



To: SUNDA Project Cooperatives

From: February 3, 2015

Re: Reference Block Design for Utility Scale PV Solar System

Purpose: Provides a reference block design with simple, convenient features, which is intended to reduce field time and provides monitoring features. This is a reference design and will need to be adjusted for the particulars of a field site, including electrical string length (based on minimum site temperatures), climatic conditions (such as wind and snow loads), row spacing (based on latitude), land contours, shading, and others. Typical engineering time for such adjustment is intended to be, and historically has been, under 100 hrs for site specific modifications.

What's included: a cover sheet that provides a drawing sheet list, six site plans (layouts, trenching and grounding), single line diagrams, schedules, labels, partial plans for inverter pad, conduit details and stringing plans for arrays.

Design Criteria and Attributes used in creating this design:

- Maximize ground coverage ratio, expandable symmetric block
- Fixed, non-tracking design for cost effective construction and low O&M costs
- Efficient design, allows for most of the array construction to be duplicated
- Combiner box locations optimized to reduce DC conductors, avoiding jumpers or other pull boxes in unusual locations
- Equipment pad centrally located, driving reduced feeder cost and transformation local to solar inverters – configurable with other variations
- Immediate transformation drives lower cost of AC MV conductors
- Access roads can be on either side
- Grounding and Surge Protection: metallic array parts, pad halo grounding, fence grounding, surge arrestors in gear
- MV switch is used as site AC disconnect, reduces pad footprint
- Racking system is ETL listed for grounding, reducing significant bonding requirements and on-site labor
- Racking has integrated wire management
- Racking design is very modular, fast to install and accessible height good for install
- AC Switchgear contains the AC bus, the step down transformer for local 120V power and the revenue meter for DAS
- Using 500kw inverters allows for a centralized electrical equipment pad
- Electrical equipment pad is conveniently accessible. Designed to provide easy service access, minimize concrete, optimize feeder stub ups, 1MW pad is cost effective and allows ability to use shared transformer.
- Expandability and flexible re-design options to meet site specific issues
- Track environmental offsets

- Public view website to view performance online or any internet device
- Remotely troubleshoot and track on-site weather data
- Option features: cell-modem, online storage of data, historical data exports, monthly reporting, alarms, curtailment, fault codes and sensors (horizontal/plane of array pyranometers, wind speed/direction, humidity, ambient temp, cell temp, revenue grade meters, load or bus kw meters)

DISCLAIMER

While significant effort has been made to incorporate all applicable standards and ensure good engineering and correct practice in the development of this design, and this design has been used to develop actual field deployed, utility-scale, solar PV systems, no warranty or guaranty is made on this design for its fitness, suitability, safety or applicability for any purpose. Utilities must employ a trained engineer to interpret and adjust this reference design for the specific requirements of their application.

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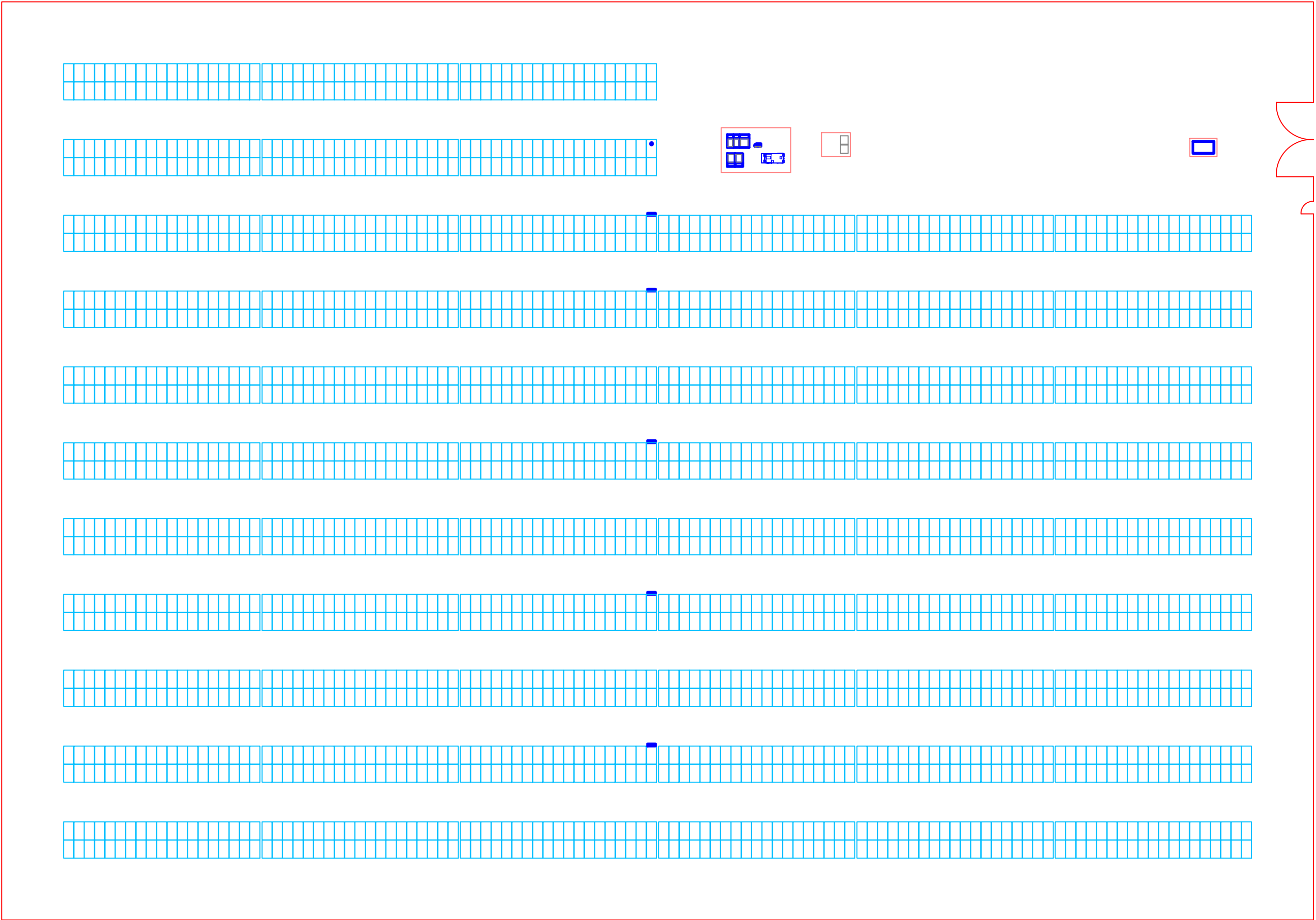
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SUNDA REFERENCE DESIGN

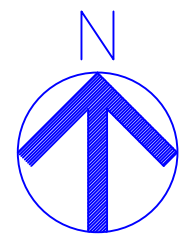
500KWac 1,000Vdc

AC SYSTEM SIZE: 500 KW AC
DC SYSTEM SIZE: 695.4 KW DC
STRING SIZE: 19 MODULES
STRING COUNT: 120
MODULES: 2,280 REC 305W
INVERTERS: 1 ADVANCED ENERGY 500KW
DC VOLTAGE: 1,000V
AC VOLTAGE: 420V, 3φ
ARRAY TILT: 25°
RACKING: SCHLETTER FS
2 HIGH PORTRAIT X 19 WIDE



DRAWING SHEET LIST	
PV0.1	COVER SHEET
PV1.0	SITE PLAN-ARRAY LAYOUT
PV1.1	SITE PLAN-FENCE LAYOUT
PV1.2	SITE PLAN-MEDIUM VOLTAGE ROUTING
PV1.3	SITE PLAN-COMBINER LAYOUT
PV1.4	SITE PLAN-DC ROUTING
PV1.5	SITE PLAN-ARRAY GOUNDING
PV2.0	PV SINGLE LINE DIAGRAM
PV2.1	PV SCHEDULES
PV3.0	PARTIAL PLAN - EQUIPMENT PAD DIMENSIONS
PV3.1	PARTIAL PLAN - EQUIPMENT PAD FEEDER ROUTING
PV3.2	PARTIAL PLAN - EQUIPMENT PAD GROUNDING
PV4.0	PV RISER DIAGRAM
PV4.1	FENCE GROUNDING DETAIL
PV4.2	COMBINER GROUNDING DETAILS
PV5.0	CONDUIT STUB UP DETAILS
PV5.1	CONDUIT DETAILS & COMBINER DETAIL
PV6.0	STRINGING PLAN-ARRAY A

PRELIMINARY
NOT FOR
CONSTRUCTION



1609 Heritage Commerce Ct.
Wake Forest, NC 27587

THIS LINE SHOULD
MEASURE ONE INCH

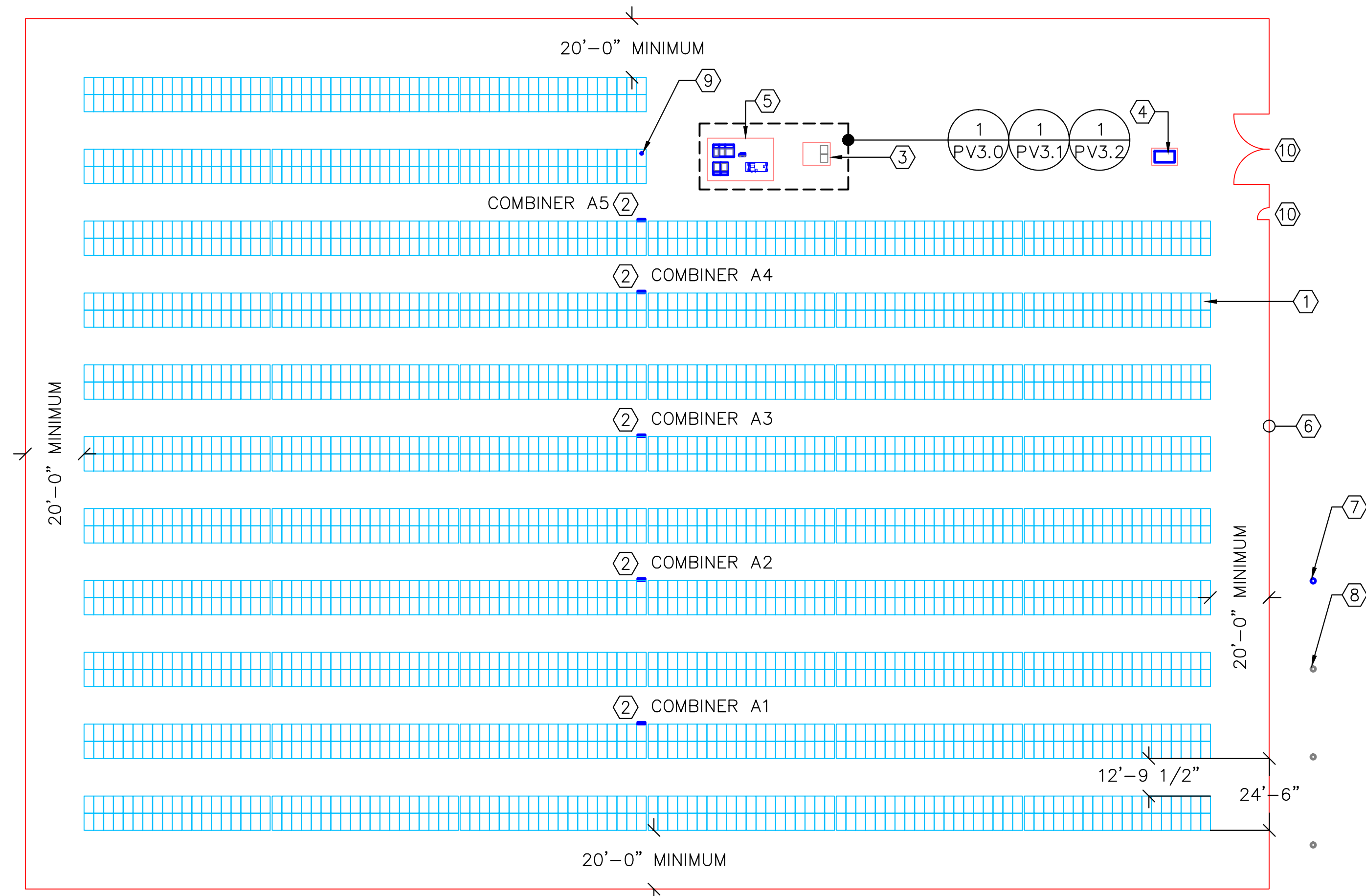
REV.	DATE	DESCRIPTION

TITLE:	COVER SHEET
PROJECT:	NRECA SUNDA REFERENCE DESIGN 500KW — 1,000Vdc

DATE:	02.06.2015
SHEET:	PV0.1



THIS LINE SHOULD
MEASURE ONE WAY



1 SITE PLAN - ARRAY LAYOUT
SCALE: 1/32"=1'-0"

LINE TYPE LEGEND

MODULE	
CONCRETE PAD	
FENCE LINE	
CONTRACTOR PROVIDED EQUIPMENT	
EXISTING/UTILITY PROVIDED EQUIPMENT	

KEYED NOTES (X)

1. PV MODULE, TYPICAL OF 2,280.
2. DISCONNECTING COMBINER BOX.
3. MEDIUM VOLTAGE TRANSFORMER.
4. GROUND MOUNTED MEDIUM VOLTAGE FUSED DISCONNECT SWITCH.
5. EQUIPMENT PAD.
6. FENCE LINE.
7. CONTRACTOR PROVIDED POLE MOUNTED COORDINATED SWITCH.
8. UTILITY PROVIDED POLE, POINT OF INTERCONNECTION.
9. BACK OF MODULE SENSOR.
10. GATE.

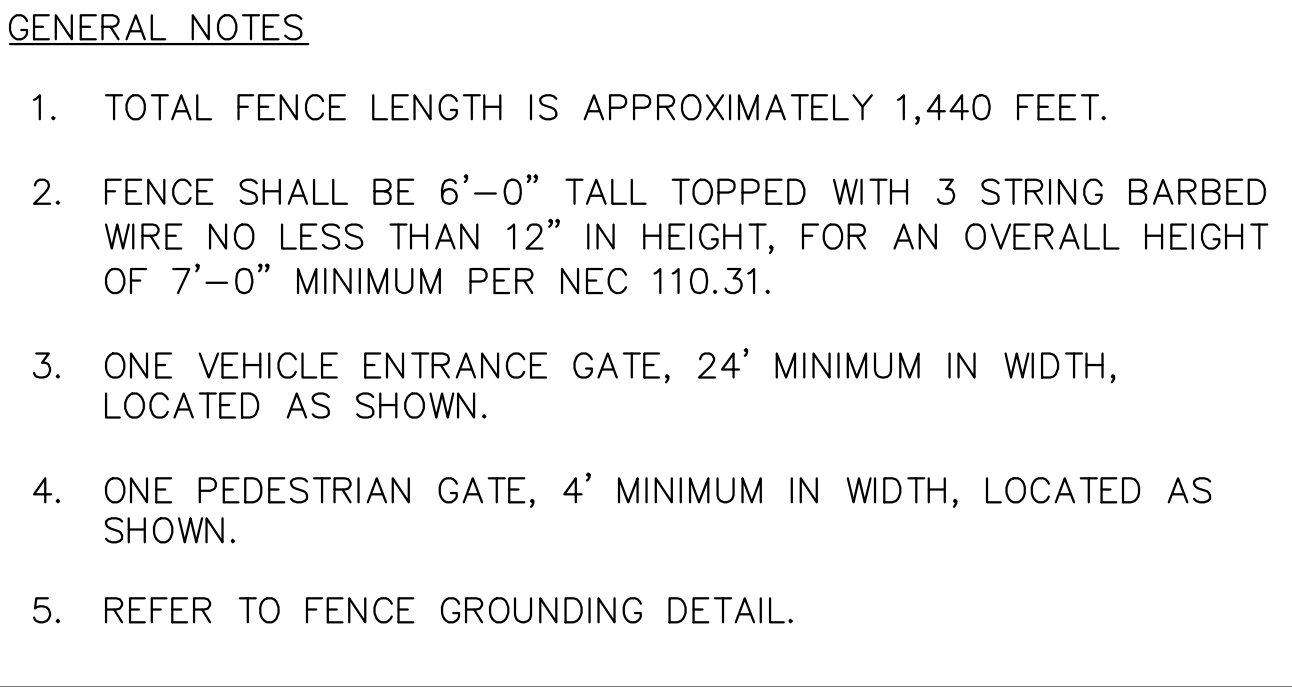
GENERAL NOTES:

1. REFER TO EQUIPMENT SCHEDULE FOR SPECIFICATION.
2. REFER TO SINGLE LINE DIAGRAM AND FEEDER SCHEDULE FOR SPECIFICATIONS.
3. PROVIDE RACKING SYSTEM AT 25° TILT. RACKING SYSTEM SHALL BE A PIER DRIVEN SYSTEM. EACH RACKING SECTION SHALL CONTAIN 2 MODULES HIGH IN PORTRAIT. HORIZONTAL DISTANCE BETWEEN RACK SECTIONS SHALL BE SPECIFIED BY MANUFACTURE. THE RACKING SYSTEM SHALL BE UL LISTED FOR GROUNDING CONTINUITY. COMPONENTS WITHIN THE RACKING SYSTEM SHALL FORM AN ELECTRICALLY BONDED UNIT AND WILL REQUIRE ADDITIONAL BONDING FROM ONE INDIVIDUAL RACK SECTION TO ADJACENT SECTIONS. MANUFACTURER SHALL PROVIDE SIGNED AND SEALED STRUCTURAL DOCUMENTATION.
4. STRINGING FEEDERS SHALL BE ROUTED IN RACKING INTEGRATED WIRE MANAGEMENT OR BELOW GRADE AS NOTED ON DC ROUTING PLAN.
5. COMBINER FEEDERS SHALL BE ROUTED BELOW GRADE TO EQUIPMENT PAD, REFER TO DC ROUTING PLAN.

