400 kW DC SYSTEM SIZE
11.400 kW AC SYSTEM SIZE

DATE: 6/1/2023
REV: A
DRAWN BY: HM

SEAL:

EQUIPMENT SPECIFICATIONS
PV 10

intertek
Total Quality. Assured.

Intertek
3933 US Route 11
Cortland, NY 13045
Telephone: 607-753-7311
www.intertek.com

Subject: ETL Evaluation of SolarEdge Products to Rapid Shutdown Requirements

To, whom it may concern

This letter represents the testing results of the below listed products to the requirements contained in the following standards:

The evaluation was done on the PV Rapid Shutdown System (PVRSS), and covers installations consisting of optimizers and inverters with part numbers listed below.

The testing done has verified that controlled conductors are limited to:

- Not more than 30 volts and 240 voltamperes within 30 seconds of rapid shutdown initiation outside the array.
- Not more than 80 volts and 240 voltamperes within 30 seconds of rapid shutdown initiation inside the array.

The rapid shutdown initiation is performed by either disconnecting the AC feed to the inverter, or – if the inverter DC Safety switch is readily accessible – by turning off the DC Safety switch.

Applicable products:

(1) Power optimizers:

PB followed by 001 to 350; followed by -AOB or -TFI.
OP followed by 001 to 500; followed by -LV, -MV, -IV or -EV.
P followed by 001 to 1100.
SP followed by 001 to 350.

When optimizers are connected to 2 or more modules in series, the max input voltage may exceed 80V. Following the implementation of the NEC 2017 rapid shutdown value of 80V max inside of the array at the beginning of 2019, modules exceeding this combined input max voltage will be required to use optimizers with parallel inputs. Also meeting NEC 2020 rapid shutdown requirement.

(2) 1 -PH Inverters

SE3000A-US / SE3800A-US / SE5000A-US / SE6000A-US / SE7600A-US / SE10000A-US / SE11400A-US / SE3000H-US / SE3800H-US / SE5000H-US / SE6000H-US / SE7600H-US / SE10000H-US / SE11400H-US when the following label is labeled on the side of the inverter:

Inverter part number may be followed by a suffix.

(3) 3 -PH Inverters

intertek
Total Quality. Assured.

Intertek
3933 US Route 11
Cortland, NY 13045
Telephone: 607-753-7311
www.intertek.com

SE9KUS / SE10KUS / SE14.4KUS/ SE16.7kUS / SE17.3kUS / SE20KUS/ SE24KUS / SE30KUS / SE33.3KUS / SE40KUS / SE43.2KUS / SE50KUS / SE66.6KUS / SE80KUS / SE85KUS / SE100KUS / SE120KUS; when the following label is labeled on the side of the inverter:

Please note, this Letter Report does not represent authorization for the use of any Intertek certification marks.

Brand Name(s)	SolarEdge
Relevant Standard(s)	UL 1741, UL 1741 CRD for rapid shutdown National Electric Code, 2020, Section 690.12 requirement for rapid shutdown
Verification Issuing Office	3933 US Route 11, Cortland, NY 13045

Signature:

Name: Mukund Rana
Position: Staff Engineer
Date:5/17/2021

intertek
Total Quality. Assured.

Intertek
3933 US Route 11
Cortland, NY 13045
Telephone: 607-753-7311
www.intertek.com

Date	Engineer / Reviewer	Description
5/17/2021 G104683664CRT	Dishant Patel	Added New 3-PH Inverter model SE50KUS, SE80KUS, SE85KUS and SE120KUS.
	Mukund Rana	Updated Power optimizers from "P followed by 001 to 960" to "P followed by 001 to 1100" Updated NEC standard from "National Electric Code, 2017, Section 690.12 requirement for rapid shutdown" To "National Electric Code, 2020, Section 690.12 requirement for rapid shutdown"

Power Optimizer

For Residential Installations

S440 / S500 / S500B

POWER OPTIMIZER

Enabling PV power optimization at the module level

- Specifically designed to work with SolarEdge residential inverters
- Detects abnormal PV connector behavior, preventing potential safety issues*
- Module-level voltage shutdown for installer and firefighter safety
- Superior efficiency (99.5%)
- Mitigates all types of module mismatch loss, from manufacturing tolerance to partial shading
- Faster installations with simplified cable management and easy assembly using a single bolt
- Flexible system design for maximum space utilization
- Compatible with bifacial PV modules

