

CLOVELLY SOLAR FARM SOLAR ELECTRIC POWER PLANT

555 NEILLS CREEK ROAD

LILLINGTON, NC 27546

SOLAR ELECTRIC SYSTEM PROJECT - 6988.80 KWDC/ 5000 KWAC

35°24'56"N, 78°46'11"W



Booth & Associates, LLC
5811 Glenwood Avenue
Raleigh, NC 27612
NC F-0221



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PROJECT LOCATION:



SYSTEM SUMMARY	
MODULE	CANADIAN SOLAR (17,472) CS3W-400PB-AG
INVERTER	(2) SUNGROW SG3150U
TRANSFORMER	(2) 2500 KVA AT 22.86KV
RACKING	TRACKER SYSTEM
MONITORING	REVENUE-GRADE METERING
QTY STRINGS (28MODS./STRING)	624
DC CAPACITY (W)	6,988,800
AC CAPACITY (W)	5,000,000
POWER RATIO DC/AC	140%
INTERCONNECTION UTILITY	DUKE ENERGY PROGRESS

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STREET MAP:



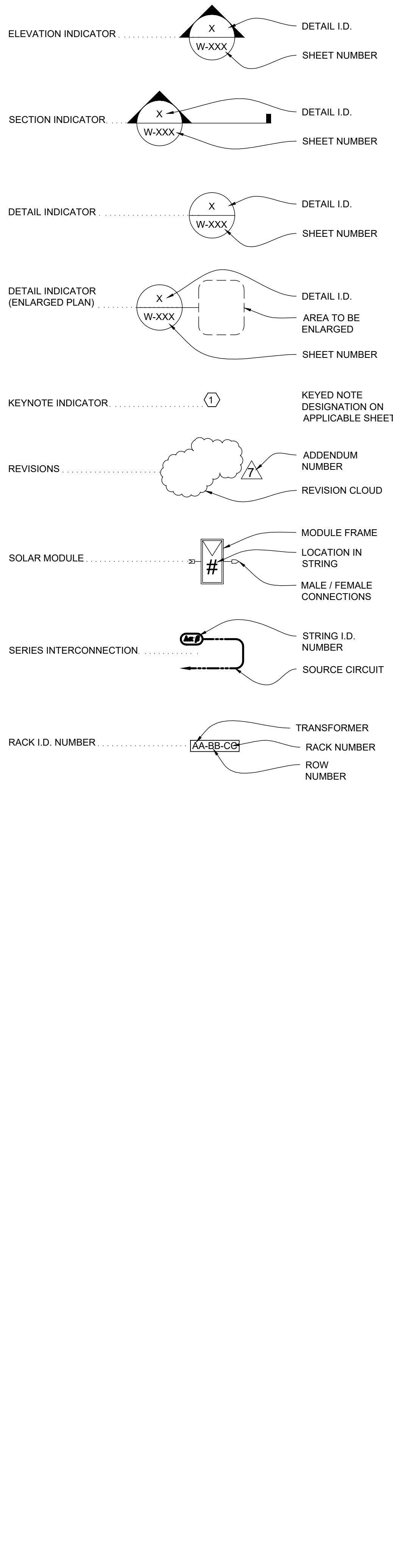
AERIAL VIEW:



NO.	DATE	ENG.	DATE	REVISIONS
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STATION NAME:	CLOVELLY SOLAR ELECTRIC POWER PLANT
DRAWING TITLE:	TITLE SHEET
DRAWN BY:	ALH
CHECKED BY:	EDR
APPROVED BY:	JEH
DATE:	05/01/2020
SCALE:	NTS
FILE NUMBER:	69965
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SYMBOLS:



ABBREVIATIONS:

AC	ALTERNATING CURRENT
ACD	AC DISCONNECT
ADJ	ADJUSTABLE
AHJ	AUTHORITY HAVING JURISDICTION
ALT	ALTERNATE
ALUM	ALUMINUM
ANSI	AMERICAN NATIONAL STANDARDS INSTITUTE
APPROX	APPROXIMATE
ASTM	AMERICAN SOCIETY FOR TESTING AND MATERIALS
AWG	AMERICAN WIRE GAUGE
AZ	AZIMUTH
BLDG	BUILDING
BOT	BOTTOM
C	CELSIUS
C/L	CENTER LINE
CB	COMBINER BOX
CIP	CAST-IN-PLACE
CLR	CLEAR
CONT	CONTINUOUS
CU	COPPER
DAS	DATA ACQUISITION SYSTEM
DC	DIRECT CURRENT
DCD	DC DISCONNECT
DIA	DIAMETER
DOM	DOMINION ENERGY
DISC	DISCONNECT
DWG	DRAWING
(E)	EXISTING
EGC	EQUIPMENT GROUNDING CONDUCTOR
EL	ELEVATION
EMT	ELECTRICAL METALLIC TUBING
EQ	EQUAL
F	FAHRENHEIT
FO	FIBER OPTIC
GALV	GALVANIZED
GEC	GROUNDING ELECTRODE CONDUCTOR
GOAB	GANG OPERATED AIR BREAK SWITCH
GND	GROUND
ID	INSIDE DIAMETER
IMC	INTERMEDIATE METAL CONDUIT
JB	JUNCTION BOX
kV	KILOVOLT, KILOVOLTS
kW	KILOWATT, KILOWATTS
LFNC	LIQUID TIGHT FLEXIBLE NON-METALLIC CONDUIT
LV	LOW VOLTAGE
MCB	MAIN COMBINER BOX
MFR	MANUFACTURER
MIN	MINIMUM
MISC	MISCELLANEOUS
MOV	METAL OXIDE VARISTOR
MV	MEDIUM VOLTAGE
MVA	MEGA VOLT-AMPS
MW	MEGAWATT, MEGAWATTS
(N)	NEW
NEC	NATIONAL ELECTRICAL CODE
NEG	NEGATIVE
NTRL	NEUTRAL
OAE	OR APPROVED EQUAL
OC	ON CENTER
OCPD	OVER CURRENT PROTECTION DEVICE
OD	OUTSIDE DIAMETER
OH	OVERHEAD
PB	POWER BLOCK
PC	PRECAST
PHP	PHASE
POCC	POINT OF COMMON COUPLING
POS	POSITIVE
PTC	PVUSA TEST CONDITIONS
PV	PHOTOVOLTAIC
PVC	POLYVINYL CHLORIDE
RFI	REQUEST FOR INFORMATION
RMC	RIGID METAL CONDUIT
SCADA	SUPERVISORY CONTROL AND DATA ACQUISITION
SCH	SCHEDULE
SD	STORM DRAIN
SF	SQUARE FOOT/FEET
SIM	SIMILAR
STC	STANDARD TEST CONDITIONS
TBD	TO BE DETERMINED
TOF	TOP OF FOOTING
TYP	TYPICAL
UL	UNDERWRITERS LABORATORIES
UGPB	UNDERGROUND PULL BOX
UON	UNLESS OTHERWISE NOTED
UPS	UNINTERRUPTIBLE POWER SUPPLY
V	VOLT, VOLTS
VA	VOLT AMPS
VAC	VOLTS ALTERNATE CURRENT
VDC	VOLTS DIRECT CURRENT
VIF	VERIFY IN FIELD
WP	WEATHERPROOF
WS	WEATHER STATION
XFMR	TRANSFORMER

NOTES:

PROCEDURAL NOTES:

P1. PRIOR TO COMMENCEMENT OF ANY WORK, THE CONTRACTOR SHALL THOROUGHLY READ AND REVIEW THE ENTIRE PLAN SET AND ASSOCIATED SPECIFICATIONS, AND NOTIFY ENGINEER OF RECORD OF ANY DISCREPANCIES. THESE DISCREPANCIES MAY INCLUDE, BUT ARE NOT LIMITED TO, EXISTING SITE CONDITIONS, PROPOSED ELECTRICAL CIRCUIT ROUTINGS, GRADING, PROPOSED STRUCTURES, EQUIPMENT PLACEMENT, ETC. IN ADDITION TO SITE CONDITIONS THE CONTRACTOR SHALL ALSO VERIFY COMPLIANCE WITH EQUIPMENT MANUFACTURER'S RECOMMENDATIONS, REGULATIONS OR RULES OF THE AUTHORITY HAVING JURISDICTION (AHJ), OR GOVERNING CODES.

P2. ALL DIMENSIONS OF EXISTING CONDITIONS MUST BE VERIFIED PRIOR TO COMMENCING WORK.

P3. ALL STRUCTURES AND SURFACES SHALL BE PROTECTED FROM DAMAGE FROM WORK ACTIVITIES. ALL STRUCTURES AND SURFACES SHALL BE LEFT IN A CONDITION EQUAL TO OR BETTER THAN WHEN WORK ACTIVITIES BEGAN.

P4. THE CONTRACTOR IS RESPONSIBLE FOR ALL BRACING AND SHORING OF EQUIPMENT DURING INSTALLATION.

P5. CONTRACTOR SHALL BE RESPONSIBLE FOR ALL SAFETY PRECAUTIONS, OSHA REQUIREMENTS AND SAFETY MEASURES ON SITE. THE ENGINEER OF RECORD HAS NO OVERALL SUPERVISORY AUTHORITY AND NO DIRECT RESPONSIBILITY FOR THE SPECIFIC WORKING CONDITIONS OR FOR POSSIBLE EXISTING HAZARDS.

P6. CONTRACTOR INITIATED CHANGES SHALL BE SUBMITTED IN WRITING TO THE ENGINEER OF RECORD FOR APPROVAL PRIOR TO MAKING ANY CHANGES. APPROVED CHANGES SHALL REQUIRE A DRAWING REVISION OR SUPPLEMENTAL APPROVED ENGINEERING DOCUMENT, SUCH AS AN RFI RESPONSE OR ENGINEERING BULLETIN, TO MAINTAIN CONTROL OVER THE ENGINEER OF RECORD APPROVED DESIGN. DEVIATION FROM THESE PLANS PRIOR TO ENGINEER OF RECORD APPROVAL PLACES ALL LIABILITY ON THE CONTRACTOR.

P7. CONTRACTOR IS NOT ALLOWED TO INTERCONNECT AND OPERATE THE PHOTOVOLTAIC (PV) SYSTEM UNTIL RECEIPT OF APPROVAL TO OPERATE LETTER FROM ENGINEER OF RECORD HAS BEEN OBTAINED, AND THE SYSTEM HAS BEEN APPROVED BY THE LOCAL AHJ.

P8. FOR PROPER MAINTENANCE AND ISOLATION OF ELECTRICAL EQUIPMENT, REFER TO ISOLATION PROCEDURE IN THE RESPECTIVE OPERATIONS MANUALS. CONTRACTOR PERFORMING THE MAINTENANCE IS RESPONSIBLE TO FOLLOW ALL LOCKOUT/TAGOUT PROCEDURES AND ALL OTHER SAFETY PROCEDURES.

P9. THE ELECTRICAL CONTRACTOR SHALL PERFORM INITIAL HARDWARE CHECKS AND PV/WIRING CONDUCTIVITY CHECKS PRIOR TO TERMINATING ANY WIRES. ALL AC AND DC WIRE RUNS, FOR CIRCUITS 1500 VDC OR LESS, SHALL BE MEGGER (INSULATION) TESTED.

MEGGER TESTS SHALL BE PERFORMED AT 1500 VDC TO AT LEAST 5 MEGAOHMS BETWEEN THE CONDUCTOR UNDER TEST AND THE NEAREST GROUND REFERENCE POINT. PROJECT SPECIFIC REQUIREMENTS MAY DICTATE A HIGHER LEVEL OF RESISTANCE TO GROUND BE ACHIEVED IN THIS TESTING. MEDIUM AND HIGH VOLTAGE CONDUCTORS SHALL UNDERGO RESISTANCE TESTING PER THE WIRE MANUFACTURER'S RECOMMENDATION.

MEGGER TESTING SHOULD BE PERFORMED IN ACCORDANCE WITH THE TEST EQUIPMENT MANUFACTURER'S SPECIFICATION AND INSTRUCTIONS. RECORD ALL VALUES ON COMMISSIONING FORMS TO DOCUMENT 100% OF TESTING OF ALL INSTALLED CONDUCTORS. CONDUCT TEST AFTER WIRE IS PULLED THROUGH CONDUIT, BUT BEFORE TERMINATING TO THE MODULES, COMBINERS, DISCONNECTS, INVERTER, OR OVERCURRENT PROTECTION DEVICES. DO NOT MEGGER TEST THE MODULES AS THIS MAY DAMAGE THEIR INTERNAL DIODES.

GENERAL NOTES:

G1. THE ELECTRICAL CONTRACTOR IS RESPONSIBLE FOR INSTALLING ALL EQUIPMENT AND FOLLOWING ALL MANUFACTURER'S OR ENGINEER OF RECORD'S DIRECTIONS AND INSTRUCTIONS SHOWN HERE. IF SPECIFICATIONS ARE NOT APPARENT, THE CONTRACTOR SHALL USE DILIGENT EFFORTS TO MOUNT EQUIPMENT SUCH THAT IT WILL BE CLEAN, LEVEL, AND SOLID IN ORDER TO LAST THE LIFETIME OF THIS PV SYSTEM.

G2. THE ELECTRICAL CONTRACTOR IS ADVISED THAT ALL DRAWINGS, COMPONENT MANUALS, ESPECIALLY THE INVERTER MANUALS, ARE TO BE READ AND UNDERSTOOD PRIOR TO INSTALLATION OR ENERGIZING OF ANY EQUIPMENT. THE CONTRACTOR IS ALSO ADVISED TO HAVE ALL COMPONENT SWITCHES IN THE OFF (OPEN) POSITION AND FUSES REMOVED PRIOR TO INSTALLATION OF FUSE-BEARING COMPONENTS.