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TITLE: SITE PLAN - ARRAY LAYOUT
PROJECT: NRECA
SUNDA REFERENCE DESIGN
500KW - 1,000Vdc

DATE: 02.06.2015
SHEET: PV1.0

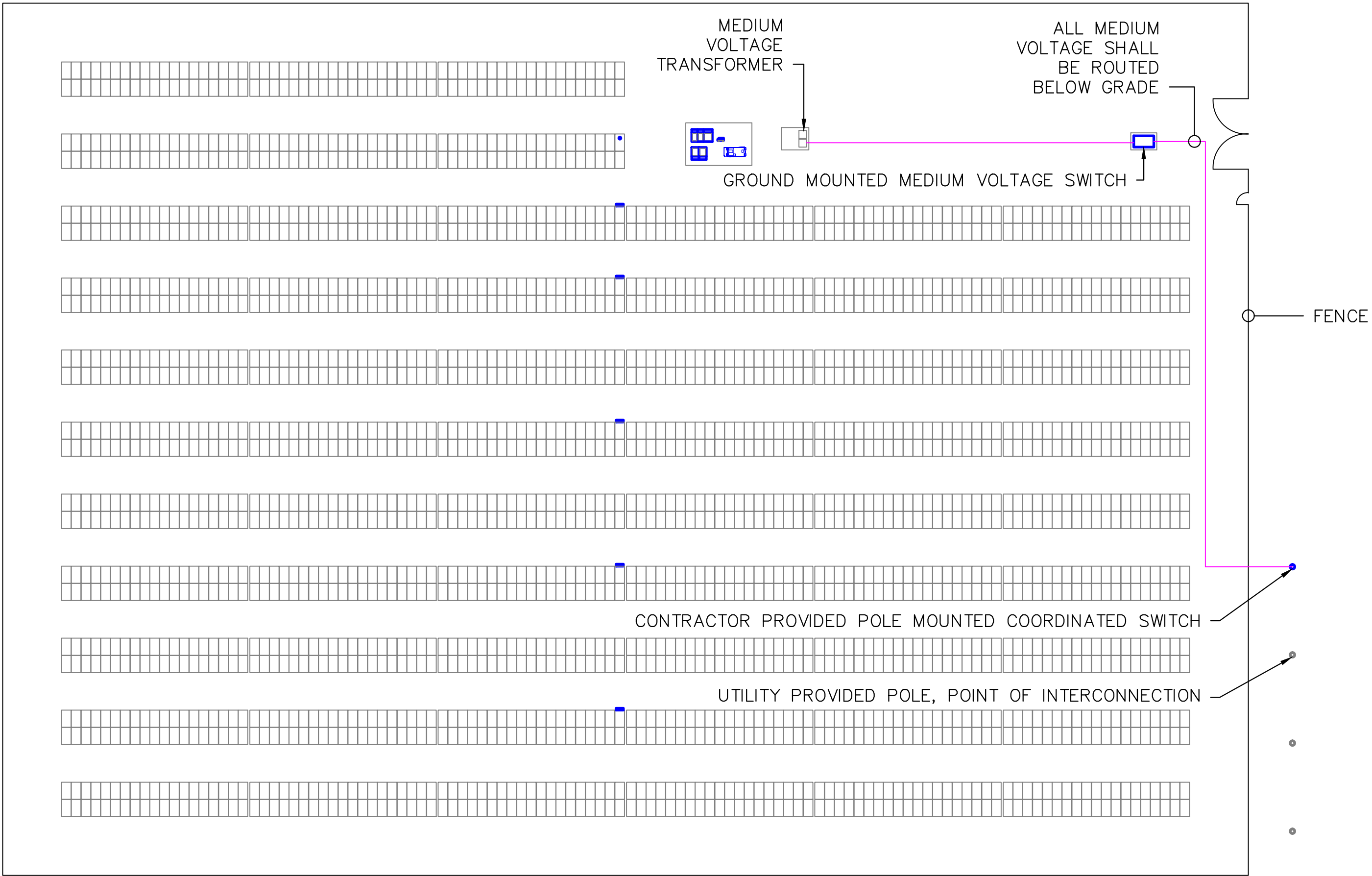


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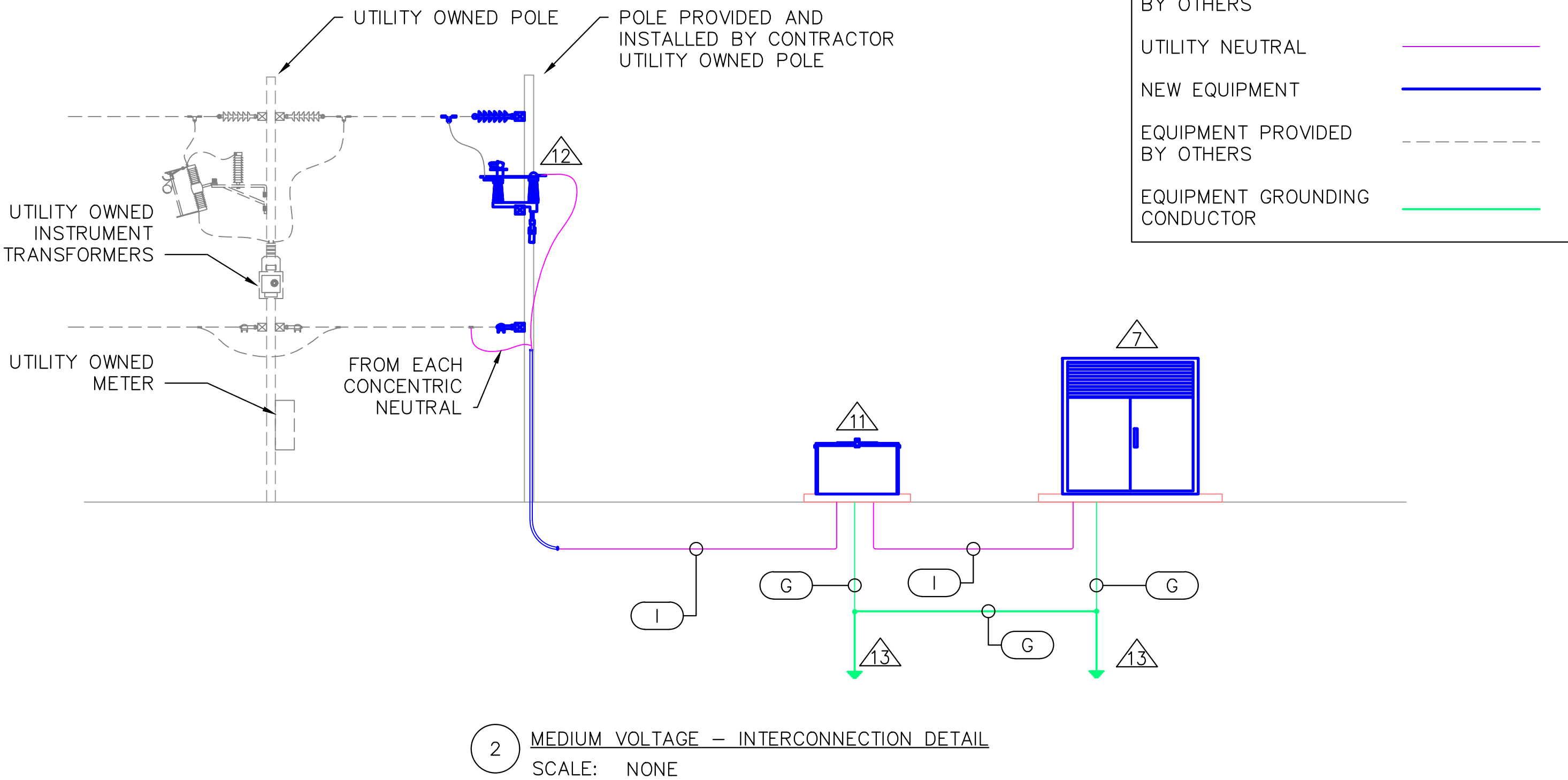
EQUIPMENT SCHEDULE			
**EQUIPMENT IS NOTED BY			
TAG	DESCRIPTION	QUANTITY	DESCRIPTION
1	SOLAR PV MODULE	2280	305 WATT MODULE (REFER TO DRAWINGS FOR QUANTITY AND LOCATION). MODULES SHALL BE LABELED PER NEC 690 VI.
2	CONTACTOR COMBINER	5	24 STRING DISCONNECTING COMBINER TO CONTAIN 24 STRINGS, RATED AT 400A WITH EACH POSITIVE AND EACH NEGATIVE FUSED (TOTAL 48) 15A FUSES, 1000 VDC, RATED FOR CONTINUOUS DUTY, WITH DISCONNECT HANDLE MOUNTED ON DOOR EXTERIOR, NEMA 3R ENCLOSURE, TRANSIENT SURGE SUPPRESSION. ENCLOSURE SHALL BE A MINIMUM OF 30" W X 38" H X 8" DEEP.
3	DC CIRCUIT BREAKER UNIT	1	NEMA 3R ENCLOSURE WITH (5) 350A, 1000Vdc CIRCUIT BREAKERS
4	INVERTER	1	500 KWATT, 1000VDC, 3 PHASE 420 VAC, FLOATING GROUND CONFIGURATION. (REFER TO INVERTER RATING SCHEDULE FOR ADDITIONAL INFORMATION)
5	AC CIRCUIT BREAKER UNIT	1	NEMA 3R ENCLOSURE, 2000A BUS WITH 1000AF/AT MAIN CIRCUIT BREAKER, (1) 1000AF/900AT 3 POLE CIRCUIT BREAKER, (1) 30A 3 POLE CIRCUIT BREAKER PROVIDE SURGE PROTECTION, RATED FOR SERVICE ENTRANCE. INTEGRATED 2KVA STEPDOWN TRANSFORMER WITH CAPACITY FOR (1) 15A SINGLE POLE 120V CIRCUIT BREAKER AND (1) 15A 2 POLE 240V CIRCUIT BREAKER.
6	RECEPTACLE	1	120V, 20 AMP, WEATHER PROOF GFI DUPLEX RECEPTACLE.
7	MEDIUM VOLTAGE TRANSFORMER	1	2000KVA, THREE PHASE, 12.47KV YGRD/7.2KV PRIMARY AND 420V WYE SECONDARY, LIQUID COOLED TRANSFORMER, BAYONET FUSES ON PRIMARY SIDE. REQUIRED TO MEET UTILITY REQUIREMENTS.
8	PHOTOVOLTAIC PRODUCTION MONITORING EQUIPMENT	1	CENTRAL DATA ACQUISITION UNIT, NEMA 3R ENCLOSURE WITH BATTERY BACK UP, LOCAL DATA STORAGE, INTEGRAL CELL MODEM COMMUNICATIONS, WEB BASED DISPLAY AND LOCAL KEYPAD DISPLAY. 120V POWER SUPPLY.
9	PHOTOVOLTAIC MONITORING METEOROLOGICAL STATION	1	STATION INCLUDES: PYRANOMETER - PLANE OF ARRAY, BACK OF MODULE TEMPERATURE SENSOR, AMBIENT TEMPERATURE, ANEMOMETER
10	PHOTOVOLTAIC PRODUCTION MONITORING METER	1	REVENUE GRADE METER WITH MODBUS RTU COMMUNICATIONS
11	MEDIUM VOLTAGE FUSED SWITCH	1	15KV PAD MOUNTED SWITCH WITH INTEGRATED 60A STANDARD SPEED FUSES
12	COORDINATED POLE MOUNTED SWITCH	1	SWITCH TO MEET THE REQUIREMENTS OF THE UTILITY
13	GROUND ROD	4	3/4" DIAMETER, 30'-0" LONG COPPER CLAD GROUND ROD

FEEDER SCHEDULE									
NOTED BY α **FEEDER IS									
TAG	CONDUCTOR TYPE	CONDUCTOR TYPE	INSULATION TYPE	GROUND SIZE	GROUND TYPE	GROUND INSULATION TYPE	RACEWAY SIZE	RACEWAY QUANTITY	NOTES
A12	(12) #10 PER RACEWAY	COPPER	PV	(1) #10 PER RACEWAY	COPPER	PV	2" NOTE 5	(1)	
A24	(24) #10 PER RACEWAY	COPPER	PV	(1) #10 PER RACEWAY	COPPER	PV	2-1/2" NOTE 5	(1)	
B	(4) #4/0 PER RACEWAY	ALUMINUM	PV	(1) #3 PER RACEWAY	COPPER	PV	2-1/2"	(1)	
C	(3) 500 KCMIL PER RACEWAY	ALUMINUM	THWN-2	(1) #4/0 PER RACEWAY	ALUMINUM	THWN-2	3"	(3)	
D	(3) 400 KCMIL PER RACEWAY	ALUMINUM	THWN-2				3"	(4)	
	(1) 400 KCMIL NEU PER RACEWAY	ALUMINUM	THWN-2						
E	(1) #12 PER RACEWAY	COPPER	THWN-2	(1) #12 PER RACEWAY	COPPER	BARE	3/4"	(1)	
	(1) #12 NEU PER RACEWAY	COPPER	THWN-2						
F	(2) 500 KCMIL PER RACEWAY	COPPER	PV	(1) #3 PER RACEWAY	COPPER	PV	3"	(1)	
G				(1) #2/0 PER RACEWAY	COPPER	BARE			
H				(1) #3 PER RACEWAY	COPPER	THWN-2	3/4"	(1)	
I	NOTE 6	(3) #1/0 PER RACEWAY	ALUMINUM	MV TR-XLPE WITH CONCENTRIC NEUTRAL			3-1/2"	(1)	
J				BELDEN #3084A			3/4"	(1)	
K				MANUFACTURER WHIP			3/4"	(1)	

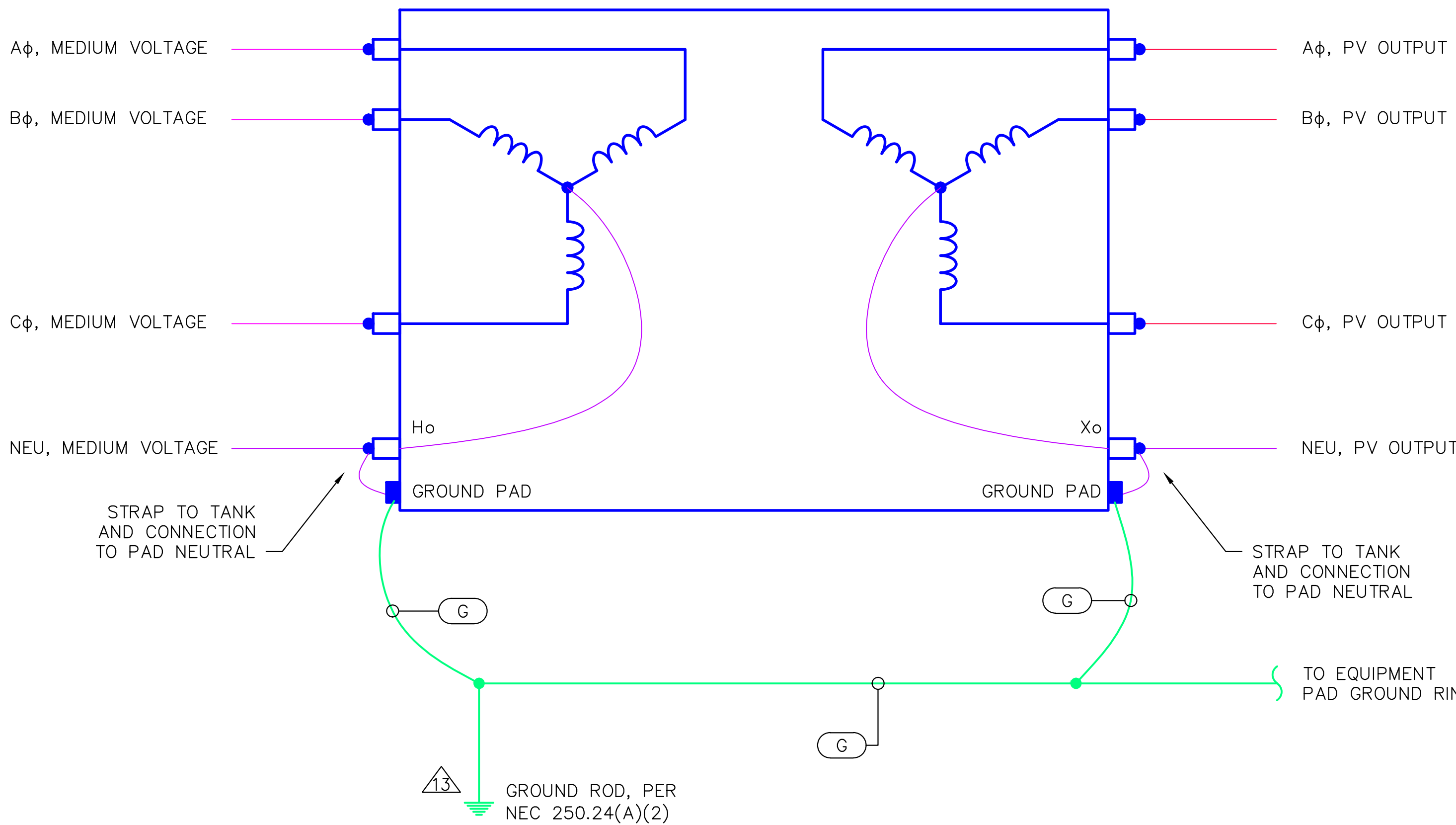
- NOTES:
- (#) - DENOTES QUANTITY TO BE PROVIDED
 - WHERE MULTIPLE CONDUITS ARE NOTED, THE RACEWAYS SHALL BE PROVIDED IN PARALLEL.
 - REFER TO RACEWAY APPLICATION SCHEDULE FOR RACEWAY TYPE.
 - ALL RACEWAY SIZES ARE NEC MINIMUM REQUIREMENTS, LARGER CONDUITS ARE PERMITTED FOR EASE OF INSTALLATION.
 - PV SOURCE CIRCUITS SHALL NOT BE REQUIRED TO BE IN RACEWAY IF CONDUCTORS ARE NOT READILY ACCESSIBLE AND NOT EXPOSED TO PHYSICAL DAMAGE. BELOW GRADE PV SOURCE CIRCUITS SHALL BE IN RACEWAY.
 - PROVIDE 15 KV MEDIUM VOLTAGE FEEDERS WITH 100% INSULATION.



1 SITE PLAN — MEDIUM VOLTAGE ROUTING
SCALE: 1/32"=1'-0"

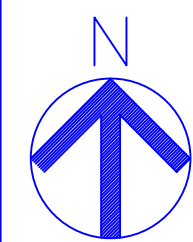


2 MEDIUM VOLTAGE — INTERCONNECTION DETAIL
SCALE: NONE



3 MEDIUM VOLTAGE TRANSFORMER DETAIL
SCALE: NONE

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CONSTRUCTION



THIS LINE SHOULD
MEASURE ONE WAY

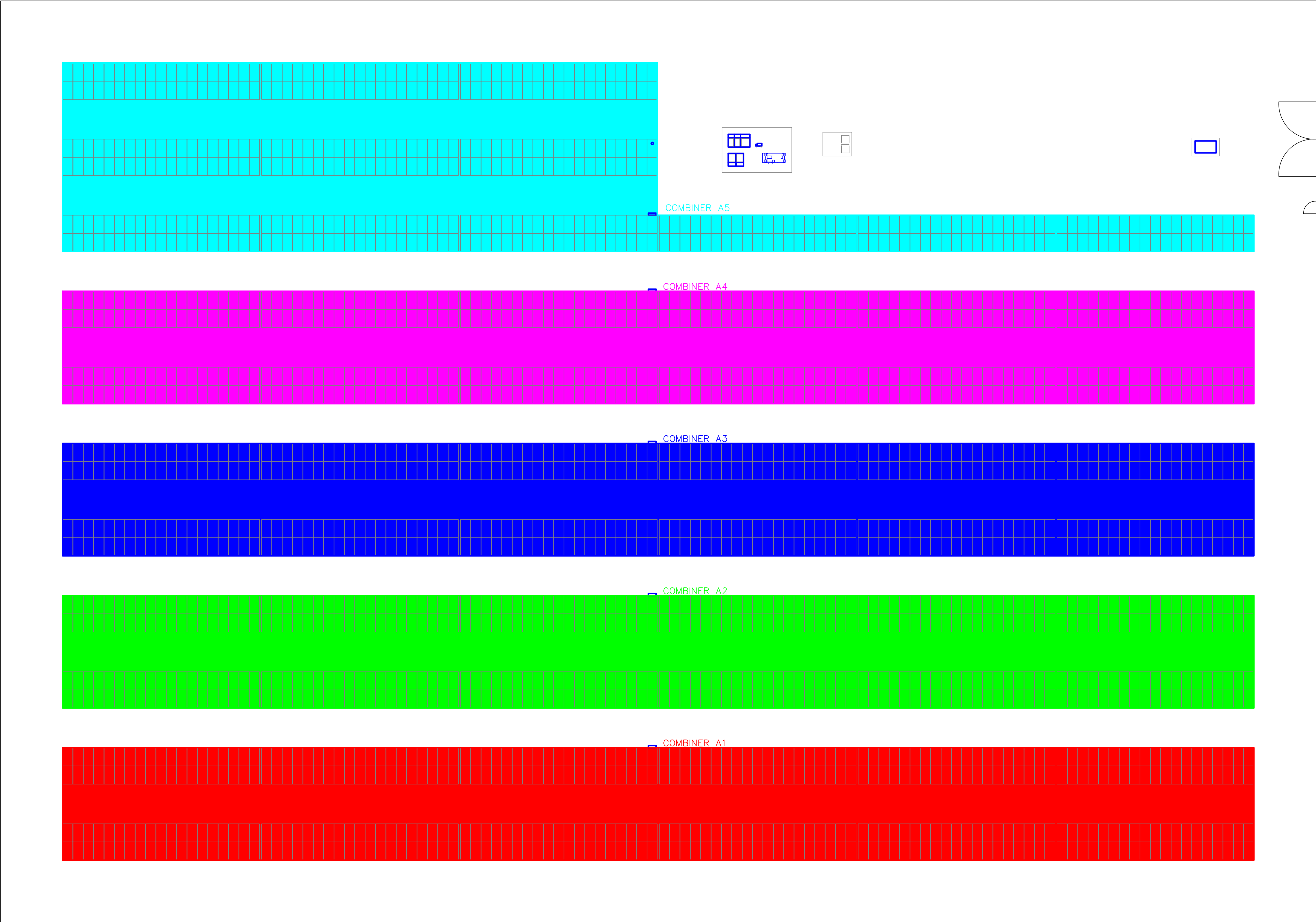
REV. DATE DESCRIPTION

SITE PLAN — MEDIUM VOLTAGE ROUTING
NRECA REFERENCE DESIGN
BOOKW — 1,000Vdc

TITLE:
PROJECT:
DATE:
SHEET:

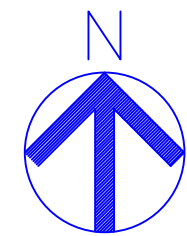
PV1.2

Pkg Date: 2/10/2015



1 SITE PLAN - COMBINER LAYOUT
SCALE: 1/16"=1'-0"

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CONSTRUCTION



THIS LINE SHOULD
MEASURE ONE WAY

REV.	DATE	DESCRIPTION

TITLE: SITE PLAN - COMBINER LAYOUT
PROJECT: NRECA
SUNDA REFERENCE DESIGN
500KW - 1,000VDC

DATE:
02.06.2015
SHEET:

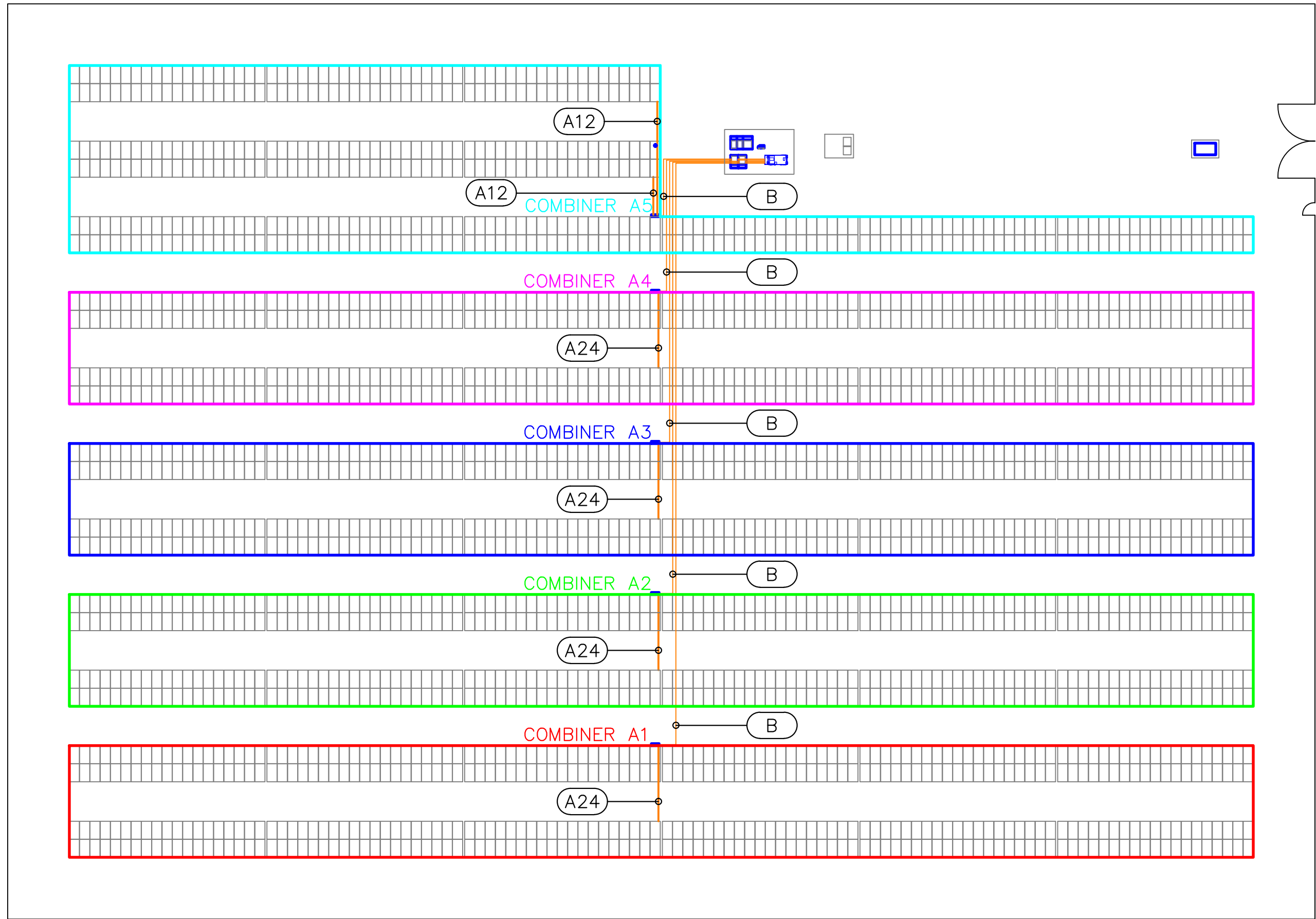
PV1.3

GENERAL NOTES:

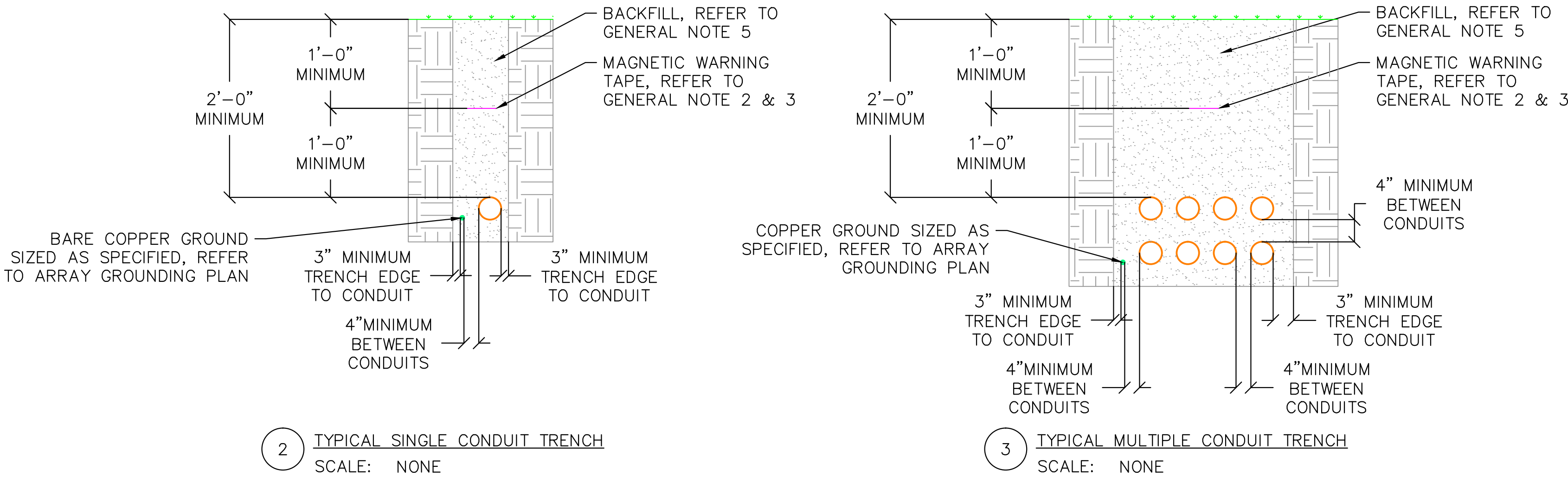
1. RACEWAY SHALL BE PER CONDUIT APPLICATION SCHEDULE.
2. FOR TRENCHES 24" WIDE AND LESS, ONLY ONE RUN OF MAGNETIC ELECTRICAL WARNING TAPE SHALL BE REQUIRED PER DETAIL 3.
3. FOR TRENCHES WIDER THAN 24" ONE PIECE OF TAPE SHALL BE LOCATED AT EACH SIDE OF THE TRENCH WITH ADDITIONAL RUNS PROVIDED AS NECESSARY. THE MAXIMUM DISTANCE BETWEEN TAPE RUNS SHALL BE 24" ON CENTER.
4. TRENCH BOTTOMS: EXCAVATE TRENCHES 3" DEEPER THAN BOTTOM OF PIPE ELEVATION TO ALLOW FOR BEDDING COURSE. HAND EXCAVATE FOR BELL OF PIPE. EXCAVATE TRENCHES 3" DEEPER THAN ELEVATION REQUIRED IN ROCK OR OTHER UNYIELDING BEARING MATERIAL TO ALLOW BEDDING COURSE.
5. ALL BACKFILL SHOULD BE FREE OF MATERIALS THAT MAY DAMAGE THE CONDUIT OR CABLE SYSTEM. BACKFILL WITHIN 150 MM (6 IN) OF THE CONDUIT OR CABLE SHOULD BE FREE OF SOLID MATERIAL GREATER THAN 100 MM (2 IN) IN MAXIMUM DIMENSION OR WITH SHARP EDGES LIKELY TO DAMAGE IT. THE BALANCE OF BACKFILL SHOULD BE FREE OF SOLID MATERIAL GREATER THAN 200 MM (8 IN) IN MAXIMUM DIMENSION. BACKFILL MATERIAL SHOULD BE ADEQUATELY COMPACTED.
6. REFER TO ARRAY GROUNDING PLAN FOR BARE COPPER GROUND TRENCH ROUTING.
7. FEEDER ROUTING SHOWN DIAGRAMMATICALLY, COORDINATION WITH SITE CONDITIONS REQUIRED.

FEEDER SCHEDULE											**FEEDER IS	
NOTED BY											α	
TAG	CONDUCTOR TYPE			CONDUCTOR TYPE	INSULATION TYPE	GROUND SIZE		GROUND TYPE	GROUND INSULATION TYPE	RACEWAY SIZE	RACEWAY QUANTITY ^{NOTE2}	
A12	(12)	#10	PER RACEWAY	COPPER	PV	(1)	#10	PER RACEWAY	COPPER	PV	2" ^{NOTE 5}	(1)
A24	(24)	#10	PER RACEWAY	COPPER	PV	(1)	#10	PER RACEWAY	COPPER	PV	2-1/2" ^{NOTE 5}	(1)
B	(4)	#4/0	PER RACEWAY	ALUMINUM	PV	(1)	#3	PER RACEWAY	COPPER	PV	2-1/2"	(1)
C	(3)	500 KCMIL	PER RACEWAY	ALUMINUM	THWN-2	(1)	#4/0	PER RACEWAY	ALUMINUM	THWN-2	3"	(3)
D	(3) 400 KCMIL PER RACEWAY			ALUMINUM	THWN-2						3"	(4)
	(1) 400 KCMIL NEU PER RACEWAY			ALUMINUM	THWN-2							
E	(1) #12 PER RACEWAY			COPPER	THWN-2	(1)	#12	PER RACEWAY	COPPER	BARE	3/4"	(1)
	(1) #12 NEU PER RACEWAY			COPPER	THWN-2							
F	(2) 500 KCMIL PER RACEWAY			COPPER	PV	(1)	#3	PER RACEWAY	COPPER	PV	3"	(1)
G						(1) #2/0 PER RACEWAY		COPPER	BARE			
H						(1) #3 PER RACEWAY		COPPER	THWN-2	3/4"	(1)	
I ^{NOTES}	(3) #1/0 PER RACEWAY			ALUMINUM	MV TR-XLPE WITH CONCENTRIC NEUTRAL						3-1/2"	(1)
J	BELDEN #3084A										3/4"	(1)
K	MANUFACTURER WHIP										3/4"	(1)

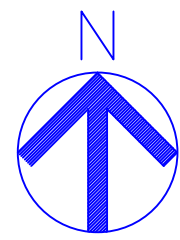
- NOTES:
- 1 (#) - DENOTES QUANTITY TO BE PROVIDED
 2. WHERE MULTIPLE CONDUITS ARE NOTED, THE RACEWAYS SHALL BE PROVIDED IN PARALLEL.
 3. REFER TO RACEWAY APPLICATION SCHEDULE FOR RACEWAY TYPE.
 4. ALL RACEWAY SIZES ARE NEC MINIMUM REQUIREMENTS, LARGER CONDUITS ARE PERMITTED FOR EASE OF INSTALLATION.
 5. PV SOURCE CIRCUITS SHALL NOT BE REQUIRED TO BE IN RACEWAY IF CONDUCTORS ARE NOT READILY ACCESSIBLE AND NOT EXPOSED TO PHYSICAL DAMAGE. BELOW GRADE PV SOURCE CIRCUITS SHALL BE IN RACEWAY.
 6. PROVIDE 15 KV MEDIUM VOLTAGE FEEDERS WITH 100% INSULATION.



1 SITE PLAN - DC ROUTING
SCALE: 1/32"=1'-0"



PRELIMINARY
NOT FOR
CONSTRUCTION



THIS LINE SHOULD
MEASURE ONE WAY

REV.	DATE	DESCRIPTION

SITE PLAN - DC ROUTING
NPECA
SUNDA REFERENCE DESIGN
500KW - 1,000Vdc

TITLE:
PROJECT:
DATE:
SHEET:

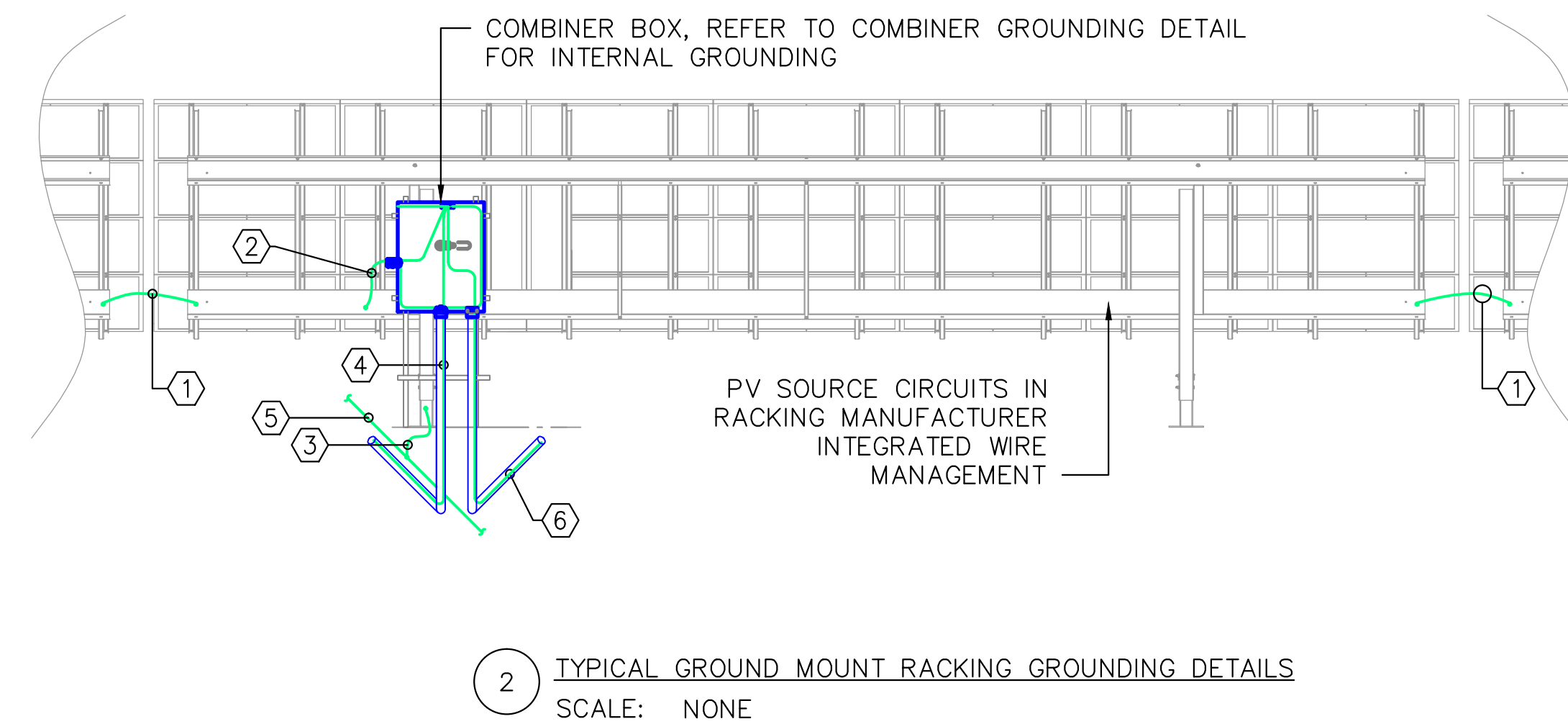
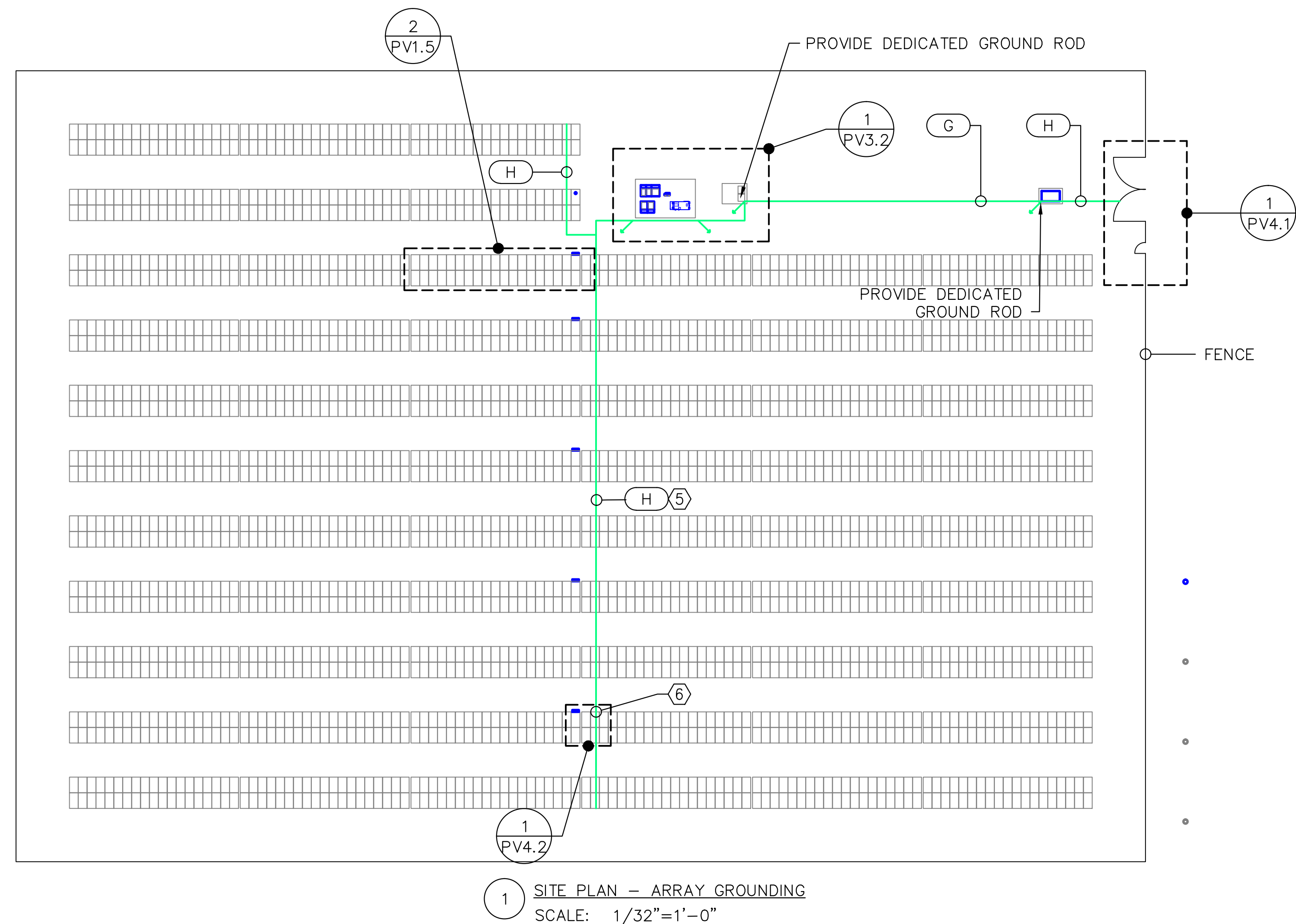
PV1.4