* Functionality subject to inverter model and firmware version

solaredge.com

solaredge

Power Optimizer

For Residential Installations

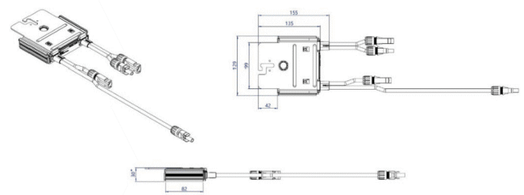
S440 / S500 / S500B

	S440	S500	S500B	UNIT
INPUT				
Rated Input DC Power(1)	440	500		W
Absolute Maximum Input Voltage (Voc)	60		125	Vdc
MPPT Operating Range	8 – 60		12.5 – 105	Vdc
Maximum Short Circuit Current (Isc) of Connected PV Module	14.5	15		Adc
Maximum Efficiency	99.5			%
Weighted Efficiency	98.6			%
Overvoltage Category	II			
OUTPUT DURING OPERTION				
Maximum Output Current	15			Adc
Maximum Output Voltage	60		80	Vdc
OUTPUT DURING STANDBY (POWER OPTIMIZER DISCONNECTED FROM INVERTER OR INVERTER OFF)				
Safety Output Voltage per Power Optimizer	1 ± 0.1			Vdc
STANDARD COMPLIANCE(2)				
EMC	FCC Part 15 Class B, IEC61000-6-2, IEC61000-6-3, CISPR11, EN-55011			
Safety	IEC62109-1 (class II safety), UL1741			
Material	UL94 V-0, UV Resistant			
RoHS	Yes			
Fire Safety	VDE-AR-E 2100-712:2018-12			
INSTALLATION SPECIFICATIONS				
Maximum Allowed System Voltage	1000			Vdc
Dimensions (W x L x H)	129 x 155 x 30		129 x 155 x 45	mm
Weight (including cables)	655			gr
Input Connector	MC4(3)			
Input Wire Length	0.1			m
Output Connector	MC4			
Output Wire Length	(+) 2.3, (-) 0.10			m
Operating Temperature Range(4)	-40 to +85			°C
Protection Rating	IP68			
Relative Humidity	0 – 100			%

(1) Rated power of the module at STC will not exceed the Power Optimizer Rated Input DC Power. Modules with up to +5% power tolerance are allowed.
(2) For details about CE compliance, see Declaration of Conformity – CE
(3) For other connector types please contact SolarEdge.
(4) For ambient temperatures above +70°C power de-rating is applied. Refer to Power Optimizers Temperature De-Rating Technical Note for details.

PV System Design Using a SolarEdge Inverter(5)		SolarEdge Home Wave Inverter Single Phase	SolarEdge Home Short String Inverter Three Phase	Three Phase for 230/400V Grid	Three Phase for 277/480V Grid	
Minimum String Length (Power Optimizers)	S440, S500	8	9	16	18	
	S500B	6	8	14		
Maximum String Length (Power Optimizers)		25	20	50		
Maximum Continuous Power per String		5700	5625	11250	12750	W
Maximum Allowed Connected Power per String (Permitted only when the power difference between strings is less than 2,000W)		See(6)	See(6)	13500	15000	W
Parallel Strings of Different Lengths or Orientations		Yes				

(5) It is not allowed to mix S-series and P-series Power Optimizers in new installations.
(6) If the inverter's rated AC power ≤ maximum nominal power per string, then the maximum power per string will be able to reach up to the inverters maximum input DC power. Refer to Application Note: Single String Design Guidelines.