G3. INSTALLATION CREW IS TO HAVE A MINIMUM OF ONE JOURNEYMAN LEVEL ELECTRICIAN ON SITE AT ALL TIMES WHEN ELECTRICAL WORK IS BEING PERFORMED.

G4. FOR SAFETY, IT IS RECOMMENDED THE INSTALLATION CREW ALWAYS HAVE A MINIMUM OF TWO PEOPLE WORKING TOGETHER.

G5. THIS PV SYSTEM IS TO BE INSTALLED FOLLOWING THE CONVENTIONS OF THE NATIONAL ELECTRIC CODE (NEC), ANY LOCAL CODE WHICH MAY SUPERSEDE THE NEC SHALL GOVERN. ALL COMPONENTS SHALL BE LISTED BY A NATIONALLY RECOGNIZED TESTING LABORATORY.

G6. THE CONTRACTOR IS RESPONSIBLE FOR SELECTING, PURCHASING AND INSTALLING EQUIPMENT. ALL ENCLOSURES, CONDUIT, STRAPS, PAINTED METAL SURFACES, CONCRETE, GROUNDING EQUIPMENT AND OTHER PRODUCTS SHALL BE SELECTED TO LAST THE LIFETIME OF THE PV SYSTEM. THE ENGINEER OF RECORD SPECIFIES THE MINIMUM REQUIRED EQUIPMENT AND SPECIFICATIONS TO ACCOMPLISH THE PROJECT AND THE ELECTRICAL CONTRACTOR IS RESPONSIBLE TO ENSURE THAT THESE SPECIFICATIONS ARE MET, OR EXCEEDED, WITH GOOD QUALITY EQUIPMENT, WORKMANSHIP, AND SKILL.

G7. DC VOLTAGE FROM THE PV ARRAY IS ALWAYS PRESENT AT THE DC DISCONNECT ENCLOSURE AND THE DC TERMINALS OF THE INVERTER DURING DAYLIGHT HOURS. ALL PERSONS WORKING ON OR INVOLVED WITH THIS PV SYSTEM MUST BE WARNED THAT SOLAR MODULES ARE ENERGIZED WHEN EXPOSED TO DAYLIGHT. THE LINE AND LOAD TERMINALS ON THE DC DISCONNECTS MAY BE ENERGIZED IN THE OPEN POSITION; THE SWITCH IS TO BE LABELED IN COMPLIANCE WITH NEC 690.17 TO REFLECT THIS.

G8. ALL PORTIONS OF THIS PV SYSTEM SHALL BE CLEARLY MARKED IN ACCORDANCE WITH ARTICLES 110, 690 AND 705 OF THE NEC.

G9. THIS PV SYSTEM'S UTILITY INTERCONNECTION POINT SHALL MEET THE SPECIFIC REQUIREMENTS OF NEC 705.12. THE CONTRACTOR SHALL FOLLOW THE SPECIFIC INSTRUCTIONS IN THIS DRAWING SET TO MEET THIS CODE REQUIREMENT.

G10. THE GROUNDING OF THE PV SYSTEM SHALL COMPLY WITH NEC 690.45 AND 690.47. IF THE REQUIREMENTS DESCRIBED IN THIS DRAWING SET ARE CLOSELY FOLLOWED, THE GROUNDING REQUIREMENT WILL BE MET. ANY CHANGES WILL NEED TO BE REVIEWED AND DEEMED ACCEPTABLE BY THE ENGINEER OF RECORD, MANUFACTURER, AND LISTING AGENCY FOR PRODUCT SAFETY.

G11. ANY METAL SHAVINGS RESULTING FROM SITE WORK SHALL BE CLEANED FROM ENCLOSURE INTERIORS, TOP SURFACES OF ENCLOSURES, ROOF SURFACE, GROUND SURFACE AND ANY ADDITIONAL AREAS WHERE OXIDIZED OR CONDUCTIVE METAL SHAVINGS MAY CAUSE RUST, ELECTRICAL SHORT CIRCUITS, OR OTHER DAMAGE.

G12. THE ELECTRICAL CONTRACTOR SHALL CONSIDER THE WEATHERING OF EQUIPMENT OVER TIME AND ELIMINATE THE POSSIBILITY OF DEGRADATION OF EQUIPMENT DUE TO WATER ENTRY AND UV EXPOSURE. AS A RESULT, THE USE OF UNISTRUT OR SIMILAR MOUNTING SYSTEMS TO MOUNT ENCLOSURES, PULL BOXES, LOAD CENTERS, FUSE BOXES OR OTHER EQUIPMENT TO ROOFTOPS AND WALLS TO PREVENT WATER BUILD-UP MAY BE REQUIRED.

METHOD(S) FOR REMOVING AND PREVENTING THE BUILD-UP OF WATER OR MOISTURE SHALL BE PROVIDED IN ENCLOSURES WHERE CONDENSATION OR WATER BUILD-UP MAY OCCUR. MODIFICATION OF COMPONENTS AND ENCLOSURES SHALL COMPLY WITH THE MANUFACTURER'S RECOMMENDATIONS AND SHALL NOT VOID ITS NEMA RATING AS SPECIFIED PER PLAN. CARE SHOULD BE TAKEN TO PREVENT PEST INTRUSION INTO ENCLOSURES WITH THE CHOSEN METHOD(S).

SEALING CONDUIT ENDS WITH A FIRE RETARDANT FOAM OR CAULK AT ENCLOSURE ENTRY/EXIT POINTS IS REQUIRED TO MINIMIZE CONDENSATION AND PESTS IN ENCLOSURES. FOR CONDUIT LOCATIONS RUNNING THROUGH WALLS, FIRE RETARDANT FOAM OR CAULK MUST BE USED TO MAINTAIN THE CURRENT FIRE RATING OF THE WALL AND MUST COMPLY WITH UL 1479 & UL 723 STANDARDS FOR THROUGH-PENETRATIONS FIRESTOP SYSTEMS.

G13. THE BASIS OF THE PROJECT DESIGN SHALL BE A 40-YEAR DESIGN LIFE.

ELECTRICAL NOTES:

E1. THE ELECTRICAL CONTRACTOR IS REQUIRED TO USE PERMANENTLY COLOR CODED INSULATION PER THE COLOR WIRE INSULATION COLOR CODE TABLE SHOWN IN FIGURE 1 FOR SYSTEMS 2000V AND LESS. PHASE TAPING BLACK CONDUCTORS DOES NOT MEET THIS REQUIREMENT. THE CONTRACTOR ACCEPTS ALL RISK AND LIABILITY IF THESE INSTRUCTIONS ARE NOT FOLLOWED.

E2. IN EVERY PULL BOX, TERMINAL BOX, AND AT ALL PLACES WHERE WIRES MAY NOT BE READILY IDENTIFIED BY NAMEPLATE MARKINGS ON THE EQUIPMENT TO WHICH THEY CONNECT, IDENTIFY EACH CIRCUIT WITH A PLASTIC LABEL OR TAG FOR NUMBER, POLARITY, OR PHASE.

E3. THE LAYOUT OF CONDUIT SHOWN IN THESE PLANS IS INDICATIVE ONLY. CONTRACTOR SHALL ROUTE AND LOCATE THE CONDUITS TO SUIT SITE CONDITIONS, BUT SHALL NOT EXCEED THE MAXIMUM CONDUCTOR LENGTHS IDENTIFIED ON THE WIRE SCHEDULE. CONTRACTOR WILL COORDINATE ALL CHANGES IN WIRING AND CONDUIT WITH THE ENGINEER OF RECORD.

E4. WHERE WIRE AND CABLE ROUTING IS NOT SHOWN, AND ONLY DESTINATION IS INDICATED, CONTRACTOR SHALL DETERMINE EXACT ROUTING AND LENGTHS REQUIRED. A SHOP DRAWING OF PROPOSED INSTALLATION SHALL BE SUPPLIED TO THE ENGINEER OF RECORD PRIOR TO INSTALLATION.

E5. BENDS SHALL NOT DAMAGE THE RACEWAY OR SIGNIFICANTLY CHANGE THE INTERNAL DIAMETER OF RACEWAYS (NO KINKS).

E6. SUPPORT CONDUCTORS IN VERTICAL CONDUITS IN ACCORDANCE WITH REQUIREMENTS IN NEC 300.19.

E7. INSTALL ALL WIRING MATERIALS IN A NEAT WORKMANLIKE MANNER. USE GOOD TRADE PRACTICES AS REQUIRED BY CHAPTER 3 OF THE NEC.

E8. INSTALL CONDUIT SUCH THAT PROPER CLEARANCES ARE MAINTAINED, AND IN A NEAT INCONSPICUOUS MANNER. RUN PARALLEL AND AT RIGHT ANGLES TO STRUCTURAL MEMBERS OR OTHER CONDUITS. PROVIDE BOXES, FITTINGS AND BENDS FOR CHANGES IN DIRECTION. FASTEN CONDUIT SECURELY IN PLACE.

E9. WHERE APPLICABLE, SUPPORT CONDUIT USING STEEL PIPE STRAPS (OAE), LAY-IN ADJUSTABLE HANGERS, CLEVIS HANGERS, OR SPLIT-HANGERS. HANGER SPACING SHALL BE DETERMINED AND INSTALLED PER NEC REQUIREMENTS FOR THE TYPE OF CONDUIT BEING INSTALLED. USE APPROVED BEAM CLAMPS FOR CONNECTION TO STRUCTURAL MEMBERS.

E10. PROVIDE PULL JUNCTION, OR CHRISTY BOXES WHERE REQUIRED TO FACILITATE THE INSTALLATION OF WIRING IN ADDITION TO THOSE SHOWN ON THE DRAWINGS. BENDS IN CONDUITS BETWEEN PULL BOXES SHALL NOT EXCEED THE EQUIVALENT OF FOUR 90 DEGREE BENDS.

E11. WHEN FIELD CUTTING IS REQUIRED, THE CONDUIT SHALL BE CUT SQUARE AND DEBURRED.

E12. CONDUIT SIZES NOT SPECIFIED SHOULD CONFORM TO NEC SPECIFICATIONS, TO INCLUDE FILL FACTOR AND DERATING FOR NUMBER OF CONDUCTORS WITH A MINIMUM CONDUIT SIZE OF 3/4".

E13. FOR ALL POWER CIRCUITS, THE MINIMUM WIRE SIZE SHALL BE #12AWG, UNLESS SPECIFIED OTHERWISE IN THIS PLAN SET. THIS PROVISION DOES NOT APPLY TO COMMUNICATION OR DATA CIRCUITS.

E14. THE WIRING SIZE IS BASED ON THE ESTIMATED CONDUIT ROUTING AS SHOWN IN THIS DRAWING PACKAGE. SHOULD THE CONDUIT'S LENGTH INCREASE DUE TO RELOCATION OF SOURCE AND/OR ROUTING, THE CONDUITS AND THE CONDUCTORS MAY NEED TO BE RESIZED. PLEASE CONTACT THE ENGINEER OF RECORD PRIOR TO MAKING ANY FIELD CHANGES.

E15. FOR INTERCONNECTION VIA BUS TAP:

A. OVERCURRENT PROTECTION (SWITCHING DEVICE AND MEANS OF DISCONNECT) MUST BE PLACED PER NEC 240.21.

B. THE CONDUCTORS SHALL BE CRIMPED WITH A COMPRESSION TERMINAL LUG, MANUFACTURED BY ILSCO, BURNDY, OAE. THE TERMINAL LUG AND CRIMP DIE SHALL HAVE IDENTIFICATION OR COLOR CODING TO MATCH THE CONDUCTOR SIZE. WHEREVER POSSIBLE THE TERMINAL LUGS SHALL HAVE LONG BARRELS TO PROVIDE 2 CRIMPS PER TERMINAL LUG PER CONDUCTOR, AND SHALL BE 2-HOLE.

C. COMPRESSION TERMINAL LUGS SHALL BE LISTED FOR USE WITH COPPER OR ALUMINUM CONDUCTORS AS APPROPRIATE. COMPRESSION TERMINAL LUGS SHALL BE RATED FOR THE SAME VOLTAGE AND TEMPERATURE AS THE CONDUCTOR THEY ARE BEING APPLIED TO.

D. THE CRIMP MUST BE MADE WITH THE MANUFACTURER'S APPROVED TOOL OR DEVICE TO ACHIEVE THE PROPER CRIMP CONNECTION.

E. USE STAINLESS STEEL HARDWARE WITH THE FASTENER TORQUED TO MANUFACTURER'S RECOMMENDATIONS ON ALL PHASES TO COMPLY WITH NEC 110.14.

F. FOLLOW MANUFACTURER'S GUIDELINES, OR THE APPLICABLE AHJ, FOR MODIFICATION OF BUS BAR(S).

G. CONDUCTORS SHALL NOT TOUCH OR REST ON BUS BARS OR INTERNAL FRAME PARTS.

E16. ALL CONDUITS SHALL BE FREE OF ANY OBSTRUCTIONS AND PROPERLY SECURED BEFORE WIRE IS PULLED.

E17. CONTRACTOR IS TO PROVIDE SIGNAGE ON ALL ELECTRICAL BOXES, JUNCTION BOXES, PULL BOXES, DC DISCONNECTS, CONDUIT RUNS, AC DISCONNECTS, SUB PANELS, AND MAIN SERVICES PER NEC ARTICLE 690.

E18. WHERE CONDUCTORS WITH INSULATION RATINGS GREATER THAN 75°C ARE SPECIFIED TO BE INSTALLED WITHIN PVC CONDUIT, THE PVC CONDUIT SHALL BE RATED FOR USE WITH CONDUCTORS OF THAT INSULATION RATING UNLESS OTHERWISE ALLOWED FOR WITHIN THE NEC OR BY THE AHJ.