REV.	DATE	DESCRIPTION

TITLE: SITE PLAN - ARRAY GROUNDING
PROJECT: NRECA
SUNDA REFERENCE DESIGN
BOOKW - 1,000Vdc

DATE: 02.06.2015
SHEET: PV1.5



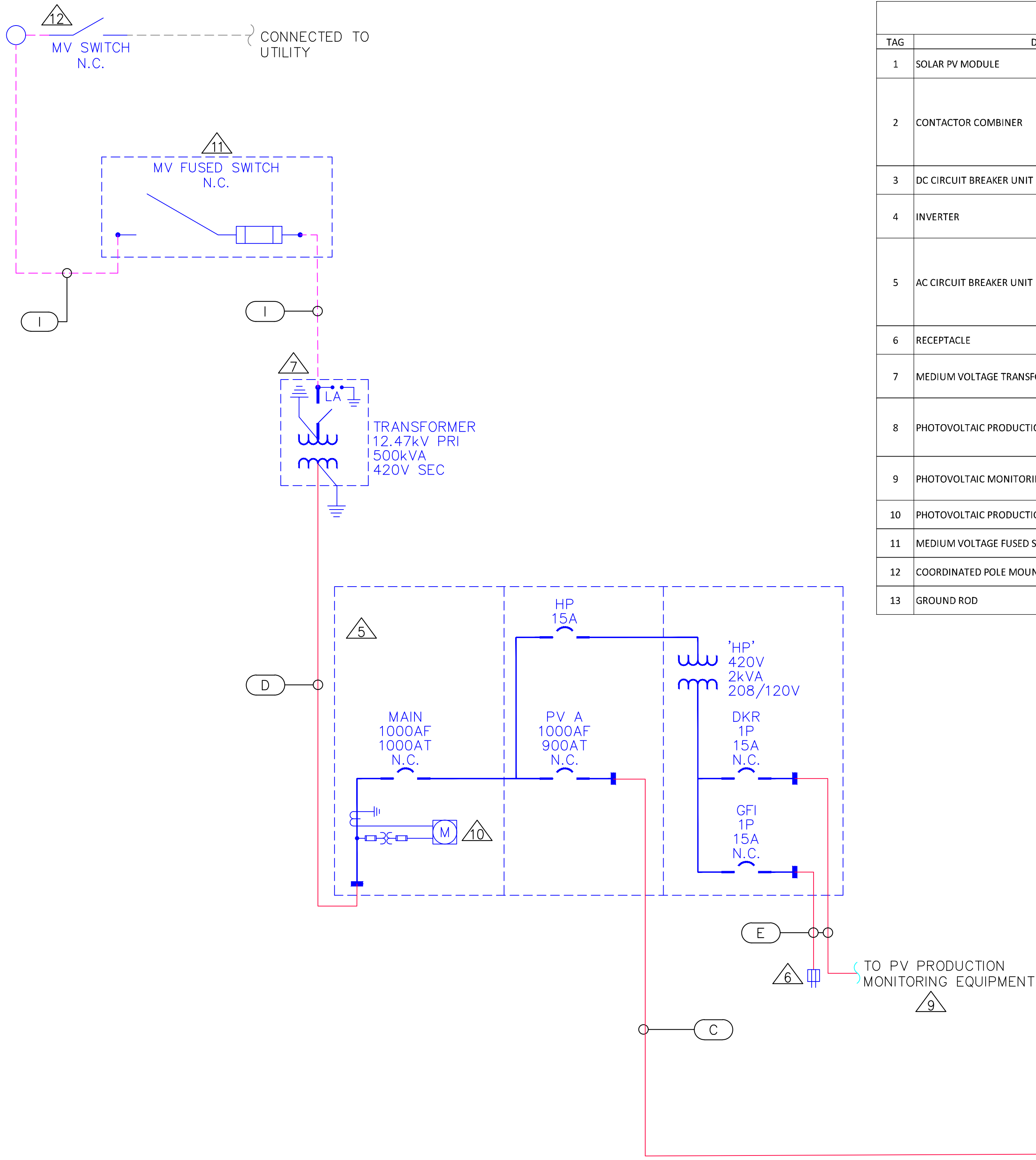
GENERAL NOTES

1. THE RACKING SYSTEM IS LISTED PER UL 2703 FOR GROUNDING CONTINUITY. COMPONENTS WITHIN THE RACKING SYSTEM FORM AN ELECTRICALLY BONDED UNIT AND REQUIRE ADDITIONAL BONDING FROM ONE INDIVIDUAL RACK SECTION TO ADJACENT SECTIONS.
2. REFER TO PV RISER DIAGRAM FOR SYSTEM GROUNDING.
3. REFER TO SINGLE LINE DIAGRAM AND SCHEDULES FOR SPECIFICATIONS
4. WIRE TYPE H (BARE COPPER #3) SHALL BE RUN IN TRENCH WITH COMBINER DC WIRES.
5. GROUND ROUTING SHOWN DIAGRAMMATICALLY, COORDINATION WITH SITE CONDITIONS REQUIRED.

KEYED NOTES (X)

1. PROVIDE GROUND BRAID BETWEEN RACKING SECTIONS PER RACKING MANUFACTURER INSTRUCTIONS.
2. PROVIDE #6 BARE COPPER BONDING JUMPER FROM THE COMBINER BOX GROUND BAR TO THE WIRE TRAY.
3. PROVIDE #6 BARE COPPER BONDING JUMPER VIA IRREVERSIBLE CRIMP FROM ARRAY EQUIPMENT GROUND CONDUCTOR IN TRENCH TO ONE PIER PER ROW OF RACKING. IRREVERSIBLE CRIMP SHALL BE UL LISTED FOR GROUNDING AND BONDING. ENSURE ALL CONNECTIONS ARE TORQUED TO MANUFACTURER'S RECOMMENDED TORQUE VALUE.
4. PROVIDE EQUIPMENT GROUND CONDUCTOR (REFER TO SINGLE LINE DIAGRAM AND SCHEDULES FOR EGC SIZE) FROM COMBINER BOX GROUND BUS BAR TO ASSOCIATED INVERTER BUS BAR. EQUIPMENT GROUND CONDUCTOR SHALL BE RUN IN CONDUIT WITH ASSOCIATED PV OUTPUT CONDUCTORS.
5. PROVIDE ARRAY EQUIPMENT GROUND CONDUCTOR LENGTH OF ARRAY.
6. PROVIDE #10 PV COPPER BONDING JUMPER FROM THE COMBINER BOX GROUND BAR TO THE WIRE TRAY ON ADJACENT ROW SUPPLIED BY ASSOCIATED COMBINER.

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LINE TYPE LEGEND:

DC FEEDERS	
AC FEEDERS	
MEDIUM VOLTAGE FEEDER	
EQUIPMENT	
MODULES	
PROVIDED BY OTHERS	

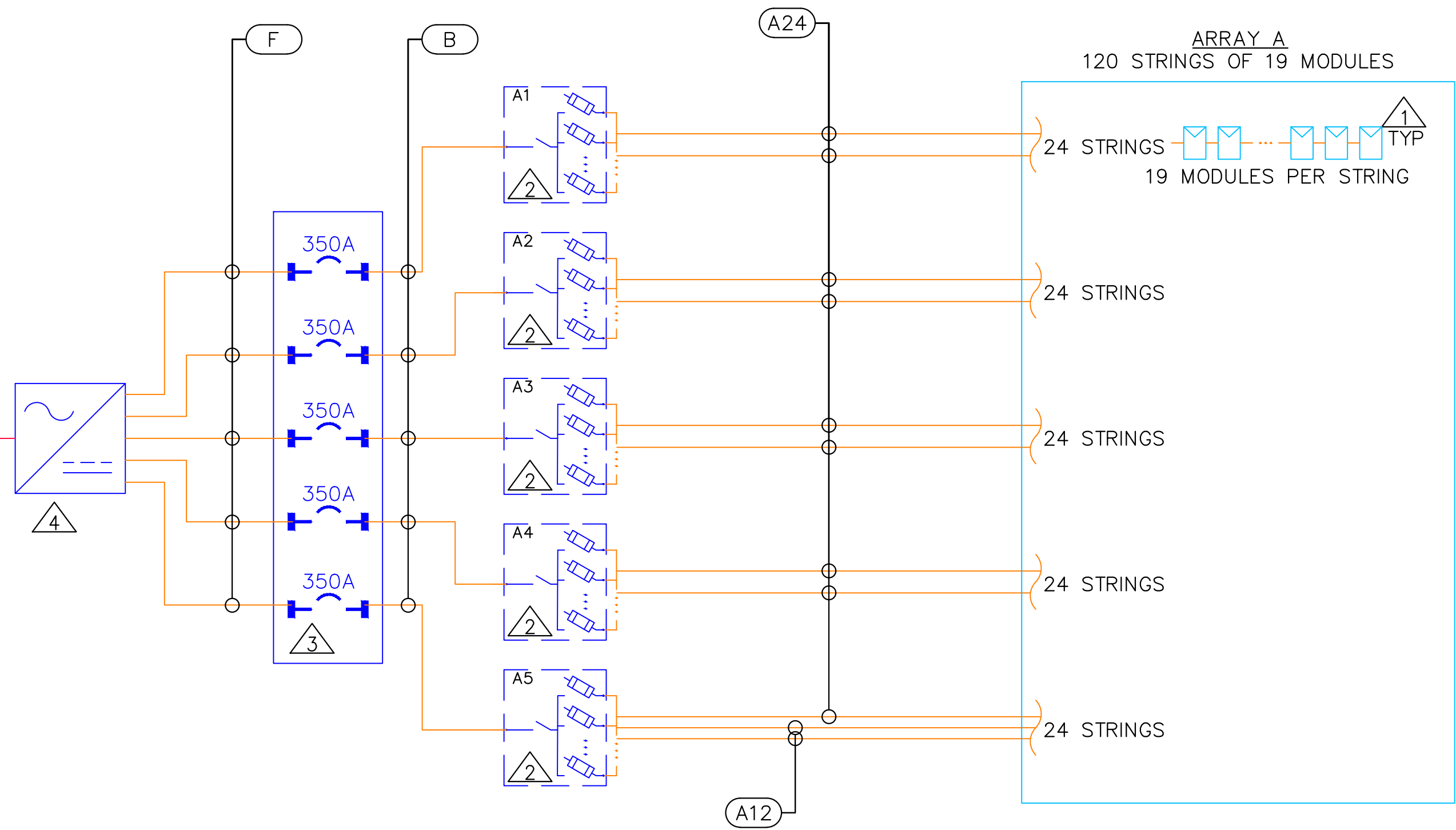
GENERAL NOTES:

- USE COMPRESSION LUGS WITH BELLEVILLE WASHERS ON AC AND DC FEEDERS WITHIN INVERTER.
- PROVIDE LABELS TO EACH INCOMING CIRCUIT IN THE INVERTER.
- PROVIDE LIQUID TIGHT BONDING HUB ASSEMBLY ON EXTERIOR OF ENCLOSURE AT EACH CONDUIT PENETRATION FOR ENCLOSURES EXPOSED TO ELEMENTS.
- PROVIDE ANTIOXIDANT CORROSION INHIBITOR FOR APPLICATION ON ALL LISTED CONNECTIONS.
- PROVIDE IRREVERSIBLE BONDS AT ALL GROUNDING ELECTRODE CONDUCTORS.

EQUIPMENT SCHEDULE			
**EQUIPMENT IS NOTED BY #			
TAG	DESCRIPTION	QUANTITY	DESCRIPTION
1	SOLAR PV MODULE	2280	305 WATT MODULE (REFER TO DRAWINGS FOR QUANTITY AND LOCATION). MODULES SHALL BE LABELED PER NEC 690 VI.
2	CONTACTOR COMBINER	5	24 STRING DISCONNECTING COMBINER TO CONTAIN 24 STRINGS, RATED AT 400A WITH EACH POSITIVE AND EACH NEGATIVE FUSED (TOTAL 48) 15A FUSES, 1000 VDC, RATED FOR CONTINUOUS DUTY, WITH DISCONNECT HANDLE MOUNTED ON DOOR EXTERIOR, NEMA 3R ENCLOSURE, TRANSIENT SURGE SUPPRESSION. ENCLOSURE SHALL BE A MINIMUM OF 30" W X 38" H X 8" DEEP.
3	DC CIRCUIT BREAKER UNIT	1	NEMA 3R ENCLOSURE WITH (5) 350A, 1000Vdc CIRCUIT BREAKERS
4	INVERTER	1	500 KWATT, 1000VDC, 3 PHASE 420 VAC, FLOATING GROUND CONFIGURATION. (REFER TO INVERTER RATING SCHEDULE FOR ADDITIONAL INFORMATION)
5	AC CIRCUIT BREAKER UNIT	1	NEMA 3R ENCLOSURE, 2000A BUS WITH 1000AF/AT MAIN CIRCUIT BREAKER, (1) 1000AF/900AT 3 POLE CIRCUIT BREAKER, (1) 30A 3 POLE CIRCUIT BREAKER PROVIDE SURGE PROTECTION, RATED FOR SERVICE ENTRANCE. INTEGRATED 2KVA STEPDOWN TRANSFORMER WITH CAPACITY FOR (1) 15A SINGLE POLE 120V CIRCUIT BREAKER AND (1) 15A 2 POLE 240V CIRCUIT BREAKER.
6	RECEPTACLE	1	120V, 20 AMP, WEATHER PROOF GFI DUPLEX RECEPTACLE.
7	MEDIUM VOLTAGE TRANSFORMER	1	2000KVA, THREE PHASE, 12.47KV YGRD/7.2KV PRIMARY AND 420V WYE SECONDARY, LIQUID COOLED TRANSFORMER, BAYONET FUSES ON PRIMARY SIDE. REQUIRED TO MEET UTILITY REQUIREMENTS.
8	PHOTOVOLTAIC PRODUCTION MONITORING EQUIPMENT	1	CENTRAL DATA ACQUISITION UNIT, NEMA 3R ENCLOSURE WITH BATTERY BACK UP, LOCAL DATA STORAGE, INTEGRAL CELL MODEM COMMUNICATIONS, WEB BASED DISPLAY AND LOCAL KEYPAD DISPLAY. 120V POWER SUPPLY.
9	PHOTOVOLTAIC MONITORING METEOROLOGICAL STATION	1	STATION INCLUDES: PYRANOMETER - PLANE OF ARRAY, BACK OF MODULE TEMPERATURE SENSOR, AMBIENT TEMPERATURE, ANEMOMETER
10	PHOTOVOLTAIC PRODUCTION MONITORING METER	1	REVENUE GRADE METER WITH MODBUS RTU COMMUNICATIONS
11	MEDIUM VOLTAGE FUSED SWITCH	1	15KV PAD MOUNTED SWITCH WITH INTEGRATED 60A STANDARD SPEED FUSES
12	COORDINATED POLE MOUNTED SWITCH	1	SWITCH TO MEET THE REQUIREMENTS OF THE UTILITY
13	GROUND ROD	4	3/4" DIAMETER, 10'-0" LONG COPPER CLAD GROUND ROD

FEEDER SCHEDULE									
NOTED BY α									
TAG	CONDUCTOR TYPE			CONDUCTOR TYPE	INSULATION TYPE	GROUND SIZE		GROUND TYPE	GROUND INSULATION TYPE
A12	(12)	#10	PER RACEWAY	COPPER	PV	(1)	#10	PER RACEWAY	COPPER
A24	(24)	#10	PER RACEWAY	COPPER	PV	(1)	#10	PER RACEWAY	COPPER
B	(4)	#4/0	PER RACEWAY	ALUMINUM	PV	(1)	#3	PER RACEWAY	COPPER
C	(3)	500 KCMIL	PER RACEWAY	ALUMINUM	THWN-2	(1)	#4/0	PER RACEWAY	ALUMINUM
D	(3)	400 KCMIL	PER RACEWAY	ALUMINUM	THWN-2				
	(1)	400 KCMIL	NEU PER RACEWAY	ALUMINUM	THWN-2				
E	(1)	#12	PER RACEWAY	COPPER	THWN-2	(1)	#12	PER RACEWAY	COPPER
	(1)	#12	NEU PER RACEWAY	COPPER	THWN-2				
F	(2)	500 KCMIL	PER RACEWAY	COPPER	PV	(1)	#3	PER RACEWAY	COPPER
G						(1)	#2/0	PER RACEWAY	COPPER
H						(1)	#3	PER RACEWAY	COPPER
I	(3)	#1/0	PER RACEWAY	ALUMINUM	MV TR-XLPE WITH CONCENTRIC NEUTRAL				
J	BELDEN #3084A								
K	MANUFACTURER WHIP								

- NOTES:
- 1 (#) - DENOTES QUANTITY TO BE PROVIDED
 2. WHERE MULTIPLE CONDUITS ARE NOTED, THE RACEWAYS SHALL BE PROVIDED IN PARALLEL.
 3. REFER TO RACEWAY APPLICATION SCHEDULE FOR RACEWAY TYPE.
 4. ALL RACEWAY SIZES ARE NEC MINIMUM REQUIREMENTS. LARGER CONDUITS ARE PERMITTED FOR EASE OF INSTALLATION.
 5. PV SOURCE CIRCUITS SHALL NOT BE REQUIRED TO BE IN RACEWAY IF CONDUCTORS ARE NOT READILY ACCESSIBLE AND NOT EXPOSED TO PHYSICAL DAMAGE. BELOW GRADE PV SOURCE CIRCUITS SHALL BE IN RACEWAY.
 6. PROVIDE 15 KV MEDIUM VOLTAGE FEEDERS WITH 100% INSULATION.



PRELIMINARY
NOT FOR
CONSTRUCTION




THIS LINE SHOULD
MEASURE ONE WAY

REV.	DATE	DESCRIPTION

TITLE: PV SINGLE LINE DIAGRAM
PROJECT: NRECA REFERENCE DESIGN
500KW - 1,000Vdc

DATE: 02.06.2015
SHEET: PV2.0

EQUIPMENT SCHEDULE			
**EQUIPMENT IS NOTED BY 			
TAG	DESCRIPTION	QUANTITY	DESCRIPTION
1	SOLAR PV MODULE	2280	305 WATT MODULE (REFER TO DRAWINGS FOR QUANTITY AND LOCATION). MODULES SHALL BE LABELED PER NEC 690 VI.
2	CONTACTOR COMBINER	5	24 STRING DISCONNECTING COMBINER TO CONTAIN 24 STRINGS, RATED AT 400A WITH EACH POSITIVE AND EACH NEGATIVE FUSED (TOTAL 48) 15A FUSES, 1000 VDC, RATED FOR CONTINUOUS DUTY, WITH DISCONNECT HANDLE MOUNTED ON DOOR EXTERIOR, NEMA 3R ENCLOSURE, TRANSIENT SURGE SUPPRESSION. ENCLOSURE SHALL BE A MINIMUM OF 30" W X 38" H X 8" DEEP.
3	DC CIRCUIT BREAKER UNIT	1	NEMA 3R ENCLOSURE WITH (5) 350A, 1000Vdc CIRCUIT BREAKERS
4	INVERTER	1	500 KWATT, 1000VDC, 3 PHASE 420 VAC, FLOATING GROUND CONFIGURATION. (REFER TO INVERTER RATING SCHEDULE FOR ADDITIONAL INFORMATION)
5	AC CIRCUIT BREAKER UNIT	1	NEMA 3R ENCLOSURE, 2000A BUS WITH 1000AF/AT MAIN CIRCUIT BREAKER, (1) 1000AF/900AT 3 POLE CIRCUIT BREAKER, (1) 30A 3 POLE CIRCUIT BREAKER PROVIDE SURGE PROTECTION, RATED FOR SERVICE ENTRANCE. INTEGRATED 2KVA STEPDOWN TRANSFORMER WITH CAPACITY FOR (1) 15A SINGLE POLE 120V CIRCUIT BREAKER AND (1) 15A 2 POLE 240V CIRCUIT BREAKER.
6	RECEPTACLE	1	120V, 20 AMP, WEATHER PROOF GFI DUPLEX RECEPTACLE.
7	MEDIUM VOLTAGE TRANSFORMER	1	2000KVA, THREE PHASE, 12.47KV YGRD/7.2KV PRIMARY AND 420V WYE SECONDARY, LIQUID COOLED TRANSFORMER, BAYONET FUSES ON PRIMARY SIDE. REQUIRED TO MEET UTILITY REQUIREMENTS.
8	PHOTOVOLTAIC PRODUCTION MONITORING EQUIPMENT	1	CENTRAL DATA ACQUISITION UNIT, NEMA 3R ENCLOSURE WITH BATTERY BACK UP, LOCAL DATA STORAGE, INTEGRAL CELL MODEM COMMUNICATIONS , WEB BASED DISPLAY AND LOCAL KEYPAD DISPLAY. 120V POWER SUPPLY.
9	PHOTOVOLTAIC MONITORING METEOROLOGICAL STATION	1	STATION INCLUDES: PYRANOMETER - PLANE OF ARRAY, BACK OF MODULE TEMPERATURE SENSOR, AMBIENT TEMPERATURE, ANEMOMETER
10	PHOTOVOLTAIC PRODUCTION MONITORING METER	1	REVENUE GRADE METER WITH MODBUS RTU COMMUNICATIONS
11	MEDIUM VOLTAGE FUSED SWITCH	1	15KV PAD MOUNTED SWITCH WITH INTEGRATED 60A STANDARD SPEED FUSES
12	COORDINATED POLE MOUNTED SWITCH	1	SWITCH TO MEET THE REQUIREMENTS OF THE UTILITY
13	GROUND ROD	4	3/4" DIAMETER, 10'-0" LONG COPPER CLAD GROUND ROD