* 45mm for S500B

CE RoHS

TITAN SOLAR POWER
525 W BASELINE RD., MESA AZ, 85210
CONTRACTOR LIC# U.34445

JIMENEZ, LUIS RESIDENCE
415 HIGHGROVE DRIVE , SPRING LAKE, NC, 28390
LAT:35.238534, LON:-78.975111
TSP159468

(36) HY-DH108P8-400B
(1) SOLAREDGE SE11400H-US
14.400 kW DC SYSTEM SIZE
11.400 kW AC SYSTEM SIZE

DATE: 6/1/2023
REV: A
DRAWN BY: HM

SEAL:

EQUIPMENT SPECIFICATIONS
PV 12

390-410W

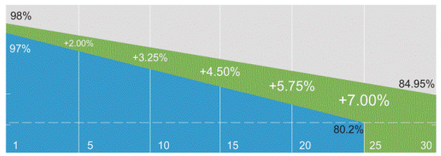
HY-DH108P8
108 HALF-CELL BIFACIAL MODULE

High Conversion Efficiency
Module efficiency up to 21.0% through advanced cell technology and manufacturing process

Excellent Weak Light Performance
More power output in weak light condition, such as cloudy days, morning and sunset

Extended Mechanical Performance
Module certified to withstand extreme wind (2400 Pa) and snow loading (5400 Pa)

Quality Guarantee
High module quality ensures long-term reliability



12 Years warranty for materials and workmanship

30 Years warranty for extra linear power output

Intertek

IEC61215 / IEC61730 / UL61730
IEC61701 / IEC62716
ISO9001: Quality Management System

info@hyperion-usa.com
7/559 Moo.6, Mapyangphon Subdistrict,
Pluak Daeng District, Rayong Province,
21140, Thailand

HYPERION SOLAR

BLACK DH108P8

HY-DH108P8-390/410B

Mechanical Parameters

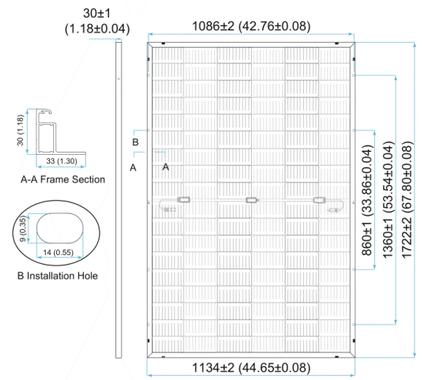
Solar Cell	Mono PERC 182mm
No. of Cells	108 (6 × 18)
Dimensions	1722 × 1134 × 30mm (67.08 × 44.65 × 1.18in.)
Weight	25.2kg (55.55lbs)
Junction Box	IP68 rated (3 bypass diodes)
Output Cables	4mm² (IEC),12 AWG(UL) (-/+)1200mm (47.24in.) or customized
Connector	EVO2 or customized
Front Cover	2.0mm (0.079in.) semi-tempered AR glass
Back Cover	2.0mm (0.079in.) semi-tempered glass
Container	36 pcs/Pallet, 792 pcs/40' HC

Operating Parameters

Max. System Voltage	DC 1500V (IEC/UL)
Operating Temperature	-40°C ~ +85°C (-40°F ~ +185°F)
Max. Fuse Rating	30A
Frontside Max. Loading	5400Pa (112lb/ft²)
Backside Max. Loading	2400Pa (50lb/ft²)
Bifaciality	70%±10%
Fire Resistance	IEC Class A, UL Type 29

Engineering Drawing

Unit: mm (inch)



Electrical Characteristics - STC

Irradiance 1000 W/m², ambient temperature 25 °C, AM1.5.

Maximum Power at STC (Pmax/W)	410	405	400	395	390
Power Tolerance (W)			0 ~ +5		
Optimum Operating Voltage (Vmp/V)	31.45	31.21	31.01	30.84	30.64
Optimum Operating Current (Imp/A)	13.04	12.98	12.90	12.81	12.73
Open Circuit Voltage (Voc/V)	37.32	37.23	37.07	36.98	36.85
Short Circuit Current (Isc/A)	13.95	13.87	13.79	13.70	13.61
Module Efficiency	21.0%	20.7%	20.5%	20.2%	20.0%

Electrical Characteristics - NMOT

Irradiance 800 W/m², ambient temperature 20 °C, AM1.5, wind speed 1 m/s.