E19. PULL TENSION LIMITS OF CONDUCTORS SHALL NOT BE EXCEEDED. TENSION METERS SHALL BE USED ON ALL PULLS TO MONITOR COMPLIANCE WITH THIS REQUIREMENT. USE ONLY COMPATIBLE AND CONDUCTOR MANUFACTURER APPROVED CONDUCTOR LUBRICANTS.

**FIGURE 1:
CONDUCTOR COLOR TABLE**

DESCRIPTION	PHASE/CODE LETTER	FIELD WIRE COLOR
VOLTAGE GREATER THAN 2kV, 3φ	PHASE A	BLACK
	PHASE B	RED
	PHASE C	BLUE
600V, 3φ	PHASE A	BROWN
	PHASE B	ORANGE
	PHASE C	YELLOW
240/120V, 1φ	L1	BLACK
	L2	RED
AC NEUTRAL	N	WHITE
GROUND	G	GREEN
FUNCTIONALLY GROUNDED SYSTEM	POSITIVE	RED
	NEGATIVE	BLACK

*NOTE: PV SYSTEMS UNREFERENCED TO GROUND (NEITHER POSITIVE NOR NEGATIVE DC CONDUCTORS ARE GROUNDED AT THE INVERTER DURING NORMAL OPERATION) MUST COMPLY WITH THE REQUIREMENTS OF NEC 690.31. BATTERY SYSTEMS, WHETHER REFERENCED OR UNREFERENCED TO GROUND, MUST COMPLY WITH THE REQUIREMENTS OF NEC ARTICLE 480. GROUNDED CONDUCTORS SHALL BE MARKED IN ACCORDANCE WITH NEC 200.7.

MODULE HANDLING NOTES:

M1. CONTRACTOR IS RESPONSIBLE FOR ALL MODULE HANDLING ON THE JOB SITE.

M2. REFER TO MODULE MANUAL FOR DETAILS ON RIGGING, UNPACKING, HANDLING, PLANNING, AND INSTALLATION. SHIPPED MODULE BOXES MAY CONTAIN SEVERAL MODULES. HANDLE SECURELY. NEVER LEAVE A MODULE UNSUPPORTED OR UNSECURED.

PV ARRAY COMMISSIONING:

PC1. BEFORE CLOSING DISCONNECTS OR ATTEMPTING TO ENERGIZE THE INVERTERS, THE FOLLOWING COMMISSIONING PROCEDURE SHALL BE COMPLETED:

A. CHECK THE OPEN CIRCUIT VOLTAGE (V_{oc}) AND POLARITY (+/-) OF EACH SOURCE CIRCUIT. RECORD THE VALUES ON THE COMMISSIONING RECORD DOCUMENTS.

B. CHECK THE SHORT CIRCUIT CURRENT (I_{sc}) FOR EACH SOURCE CIRCUIT. RECORD THE VALUES ON COMMISSIONING RECORD DOCUMENTS.

C. CHECK THAT ALL FUSES, DISCONNECTS AND OTHER BALANCE OF SYSTEM COMPONENTS ARE MINIMALLY RATED FOR THE APPROPRIATE VOLTAGE AND CURRENT CAPACITY.

D. COMPLETE A VISUAL INSPECTION OF ALL THE MODULES TO CHECK FOR BROKEN GLASS, FRAYED WIRES, EXPOSED CONDUCTORS, AND ANY OTHER PROBLEMS THAT MAY CAUSE A FAULT.

E. DATA MUST BE REVIEWED BY ENGINEER OF RECORD AND UPON APPROVAL ENGINEER OF RECORD WILL ISSUE AN AUTHORIZATION TO OPERATE LETTER.

INVERTER COMMISSIONING:

IC1. BEFORE TURNING THE INVERTER ON, OR CLOSING ANY OF THE INVERTER DISCONNECTS, THE FOLLOWING COMMISSIONING PROCEDURE SHALL BE COMPLETED:

A. CHECK THAT THE INVERTER IS PROPERLY GROUNDED, AS DESCRIBED BY THE MANUFACTURER AND THESE INSTRUCTIONS.

B. CHECK THE INVERTER DC INPUT VOLTAGE (V_{oc}) FROM THE PV ARRAY FOR PROPER POLARITY INSIDE THE INVERTER CABINET.

C. CHECK THAT THE DC INPUT VOLTAGE (V_{oc}) IS WITHIN THE PROPER RANGE IN THE INVERTER CABINET, AS DEFINED BY THE INVERTER RATING LABEL AND ACCOMPANIED MANUAL.

D. CHECK THAT THE AC INPUT VOLTAGE IS IN THE PROPER PHASE SEQUENCE (CLOCKWISE), IF APPLICABLE.

E. CHECK THAT THE AC GRID VOLTAGE, AT THE INVERTER AC TERMINALS, IS WITHIN THE PROPER RANGE, AS DEFINED BY THE INVERTER RATING LABEL AND ACCOMPANIED MANUAL.

F. FOLLOW START-UP SEQUENCE IN MANUFACTURER'S OPERATION AND MAINTENANCE MANUAL.

G. DATA MUST BE REVIEWED BY ENGINEER OF RECORD AND UPON APPROVAL ENGINEER OF RECORD WILL ISSUE AN AUTHORIZATION TO OPERATE LETTER.



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 DRAWING TITLE: SYMBOLS & NOTES

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I GENERAL

1.1 CODES & STANDARDS

1.1.1 THE SOLAR FACILITY SHALL BE DESIGNED TO COMPLY WITH THE FOLLOWING CODES AND STANDARDS, UNLESS OTHERWISE SPECIFIED BY THE LOCAL AHJ. WHEN CODE AND OWNER SPECIFICATIONS CONFLICT, CONTRACTOR SHALL CONTACT OWNER FOR DIRECTION.

- NATIONAL ELECTRICAL CODE (NEC)
- NATIONAL ELECTRICAL SAFETY CODE (NESC)
- IEEE STD. 80, IEEE GUIDE FOR SAFETY IN AC SUBSTATION GROUNDING AND OTHER IEEE STANDARDS AS REQUIRED
- ANSI/IEEE STD. 81, IEEE GUIDE FOR MEASURING EARTH RESISTIVITY, GROUND IMPEDANCE, AND EARTH SURFACE POTENTIALS OF A GROUND SYSTEM AND OTHER ANSI/IEEE STANDARDS AS REQUIRED
- IEEE 519 RECOMMENDED PRACTICES AND REQUIREMENTS FOR HARMONIC CONTROL IN ELECTRICAL POWER SYSTEMS
- IEEE 1547 STANDARD FOR INTERCONNECTING DISTRIBUTED RESOURCES WITH ELECTRIC POWER SYSTEMS
- UL 1741 STANDARD FOR INVERTERS, CONVERTERS, CONTROLLERS AND INTERCONNECTION SYSTEM EQUIPMENT FOR USE WITH DISTRIBUTED ENERGY RESOURCES
- UL 62109-1 STANDARD FOR SAFETY OF POWER CONVERTERS FOR USE IN PHOTOVOLTAIC POWER SYSTEMS
- UL 44 THERMOSET-INSULATED WIRES AND CABLES
- UL 854 SERVICE ENTRANCE CABLES
- UL1703 FLAT-PLATE PHOTOVOLTAIC MODULES AND PANELS
- UL 2703 STANDARD FOR MOUNTING SYSTEMS, MOUNTING DEVICES, CLAMPING/RETENTION DEVICES, AND GROUND LUGS FOR USE WITH FLAT-PLATE PHOTOVOLTAIC MODULES AND PANELS
- UL 3703 STANDARD FOR SOLAR TRACKERS
- UL 4703 PHOTOVOLTAIC WIRE
- NFPA 70E STANDARD FOR ELECTRICAL SAFETY IN THE WORKPLACE
- INTERNATIONAL BUILDING CODE (IBC)
- AMERICAN SOCIETY OF CIVIL ENGINEERS (ASCE)
- ASCE 7-10 MINIMUM DESIGN LOADS FOR BUILDINGS AND OTHER STRUCTURES
- AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)
- AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)
- AMERICAN CONCRETE INSTITUTE (ACI)
- AMERICAN IRON AND STEEL INSTITUTE (AISI)
- AMERICAN INSTITUTE OF STEEL CONSTRUCTION (AISC)
- STATE AND LOCAL ELECTRIC REQUIREMENTS TO THE EXTENT REQUIRED

1.2 PROVISIONS

- 1.2.1 THIS SOLAR ELECTRIC SYSTEM IS INTENDED TO OPERATE IN PARALLEL WITH POWER RECEIVED FROM THE UTILITY. THIS SYSTEM IS INTENDED TO CONNECT TO THE EXISTING UTILITY POWER SYSTEM AT A SINGLE POINT OF COMMON COUPLING (POCC), INTERCONNECTION POINT. THIS CONNECTION SHALL BE IN COMPLIANCE WITH NEC SECTION 705.12 "POINT OF CONNECTION".
- 1.2.2 THE CONTRACTOR SHALL FURNISH AND INSTALL ALL WORK AS INDICATED ON THE ISSUED FOR CONSTRUCTION DRAWINGS AND SPECIFICATIONS SUBMITTED TO THE OWNER AND PER THE CONTRACT DOCUMENTS.
- 1.2.3 THE CONTRACTOR SHALL BE RESPONSIBLE FOR LOCATING AND PROTECTING ANY EXISTING UTILITIES AND EQUIPMENT ENCOUNTERED IN THE WORK AREAS.
- 1.2.4 ALL COMMUNICATION AND/OR APPROVALS WITH OWNER SHALL BE THROUGH THE PROJECT MANAGER OR THROUGH THE RFI PROCESS.
- 1.2.5 CONTRACTOR IS RESPONSIBLE FOR ALL DIMENSIONS ON THE DRAWINGS, AND LAYOUT ALL AREAS OF THE ARRAY AND EQUIPMENT PRIOR TO ANY INSTALLATION WORK TO VERIFY THAT NO DISCREPANCIES, EXISTING CONDITIONS, OR OBSTRUCTIONS EXIST. IF ISSUES ARE DISCOVERED WITH THE CONTRACT DOCUMENTS THE CONTRACTOR SHALL NOTIFY OWNER IMMEDIATELY.
- 1.2.6 SOME OF THE DESIGN REQUIREMENTS STATED MAY OVER EXCEED THE MINIMUM REQUIREMENTS OF THE NEC. SUCH REQUIREMENTS ARE TO INCREASE RELIABILITY AND SERVICE LIFE OF SYSTEM COMPONENTS, CHANGES ARE NOT PERMITTED UNLESS APPROVED BY OWNER IN WRITING.
- 1.2.7 ALL CONTRACTOR PERSONNEL PERFORMING WORK ON THIS PROJECT SHALL BE GRANTED "STOP WORK AUTHORITY" AND SHOULD STOP WORK OF THEMSELVES AND CO-WORKERS WHEN THEY FEEL AN UNSAFE CONDITION IS PRESENT AND POSING AN ENVIRONMENTAL, HEALTH, AND/OR SAFETY HAZARD TO WORKERS OR THE PROJECT.

1.3 WORK QUALITY

- 1.3.1 ALL PV MODULES SHALL BE PHYSICALLY INSPECTED PRIOR TO INSTALLATION ON RACKING. MODULES WITH UNDERSIDE SCRATCHES THAT PENETRATE THE PROTECTIVE LAMINATE LAYER SHALL NOT BE INSTALLED.
- 1.3.2 IN LOCATIONS WHERE ELECTRICAL EQUIPMENT MAY BE EXPOSED TO PHYSICAL DAMAGE, ENCLOSURES OR GUARDS SHALL BE INSTALLED WHICH POSSESS ADEQUATE STRENGTH AS TO PREVENT DAMAGE.
- 1.3.3 INTERNAL PARTS OF ELECTRICAL EQUIPMENT, INCLUDING BUSBARS, WIRING TERMINALS, INSULATORS, AND OTHER SURFACES, SHALL NOT BE DAMAGED OR CONTAMINATED BY FOREIGN MATERIALS SUCH AS PAINT, PLASTER, CLEANERS, ABRASIVES, OR CORROSIVE RESIDUES. THERE SHALL BE NO DAMAGED PARTS THAT MAY ADVERSELY AFFECT SAFE OPERATION OR MECHANICAL STRENGTH OF THE EQUIPMENT SUCH AS PARTS THAT ARE BROKEN, BENT, CUT, OR DETERIORATING BY CORROSION, CHEMICAL ACTION OR OVERHEATING.
- 1.3.4 ALL HOT-DIPPED GALVANIZED FERROUS MATERIAL THAT WILL BE SUBJECT TO ANY DRILLING, ARE PILE DRIVEN, AND/OR COMPROMISE THE INTEGRITY OF THE GALVANIZED PROTECTION, SHALL BE TREATED WITH GALVANIZED ZINC COMPOUND TO PREVENT CORROSION.
- 1.3.5 IMPACT DRIVERS SHALL NOT BE USED FOR TIGHTENING ANY HARDWARE.
- 1.3.6 ALL PACKAGING SHALL BE REMOVED FROM ALL EQUIPMENT PRIOR TO COMMISSIONING.
- 1.3.7 CONTRACTOR SHALL INSTALL MODULES SQUARE AND PLUMB WITH ADJACENT MODULES, IN AN AESTHETIC WAY, WITHIN THE ADJUSTABILITY OF THE RACKING. RACKING SUBJECT TO INSPECTION AND FIELD REVIEW BY OWNER OR OWNER'S REPRESENTATIVES.
- 1.3.8 ALL WIRE MANAGEMENT SHALL BE DONE NEATLY AND IN AN ORDERLY AND PROFESSIONAL MANNER.
- 1.3.9 ALL MODULE, DC STRING, AND PV OUTPUT CIRCUIT CONNECTORS SHALL BE CLEAN AND KEPT DRY UNTIL CONNECTION.