INVERTER A											
DC INPUT SPECIFICATION											
COMBINER DESIGNATION	MODULE	MODULE I _{sc}	QUANTITY OF STRINGS	COMBINER RATING	OCPD TRIP	DISCONNECTING MEANS FRAME	RATED MPP CURRENT	RATED MPP VOLTAGE	MAX SYSTEM VOLTAGE	MAX CIRCUIT CURRENT	MAX POWER
A1	REC305PE72	8.95 A	24	400 A	350 A	400 A	202.08 A	695.40 V	930.70 V	268.50 A	139.08 KW
A2	REC305PE72	8.95 A	24	400 A	350 A	400 A	202.08 A	695.40 V	930.70 V	268.50 A	139.08 KW
A3	REC305PE72	8.95 A	24	400 A	350 A	400 A	202.08 A	695.40 V	930.70 V	268.50 A	139.08 KW
A4	REC305PE72	8.95 A	24	400 A	350 A	400 A	202.08 A	695.40 V	930.70 V	268.50 A	139.08 KW
A5	REC305PE72	8.95 A	24	400 A	350 A	400 A	202.08 A	695.40 V	930.70 V	268.50 A	139.08 KW
	-										
	-										
	-										
	-										
	-										
INVERTER TOTALS			120				1010.40 A	695.40 V	930.70 V	1342.50 A	695.4 KW

INVERTER DESIGNATION	A
INVERTER QUANTITY	1
INVERTER MAKE	ADVANCED ENERGY
INVERTER MODEL	AE 500NX-1KV
INVERTER TYPE	UNGROUNDDED
MAX DC VOLTAGE RATING	1000
MAX POWER @ 40°C	500 KW
NOMINAL AC VOLTAGE	420, 3φ
MAX AC OUTPUT CURRENT	700 A
MAX OCPD	900 A
MIN V _{MP}	600 V
MAX V _{MP}	1000 V
START UP VOLTAGE	700 V
ENCLOSURE RATING	NEMA 3R
INTEGRATED DC DISCONNECT	NO
INTEGRATED DC FUSING	NO
INTEGRATED AC DISCONNECT	NO

MODULE MANUFACTURER	REC
MODULE MODEL NUMBER	REC305PE72
MAX POWER (P _{MAX})	305 W
CELLS	MULTICRYSTALLINE
FRAME	SILVER
MAX POWER-POINT CURRENT (I _{MP})	8.42 A
MAX POWER-POINT VOLTAGE (V _{MP})	36.60 V
OPEN CIRCUIT VOLTAGE (V _{OC})	45.10 V
SHORT CIRCUIT CURRENT (I _{SC})	8.95 A
MAX SERIES FUSE (OCPD)	20 A
MAX VOLTAGE (V _{DC})	1000
V _{OC} TEMP COEFF (%/°C)	-0.27
CONNECTOR	MC4 OR EQUIVALENT
MANUFACTURER RECOMMENDED GROUND	WEEB CLIP
WEEB CLIP QUANTITY	4560

MINIMUM CONDUIT REQUIRED PER APPLICATION	
APPLICATION	CONDUIT TYPE
ROOF MOUNTED (EXPOSED)	RGS
BUILDING INTERIOR (EXPOSED TO PHYSICAL DAMAGE)	RGS
BUILDING INTERIOR (PROTECTED FROM PHYSICAL DAMAGE)	EMT
BUILDING EXTERIOR (EXPOSED TO PHYSICAL DAMAGE)	RGS
BUILDING EXTERIOR (PROTECTED FROM PHYSICAL DAMAGE)	RGS
BELOW GRADE (IN DIRECT CONTACT WITH EARTH)	PVC SCHED 40
TRANSITION FROM BELOW GRADE TO ABOVE GRADE	RGS OR PVC SCHEDULE 80

FEEDER SCHEDULE											NOTED BY		<div>α</div>	**FEEDER IS
TAG	CONDUCTOR TYPE			CONDUCTOR TYPE	INSULATION TYPE	GROUND SIZE		GROUND TYPE	GROUND INSULATION TYPE	RACEWAY SIZE	RACEWAY QUANTITY	NOTE2		
A12	(12)	#10	PER RACEWAY	COPPER	PV	(1)	#10	PER RACEWAY	COPPER	PV	2" NOTE 5	(1)		
A24	(24)	#10	PER RACEWAY	COPPER	PV	(1)	#10	PER RACEWAY	COPPER	PV	2-1/2" NOTE 5	(1)		
B	(4)	#4/0	PER RACEWAY	ALUMINUM	PV	(1)	#3	PER RACEWAY	COPPER	PV	2-1/2"	(1)		
C	(3)	500 KCMIL	PER RACEWAY	ALUMINUM	THWN-2	(1)	#4/0	PER RACEWAY	ALUMINUM	THWN-2	3"	(3)		
D	(3)	400 KCMIL	PER RACEWAY	ALUMINUM	THWN-2						3"	(4)		
	(1)	400 KCMIL	NEU PER RACEWAY	ALUMINUM	THWN-2									
E	(1)	#12	PER RACEWAY	COPPER	THWN-2	(1)	#12	PER RACEWAY	COPPER	BARE	3/4"	(1)		
	(1)	#12	NEU PER RACEWAY	COPPER	THWN-2									
F	(2)	500 KCMIL	PER RACEWAY	COPPER	PV	(1)	#3	PER RACEWAY	COPPER	PV	3"	(1)		
G						(1)	#2/0	PER RACEWAY	COPPER	BARE				
H						(1)	#3	PER RACEWAY	COPPER	THWN-2	3/4"	(1)		
I NOTE6	(3)	#1/0	PER RACEWAY	ALUMINUM	MV TR-XLPE WITH CONCENTRIC NEUTRAL						3-1/2"	(1)		
J	BELDEN #3084A										3/4"	(1)		
K	MANUFACTURER WHIP										3/4"	(1)		

- NOTES:
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AC SWITCHBOARD			
SERVICE SUPPLY: 420V, 3φ, 4 WIRE			
BUS: 2000A			
MAIN: 1000A			
FEEDER: REFER TO SINGLE LINE DIAGRAM			
AIC RATING: VERIFY WITH UTILITY PRIOR TO INSTALLATION			
<div>MAIN CIRCUIT BREAKER 1000 AMP</div> <p>*NOTE - MAIN BREAKER SHALL HAVE GROUND FAULT PROTECTION CAPABILITY</p>	INVERTER A 900 AMP TRIP		
	AUXILIARY POWER VIA 2KVA TRANSFORMER 15 AMP	SPACE	
	SPACE	SPACE	SPACE
	SPACE	SPACE	SPACE
	SPACE	SPACE	SPACE
	SPACE	SPACE	SPACE
	SPACE	SPACE	SPACE
	SPACE	SPACE	SPACE
	SPACE	SPACE	SPACE

PRELIMINARY
NOT FOR
CONSTRUCTION



1609 Heritage Commerce Ct.
Wake Forest, NC 27587

1609 Heritage Commerce Ct.
Wake Forest, NC 27587


REV. DATE DESCRIPTION




PV SCHEDULES

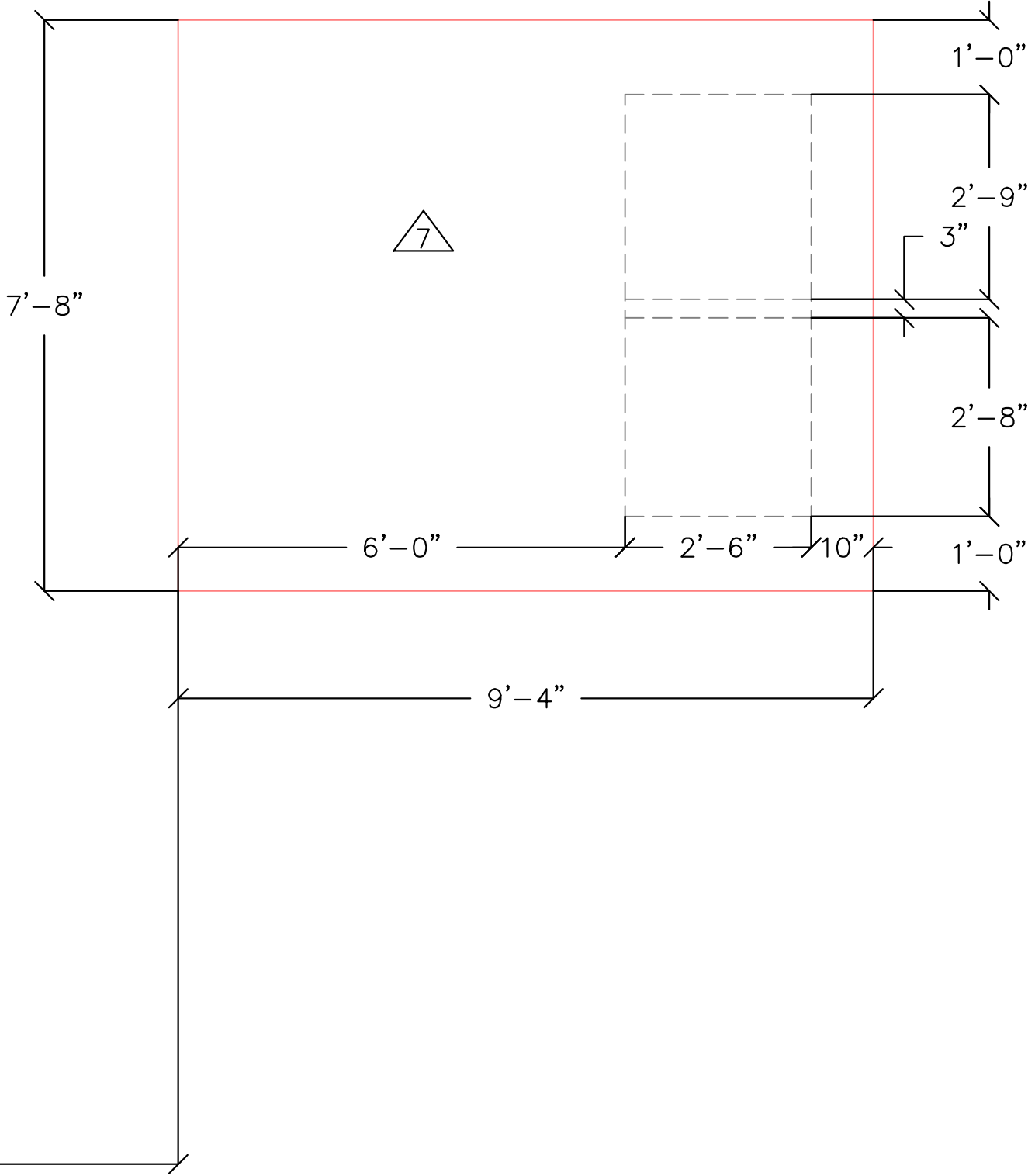
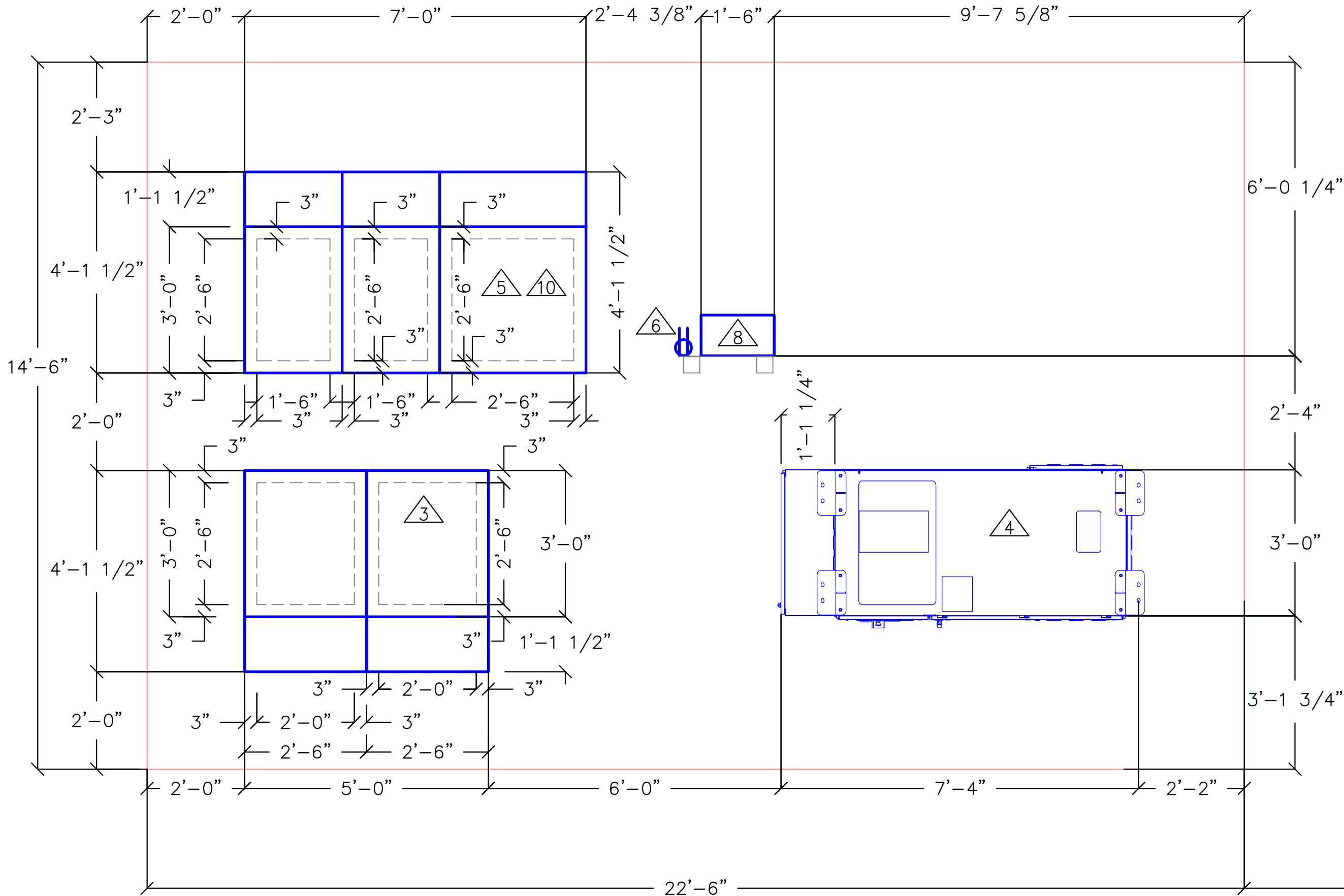
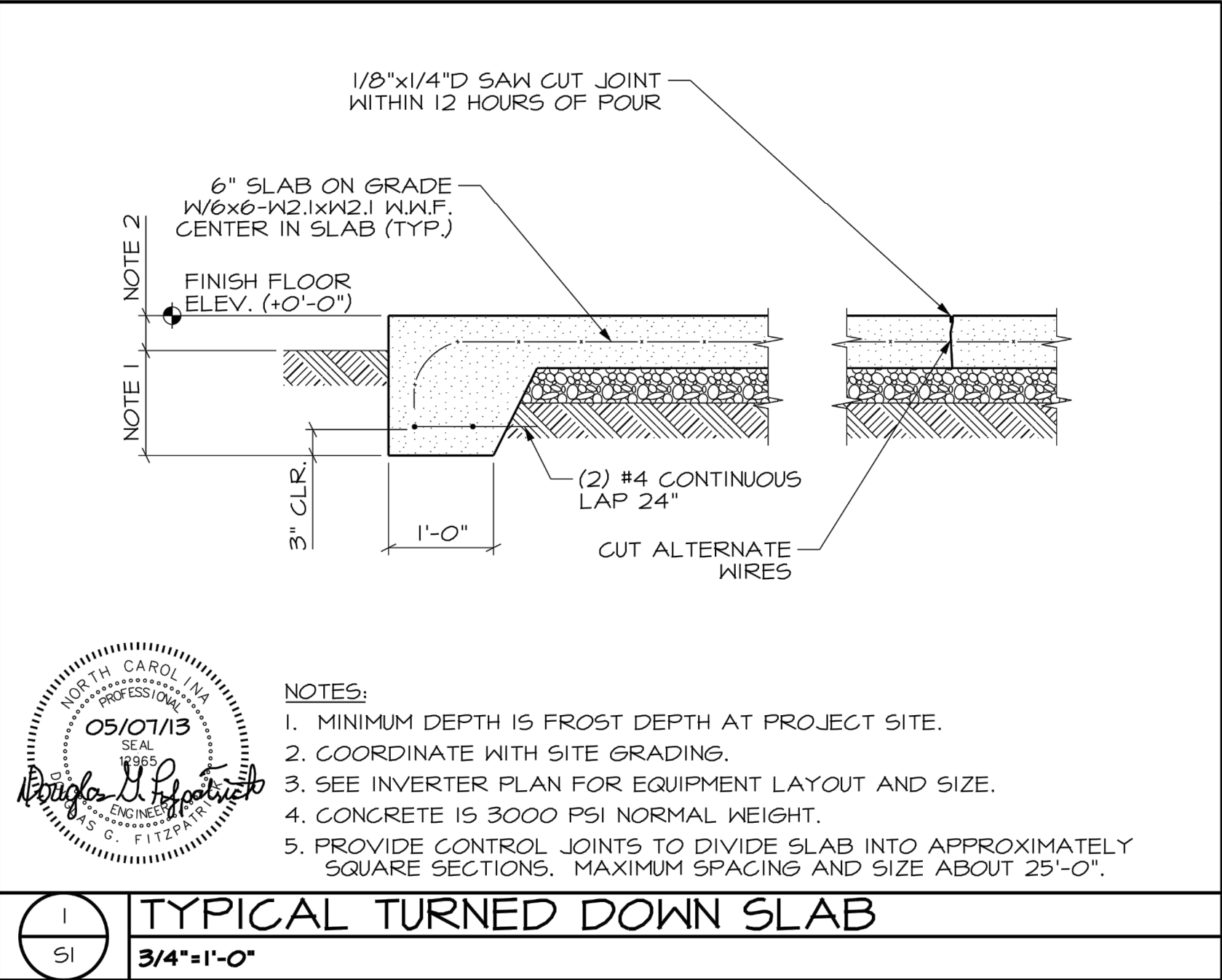
PROJECT: NRECA
SUNDA REFERENCE DESIGN
500kW — 1,000 Vdc

DATE: 02.06.2015
SHEET:

PV2.1

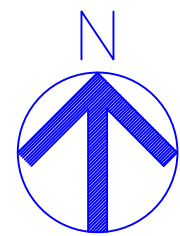
EQUIPMENT SCHEDULE			
**EQUIPMENT IS NOTED BY 			
TAG	DESCRIPTION	QUANTITY	DESCRIPTION
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11	MEDIUM VOLTAGE FUSED SWITCH	1	15KV PAD MOUNTED SWITCH WITH INTEGRATED 60A STANDARD SPEED FUSES
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13	GROUND ROD	4	3/4" DIAMETER, 10'-0" LONG COPPER CLAD GROUND ROD