Maximum Power at NMOT (Pmax/W)	310.2	306.4	302.5	298.8	295.0
Optimum Operating Voltage (Vmp/V)	29.82	29.60	29.41	29.25	29.15
Optimum Operating Current (Imp/A)	10.40	10.35	10.29	10.22	10.15
Open Circuit Voltage (Voc/V)	35.39	35.31	35.15	35.07	34.95
Short Circuit Current (Isc/A)	11.25	11.19	11.13	11.05	10.98

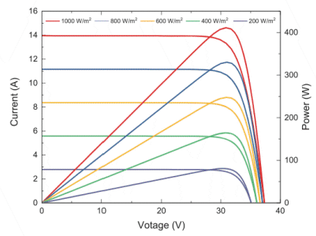
Rearside Power Gain (Reference to 410W Front)

Rearside Power Gain	5%	15%	25%
Maximum Power (Pmax/W)	431.4	472.3	514.8
Optimum Operating Voltage (Vmp/V)	31.57	31.57	31.65
Optimum Operating Current (Imp/A)	13.66	14.96	16.27
Open Circuit Voltage (Voc/V)	37.46	37.46	37.46
Short Circuit Current (Isc/A)	14.57	15.96	17.35
Module Efficiency	22.1%	24.2%	26.4%

Temperature Characteristics

Nominal Module Operating Temperature	42 ± 2 °C
Nominal Cell Operating Temperature	45 ± 2 °C
Temperature Coefficient of Pmax	-0.35%/°C
Temperature Coefficient of Voc	-0.27%/°C
Temperature Coefficient of Isc	0.05%/°C

Current-Voltage & Power-Voltage Curve (410W)



TITAN SOLAR POWER
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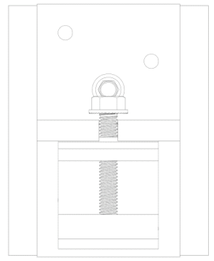
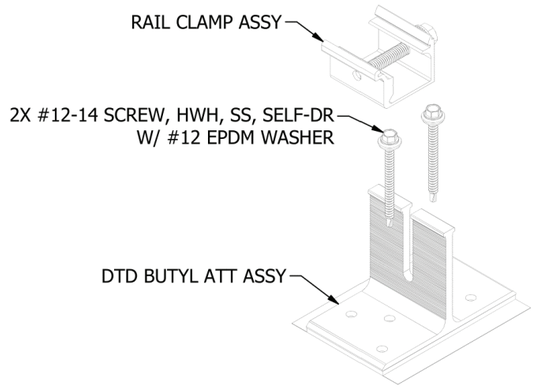
DRAWN BY: HM

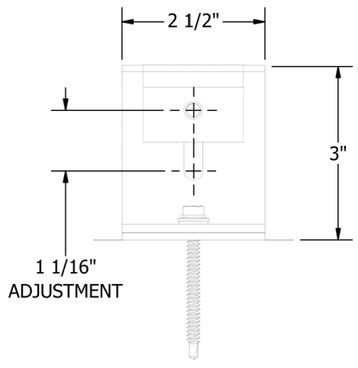
SEAL:

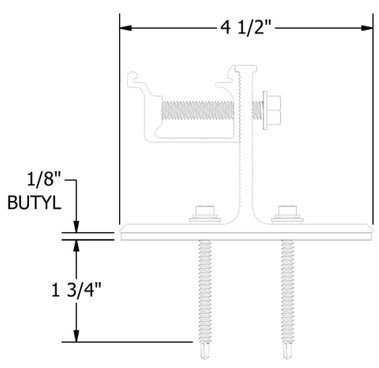
EQUIPMENT SPECIFICATIONS
PV 13

PART # TABLE	
P/N	DESCRIPTION
SBUTYLM1	STRONGHOLD ATT W/BUTYL, MILL
SBUTYLD1	STRONGHOLD ATT W/BUTYL, DARK









UNIRAC
1411 BROADWAY BLVD. NE
ALBUQUERQUE, NM 87102 USA
PHONE: 505.242.6411
WWW.UNIRAC.COM

PRODUCT LINE:	NXT UMOUNT
DRAWING TYPE:	PARTS
DESCRIPTION:	SH BUTYL ATTACHMENT
REVISION DATE:	2/3/2023

DRAWING NOT TO SCALE
ALL DIMENSIONS ARE NOMINAL

PRODUCT PROTECTED BY ONE OR MORE US PATENTS
LEGAL NOTICE

NU-A10
SHEET

TITAN SOLAR POWER
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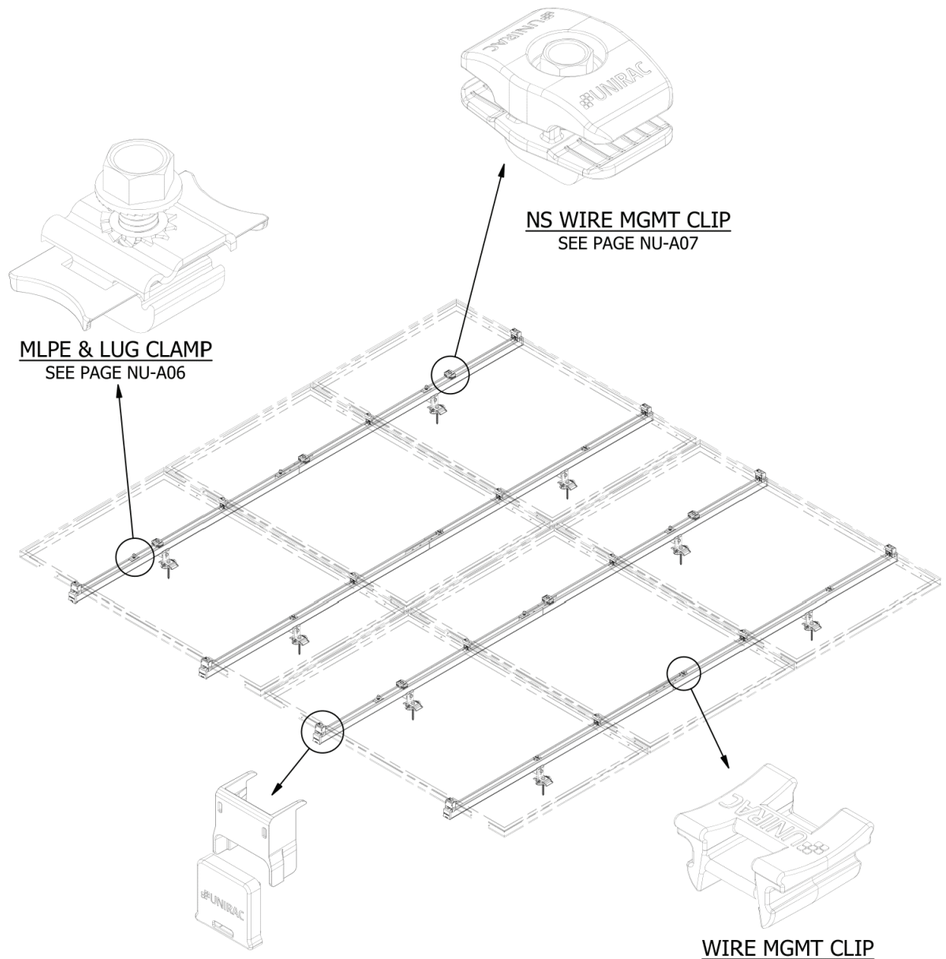
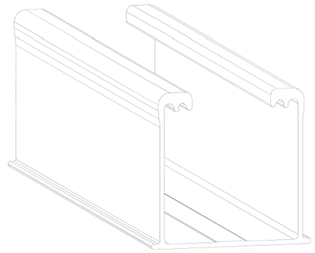
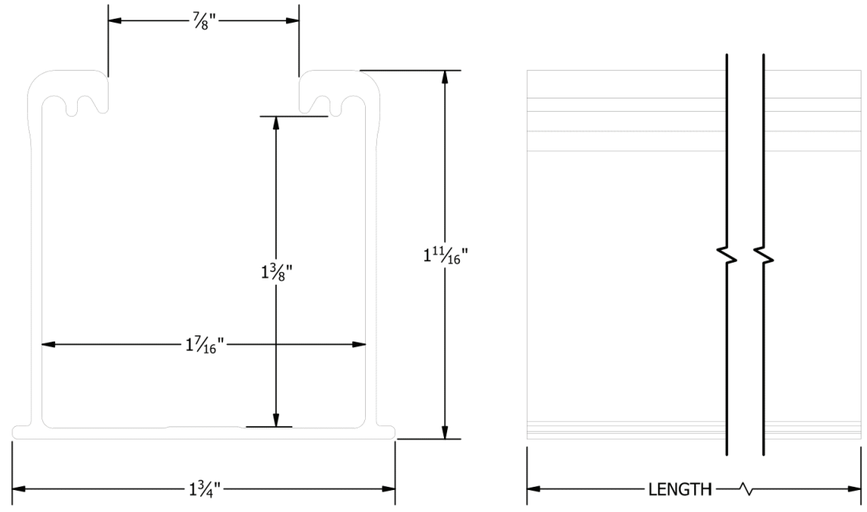
PV 14