- 1.3.10 DISSIMILAR METALS SHALL NOT COME INTO CONTACT WITH EACH OTHER.
- 1.3.11 ALL UNTERMINATED ENDS OF MEDIUM VOLTAGE CABLE SHALL BE SEALED WITH HEAT SHRINKABLE END CAPS TO PREVENT MOISTURE INGRESS.
- 1.3.12 ALL MATERIALS SHALL BE NEW, IN PROPER WORKING CONDITION, AND MARKED AND LISTED BY A NATIONALLY RECOGNIZED TESTING LABORATORY (NRTL). THE MATERIALS SHALL BE USED FOR THEIR INTENDED PURPOSES.
- 1.3.13 ALL EQUIPMENT SHALL BE ASSEMBLED, INSTALLED, AND TESTED PER MANUFACTURER'S SPECIFICATIONS AND MANUALS. IF INSTALLATION MANUALS ARE NOT PROVIDED THEY MUST BE REQUESTED, RECEIVED AND REVIEWED PRIOR TO INSTALLATION.

2 EQUIPMENT

2.1 PHOTOVOLTAIC (PV) MODULES

- 2.1.1 PV MODULES SHALL BE PER CONTRACT DRAWINGS OR PER OWNER APPROVAL.
- 2.1.2 PV MODULES SHALL BE IEEE 1262 (LATEST EDITION) COMPLIANT AND LISTED TO UL-1703 (LATEST EDITION).
- 2.1.3 PV MODULES SHALL BE LISTED AS A TIER 1 SUPPLIER BY BLOOMBERG NEW ENERGY FINANCE (BNEF).

2.2 MOUNTING SYSTEM

- 2.2.1 THE DESIGN SPECIFICATIONS FOR THE FOUNDATIONS OF THE MODULE MOUNTING SYSTEM ("MOUNTING SYSTEM") SHALL BE PROVIDED AS PART OF THE MOUNTING SYSTEM DESIGN SPECIFICATIONS.
- 2.2.2 ALL DESIGN DRAWINGS AND SPECIFICATIONS PRODUCED SHALL BE SEALED BY A PROFESSIONAL OR STRUCTURAL ENGINEER LICENSED TO PRACTICE IN THE STATE IN WHICH THE PROJECT IS LOCATED.
- 2.2.3 DESIGNS SHALL TAKE INTO ACCOUNT ALL APPLIED LOADS INCLUDING DEAD, LIVE, WIND, SNOW, EARTHQUAKE, ICE AND THERMAL LOADS. ERECTION, MAINTENANCE, IMPACT, MOVEMENT, SETTLEMENT AND OTHER LOADING CONDITIONS SHALL ALSO BE CONSIDERED WHERE APPROPRIATE.
- 2.2.4 THE MOUNTING SYSTEM STRUCTURAL COATINGS INCLUDING FOUNDATIONS SHALL MEET MANUFACTURER WARRANTY REQUIREMENTS.
- 2.2.5 THE MOUNTING SYSTEM FOUNDATION WITHSTAND THE SOIL CHEMISTRY OF THE SITE LOCATION FOR A MINIMUM THE SPECIFIED DESIGN LIFE WITHOUT REPLACEMENT.
- 2.2.6 THE FOUNDATION SHALL COMPLY WITH ALL OF THE ENVIRONMENTAL CONDITIONS OF THE SITE.
- 2.2.7 GROUND-MOUNTED SYSTEMS SHALL ALLOW FOR A MINIMUM CLEARANCE FROM GRADE TO ALLOW FOR SNOW, VEGETATION, AND MAINTENANCE CONSIDERATIONS. MINIMUM CLEARANCE REQUIREMENT SHALL BE APPROVED BY OWNER.
- 2.2.8 THE FOUNDATION SYSTEM SHALL MEET THE MANUFACTURER'S REQUIREMENTS FOR HEIGHT, TORSION, AND VERTICAL OR HORIZONTAL ALIGNMENT. FOR TRACKER SYSTEMS THE FOUNDATION ALIGNMENT OF A SINGLE TRACKER ROW, OR ALL FOUNDATIONS IN A LINKED TRACKER SYSTEM, SHALL MEET THE MANUFACTURER'S SPECIFICATIONS WITH SPECIAL CONSIDERATION FOR SITE SLOPE AND CHANGE OF GRADE.
- 2.2.9 THE MOUNTING SYSTEM SHALL BE CERTIFIED BY UL OR ANOTHER OWNER-APPROVED TESTING AGENCY TO MEET THE REQUIREMENTS OF UL SUBJECT 2703.
- 2.2.10 TRACKER SYSTEMS SHALL BE CERTIFIED TO UL 3703.
- 2.2.11 TRACKER SYSTEMS DEPLOYED IN EXTREME CLIMATE CONDITIONS SHALL HAVE SPECIAL CONSIDERATION FOR MOVING PARTS WITH RESPECT TO SNOW, ICE, SAND/DUST, PRECIPITATION, WIND LOADS AND SHOULD BE DEMONSTRATED THROUGH THE ENGINEERING CALCULATIONS AND, DESIGN DOCUMENTS, AND VERIFIED BY THE TRACKER MANUFACTURER.
- 2.2.12 THE MOUNTING SYSTEM SHALL HAVE WRITTEN APPROVAL BY THE PV MODULE MANUFACTURER FOR USE WITH THE SPECIFIED PV MODULES SELECTED FOR THE PROJECT AND FOR THE ORIENTATION IN WHICH THE PV MODULES WILL BE INSTALLED ON THE RACKING SYSTEM.
- 2.2.13 PV MODULE MOUNTING HARDWARE SHALL BE STAINLESS STEEL.

2.3 DC WIRING

- 2.3.1 STRING AND HARNESS SOURCE CONDUCTORS SHALL BE TYPE PV WIRE, COPPER, 2KV WITH XLPE INSULATION RATED 90°C.
- 2.3.2 COLLECTOR SOURCE CONDUCTORS (IE BLA, TRUNK BUS) SHALL BE TYPE PV WIRE, ALUMINUM, 2KV WITH XLPE INSULATION RATED 90°C.
- 2.3.3 OUTPUT CONDUCTORS SHALL BE TYPE PV WIRE, ALUMINUM, 2KV WITH XLPE INSULATION RATED 90°C.
- 2.3.4 THE CONDUCTOR OUTER JACKET SHALL BE LABELED WITH A UL LISTING, MARKED AS SUNLIGHT RESISTANT, AND RATED FOR DIRECT BURIAL OR USE IN CONDUIT.
- 2.3.5 ALL DC MATERIAL SHALL HAVE A UL LISTED VOLTAGE RATING EQUAL TO, OR GREATER THAN, THE DC SYSTEM VOLTAGE SHOWN IN THE CONTRACT DRAWINGS.
- 2.3.6 IF A PREMANUFACTURED WIRING HARNESS IS USED TO COMBINE SOURCE CIRCUITS IN PARALLEL, THE CONTRACTOR SHALL SUBMIT THE MANUFACTURER'S SPECIFICATIONS AND AVAILABLE DRAWINGS TO THE OWNER FOR APPROVAL PRIOR TO PURCHASE.
- 2.3.7 STRING HARNESSES SHALL BE CONSTRUCTED OF HIGH-QUALITY MATERIAL, AND ALL CONNECTIONS SHALL BE MEGGER TESTED TO DEMONSTRATE INSULATION QUALITY.
- 2.3.8 CONNECTORS SHALL BE THE SAME AS THE MODULE MANUFACTURER-PROVIDED CONNECTORS. AN EXACT MATCH MUST BE VERIFIED.
- 2.3.9 WIRE HARNESSES SHALL UTILIZE IN-LINE FUSES DESIGNED FOR OVERMOLDING.

- 2.3.10 OVERMOLDING SHALL BE MADE OF UV STABILIZED MATERIALS WITH DESIGN LIFE OF AT LEAST 40 YEARS OR AS APPROVED.

2.4 DC COMBINER / LOAD BREAK DISCONNECT BOXES

- 2.4.1 COMBINER BOX ENCLOSURES SHALL BE CONSTRUCTED WITH FIBERGLASS, POWDER-COATED STEEL, OR STAINLESS STEEL AND SHALL HAVE A NEMA 3R MINIMUM RATING IF MOUNTED VERTICALLY, AND NEMA 4X RATING IF MOUNTED WITH ACCESS DOOR/PANEL MOUNTED OUT OF VERTICAL.
- 2.4.2 THE ENCLOSURE SHALL BE MADE LARGE ENOUGH TO ACCOMMODATE ALL WIRE BENDING RADI, ALL WIRE TERMINATIONS, FUSE HOLDERS, DISCONNECTING MEANS, AND AFCI COMPONENTS WHERE APPLICABLE.
- 2.4.3 ALL DC MATERIALS SHALL BE UL LISTED FOR THE SYSTEM VOLTAGE SHOWN IN THE DC DESIGN.
- 2.4.4 DOORS OR REMOVABLE PANELS PROVIDING ACCESS TO PARTS NORMALLY ENERGIZED SHALL BE PAD-LOCKABLE CLOSED OR SHALL REQUIRE TOOLS FOR REMOVAL.
- 2.4.5 ARC FAULT CIRCUIT INTERRUPTERS (AFCI) SHALL BE PROVIDED FOR PROJECTS IF REQUIRED AND SUBJECT TO THE PROVISIONS OF THE NEC.
- 2.4.6 EACH COMBINER BOX SHALL HAVE A SINGLE LOAD BREAK RATED DISCONNECT WITH A MAXIMUM RATING OF 1500VDC AND 400A.
- 2.4.7 DISCONNECT HANDLE SHALL BE ACCESSIBLE FROM THE EXTERIOR OF THE ENCLOSURE TO ALLOW FOR SAFE OPERATION WITHOUT OPENING THE ENCLOSURE DOOR.
- 2.4.8 IT IS OWNER STANDARD TO USE A MAXIMUM DC FUSE RATING OF 400A PER EACH COMBINER BOX OUTPUT CIRCUIT, UNLESS OTHERWISE SPECIFIED IN THE DRAWINGS.
- 2.4.9 SOURCE CIRCUIT INPUT FUSES SHALL HAVE A VOLTAGE AND CURRENT RATING IN ACCORDANCE WITH NEC.

2.5 LOW VOLTAGE AC WIRING

- 2.5.1 LOW VOLTAGE AC CONDUCTORS (LESS THAN 240 VAC) SHALL BE TYPE XHHW-2 OR THWN-2, COPPER OR ALUMINUM, RATED 90°C. THIS RATING MAY BE SUPERSEDED BY ANY EQUIPMENT SPECIFICATIONS REQUIRING LOW VOLTAGE AC WIRE TO MEET HIGHER VOLTAGE OR INSULATION STANDARDS.
- 2.5.2 THE CONDUCTOR OUTER JACKET SHALL BE LABELED WITH A UL LISTING AND RATED FOR USE IN CONDUIT.
- 2.5.3 MINIMUM ALUMINUM CONDUCTOR SHALL SIZE BE #2 AWG STRANDED, COMPACT ELECTRICAL GRADE AA-8000 SERIES ALLOY.

2.6 LOW VOLTAGE AC ENCLOSURE

- 2.6.1 ALL LOW VOLTAGE AC ELECTRICAL ENCLOSURES SHALL BE FIBER GLASS, POWDER-COATED STEEL, OR STAINLESS STEEL AND SHALL HAVE A MINIMUM NEMA 3R RATING FOR OUTDOOR APPLICATIONS, IF MOUNTED VERTICALLY, AND NEMA 4X IF MOUNTED WITH ACCESS DOOR/PANEL MOUNTED OUT OF VERTICAL.
- 2.6.2 ENCLOSURES SHALL BE DESIGNED AND LISTED FOR THEIR INTENDED USE, AND SHALL BARE THE APPROPRIATE CURRENT, VOLTAGE, AND INTERRUPT RATINGS FOR THEIR APPLICATION.

2.7 INVERTERS

- 2.7.1 INVERTER SHALL BE CONSTRUCTED WITH A STEEL ENCLOSURE, COATED TO WITHSTAND THE ENVIRONMENTAL CONDITIONS IN WHICH IT IS TO BE INSTALLED. THE MAIN ENCLOSURE SHALL BE RATED NEMA 3R, WITH ALL ELECTRONICS HOUSED IN A NEMA 4X ENCLOSURE.
- 2.7.2 THE MAXIMUM DC FUSE RATING SHALL BE 400A AND 1500V.
- 2.7.3 EACH POSITIVE DC INPUT SHALL HAVE A MEANS OF DISCONNECT LOCATED ADJACENT TO THE INPUT TERMINALS. DC FUSES SHALL BE ABLE TO BE DISCONNECTED ON THE LINE AND LOAD SIDE OF FUSE TO COMPLY WITH NEC FUSE SERVICING REQUIREMENTS.
- 2.7.4 THE MAXIMUM DC OPEN CIRCUIT VOLTAGE FROM THE PV ARRAY SHALL NOT EXCEED THE MAXIMUM RATING OF THE INVERTER.
- 2.7.5 CENTRAL INVERTERS SHALL BE CONNECTED TO THE STEP-UP TRANSFORMER VIA A THROATED BUS CONNECTION, OR VIA CONDUCTORS IN CONDUIT.
- 2.7.6 STRING INVERTERS SHALL BE CONNECTED TO A SWITCHBOARD VIA CONDUCTORS IN CONDUIT OR CABLE TRAY.
- 2.7.7 ALL DIRECT BUS CONNECTIONS SHALL BE APPROVED BY THE INVERTER AND TRANSFORMER MANUFACTURERS.
- 2.7.8 IF CABLE CONDUCTORS ARE USED, THE CONDUCTOR VOLTAGE RATING SHALL BE SUFFICIENT TO WITHSTAND THE INVERTER'S MAXIMUM OPERATIONAL VOLTAGE.
- 2.7.9 THE INVERTER CONNECTION TO THE TRANSFORMER SHALL BE PER FACTORY SPECIFICATIONS.
- 2.7.10 THE INVERTER SHALL BE ABLE TO DETECT AND INTERRUPT A GROUND FAULT IN THE PV ARRAY.
- 2.7.11 THE INVERTER SHALL BE CAPABLE OF CONTINUOUSLY MONITORING THE FOLLOWING AT A MINIMUM:
 - DC BUS VOLTAGE
 - DC CURRENT FOR EACH DC INPUT
 - AC OUTPUT POWER (REAL AND REACTIVE)
 - FREQUENCY
 - INVERTER TEMPERATURE
 - FAULTS/FAULT CODES
- 2.8 INVERTER STEP-UP TRANSFORMER (ISU)
- 2.8.1 THE TRANSFORMER ENCLOSURE AND TANK SHALL BE CONSTRUCTED OF STEEL, COATED TO WITHSTAND THE ENVIRONMENTAL CONDITIONS IN WHICH IT IS TO BE INSTALLED AND RATED NEMA 3R. THE ENCLOSURE SHALL HAVE A STEEL DIVIDER BETWEEN THE LOW VOLTAGE AND HIGH VOLTAGE COMPARTMENTS.