LINE TYPE LEGEND	
CONCRETE PAD	
EQUIPMENT	
CONDUIT WINDOW	



1 PARTIAL PLAN - EQUIPMENT PAD DIMENSIONS
SCALE: 1/2"=1'-0"

PRELIMINARY
NOT FOR
CONSTRUCTION



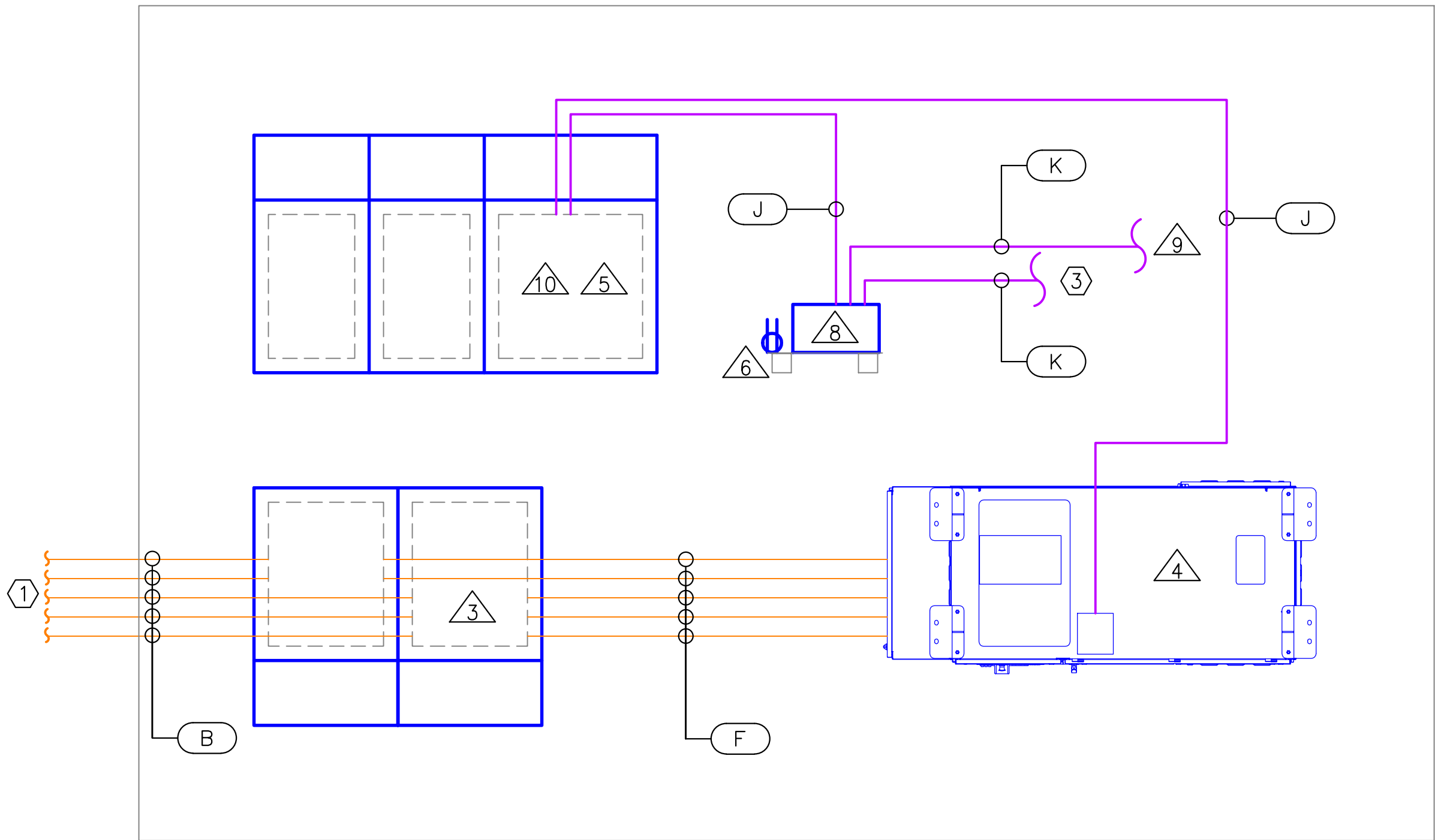
THIS LINE SHOULD
MEASURE ONE WAY

REV.	DATE	DESCRIPTION

TITLE: PARTIAL PLAN - EQUIPMENT PAD DIMENSIONS
PROJECT: NRECA
SUNDA REFERENCE DESIGN
500KW - 1,000VDC

DATE: 02.06.2015
SHEET:

PV3.0



1 PARTIAL PLAN – DC & COMMUNICATION FEEDER ROUTING
SCALE: 1/2"=1'-0"

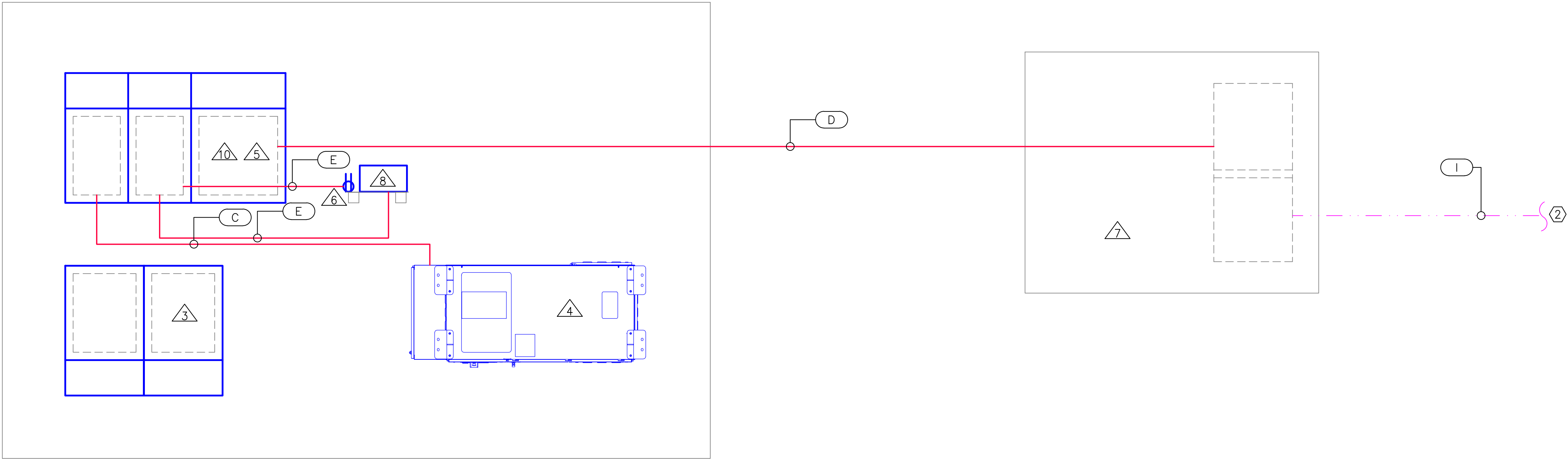
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FEEDER SCHEDULE											**FEEDER IS	
NOTED BY											<div>α</div>	
TAG	CONDUCTOR TYPE			CONDUCTOR TYPE	INSULATION TYPE	GROUND SIZE		GROUND TYPE	GROUND INSULATION TYPE	RACEWAY SIZE	RACEWAY QUANTITY ^{NOTE2}	
A12	(12)	#10	PER RACEWAY	COPPER	PV	(1)	#10	PER RACEWAY	COPPER	PV	2" ^{NOTE 5}	(1)
A24	(24)	#10	PER RACEWAY	COPPER	PV	(1)	#10	PER RACEWAY	COPPER	PV	2-1/2" ^{NOTE 5}	(1)
B	(4)	#4/0	PER RACEWAY	ALUMINUM	PV	(1)	#3	PER RACEWAY	COPPER	PV	2-1/2"	(1)
C	(3)	500 KCMIL	PER RACEWAY	ALUMINUM	THWN-2	(1)	#4/0	PER RACEWAY	ALUMINUM	THWN-2	3"	(3)
D	(3)	400 KCMIL	PER RACEWAY	ALUMINUM	THWN-2						3"	(4)
	(1)	400 KCMIL	NEU PER RACEWAY	ALUMINUM	THWN-2							
E	(1)	#12	PER RACEWAY	COPPER	THWN-2	(1) #12 PER RACEWAY		COPPER	BARE	3/4"	(1)	
	(1)	#12	NEU PER RACEWAY	COPPER	THWN-2							
F	(2)	500 KCMIL	PER RACEWAY	COPPER	PV	(1)	#3	PER RACEWAY	COPPER	PV	3"	(1)
G						(1)	#2/0	PER RACEWAY	COPPER	BARE		
H						(1)	#3	PER RACEWAY	COPPER	THWN-2	3/4"	(1)
I ^{NOTE6}	(3)	#1/0	PER RACEWAY	ALUMINUM	MV TR-XLPE WITH CONCENTRIC NEUTRAL						3-1/2"	(1)
J	BELDEN #3084A										3/4"	(1)
K	MANUFACTURER WHIP										3/4"	(1)

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 6. PROVIDE 15 KV MEDIUM VOLTAGE FEEDERS WITH 100% INSULATION.

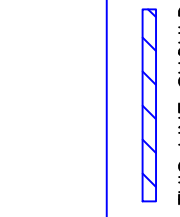
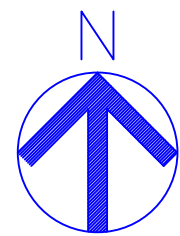
LINE TYPE LEGEND	
DC FEEDER	—————
AC FEEDER	—————
COMMUNICATIONS	—————
MV FEEDER	- - - - -

KEYED NOTES: (X)	
1.	REFER TO DC ROUTING PLAN FOR CONTINUATION.
2.	TO MEDIUM VOLTAGE SWITCH. REFER TO MEDIUM VOLTAGE ROUTING FOR CONTINUATION.
3.	TO BACK OF MODULE TEMPERATURE SENSOR.



2 PARTIAL PLAN – AC FEEDER ROUTING
SCALE: 1/2"=1'-0"

PRELIMINARY
NOT FOR
CONSTRUCTION



REV.	DATE	DESCRIPTION

TITLE:	PARTIAL PLAN – EQUIPMENT PAD FEEDER ROUTING
PROJECT:	NRECA SUNDA REFERENCE DESIGN 500KW – 1,000Vdc

DATE:	02.06.2015
SHEET:	

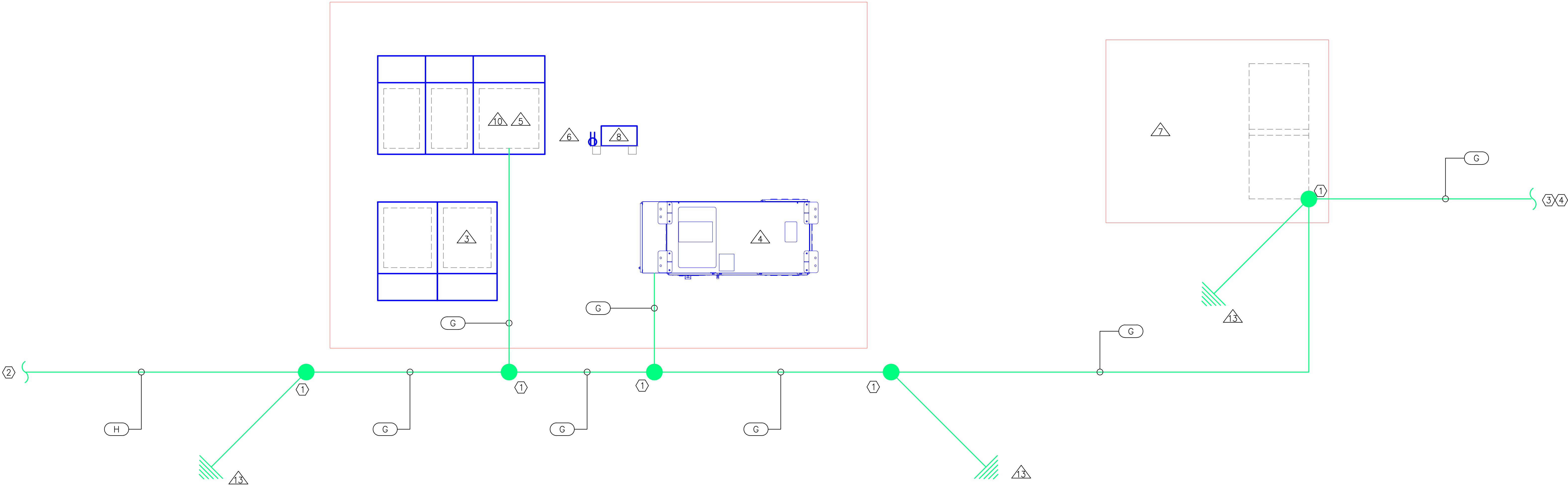
PV3.1

- KEYED NOTES: (X)
1. PROVIDE IRREVERSIBLE BOND TO GROUND RING.
 2. TO ARRAY, REFER TO ARRAY GROUNDING PLAN FOR CONTINUATION.
 3. TO FENCE, REFER TO ARRAY GROUNDING PLAN FOR CONTINUATION AND TO FENCE GROUNDING DETAIL.
 4. TO MEDIUM VOLTAGE FUSED SWITCH GROUND ROD, REFER TO ARRAY GROUNDING PLAN FOR CONTINUATION.

EQUIPMENT SCHEDULE			
**EQUIPMENT IS NOTED BY			
TAG	DESCRIPTION	QUANTITY	DESCRIPTION
1	SOLAR PV MODULE	2280	305 WATT MODULE (REFER TO DRAWINGS FOR QUANTITY AND LOCATION). MODULES SHALL BE LABELED PER NEC 690 VI.
2	CONTACTOR COMBINER	5	24 STRING DISCONNECTING COMBINER TO CONTAIN 24 STRINGS, RATED AT 400A WITH EACH POSITIVE AND EACH NEGATIVE FUSED (TOTAL 48) 15A FUSES, 1000 VDC, RATED FOR CONTINUOUS DUTY, WITH DISCONNECT HANDLE MOUNTED ON DOOR EXTERIOR, NEMA 3R ENCLOSURE, TRANSIENT SURGE SUPPRESSION. ENCLOSURE SHALL BE A MINIMUM OF 30" W X 38" H X 8" DEEP.
3	DC CIRCUIT BREAKER UNIT	1	NEMA 3R ENCLOSURE WITH (5) 350A, 1000Vdc CIRCUIT BREAKERS
4	INVERTER	1	500 KWATT, 1000VDC, 3 PHASE 420 VAC, FLOATING GROUND CONFIGURATION. (REFER TO INVERTER RATING SCHEDULE FOR ADDITIONAL INFORMATION)
5	AC CIRCUIT BREAKER UNIT	1	NEMA 3R ENCLOSURE, 2000A BUS WITH 1000AF/AT MAIN CIRCUIT BREAKER, (1) 1000AF/900AT 3 POLE CIRCUIT BREAKER, (1) 30A 3 POLE CIRCUIT BREAKER PROVIDE SURGE PROTECTION, RATED FOR SERVICE ENTRANCE. INTEGRATED 2KVA STEPDOWN TRANSFORMER WITH CAPACITY FOR (1) 15A SINGLE POLE 120V CIRCUIT BREAKER AND (1) 15A 2 POLE 240V CIRCUIT BREAKER.
6	RECEPTACLE	1	120V, 20 AMP, WEATHER PROOF GFI DUPLEX RECEPTACLE.
7	MEDIUM VOLTAGE TRANSFORMER	1	2000KVA, THREE PHASE, 12.47KV YGRD/7.2KV PRIMARY AND 420V WYE SECONDARY, LIQUID COOLED TRANSFORMER, BAYONET FUSES ON PRIMARY SIDE. REQUIRED TO MEET UTILITY REQUIREMENTS.
8	PHOTOVOLTAIC PRODUCTION MONITORING EQUIPMENT	1	CENTRAL DATA ACQUISITION UNIT, NEMA 3R ENCLOSURE WITH BATTERY BACK UP, LOCAL DATA STORAGE, INTEGRAL CELL MODEM COMMUNICATIONS, WEB BASED DISPLAY AND LOCAL KEYPAD DISPLAY. 120V POWER SUPPLY.
9	PHOTOVOLTAIC MONITORING METEOROLOGICAL STATION	1	STATION INCLUDES: PYRANOMETER - PLANE OF ARRAY, BACK OF MODULE TEMPERATURE SENSOR, AMBIENT TEMPERATURE, ANEMOMETER
10	PHOTOVOLTAIC PRODUCTION MONITORING METER	1	REVENUE GRADE METER WITH MODBUS RTU COMMUNICATIONS
11	MEDIUM VOLTAGE FUSED SWITCH	1	15KV PAD MOUNTED SWITCH WITH INTEGRATED 60A STANDARD SPEED FUSES
12	COORDINATED POLE MOUNTED SWITCH	1	SWITCH TO MEET THE REQUIREMENTS OF THE UTILITY
13	GROUND ROD	4	3/4" DIAMETER, 10'-0" LONG COPPER CLAD GROUND ROD

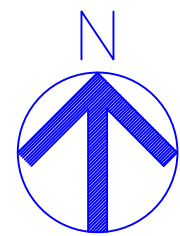
FEEDER SCHEDULE											**FEEDER IS	
NOTED BY											α	
TAG	CONDUCTOR TYPE			CONDUCTOR TYPE	INSULATION TYPE	GROUND SIZE		GROUND TYPE	GROUND INSULATION TYPE	RACEWAY SIZE	RACEWAY QUANTITY ^{NOTE2}	
A12	(12)	#10	PER RACEWAY	COPPER	PV	(1)	#10	PER RACEWAY	COPPER	PV	2" ^{NOTE 5}	(1)
A24	(24)	#10	PER RACEWAY	COPPER	PV	(1)	#10	PER RACEWAY	COPPER	PV	2-1/2" ^{NOTE 5}	(1)
B	(4)	#4/0	PER RACEWAY	ALUMINUM	PV	(1)	#3	PER RACEWAY	COPPER	PV	2-1/2"	(1)
C	(3)	500 KCMIL	PER RACEWAY	ALUMINUM	THWN-2	(1)	#4/0	PER RACEWAY	ALUMINUM	THWN-2	3"	(3)
D	(3)	400 KCMIL	PER RACEWAY	ALUMINUM	THWN-2						3"	(4)
	(1)	400 KCMIL	NEU PER RACEWAY	ALUMINUM	THWN-2							
E	(1)	#12	PER RACEWAY	COPPER	THWN-2	(1)	#12	PER RACEWAY	COPPER	BARE	3/4"	(1)
	(1)	#12	NEU PER RACEWAY	COPPER	THWN-2							
F	(2)	500 KCMIL	PER RACEWAY	COPPER	PV	(1)	#3	PER RACEWAY	COPPER	PV	3"	(1)
G						(1)	#2/0	PER RACEWAY	COPPER	BARE		
H						(1)	#3	PER RACEWAY	COPPER	THWN-2	3/4"	(1)
I ^{NOTE6}	(3)	#1/0	PER RACEWAY	ALUMINUM	MV TR-XLPE WITH CONCENTRIC NEUTRAL						3-1/2"	(1)
J	BELDEN #3084A										3/4"	(1)
K	MANUFACTURER WHIP										3/4"	(1)

- NOTES:
1. (#) - DENOTES QUANTITY TO BE PROVIDED
 2. WHERE MULTIPLE CONDUITS ARE NOTED, THE RACEWAYS SHALL BE PROVIDED IN PARALLEL.
 3. REFER TO RACEWAY APPLICATION SCHEDULE FOR RACEWAY TYPE.
 4. ALL RACEWAY SIZES ARE NEC MINIMUM REQUIREMENTS, LARGER CONDUITS ARE PERMITTED FOR EASE OF INSTALLATION.
 5. PV SOURCE CIRCUITS SHALL NOT BE REQUIRED TO BE IN RACEWAY IF CONDUCTORS ARE NOT READILY ACCESSIBLE AND NOT EXPOSED TO PHYSICAL DAMAGE. BELOW GRADE PV SOURCE CIRCUITS SHALL BE IN RACEWAY.
 6. PROVIDE 15 KV MEDIUM VOLTAGE FEEDERS WITH 100% INSULATION.