PART # TABLE		
P/N	DESCRIPTION	LENGTH
084RLM1	NXT UMOUNT RAIL 84" MILL	84"
084RLD1	NXT UMOUNT RAIL 84" DARK	84"
168RLM1	NXT UMOUNT RAIL 168" MILL	168"
168RLD1	NXT UMOUNT RAIL 168" DARK	168"
208RLM1	NXT UMOUNT RAIL 208" MILL	208"
208RLD1	NXT UMOUNT RAIL 208" DARK	208"
246RLM1	NXT UMOUNT RAIL 246" MILL	246"
246RLD1	NXT UMOUNT RAIL 246" DARK	246"
171RLM1	NXT UMOUNT RAIL 171" MILL	171.50"
171RLD1	NXT UMOUNT RAIL 171" DARK	171.50"





UNIRAC 1411 BROADWAY BLVD. NE ALBUQUERQUE, NM 87102 USA PHONE: 505.242.6411 WWW.UNIRAC.COM	PRODUCT LINE: NXT UMOUNT DRAWING TYPE: PART & ASSEMBLY DESCRIPTION: MODULE ASSEMBLY REVISION DATE: 11/17/2022	DRAWING NOT TO SCALE ALL DIMENSIONS ARE NOMINAL PRODUCT PROTECTED BY ONE OR MORE US PATENTS LEGAL NOTICE	NU-A02 SHEET

UNIRAC 1411 BROADWAY BLVD. NE ALBUQUERQUE, NM 87102 USA PHONE: 505.242.6411 WWW.UNIRAC.COM	PRODUCT LINE: NXT UMOUNT DRAWING TYPE: PART DETAIL DESCRIPTION: RAIL REVISION DATE: 11/17/2022	DRAWING NOT TO SCALE ALL DIMENSIONS ARE NOMINAL PRODUCT PROTECTED BY ONE OR MORE US PATENTS LEGAL NOTICE	NU-P01 SHEET

TITAN SOLAR POWER
525 W BASELINE RD., MESA AZ, 85210
CONTRACTOR LIC# U.34445

JIMENEZ, LUIS RESIDENCE
415 HIGHGROVE DRIVE , SPRING LAKE, NC, 28390
LAT:35.238534, LON:-78.975111
TSP159468

(36) HY-DH108P8-400B
(1) SOLAREDGE SE11400H-US
14.400 kW DC SYSTEM SIZE
11.400 kW AC SYSTEM SIZE

DATE: 6/1/2023
REV: A
DRAWN BY: HM

SEAL:

EQUIPMENT SPECIFICATIONS
PV 15

Recommended OCPD Size per Grid

Inverter	Maximum Output Current (A)	Minimum Fuse Rating (A)	Maximum Fuse Rating (A)
SE3000H-US	12.5	20	50
SE3800H-US	16	20	50
SE5000H-US	24 @ 208V 21 @ 240V	30	50
SE6000H-US	24 @ 208V 25 @ 240V	30 @ 208V 35 @ 240V	50
SE7600H-US	32	40	50
SE10000H-US	42	60	80
SE11400H-US	48.5 @ 208V 47.5 @ 240V	70 @ 208V 60 @ 240V	80

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SEAL:

EQUIPMENT SPECIFICATIONS
PV 16