- 2.8.2 THE TRANSFORMER APPARENT POWER RATING SHALL MATCH THE EXPECTED CONTINUOUS INVERTER OUTPUT POWER AT THE CORRESPONDING OPERATING TEMPERATURES.
- 2.8.3 TRANSFORMER VOLTAGE LEVELS SHALL BE SELECTED TO STEP UP FROM THE INVERTER OUTPUT VOLTAGE LEVEL TO GRID INTERCONNECTION OR SUBSTATION LEVEL.
- 2.8.4 FOR INSTALLATIONS IN THE CONTINENTAL UNITED STATES, THE TRANSFORMER FREQUENCY SHALL BE RATED FOR 60HZ.
- 2.8.5 THE ISU SHALL BE OIL NATURAL AND AIR NATURAL (KNAN) COOLED AND SHALL USE PLANT BASED, BIODEGRADABLE OIL SUCH AS FR3. ALTERNATIVE COOLING, SUCH AS DRY TYPE FORCED AIR, MAY BE APPROVED BY OWNER. IF FORCE AIR COOLED (ANAF OR AFAP), THE COOLING AIR SHALL BE FILTERED.
- 2.8.6 THE TRANSFORMER SHALL BE CONSTRUCTED TO WITHSTAND A 65°C AVERAGE TEMPERATURE RISE OF THE WINDINGS ABOVE THE AMBIENT (SURROUNDING) TEMPERATURE, WHEN THE TRANSFORMER IS LOADED AT ITS NAMEPLATE RATING.
- 2.8.7 THE TRANSFORMER SHALL HAVE AT LEAST TWO SETS OF THREE PHASE WINDINGS, ONE HIGH VOLTAGE SET AND ONE LOW VOLTAGE SET.
- 2.8.8 THE HIGH VOLTAGE AND LOW VOLTAGE WINDINGS SHALL BE CONFIGURED TO BE COMPATIBLE WITH THE EXPECTED INVERTER MANUFACTURER'S OPERATING REQUIREMENTS, AS WELL AS THOSE OF THE INTERCONNECTING UTILITY.
- 2.8.9 WINDINGS MAY BE CONSTRUCTED OF ALUMINUM OR COPPER.
- 2.8.10 THE INVERTER WINDINGS SHALL BE EQUIPPED WITH AN ELECTROSTATIC SHIELD.
- 2.8.11 THE HIGH SIDE INTERFACE SHALL BE DEAD FRONT, LOOP FED CONFIGURATION WITH 600A NON-LOAD BREAK OR 200A LOAD BREAK BUSHINGS PER DESIGN REQUIREMENTS.
- 2.8.12 THE HIGH SIDE INTERFACE SHALL HAVE FAULT INDICATOR.
- 2.8.13 THE LOW SIDE INTERFACE SHALL BE LIVE FRONT WITH SPADE BUSHINGS ADEQUATE TO ACCOMMODATE THE INVERTER OUTPUT CONDUCTORS OR BUSES.
- 2.8.14 THE LOW VOLTAGE SPADES SHALL BE ADEQUATELY SPACED TO ALLOW FOR PROPER PHASE-TO-PHASE AND PHASE-TO-NEUTRAL CLEARANCE FOR THE TERMINATIONS.
- 2.8.15 THE TRANSFORMER SHALL BE EQUIPPED WITH A TWO-POSITION LOAD BREAK DISCONNECT SWITCH, ACCESSIBLE EITHER FROM THE EXTERIOR OR LOCATED INSIDE THE HIGH SIDE COMPARTMENT.
- 2.8.16 THE MINIMUM BASIC INSULATION LEVEL (BIL) SHALL BE BASED ON THE TABLE BELOW. THE ABSOLUTE MINIMUM LEVEL FOR THE LOW VOLTAGE SIDE SHALL BE 30.

Voltage class, kV	Distribution class
1.2	30
2.5	45
5.0	60
8.7	75
15	95
25	125
34.5	150
46	200
69	250

- 2.8.17 THE IMPEDANCE BETWEEN THE HIGH VOLTAGE AND LOW VOLTAGE WINDINGS SHALL BE BASED ON THE INVERTER MANUFACTURER'S OPERATIONAL REQUIREMENTS. TYPICALLY, THIS VALUE WILL BE Z=5.75%, +/- 7.5%.
- 2.8.18 THE TRANSFORMER SECONDARY CONDUCTORS SHALL BE PROTECTED BY BAY-O-NET TYPE UNDER OIL EXPULSION FUSES. THE FUSE LINKS SHALL BE FIELD CHANGEABLE, WITH ACCESS TO THE CARTRIDGES EITHER INSIDE THE HIGH VOLTAGE COMPARTMENT, OR FROM AND EXTERIOR PANEL ON THE SIDE OF THE TRANSFORMER ENCLOSURE.
- 2.8.19 OVERLOAD PROTECTION FOR THE CORE SHALL BE PROVIDED BY PARTIAL RANGE CURRENT LIMITING FUSES, INSIDE THE TRANSFORMER TANK. THE CURRENT LIMITING FUSE RATINGS SHALL BE DETERMINED BY THE TRANSFORMER MANUFACTURER.
- 2.8.20 AN AUTOMATIC PRESSURE RELIEF VALVE SHALL BE PROVIDED FOR THE TRANSFORMER TANK, IN ORDER TO PREVENT EXCESSIVE PRESSURE BUILD UP.
- 2.8.21 THE TRANSFORMER SHALL BE EQUIPPED WITH DRY ALARM CONTACTS, TO MONITOR TEMPERATURE, PRESSURE, AND LIQUID LEVEL.
- 2.8.22 ALL GAUGES ARE TO BE LOCATED IN A SEPARATE CABINET THAT IS ACCESSIBLE DURING OPERATION.
- 2.8.23 TRANSFORMER ALARM I/O ARE TO BE INTEGRATED INTO THE SITE SCADA SYSTEM.
- 2.9 AUXILIARY POWER TRANSFORMERS
- 2.9.1 THE AUXILIARY TRANSFORMER ENCLOSURE SHALL BE MADE FROM COATED STEEL AND SHALL BE RATED NEMA 3R OR 4X.
- 2.9.2 DRY TYPE SINGLE PHASE OR THREE PHASE AUXILIARY TRANSFORMER POWER RATING SHALL BE ADEQUATE TO SERVICE THE CONNECTED AUXILIARY LOADS.
- 2.9.3 TRANSFORMER VOLTAGE LEVELS SHALL BE SELECTED TO STEP DOWN FROM THE INVERTER OUTPUT VOLTAGE LEVEL TO 240/120VAC OR 208/120VAC AS NEEDED.
- 2.9.4 FOR INSTALLATIONS IN THE CONTINENTAL UNITED STATES, THE TRANSFORMER FREQUENCY SHALL BE RATED FOR 60HZ.
- 2.9.5 DRY TYPE AUXILIARY TRANSFORMERS SHALL BE NATURALLY AIR COOLED.
- 2.9.6 THE WINDING MATERIAL MAY BE EITHER ALUMINUM OR COPPER. TRANSFORMER WINDINGS SHALL HAVE AN ELECTROSTATIC SHIELD AND SHALL BE CONSTRUCTED TO MEET THE INVERTER MANUFACTURER'S OPERATIONAL REQUIREMENTS. TRANSFORMER WINDINGS SHALL BE EPOXY ENCAPSULATED.

- 2.9.7 THE HIGH SIDE ELECTRICAL INTERFACE SHALL BE A CIRCUIT BREAKER OR MECHANICAL LUGS.
- 2.9.8 THE LOW VOLTAGE INTERFACE SHALL BE A TOUCH SAFE, DEAD FRONT PANEL EQUIPPED WITH BRANCH CIRCUIT BREAKERS, SIZED TO SERVICE THE ANTICIPATED AUXILIARY EQUIPMENT.
- 2.9.9 A SAFE MEANS OF DISCONNECTING THE TRANSFORMER FROM THE INVERTER, WITHOUT INTERRUPTION TO THE INVERTER OR INVERTER STEP-UP TRANSFORMER OPERATION SHALL BE PROVIDED.

2.10 MEDIUM VOLTAGE AC WIRING

- 2.10.1 MEDIUM VOLTAGE CONDUCTORS SHALL BE EPR OR XLPE, 133% INSULATION VOLTAGE RATING, MV-105 OR MV-90, AND SHALL HAVE A CONCENTRIC NEUTRAL.
- 2.10.2 MEDIUM VOLTAGE CONDUCTORS MAY BE MADE OF EITHER ALUMINUM OR COPPER.
- 2.10.3 INSULATION RATING SHALL MEET OR EXCEED THE HIGHEST EXPECTED CONTINUOUS CIRCUIT VOLTAGE. THE OUTER JACKET MAY BE PVC OR XLPE, HOWEVER SHALL BARE THE UL MARKING AND LIST OF CONDUCTOR SIZE AND RATINGS.
- 2.10.4 MEDIUM VOLTAGE CONDUCTORS SHALL BE RATED FOR DIRECT BURIED OR USE IN CONDUIT.
- 2.10.5 IN GENERAL, BARE COPPER CONCENTRIC NEUTRAL UNDER JACKET SHALL BE 1/3 FOR CABLE SMALLER THAN 500 KCMIL, 1/3 FOR 500 KCMIL, AND 1/6 FOR 750 KCMIL AND LARGER, UNLESS SHORT CIRCUIT CALCULATIONS INDICATE OTHERWISE. ENGINEER SHALL COORDINATE WITH OWNER ON PROTECTION TRIPPING MAXIMUM CLEARING TIME TO USE IN THE CALCULATION. FOR ANY NEUTRAL SIZE LESS THAN 1/6 THE OWNER MUST APPROVE.
- 2.10.6 MEDIUM VOLTAGE CONDUCTORS SHALL BE OF THE UL TYPE SPECIFIED AND HAVE BEEN DESIGNED, MANUFACTURED, AND/OR TESTED ACCORDING TO THE FOLLOWING STANDARDS: UL 1072, ICEA S-84-649 (NEMA WG 74).
- 2.11 RACEWAYS
- 2.11.1 INTERMEDIATE METAL CONDUIT SHALL BE HOT-DIPPED GALVANIZED STEEL CONFORMING TO ANSI C80.6 AND UL 1242. CONDUIT SHALL BE AS MANUFACTURED BY ALLIED TUBE AND CONDUIT CORP., WHEATLAND TUBE CO., LTV STEEL TUBULAR PRODUCTS CO. OR EQUAL.
- 2.11.2 RIGID METAL CONDUIT SHALL BE HOT-DIPPED GALVANIZED STEEL CONFORMING TO ANSI C80.1 AND UL 797. TUBING SHALL BE AS MANUFACTURED BY ALLIED TUBE AND CONDUIT CO., WHEATLAND TUBE CO., LTV STEEL TUBULAR CO., OR EQUAL.
- 2.11.3 ELECTRIC METALLIC TUBING SHALL BE HOT-DIPPED GALVANIZED STEEL CONFORMING TO ANSI C80.3 AND UL 797. TUBING SHALL BE AS MANUFACTURED BY PYLE NATIONAL, ALLIED TUBE AND CONDUIT CORP., WHEATLAND TUBE COMPANY, OR EQUAL.
- 2.11.4 PLASTIC CONDUIT SHALL BE SCHEDULE 40 AND 80 PVC 90°C AND CONFORMING TO NEMA STANDARD TC2. PLASTIC CONDUIT SHALL BE AS MANUFACTURED BY CARLON ELECTRICAL PRODUCTS CO., ALLIED TUBE AND CONDUIT COMPANY, TRIANGLE COMPANY OR EQUAL.
- 2.11.5 LIQUID-TIGHT FLEXIBLE METAL CONDUIT SHALL BE GALVANIZED STEEL WITH EXTRUDED MOISTURE AND OIL-PROOF OUTER JACKET OF POLYVINYL CHLORIDE PLASTIC. CONDUIT SHALL BE AS MANUFACTURED BY ALLIED TUBE AND CONDUIT CORP., WHEATLAND TUBE CO., LTV STEEL TUBULAR PRODUCTS CO. OR EQUAL.
- 2.11.6 INTERMEDIATE AND RIGID METAL CONDUIT FITTINGS, COUPLINGS AND CONNECTORS SHALL BE THREADED AND GALVANIZED OR CADMIUM PLATED.
- 2.11.7 MYERS HUBS SHALL BE USED FOR RIGID AND INTERMEDIATE METAL CONDUIT.
- 2.11.8 COUPLINGS AND CONNECTORS FOR ELECTRIC METALLIC TUBING SHALL BE WATER TIGHT COMPRESSION FITTINGS.
- 2.11.9 COUPLINGS AND CONNECTORS FOR PVC AND LFMC SHALL BE WATER TIGHT FITTINGS.
- 2.11.10 STEEL SUPPORT RODS OR SUPPORT BOLTS FOR CONDUITS SHALL BE 1/8 INCH DIAMETER FOR EACH INCH OR FRACTION THEREOF OF DIAMETER OF CONDUIT SIZE, BUT NO ROD OR BOLT SHALL BE LESS THAN 1/4 INCH IN DIAMETER. SUPPORTS SHALL BE GALVANIZED. SUPPORT RODS FOR STEEL CHANNEL SHALL NOT BE LESS THAN 5/8 INCH IN DIAMETER.
- 2.11.11 EXPANSION FITTINGS FOR UP TO 2 INCH MOVEMENT IN EITHER DIRECTION, SHALL BE OZ SEDNEY TYPE 'TX' FOR EMT AND TYPE 'AX' FOR IMC, OR EQUAL BY APPLETON OR GROUSE-HINDS.
- 2.11.12 PVC CONDUIT CLAMPS 2" OR SMALLER AND RATED FOR EXPANSION SHALL BE E873JC-CAR SNAP STRAP DOUBLE MOUNT SUPPORT STRAP, OR EQUAL BY CARLON.