1 PARTIAL PLAN - EQUIPMENT PAD GROUNDING
SCALE: 1/2"=1'-0"

PRELIMINARY
NOT FOR
CONSTRUCTION



THIS LINE SHOULD
MEASURE ONE INCH

REV.	DATE	DESCRIPTION

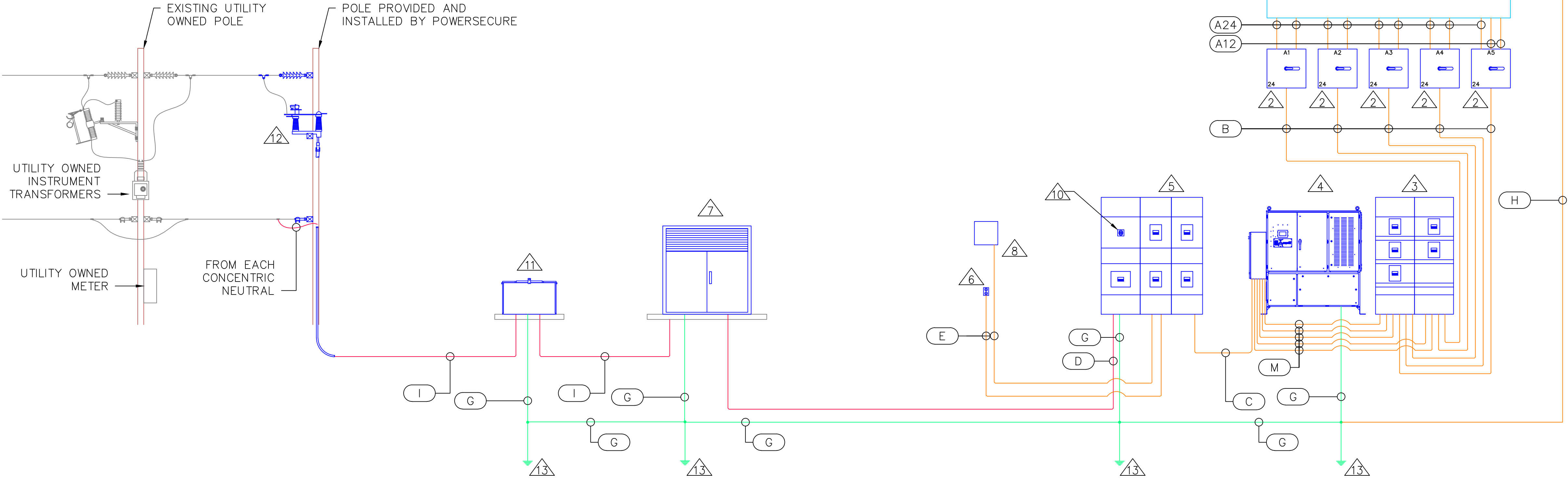
TITLE: PARTIAL PLAN - EQUIPMENT PAD GROUNDING
PROJECT: NRECA
SUNDA REFERENCE DESIGN
500KW - 1,000Vdc

DATE: 02.06.2015
SHEET:

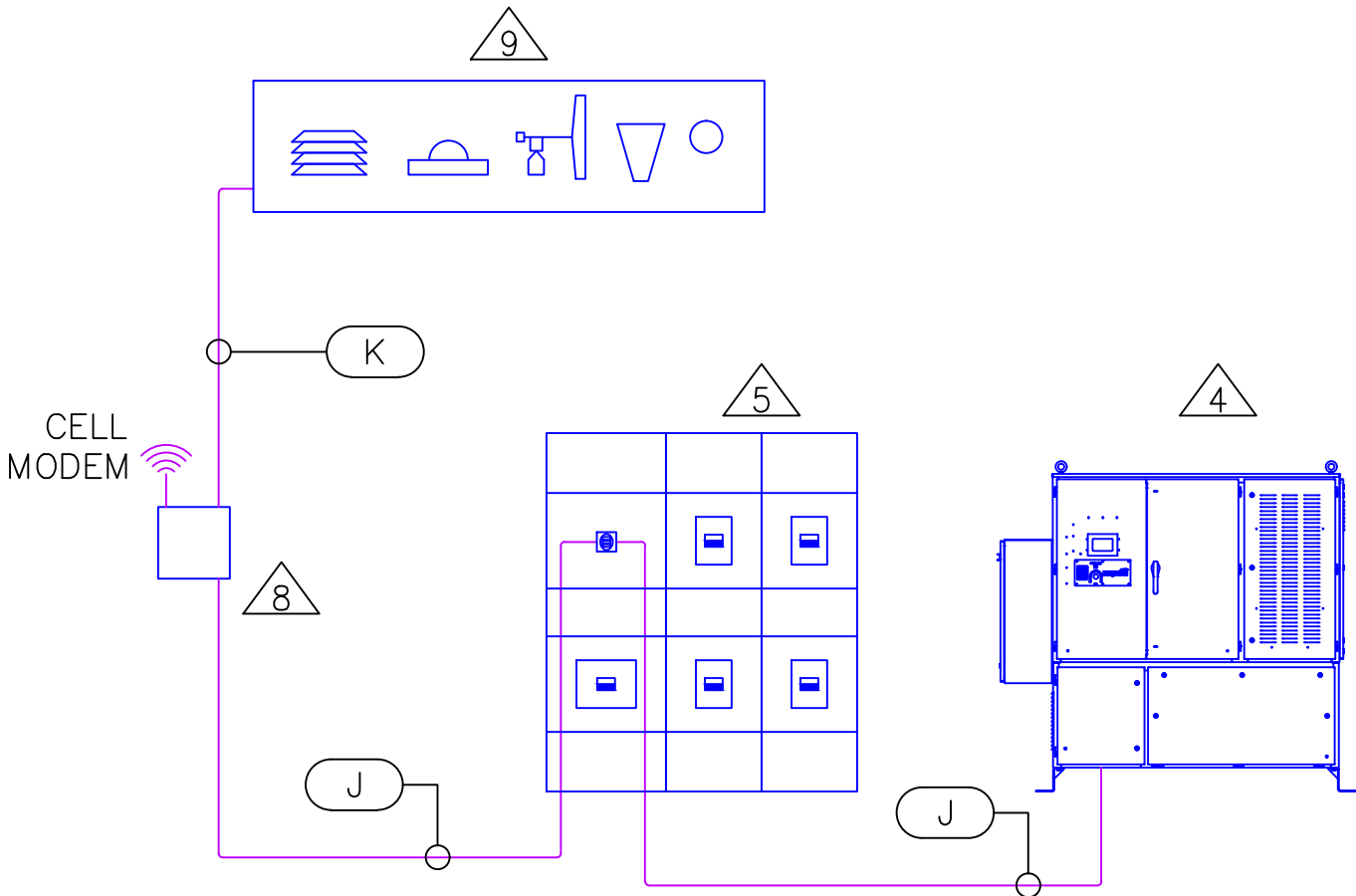
PV3.2

LINE TYPE LEGEND

EQUIPMENT GROUNDING ELECTRODE (EGC)	
GROUNDING ELECTRODE CONDUCTOR (GEC)	
UTILITY NEUTRAL	
COMMUNICATIONS	
PROVIDED BY OTHERS	



1 PV GROUNDING RISER DIAGRAM
SCALE: NONE



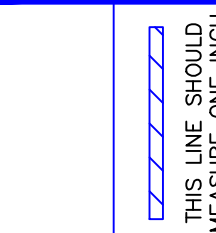
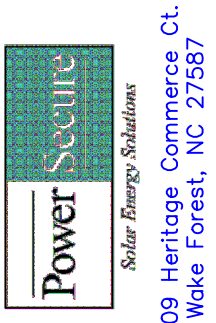
2 PV COMMUNICATIONS RISER DIAGRAM
SCALE: NONE

FEEDER SCHEDULE											**FEEDER IS	
NOTED BY											<div>α</div>	
TAG	CONDUCTOR TYPE			CONDUCTOR TYPE	INSULATION TYPE	GROUND SIZE		GROUND TYPE	GROUND INSULATION TYPE	RACEWAY SIZE	RACEWAY QUANTITY ^{NOTE 2}	
A12	(12)	#10	PER RACEWAY	COPPER	PV	(1)	#10	PER RACEWAY	COPPER	PV	2" ^{NOTE 5}	(1)
A24	(24)	#10	PER RACEWAY	COPPER	PV	(1)	#10	PER RACEWAY	COPPER	PV	2-1/2" ^{NOTE 5}	(1)
B	(4)	#4/0	PER RACEWAY	ALUMINUM	PV	(1)	#3	PER RACEWAY	COPPER	PV	2-1/2"	(1)
C	(3)	500 KC MIL	PER RACEWAY	ALUMINUM	THWN-2	(1)	#4/0	PER RACEWAY	ALUMINUM	THWN-2	3"	(3)
D	(3)	400 KC MIL	PER RACEWAY	ALUMINUM	THWN-2					3"	(4)	
	(1)	400 KC MIL	NEU PER RACEWAY	ALUMINUM	THWN-2							
E	(1)	#12	PER RACEWAY	COPPER	THWN-2	(1)	#12	PER RACEWAY	COPPER	BARE	3/4"	(1)
	(1)	#12	NEU PER RACEWAY	COPPER	THWN-2							
F	(2)	500 KC MIL	PER RACEWAY	COPPER	PV	(1)	#3	PER RACEWAY	COPPER	PV	3"	(1)
G						(1)	#2/0	PER RACEWAY	COPPER	BARE		
H						(1)	#3	PER RACEWAY	COPPER	THWN-2	3/4"	(1)
I ^{NOTES}	(3)	#1/0	PER RACEWAY	ALUMINUM	MV TR-XLPE WITH CONCENTRIC NEUTRAL					3-1/2"	(1)	
J	BELDEN #3084A										3/4"	(1)
K	MANUFACTURER WHIP										3/4"	(1)

- NOTES:
- 1 (#) - DENOTES QUANTITY TO BE PROVIDED
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 4. ALL RACEWAY SIZES ARE NEC MINIMUM REQUIREMENTS, LARGER CONDUITS ARE PERMITTED FOR EASE OF INSTALLATION.
 5. PV SOURCE CIRCUITS SHALL NOT BE REQUIRED TO BE IN RACEWAY IF CONDUCTORS ARE NOT READILY ACCESSIBLE AND NOT EXPOSED TO PHYSICAL DAMAGE. BELOW GRADE PV SOURCE CIRCUITS SHALL BE IN RACEWAY.
 6. PROVIDE 15 KV MEDIUM VOLTAGE FEEDERS WITH 100% INSULATION.

EQUIPMENT SCHEDULE			
**EQUIPMENT IS NOTED BY Δ			
TAG	DESCRIPTION	QUANTITY	DESCRIPTION
1	SOLAR PV MODULE	2280	305 WATT MODULE (REFER TO DRAWINGS FOR QUANTITY AND LOCATION). MODULES SHALL BE LABELED PER NEC 690 VI.
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3	DC CIRCUIT BREAKER UNIT	1	NEMA 3R ENCLOSURE WITH (5) 350A, 1000Vdc CIRCUIT BREAKERS
4	INVERTER	1	500 KWATT, 1000VDC, 3 PHASE 420 VAC, FLOATING GROUND CONFIGURATION. (REFER TO INVERTER RATING SCHEDULE FOR ADDITIONAL INFORMATION)
5	AC CIRCUIT BREAKER UNIT	1	NEMA 3R ENCLOSURE, 2000A BUS WITH 1000AF/AT MAIN CIRCUIT BREAKER, (1) 1000AF/900AT 3 POLE CIRCUIT BREAKER, (1) 30A 3 POLE CIRCUIT BREAKER PROVIDE SURGE PROTECTION, RATED FOR SERVICE ENTRANCE. INTEGRATED 2KVA STEPDOWN TRANSFORMER WITH CAPACITY FOR (1) 15A SINGLE POLE 120V CIRCUIT BREAKER AND (1) 15A 2 POLE 240V CIRCUIT BREAKER.
6	RECEPTACLE	1	120V, 20 AMP, WEATHER PROOF GFI DUPLEX RECEPTACLE.
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9	PHOTOVOLTAIC MONITORING METEOROLOGICAL STATION	1	STATION INCLUDES: PYRANOMETER - PLANE OF ARRAY, BACK OF MODULE TEMPERATURE SENSOR, AMBIENT TEMPERATURE, ANEMOMETER
10	PHOTOVOLTAIC PRODUCTION MONITORING METER	1	REVENUE GRADE METER WITH MODBUS RTU COMMUNICATIONS
11	MEDIUM VOLTAGE FUSED SWITCH	1	15KV PAD MOUNTED SWITCH WITH INTEGRATED 60A STANDARD SPEED FUSES
12	COORDINATED POLE MOUNTED SWITCH	1	SWITCH TO MEET THE REQUIREMENTS OF THE UTILITY
13	GROUND ROD	4	3/4" DIAMETER, 10'-0" LONG COPPER CLAD GROUND ROD

PRELIMINARY
NOT FOR
CONSTRUCTION



REV.	DATE	DESCRIPTION

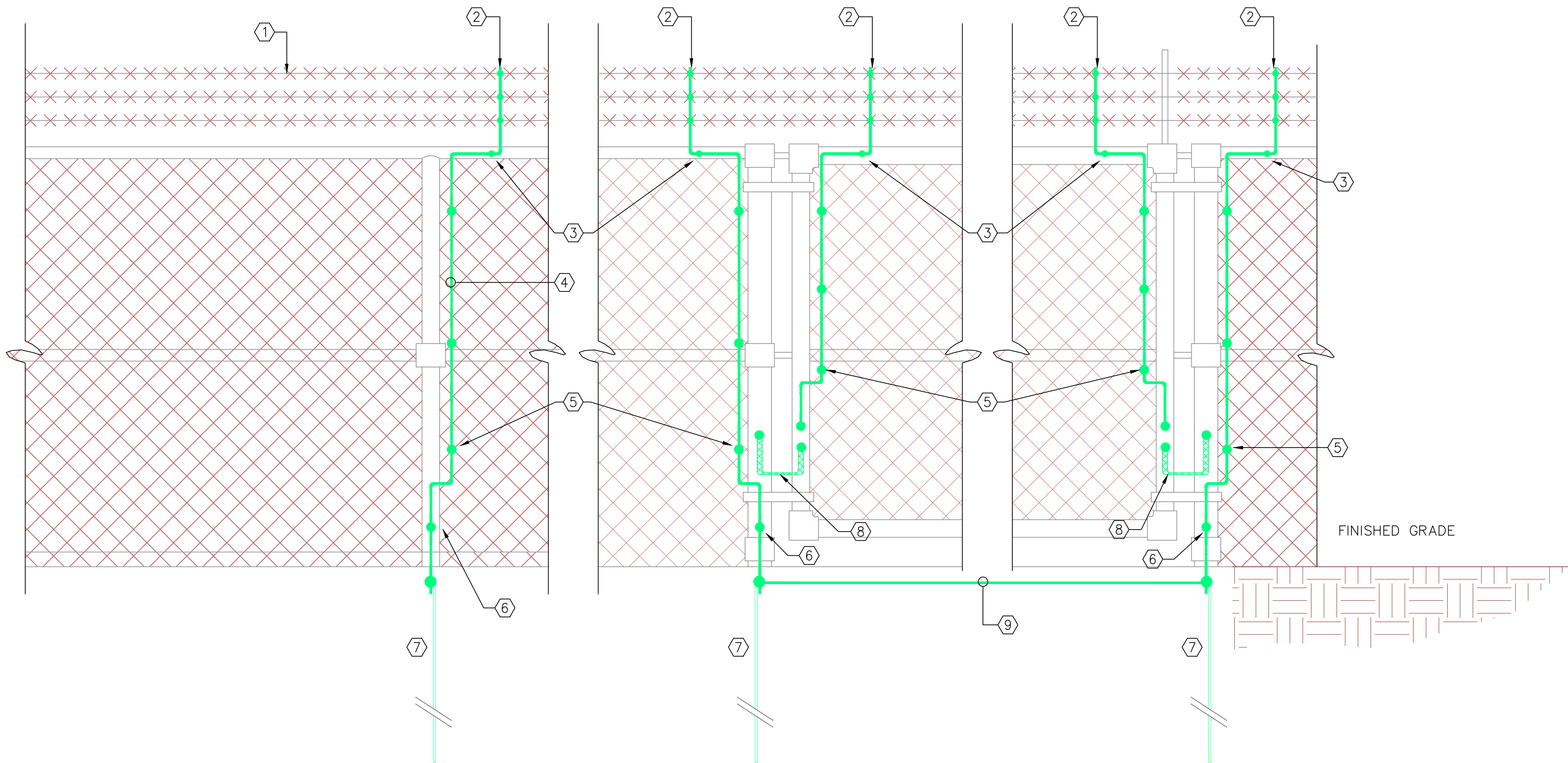
TITLE: PV RISER DIAGRAM
PROJECT: NRECA SUNDIA REFERENCE DESIGN 500KW - 1,000Vdc

DATE: 02.06.2015
SHEET:

Rev: Date: 2/16/2015

- KEYED NOTES (X)
1. BARBED WIRE
 2. PROVIDE COMPRESSION SPLICE WITH C-TAP TO CONNECT WIRE TO OUTSIDE BARB
 3. PROVIDE EXOTHERMIC WELD TO TOP RAIL
 4. #6 BARE COPPER WIRE, TYPICAL UNLESS NOTED OTHERWISE
 5. PROVIDE COMPRESSION SPLICE WITH C-TAP TO CONNECT WIRE TO FENCE FABRIC
 6. PROVIDE EXOTHERMIC WELD TO FENCE POST
 7. 3/4" X 10' COPPER CLAD GROUND ROD BONDED TO BARE COPPER WITH EXOTHERMIC WELD
 8. FLEXIBLE GROUND BRAID SECURED TO GATE WITH EXOTHERMIC WELD
 9. GATES SHALL BE BONDED TOGETHER

- GENERAL NOTE
1. ALL FENCE GROUNDING POINTS SHALL BE LOCATED WITHIN FENCE PERIMETER
 2. GROUND CORNER POSTS & ADDITIONAL POSTS AT 500' INTERVALS
 3. GROUND ALL GATE POSTS



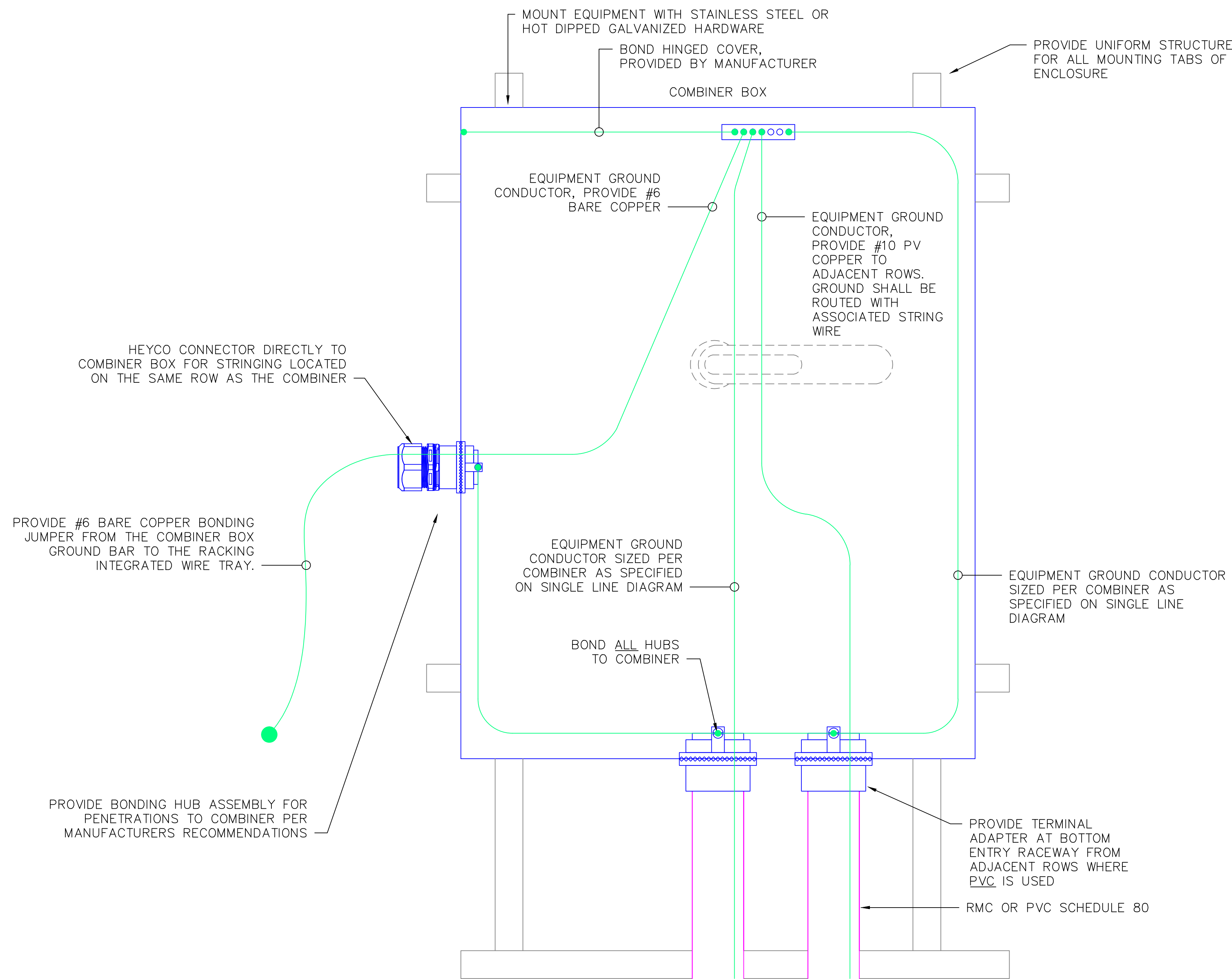
PRELIMINARY
NOT FOR
CONSTRUCTION

REV.	DATE	DESCRIPTION

TITLE: FENCE GROUNDING DETAIL
PROJECT: NRECA
SUNDA REFERENCE DESIGN
500kW - 1,000Vdc

DATE: 02.06.2015
SHEET:

Rev: 04/2/15/2015



PRELIMINARY
NOT FOR
CONSTRUCTION

TITLE: COMBINER GROUNDING DETAIL		PROJECT: NRECA SUNDA REFERENCE DESIGN 500kW - 1,000Vdc	
DATE: 02.06.2015	SHEET: PV4.2	REV. DATE DESCRIPTION	
Power Secure Solar Energy Solutions 1609 Heritage Commerce Ct. Wake Forest, NC 27587		MEASURE ONE INCH	

NOTE

WHERE SCHEDULE 80 PVC IS PROVIDED BELOW GRADE, NO TRANSITION OF RACEWAY SHALL BE REQUIRED WHERE EXPOSED TO PHYSICAL DAMAGE.