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NO.	DATE	ENG.	DATE	REVISIONS
1	05/09/2020	JEH		A ISSUED FOR PERMIT

STATION NAME: CLOVELLY SOLAR ELECTRIC POWER PLANT
DRAWING TITLE: SYMBOLS & NOTES

DRAWN BY: ALH
CHECKED BY: EDR
APPROVED BY: JEH
DATE: 05/01/2020
SCALE: NTS
FILE NUMBER: 69965
SHEET: E-011

2.12 DC AND LOW VOLTAGE AC OVERCURRENT PROTECTION DEVICES

- 2.12.1 CONTRACTOR SHALL PROVIDE OVERCURRENT PROTECTION DEVICES FOR ALL CONDUCTORS, BUSES AND ELECTRICAL EQUIPMENT THAT MAY BE DAMAGED DUE EXCESSIVE CURRENT ON THE CIRCUIT.
- 2.12.2 CONTRACTOR SHALL PROVIDE OVERCURRENT PROTECTION DEVICES FOR ALL OTHER EQUIPMENT THAT MAY BE DAMAGED DUE TO A FAULT OR OVERCURRENT EVENT WITHIN THE FACILITY'S CIRCUITS.
- 2.12.3 ALL OVERCURRENT DEVICES SHALL BE SELECTIVELY COORDINATED SUCH THAT THE BRANCH LEVEL CIRCUITS ARE DEENERGIZED FIRST, LEAVING AS MANY FEEDER AND MAIN LEVEL CIRCUITS IN OPERATION AS POSSIBLE DURING A FAULTING EVENT.

2.13 MEDIUM AND HIGH VOLTAGE OVERCURRENT PROTECTION DEVICES

- 2.13.1 CONTRACTOR SHALL PROVIDE OVERCURRENT PROTECTION DEVICES FOR ALL CONDUCTORS, BUSES AND ELECTRICAL EQUIPMENT THAT MAY BE DAMAGED DUE EXCESSIVE CURRENT ON THE CIRCUIT.
- 2.13.2 CONTRACTOR SHALL PROVIDE OVERCURRENT PROTECTION DEVICES FOR ALL OTHER EQUIPMENT THAT MAY BE DAMAGED DUE TO A FAULT OR OVERCURRENT EVENT WITHIN THE FACILITY'S CIRCUITS.
- 2.13.3 ALL OVERCURRENT DEVICES SHALL BE SELECTIVELY COORDINATED SUCH THAT THE BRANCH LEVEL CIRCUITS ARE DEENERGIZED FIRST, LEAVING AS MANY FEEDER AND MAIN LEVEL CIRCUITS IN OPERATION AS POSSIBLE DURING A FAULTING EVENT.
- 2.13.4 HV PROTECTION SHALL BE COORDINATED AND AGREED WITH THE GRID OPERATOR, AS REQUIRED.

2.14 SURGE ARRESTERS

- 2.14.1 ALL AC CIRCUITS AND EQUIPMENT SHALL BE PROTECTED FROM TRANSIENT OVER VOLTAGE EVENTS WITH THE USE OF SURGE ARRESTERS.
- 2.14.2 MEDIUM VOLTAGE SURGE ARRESTERS SHALL BE METAL OXIDE VARISTOR TYPE, AND SHALL BE RATED FOR THE ANTICIPATED MAXIMUM CONTINUOUS OVER VOLTAGE (MCOV) LEVEL FOR THE CIRCUIT.

2.15 SWITCHES

- 2.15.1 SWITCH VOLTAGE AND CURRENT RATINGS SHALL BE SUITABLE FOR THE APPLICATION.
- 2.15.2 SWITCHES SHALL COMPLY WITH LATEST UTILITY CONSTRUCTION STANDARD REQUIREMENTS AS APPLICABLE.

2.16 RELAYS

- 2.16.1 PROTECTIVE RELAYS SHALL BE USED FOR THE AUTOMATIC PROTECTION OF CIRCUITS THAT CANNOT BE PROTECTED BY THE SOLE USE OF FUSES OR STAND-ALONE CIRCUIT BREAKERS, THIS INCLUDES BUT IS NOT LIMITED TO ALL MEDIUM VOLTAGE FEEDER AND MAIN CIRCUITS, SUBSTATION TRANSFORMERS, AND MEDIUM AND HIGH VOLTAGE BUSES.
- 2.16.2 RELAYS MAY BE ELECTROMECHANICAL, SOLID STATE, OR MICROPROCESSOR CONTROLLED.
- 2.16.3 RELAYS MAY BE SINGLE OR MULTI-FUNCTION DEVICES, AS LONG AS THE APPROPRIATE PROTECTIVE FUNCTIONS AND SETTING LEVELS CAN BE ACHIEVED.

- 2.16.4 SCHWEITZER ENGINEERING LABORATORY (SEL) IS THE PREFERRED MANUFACTURER, HOWEVER THE CONTRACTOR MAY SELECT ALTERNATIVE VENDORS UPON APPROVAL FROM THE OWNER.
- 2.16.5 RELAYS SHALL HAVE APPROPRIATE FAIL-SAFE FUNCTIONALITY AS REQUIRED BY UTILITY.

- 2.16.6 THE RELAY SHALL BE SUPPLIED WITH AN UNINTERRUPTABLE POWER SUPPLY, SO AS TO CONTINUALLY OPERATE FOR A PERIOD OF NO LESS THAN 24 HOURS WITHOUT PRIMARY POWERING MEANS.

2.17 RECLOSERS

- 2.17.1 RECLOSER MANUFACTURER AND RATINGS SHALL BE PER CONTRACT DRAWING OR AS APPROVED BY OWNER.

2.18 INSTRUMENT TRANSFORMERS

- 2.18.1 INSTRUMENT TRANSFORMERS SHALL BE USED FOR CONVERTING PRIMARY LINE VOLTAGE OR CURRENT TO A LEVEL THAT MAY BE READ BY AN INSTRUMENT SUCH AS A RELAY OR METER.
- 2.18.2 INSTRUMENT TRANSFORMER CURRENT AND VOLTAGE RATINGS SHALL BE DETERMINED BY THE ENGINEER OF RECORD, BASED ON THEIR APPLICATION.
- 2.18.3 ALL INSTRUMENT TRANSFORMERS USED FOR METERING SHALL BE OF METERING CLASS, RELAY CLASS TRANSFORMERS ARE NOT ACCEPTABLE.
- 2.18.4 RELAY ACCURACY CLASS INSTRUMENT TRANSFORMERS SHALL BE USED FOR PROTECTIVE RELAY APPLICATIONS. THE ACCURACY SHALL MEET THE REQUIREMENTS OF THAT APPLICATION.
- 2.18.5 ALL INSTRUMENT CURRENT TRANSFORMERS SHALL BE OF ACCURACY CLASS 0.15B0.5 WITH FULL OUTPUT AT TWO (2) TIMES BASE RATING.
- 2.18.6 ALL INSTRUMENT POTENTIAL TRANSFORMERS SHALL BE OF ACCURACY CLASS 0.3%.

2.19 BATTERIES & BATTERY CHARGERS

- 2.19.1 BATTERIES SHALL BE USED TO PROVIDE UNINTERRUPTED POWER SUPPLY TO ELECTRONICS THROUGHOUT THE PROJECT.
- 2.19.2 BATTERIES SHALL BE OF THE FOLLOWING TYPE:
 - SEALED LEAD ACID
 - NICKLE-CADMIUM
 - LITHIUM ION
- 2.19.3 BATTERY BACKUP SHALL HAVE SUFFICIENT AH RATING TO BE PROVIDE A MINIMUM 24 HOURS OF OPERATION TIME DURING AN OUTAGE.

- 2.19.4 BATTERY CHARGING STATUS AND FAULT CONDITIONS SHOULD BE INTEGRATED INTO THE SITE SCADA SYSTEM.

2.20 DATA ACQUISITION SYSTEM (DAS)

- 2.20.1 DAS MANUFACTURER SHALL BE PER CONTRACT DRAWINGS OR PER OWNER APPROVAL.

2.21 WEATHER STATION

- 2.21.1 WEATHER STATION MANUFACTURER SHALL BE PER CONTRACT DRAWINGS OR PER OWNER APPROVAL.

2.22 FIBER OPTIC CABLE

- 2.22.1 ALL FIBER OPTIC CABLES SHALL BE ALL-DIELECTRIC, INDOOR AND OUTDOOR RATED, AND RATED FOR INSTALLATION IN DIRECT BURIAL, IN CONDUIT, OR AERIAL APPLICATIONS AS APPLICABLE FOR THE INTENDED USE.
- 2.22.2 FIBER OPTIC CABLES CONDUIT SHALL BE INSTALLED IN MIN. 2" CONDUIT UNLESS OTHERWISE APPROVED.
- 2.22.3 FIBER OPTIC CABLES SHALL BE RATED TEMPERATURE CONDITIONS BETWEEN -40°C AND 70°C.

2.23 ETHERNET CABLE

- 2.23.1 ALL CAT5E, CAT6 AND OTHER NON-OPTICAL CABLES SHALL BE CONSTRUCTED WITH SHIELDED TWISTED PAIRS, CABLED WITHIN A POLYOLEFIN INSULATED SHEATH, WITH AN ABRASION-RESISTANT PVC OR POLYETHYLENE OUTER JACKET.

2.24 GROUNDING & BONDING

- 2.24.1 GROUNDING SYSTEM COMPONENTS SHALL BE LISTED FOR THEIR PURPOSE, INCLUDING BUT NOT LIMITED TO GROUND RODS, GROUNDING LUGS, GROUNDING CLAMPS, ETC.
- 2.24.2 ALL EQUIPMENT GROUNDING CONDUCTORS (EGCS) SHALL BE BARE COPPER OR TIN-PLATED COPPER, UNLESS OTHERWISE NOTED.
- 2.24.3 GROUNDING LUGS AND CONNECTIONS USED OUTDOORS AND EXPOSED TO THE ENVIRONMENT SHALL BE LISTED FOR DIRECT BURIAL (DB). THIS INFORMATION SHALL BE CLEARLY NOTED ON PRODUCT SUBMITTALS TO BE APPROVED BY OWNER.

2.25 LABELS AND IDENTIFICATION

- 2.25.1 CONTRACTOR SHALL PROVIDE ALL SIGNS AND LABELS PER THE LOCAL AHJ, LOCAL UTILITY REQUIREMENTS, OSHA, AND THE NEC INCLUDING BUT NOT LIMITED TO SECTIONS 690 AND 705. SYSTEM SHALL BE LABELED TO MEET ALL APPLICABLE SAFETY CODES AND REQUIREMENTS.
- 2.25.2 ALL SIGNS SHALL BE UV STABILIZED. ALL TEXT HEADERS SHALL BE 3/8" HEIGHT MINIMUM. BODY TEXT SHALL BE 3/16" HEIGHT MINIMUM. WARNING SIGNS SHALL BE ORANGE WITH WHITE LETTERING. DANGER SIGNS SHALL BE RED WITH WHITE LETTERING. INFORMATIONAL SIGNS SHALL BE BLACK WITH WHITE LETTERING.
- 2.25.3 ALL LABELING AND SIGNAGE SHALL BE OF UL LISTED MATERIALS.

3 EXECUTION

3.1 GENERAL

- 3.1.1 ANY METAL SHAVINGS RESULTING FROM SITE WORK SHALL BE CLEANED FROM ENCLOSURE INTERIORS, TOP SURFACES OF ENCLOSURE, ROOF SURFACE, AND ANY ADDITIONAL AREAS WHERE OXIDATION OR CONDUCTIVE METAL SHAVINGS MAY CAUSE RUST, ELECTRICAL SHORT CIRCUIT OR OTHER DAMAGE.
- 3.1.2 ALL OUTDOOR ENCLOSURES SHALL BE INSTALLED WITH AN APPROVED MEANS OF DRAINAGE AND VENTILATION.
- 3.1.3 ALL NEMA 3 BOXES SHALL BE EQUIPPED WITH A WEEP HOLE OR LISTED DRAIN PLUG INSTALLED TO ALLOW WATER TO DRAIN. FOLLOW MANUFACTURER INSTRUCTIONS.
- 3.1.4 ALL ELECTRICAL EQUIPMENT, CONDUITS, AND COMPONENTS MUST BE ADEQUATELY PROTECTED FROM DAMAGE AND VANDALISM BY THE USE OF BOLLARDS, FENCES, SHIELDS, GUARDS OR OTHER APPROVED MEANS.
- 3.1.5 ALL CIRCUIT BREAKERS THAT ARE SUBJECT TO REVERSE POWER FLOW SHALL BE LISTED AS BACKFEED COMPATIBLE.
- 3.1.6 UNDERGROUND PULL BOXES OR HANDHOLES SHALL BE OPEN BOTTOM TYPE WITH 12 INCHES MINIMUM OF CLASS 5 STONE AT THE BASE TO ALLOW FOR DRAINAGE UNLESS OTHERWISE NOTED. PULL BOXES SHALL BE RATED FOR THE MECHANICAL LOAD APPROPRIATE FOR THE INSTALLED LOCATION.
- 3.1.7 MV EQUIPMENT INSTALLED OUTSIDE OF FENCES WHERE ACCESSIBLE TO THE PUBLIC SHALL COMPLY WITH NESC REQUIREMENTS FOR TAMPER-PROOF CONSTRUCTION.
- 3.1.8 EQUIPMENT SHALL BE SECURELY ANCHORED TO CONCRETE PADS OR FOUNDATIONS PER MANUFACTURER'S INSTRUCTIONS.
- 3.1.9 ALL OPENINGS INTO EQUIPMENT SHALL BE SEALED TO PREVENT ENTRY OF INSECTS AND RODENTS. CONDUIT GLAND PLATES SHALL BE USED WHERE APPLICABLE.
- 3.1.10 SEALANT SHALL BE POLYWATER FST 250.
 - 3.1.10.1 IF EQUIPMENT MANUFACTURER REQUIRES IT, CAULK ALONG BOTTOM PERIMETER OF EQUIPMENT MOUNTED ON CONCRETE PADS TO PREVENT WATER ENTRY BETWEEN BOTTOM OF ENCLOSURE AND TOP OF CONCRETE SLAB. USE ONLY EXTERIOR 100% ACRYLIC SILICONE ELASTOMERIC CAULK.
- 3.1.11 PROVIDE 12 INCHES OF CLASS 5 GRAVEL DRAINAGE BEDDING IN THE BOTTOM OF ALL BOTTOM CONDUIT ENTRIES TO OPEN CABLE COMPARTMENTS.
- 3.1.12 ALL CONDUCTORS SHALL BE ROUTED TO MAINTAIN ACCESS TO INDICATORS, VALVES, SAMPLE PORTS, SWITCHES, TAP CHANGES, FUSE WELLS, AND OTHER COMPONENTS AND ACCESSORIES REQUIRING OPERATOR ACCESS.
- 3.1.13 EQUIPMENT SHALL BE INSTALLED SO AS NOT TO SHADE ARRAY DURING PEAK SOLAR RESOURCE WINDOW OF 10AM-2PM.

- 3.1.14 ALL EQUIPMENT AND INSTALLATION METHODS SHALL COMPLY WITH THE LATEST UTILITY CONSTRUCTION STANDARDS AS APPLICABLE.

3.2 MODULES

- 3.2.1 PV MODULES SHALL BE MOUNTED IN A MANNER COMPLIANT WITH THE MANUFACTURER'S SPECIFICATIONS. ALTERNATIVE METHODS SHALL HAVE WRITTEN APPROVAL FROM THE MANUFACTURER WITH SPECIFIC LANGUAGE TO PRESERVE THE WARRANTY.
- 3.2.2 EXTRA CARE MUST BE TAKEN TO NOT SCRATCH THE MODULE GLASS OR BACK SHEETS. ANY SCRATCHED MODULES SHALL BE REPLACED SOLELY AT THE CONTRACTOR'S EXPENSE.
- 3.2.3 NO PERSONNEL SHALL STEP OR STAND ON MODULES AT ANY TIME, NOR SHALL INSTALLERS LEAN ON MODULE GLASS. RACK STRUCTURE AND MODULES ARE NOT DESIGNED FOR LIVE LOADS AND MAY VOID WARRANTY.

3.3 MOUNTING SYSTEM

- 3.3.1 MOUNTING SYSTEM IS TO BE INSTALLED PER THE STAMPED AND SIGNED STRUCTURAL SHEETS, MANUFACTURER'S MANUAL, AND STRUCTURAL CALCULATIONS.
- 3.3.2 ALL MOUNTING SYSTEM COMPONENTS ARE TO BE INSPECTED AND ACCEPTED AT TIME OF DELIVERY.
- 3.3.3 SETBACKS SPECIFIED BY MANUFACTURER FOR SOIL DISTURBANCE AROUND MOUNTING SYSTEM FOUNDATIONS SHALL BE OBSERVED. SETBACK INFRINGEMENT SHALL NOT BE ALLOWED.
- 3.3.4 FOUNDATION LOAD TESTING SHALL BE PERFORMED IF REQUIRED BY THE MANUFACTURER TO MAINTAIN WARRANTY.
- 3.3.5 ALTERNATIVE METHODS OF FOUNDATION INSTALLATION DUE TO REFUSAL SHALL BE PER MANUFACTURER DESIGNS AND APPROVED BY OWNER.
- 3.4.1.5 TERMINATE ALL CONTROL WIRING BETWEEN PIECES OF EQUIPMENT ON FIELD WIRING TERMINAL BOARDS. LABEL ALL CONTROL WIRES WITH TERMINAL BOARD AND TERMINAL NUMBER IDENTIFICATION AT BOTH ENDS.
- 3.4.1.6 COLOR CODING TAPE SHALL BE PREMIUM GRADE PRESSURE SENSITIVE VINYL, HEAT, COLD, MOISTURE, UV, AND FADE RESISTANT.
- 3.4.1.7 THE CUMULATIVE VOLTAGE DROP ACROSS THE CONDUCTORS SHALL BE KEPT TO THE FOLLOWING LIMITS:
 - DC VOLTAGE DROP <1.5% AVG. (<2.5% MAX.)
 - AC VOLTAGE DROP <0.5% AVG. (<1.0% MAX.)
- 3.4.1.8 IF THE ABOVE LISTED VALUES ARE NOT ATTAINABLE DUE TO EXTENUATING DESIGN CONDITIONS, THEN CONTRACTOR SHALL PROPOSE GREATER VALUES FOR REVIEW AND APPROVAL BY OWNER.
- 3.4.1.9 PV DC OUTPUT CONDUCTORS AND PV AC CONDUCTORS SHALL USE COMPRESSION STYLE LUGS AND TERMINATIONS SHALL BE RATED FOR THE MAXIMUM DC AND AC VOLTAGE OF THE SYSTEM.
- 3.4.1.10 USE OF A "ONE-SHOT" CRIMPER OR "DIE-LESS CRIMPERS" WILL NOT BE ALLOWED.
- 3.4.1.11 COMPRESSION LUGS MUST BE PRE-FILLED WITH OXIDE INHIBITOR.
- 3.4.1.12 OXIDE INHIBITOR MUST BE APPLIED TO EXPOSED CONDUCTOR IMMEDIATELY AFTER STRIPPING AND BRUSHING AND IMMEDIATELY PRIOR TO INSTALLATION OF THE LUG.
- 3.4.1.13 USE COMPRESSION TOOL LISTED FOR USE WITH SELECTED COMPRESSION CONNECTOR.
- 3.4.1.14 WHERE PHASE CLEARANCE CANNOT BE MAINTAINED, A MINIMUM 9" LENGTH OF COLD OR HEAT SHRINK WITH A VOLTAGE RATING EQUAL TO THE CONDUCTOR SHALL BE APPLIED TO COVER THE CONNECTION BETWEEN CRIMP AND THE CONDUCTOR BEGINNING AT THE STRAIGHT SECTION OF THE CRIMP.
- 3.4.1.15 ALL CONNECTORS AND CORRESPONDING CRIMPING TOOLS SHALL BE UL LISTED FOR THEIR SPECIFIC APPLICATION.
- 3.4.1.16 DIRECT LANDING OF CONDUCTORS IS ONLY ALLOWED TO BREAKERS WHICH ARE SPECIFICALLY RATED FOR CONDUCTOR MATERIAL.
- 3.4.1.17 EQUIPMENT GROUNDING CONDUCTORS MAY BE TERMINATED TO MECHANICAL SET SCREW LUGS.
- 3.4.1.18 ALL EQUIPMENT SHALL HAVE A TERMINAL TEMPERATURE RATING EQUAL TO OR GREATER THAN THAT OF THE ASSOCIATED CONDUCTORS.
- 3.4.1.19 STRIPPED CONDUCTORS SHOULD BE CLEAN AND FREE FROM DAMAGE AT ALL TERMINATIONS.
- 3.4.1.20 ALL ELECTRICAL CONNECTIONS SHALL USE CONICAL OR BELLEVILLE LOCK WASHERS, UNLESS OTHERWISE REQUIRED BY EQUIPMENT MANUFACTURERS.
- 3.4.1.21 ALL DC AND AC POWER CONDUCTOR TERMINATIONS SHALL HAVE AN OXIDE INHIBITOR APPLIED, UNLESS OTHERWISE REQUIRED BY EQUIPMENT MANUFACTURERS.
- 3.4.1.22 ALL LUG HOLE AND SPACING SIZE SHALL MATCH EQUIPMENT STUD SIZE AND/OR BUSBAR HOLE SIZE AND SPACING.
- 3.4.1.23 ALL LUGS AND CONNECTORS SHALL BE LISTED AND DESIGNATED FOR USE WITH THE APPLICABLE CONDUCTOR MATERIAL AND TERMINATION POINT.
- 3.4.1.24 NO SPLICING OF ANY WIRES IS PERMITTED WITHOUT WRITTEN CONSENT FROM OWNER.
- 3.4.1.25 ALL BOLTED CONNECTIONS WILL BE TIGHTENED USING A CALIBRATED TORQUE WRENCH AND TORQUE MARKS SHALL BE APPLIED.
- 3.4.1.26 A MAXIMUM OF TWO STACKABLE COMPRESSION LUGS SHALL BE PERMITTED WHEN MORE THAN ONE COMPRESSION LUG IS NEEDED PER PHASE OR PER A SINGLE TERMINATION LOCATION.
- 3.4.1.27 VERIFY UTILITY PHASE SEQUENCE AND COORDINATE INSTALLATION OF FEEDER CONDUCTORS TO PROVIDE CORRECT PHASE SEQUENCE AT ALL AC TERMINALS.
- 3.4.1.28 POLE MOUNTED TERMINATIONS SHALL BE COLD OR HEAT SHRINK KITS INTENDED FOR OUTDOOR USE AND SHALL COMPLY WITH IEEE 48 AS A CLASS I TERMINATION.
- 3.4.1.29 ALL MEDIUM VOLTAGE AC POWER CONDUCTOR TERMINATIONS SHALL BE IRREVERSIBLE, DOUBLE CRIMP, LONG BARREL, NEMA 2-HOLE COMPRESSION TYPE LUGS RATED AT 90°C WHERE APPROVED BY EQUIPMENT MANUFACTURER OR

SUPPLIER, WHERE NOT POSSIBLE, SINGLE BOLT COMPRESSION LUGS MAY BE USED. MECHANICAL SET SCREW TERMINATIONS ARE APPROVED FOR COMBINER BOX TERMINATIONS ONLY.

3.4.2 DC STRING WIRING

- 3.4.2.1 SOURCE CIRCUIT WIRING SHALL BE INSTALLED IN A NEAT AND WORKMAN LIKE MANNER, WITH ALL WIRES SECURELY FASTENED TO EITHER THE SOLAR MODULE FRAMES OR RACKING SUPPORT STRUCTURE. IT IS PERMISSIBLE TO USE CAB SYSTEM WIRE HANGERS, OR OTHER APPROVE MESSENGER SUPPORTED WIRE MANAGEMENT SYSTEM, WITH OWNER'S EXPRESS APPROVAL.
- 3.4.2.2 STRAIN RELIEF SHALL BE PROVIDED AT EACH MODULE JUNCTION BOX, AT ENTRY AND EXIT OF CONDUIT, AND ENTRY INTO COMBINER BOX ENCLOSURES.
- 3.4.2.3 THE SOURCE CIRCUIT WIRE SHALL BE INSTALLED SUCH THAT IT IS PROTECTED FROM PHYSICAL DAMAGE, EITHER BY LOCATION OR BY BEING ROUTED IN A PROTECTIVE RACEWAY. SOURCE CIRCUIT WIRING SHALL NOT BE DIRECT BURIED WITHOUT A CONDUIT.
- 3.4.2.4 THE PV SOURCE AND OUTPUT CIRCUITS SHALL NOT BE CONTAINED IN THE SAME RACEWAY CABLE TRAY, CABLE, OUTLET BOX, JUNCTION BOX, OR SIMILAR FITTING AS FEEDERS OR BRANCH CIRCUITS OF OTHER SYSTEMS UNLESS THE CONDUCTORS OF THE DIFFERENT SYSTEMS ARE SEPARATED BY A PARTITION.
- 3.4.2.5 MODULE LEAD CONNECTORS SHALL BE INSTALLED SUCH THAT THEY ARE EASILY ACCESSIBLE AND PROTECTED FROM EXPOSURE TO DIRECT SUNLIGHT OR RAIN. THEY SHALL NOT BE INSTALLED WITHIN TUBING, CONDUIT OR MODULE GAPS.