EQUIPMENT SHOWN GENERICALLY TO REPRESENT ANY EQUIPMENT MOUNTED IN SUCH A WAY AS TO LEAVE RACEWAY EXPOSED

EQUIPMENT SHOWN GENERICALLY TO REPRESENT ANY EQUIPMENT MOUNTED IN SUCH A WAY AS TO PROTECT RACEWAY FROM EXPOSURE

PROVIDE INSULATED THROAT OR BONDING BUSHING

RGS (OR SCHEDULE 80 PVC)

CONDUIT EXPOSED TO PHYSICAL DAMAGE

6" CONCRETE SLAB

PROVIDE MASTIC COATING ON PIPE EXTERIOR WHERE IN CONTACT WITH CONCRETE

1

PV5.1

PROVIDE PVC 90° TURN UP AND TRANSITION TO RGS VIA PVC THREADED CONNECTION WHERE CONDUIT EXPOSED TO PHYSICAL DAMAGE

REFER TO NEC T300.5 FOR MINIMUM BURIAL DEPTH

PROVIDE PVC 90° TURN UP WHERE CONDUIT NOT EXPOSED TO PHYSICAL DAMAGE

PVC THREADED UNION AT GLAND PLATE

CAP THREADED UNION WITH INSULATED THROAT AND NUT

GLAND PLATE

THREADS SHALL BE SEALED WITH 100% SILICONE DURING ASSEMBLY

CAP THREADED UNION WITH INSULATED THROAT AND NUT

GLAND PLATE

THREADS SHALL BE SEALED WITH 100% SILICONE DURING ASSEMBLY

PVC THREADED UNION AT GLAND PLATE

PROVIDE PVC 90° TURN UP WHERE CONDUIT NOT EXPOSED TO PHYSICAL DAMAGE

REFER TO NEC T300.5 FOR MINIMUM BURIAL DEPTH

SCHEDULE 40 PVC

SCHEDULE 40 PVC

PRELIMINARY
NOT FOR
CONSTRUCTION



1609 Heritage Commerce Ct.
Wake Forest, NC 27587

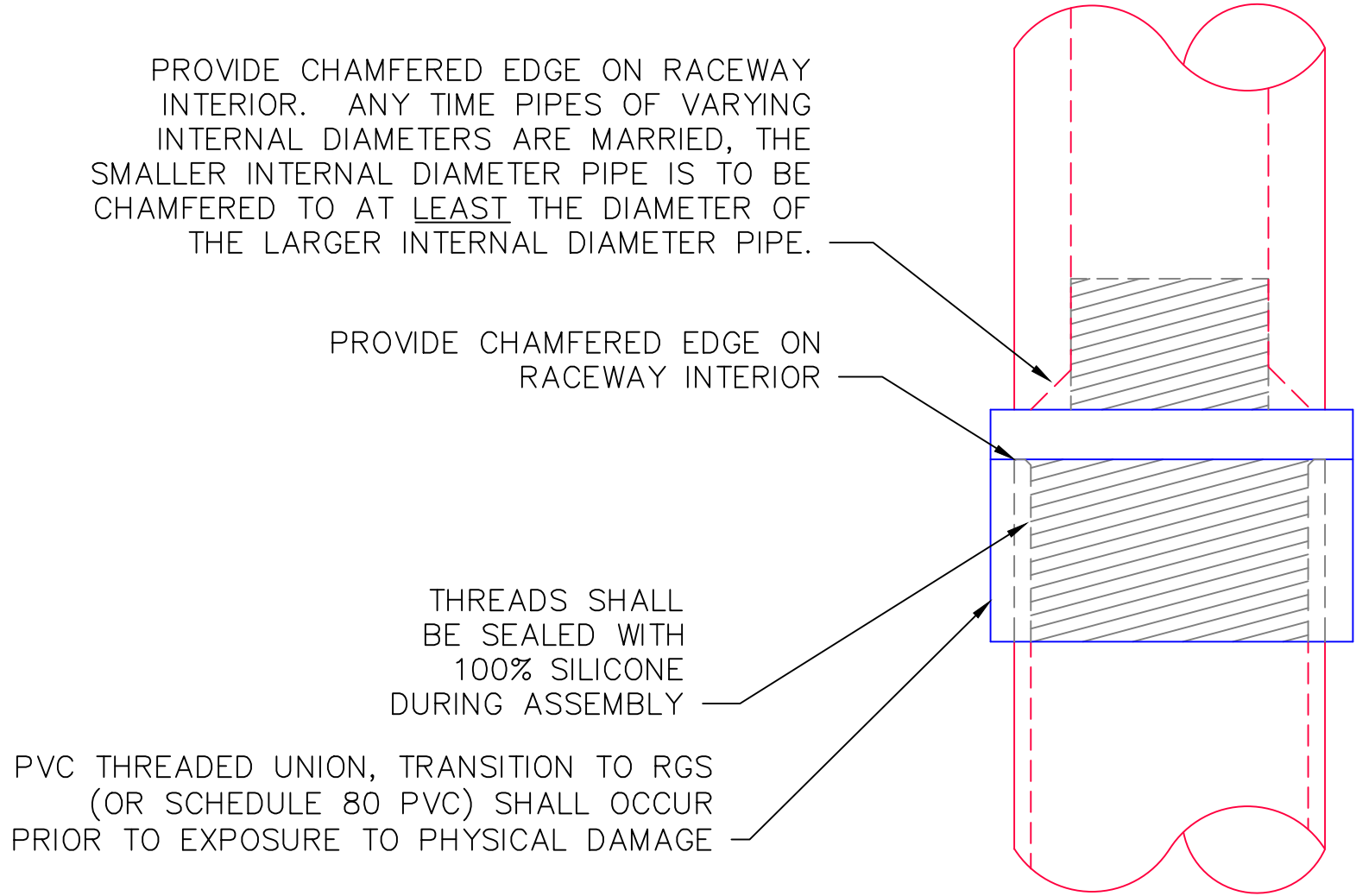
MEASURE ONE ONLY

REV.	DATE	DESCRIPTION

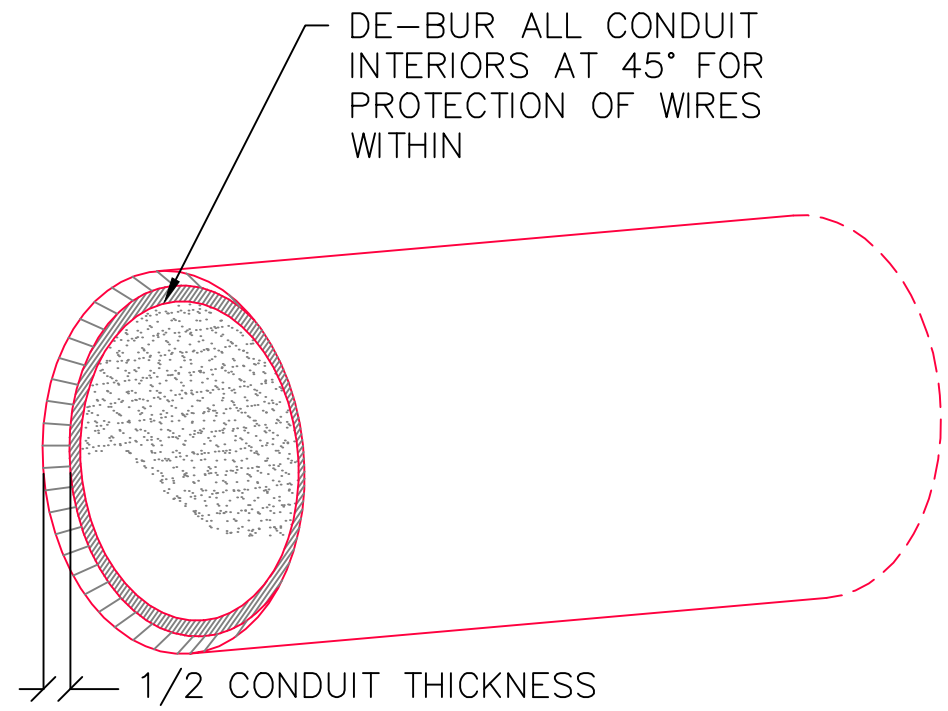
CONDUIT STUB UP DETAIL
NRECA
SUNDA REFERENCE DESIGN
500kW - 1,000Vdc

TITLE:
PROJECT:
DATE:
SHEET:

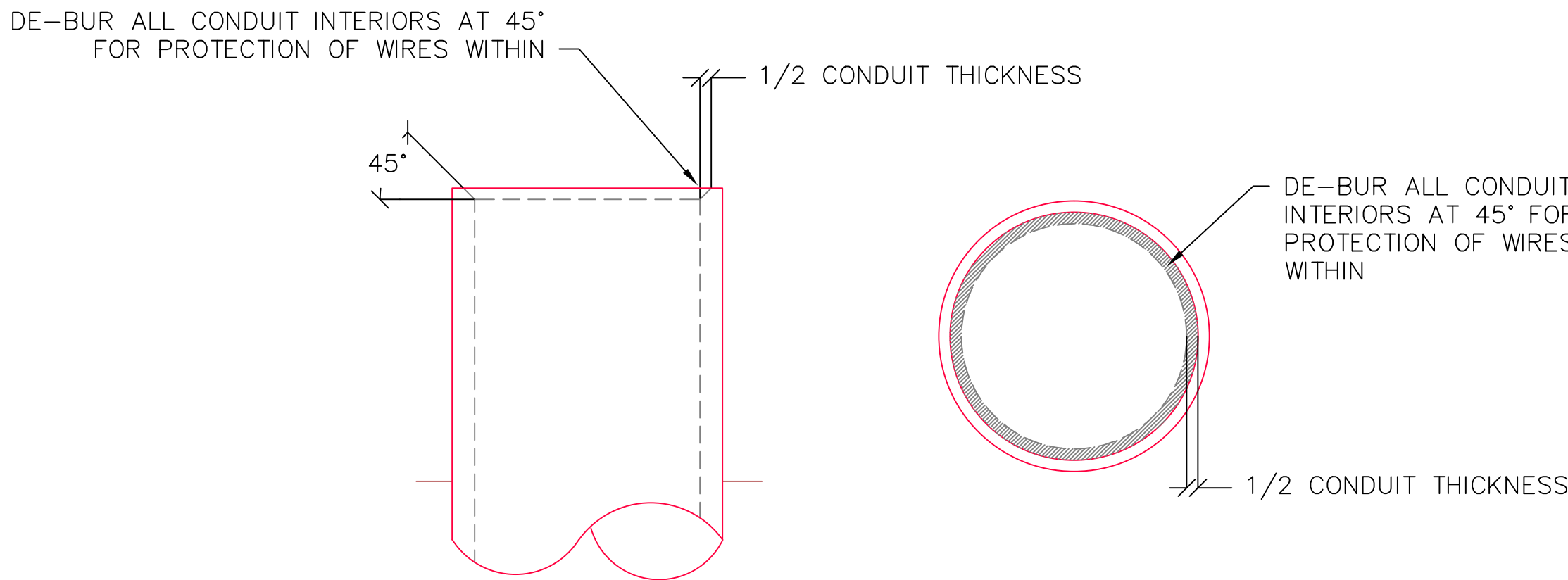
PV5.0



1 CONDUIT MATERIAL TRANSITION DETAIL – PVC TO RGS
SCALE: NONE



NOTE:
ALL CHAMFERED EDGE DETAILS APPLY TO FIELD-CUT PVC ONLY



2 CHAMFERED EDGE DETAILS
SCALE: NONE

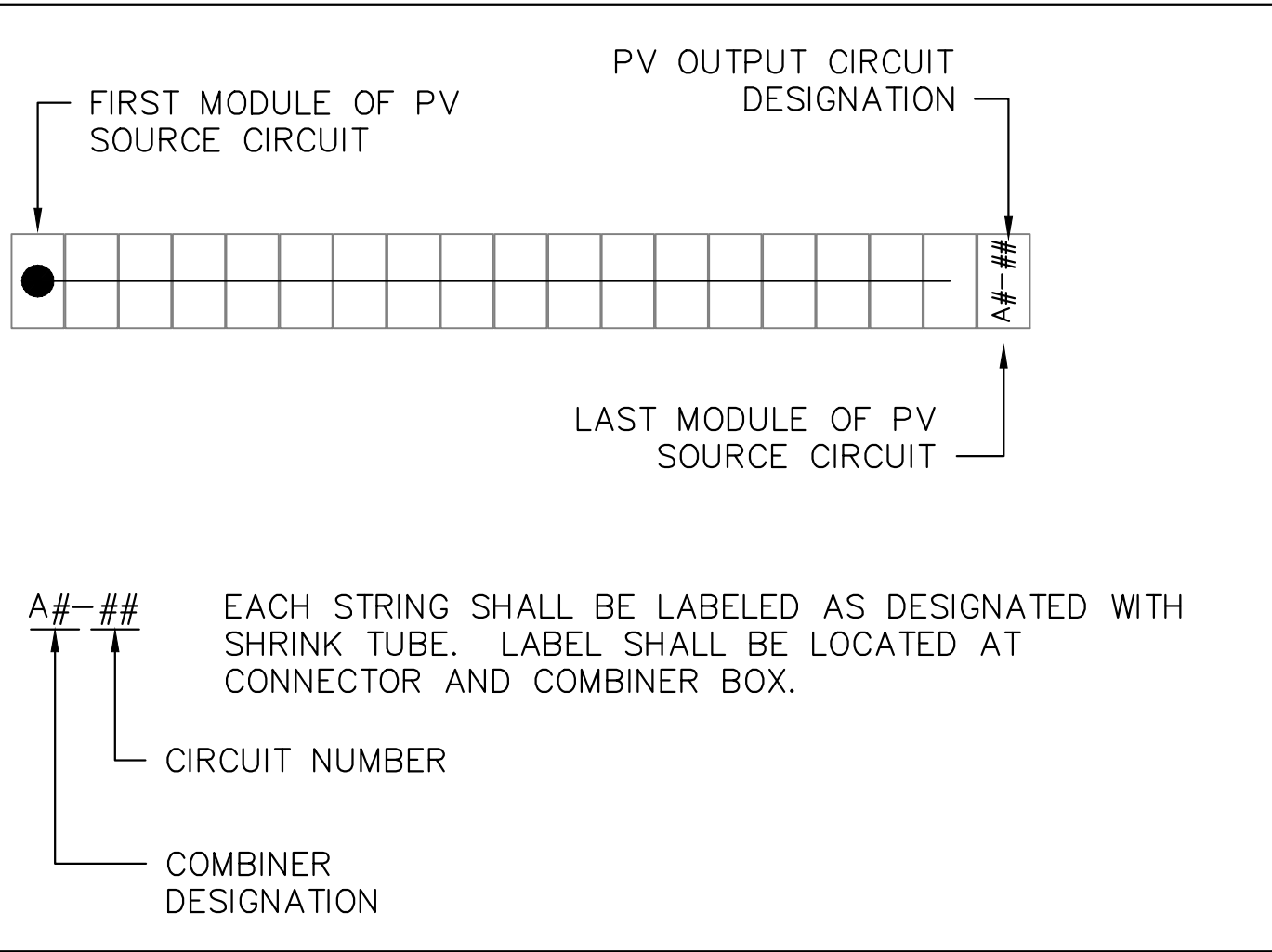
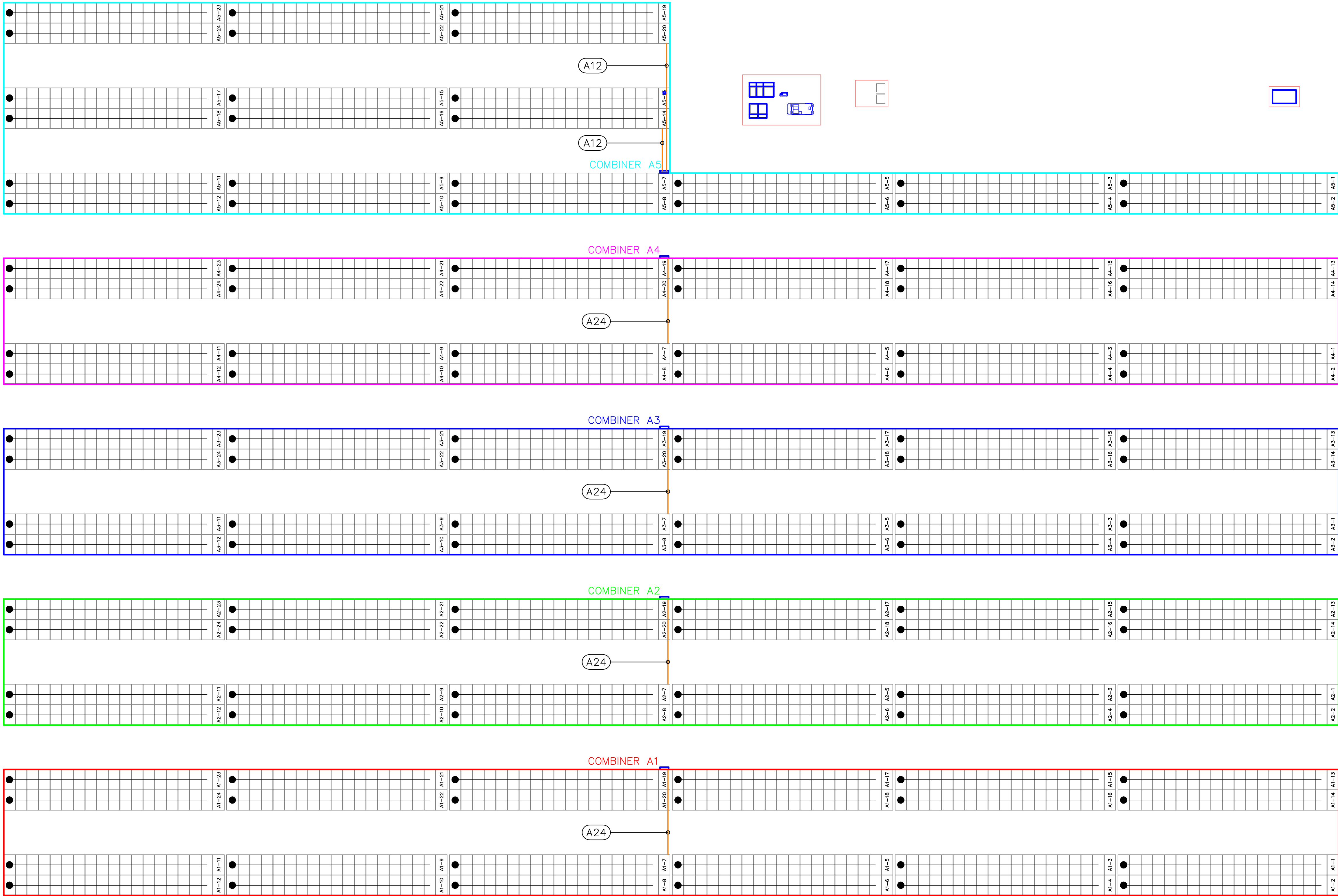
PRELIMINARY
NOT FOR
CONSTRUCTION

REV.	DATE	DESCRIPTION

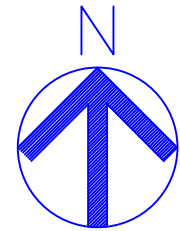
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PROJECT:	NRECA SUNDA REFERENCE DESIGN 500kW – 1,000Vdc

DATE:	02.06.2015
SHEET:	

Pkg Date: 1/10/2015



PRELIMINARY
NOT FOR
CONSTRUCTION



THIS LINE SHOULD
MEASURE ONE INCH

REV.	DATE	DESCRIPTION

TITLE: STRINGING PLAN — ARRAY A

PROJECT: NPECA
SUNDA REFERENCE DESIGN
500KW — 1,000Vdc

DATE: 02.06.2015
SHEET:

PV6.0