3.4.3 DC COMBINER BOX OUTPUT WIRING

- 3.4.3.1 COMBINER BOX OUTPUT CIRCUITS MAY BE ENCLOSED IN CONDUIT OR DIRECT BURIED IN AN UNDERGROUND TRENCH. IT IS PERMISSIBLE TO USE CAB SYSTEM WIRE HANGERS, OR OTHER APPROVE MESSENGER SUPPORTED WIRE MANAGEMENT SYSTEM. CONTRACTOR SHALL VERIFY THAT THE QUANTITY AND SPACING OF THE CIRCUITS IN EACH TRENCH WILL NOT CAUSE THE WIRES TO OVERHEAT.
- 3.4.3.2 ABOVE-GROUND AERIAL INSTALLATION OF COMBINER BOX OUTPUT CIRCUITS SHALL BE PERMISSIBLE WITH EXPRESS REVIEW AND CONSENT OF THE OWNER.
- 3.4.3.3 CONDUCTORS SHALL BE PROTECTED FROM PHYSICAL DAMAGE, EITHER BY LOCATION OR BY ROUTING IN A RACEWAY.
- 3.4.3.4 CONDUCTORS SHALL BE PROTECTED FROM OVERCURRENT WITH THE USE OF FUSES OR CIRCUIT BREAKERS.

3.4.4 LOW VOLTAGE AC WIRING

- 3.4.4.1 ALL UNDERGROUND LOW VOLTAGE AC CONDUCTORS SHALL BE Routed IN SCHEDULE 40 PVC CONDUIT. SCHEDULE 80 PVC STUB-UPS SHALL BE USED WHEN ENTERING EQUIPMENT CABINETS THAT ARE INSTALLED FLUSH ON CONCRETE PADS. SCHEDULE 40 SHALL BE ALLOWED WHEN NOT EXPOSED TO EXTERIOR OF CABINET.
- 3.4.4.2 ALL ABOVE GRADE LOW VOLTAGE AC CONDUCTORS SHALL BE INSTALLED IN SCHEDULE 80 PVC CONDUIT.
- 3.4.4.3 LOW VOLTAGE AC CONDUCTORS SHALL BE SUPPLIED POWER VIA A MOLDED CASE CIRCUIT BREAKER, SIZED TO PROTECT THEM AND THE COMPONENTS THAT THEY SERVE.
- 3.4.4.4 LOW VOLTAGE AC CABLE SPLICES SHALL NOT BE USED UNLESS APPROVED BY OWNER ON A CASE-BY-CASE BASIS. ONLY UL LISTED SPLICE LUG KITS SHALL BE UTILIZED. ELECTRICAL TAPE ALONE IS NOT SUITABLE AS THE ONLY INSULATION MEANS. FOLLOW MANUFACTURER'S INSTRUCTIONS FOR INSTALLATION, AND APPLICATION OF INSULATING PRODUCT.
- 3.4.4.5 ALUMINUM POWER CABLE, WIRE CONNECTORS, AND INSULATING AND CODING TAPE MANUFACTURERS SHALL BE APPROVED BY OWNER PRIOR TO USAGE.
- 3.4.4.6 ALL AC POWER CONDUCTOR TERMINATIONS SHALL BE IRREVERSIBLE, DOUBLE CRIMP, LONG BARREL, NEMA 2-HOLE COMPRESSION TYPE LUGS RATED AT 90°C WHERE APPROVED BY EQUIPMENT MANUFACTURER OR SUPPLIER, WHERE NOT POSSIBLE, SINGLE BOLT COMPRESSION LUGS MAY BE USED.
- 3.4.4.7 LOW VOLTAGE AC CONDUCTOR TERMINATIONS ON SERVICE LATERALS SHALL BE IN COMPLIANCE WITH THE LATEST VERSION OF THE UTILITY CONSTRUCTION STANDARDS.
- 3.4.4.8 ALL WIRES AND CABLE SHALL HAVE WRAP-AROUND LAMINATING VINYL MACHINE PRINTED ID LABELS OR OTHER APPROVED LABELING METHOD INDICATING DESIGNATION AND PHASE.
 - 480V/277V: PHASE A - BROWN, PHASE B - ORANGE, PHASE C - YELLOW
 - 208V/120V: PHASE A - BLACK, PHASE B - RED, PHASE C - BLUE
 - NEUTRAL (ANY CIRCUIT VOLTAGE) - WHITE OR GRAY
 - GROUND - GREEN, BLACK WITH GREEN STRIP, OR BARE
- 3.4.4.9 CONDUCTORS SHALL HAVE INTEGRAL COLORING OR COLORED ELECTRICAL TAPE AT ALL TERMINATIONS TO INDICATE GROUNDED CONDUCTORS, EQUIPMENT GROUNDING CONDUCTORS, AND AC PHASE CONDUCTORS. COLOR CODING SHALL BE AS FOLLOWS IF NOT OTHERWISE INDICATED ON THE DESIGN DOCUMENTS:

3.4.5 MEDIUM VOLTAGE AC WIRING

- 3.4.5.1 IF DIRECT BURIAL APPLICATION IS USED, THEN THE CONDUCTORS SHALL BE COVERED BY A MINIMUM OF 2" OF SAND OR SCREENED NATIVE SOIL ON ALL SIDES. NATIVE SOILS SHALL COMPLY WITH PGR CIVIL TRENCH BACKFILL SPECIFICATIONS.
- 3.4.5.2 CIRCUIT SPACING IN THE TRENCH SHALL BE DETERMINED BY EITHER MINIMUM CODE STANDARDS, OR BY ENGINEERING JUDGEMENT WITH THE USE OF A COMPUTER MODEL.
- 3.4.5.3 MV CABLE SPLICES ARE PROHIBITED. OWNER SHALL BE NOTIFIED IF AN UNDERGROUND BREAK IN AN MV FEEDER IS UNAVOIDABLE. IN THIS CASE, CABLES SHALL BE BROUGHT ABOVEGROUND AND TERMINATED IN A SECTIONALIZING CABINET WITH LOAD/DEAD-BREAK ELBOWS.
- 3.4.5.4 MV CABLE JACKET REPAIR SHALL BE NOT BE ALLOWED UNLESS APPROVED BY OWNER ON A CASE-BY-CASE BASIS.



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NO.	DATE	REVISIONS	ENG.
A	05/09/2020	ISSUED FOR PERMIT	EH

STATION NAME: CLOVELLY SOLAR ELECTRIC POWER PLANT
DRAWING TITLE: SYMBOLS & NOTES
DRAWN BY: ALH
CHECKED BY: EDR
APPROVED BY: JEH
DATE: 05/01/2020
SCALE: NTS
FILE NUMBER: 69965
SHEET: E-012

3.5 DC COMBINER/ LOAD BREAK DISCONNECT BOXES

- 3.5.1 DC DISCONNECT BOXES SHALL BE MOUNTED AND CONDUCTORS TERMINATED PER MANUFACTURERS SPECIFICATIONS, INSTALLATION MANUALS, AND CONTRACT DRAWINGS.
3.5.2 DC DISCONNECT BOXES SHALL BE MOUNTED A MINIMUM DISTANCE ABOVE GRADE. MINIMUM DISTANCE REQUIREMENT SHALL BE APPROVED BY OWNER.
3.5.3 DC DISCONNECT BOX CONDUIT PENETRATIONS SHALL BE THROUGH BOTTOM OF BOX ONLY. BOXES SHALL BE PROPERLY CLEANED TO REMOVE ALL METALLIC AND PLASTIC SHAVINGS/MATERIALS.
3.5.4 CONDUCTORS SHALL BE INSTALLED AND SECURED TO PREVENT CONTACT WITH SHARP EDGES AND ENSURE COMPLIANCE WITH BENDING RADIUS REQUIREMENTS.
3.5.5 CONDUCTOR WORK LOOPS SHALL BE PROVIDED WITHIN BOXES TO ALLOW FOR CLAMP ON METER AMPACITY TESTING.
3.5.6 DC DISCONNECT BOXES SHALL BE INSTALLED TO COMPLY WITH ALL WORK CLEARANCE REQUIREMENTS.

3.6 INVERTERS

- 3.6.1 INVERTERS SHALL BE MOUNTED AND CONDUCTORS TERMINATED PER MANUFACTURER'S SPECIFICATIONS, INSTALLATION MANUALS, AND CONTRACT DRAWINGS.
3.6.2 MANUFACTURER'S INVERTER LIFTING LOCATIONS SHALL BE USED.
3.6.3 STRING INVERTERS SHALL BE MOUNTED A MINIMUM DISTANCE ABOVE GRADE. MINIMUM DISTANCE REQUIREMENT SHALL BE APPROVED BY OWNER.
3.6.4 VERIFY ALL FACTORY WIRING IS INSTALLED CORRECTLY.

3.7 TRANSFORMERS

- 3.7.1 NEMA DRILLED LONG BARREL COMPRESSION LUGS TO BE USED FOR THE LOW VOLTAGE WIRE.
3.7.2 PENTA-BOLTS WILL BE FURNISHED ON BOTH SETS OF DOORS.
3.7.3 ALL CONDUCTORS SHALL BE ROUTED TO MAINTAIN ACCESS TO INDICATORS, VALVES, SAMPLE PORTS, SWITCHES, TAP CHANGES, FUSE WELLS, AND OTHER COMPONENTS AND ACCESSORIES REQUIRING OPERATOR ACCESS.
3.7.4 PROVIDE LABELING FOR HIGH VOLTAGE COMPARTMENT (WARNING AND RATING), AND LOW VOLTAGE COMPARTMENT (RATING).
3.7.5 VERIFY FACTORY WIRING DIAGRAM IS ACCURATE.
3.7.6 ENSURE TRANSFORMER IS LEVEL IN ACCORDANCE WITH MANUFACTURER'S SPECIFICATIONS.
3.7.7 VERIFY MEDIUM & LOW VOLTAGE CONDUITS ARE SEPARATED AND IN THEIR OWN COMPARTMENT.
3.7.8 VERIFY CONICAL NUTS USED FOR ALL CONNECTIONS.
3.7.9 VERIFY HARDWARE IS THE PROPER LENGTH.
3.7.10 PROVIDE PADLOCKS OR UTILITY SEAL FOR ALL DOORS.

3.8 RACEWAYS, CONDUIT BODIES, AND BOXES

- 3.8.1 COMPLETELY INSTALL ALL CONDUIT RUNS AND BACKFILL DUCT BANKS BEFORE PULLING CABLE. PULL A FLEXIBLE MANDREL AND BRUSH THROUGH EACH CONDUIT AFTER INSTALLATION. IF WET, SWAB CONDUIT INTERIOR BEFORE PULLING CABLES.
3.8.2 LONG STRAIGHT EXPOSED CONDUIT RUNS, 100 FEET OR MORE, SHALL HAVE EXPANSION FITTINGS INSTALLED PER NEC 300.7(B). EXPANSION FITTINGS SHALL ALSO BE USED WHEN CONDUIT SPANS AN EXPANSION JOINT.
3.8.3 INTENTIONALLY LEFT BLANK
3.8.4 WHEN TRANSITIONING FROM FREE AIR TO CONDUCTORS IN CONDUIT A FITTING SHALL BE USED TO PREVENT THE ENTRY OF MOISTURE.
3.8.5 SEAL ALL CONDUITS WITH APPROVED POLYWATER FST KIT FOAM OR APPROVED EQUIVALENT TO PREVENT TRANSMISSION OF HUMID AIR BETWEEN INTERIOR AND EXTERIOR OF EQUIPMENT.
3.8.6 CONDUITS WITH NEGATIVE SLOPE TOWARD ELECTRICAL EQUIPMENT GREATER THAN X% SLOPE AND LONGER THAN 100' SHALL HAVE APPROPRIATE WATER PRESSURE RELIEF/DRAINAGE HAND HOLE WITH GRAVEL BASE INSTALLED IN PROXIMITY OF LOCATION CONDUIT ENTERS ENCLOSURE OR CABINET. METHOD SHALL BE APPROVED BY OWNER.
3.8.7 CABLES OR CONDUIT BURIED BELOW STREAMS OR DRAINAGE TRENCHES SHALL MAINTAIN THEIR NEC REQUIRED DEPTH BELOW THE BOTTOM OF THE STREAM OR TRENCH.
3.8.8 CABLES BELOW GRADE, WHETHER IN CONDUIT OR DIRECT BURIED, SHALL HAVE THEIR LOCATION IDENTIFIED BY A WARNING TAPE THAT IS PLACED IN THE TRENCH IN ACCORDANCE WITH THE NATIONAL ELECTRICAL CODE. SEE PGR CIVIL SPECIFICATIONS FOR TAPE SPECIFICATIONS.
3.8.9 1/4" FOAM WRAP SHALL BE AROUND CONDUIT IN AREAS WHERE CONCRETE IS TO BE POURED AGAINST IT. THE FOAM SHALL EXTEND FOR THE FULL DEPTH OF CONCRETE.
3.8.10 CONDUITS STUBBED UP FROM BELOW GROUND SHALL BE IN THE APPROPRIATE LOCATIONS AND PLUMB.
3.8.11 CONDUITS STUBBED UP SHALL IMMEDIATELY BE CAPPED TO PREVENT WATER ENTRY DURING CONSTRUCTION.
3.8.12 UNDERGROUND TRANSITIONS BETWEEN CONDUIT AND DIRECT BURIED SHALL BE MARKED BY OWNER APPROVED EQUIPMENT.
3.8.13 TOPS OF CONDUIT SHALL BE A MINIMUM OF 4 INCHES ABOVE THE CONCRETE PAD OR GRAVEL BEDDING TO PREVENT INGRESS OF WATER.
3.8.14 CONDUITS IN CONCRETE PADS SHALL BE PROPERLY SECURED SO THEY DONT

DISPLACE DURING POUR.

- 3.8.15 DIRECT BURIAL CONDUCTORS SHALL ENTER CONCRETE PADS THROUGH UNDERGROUND CONDUIT SLEEVE EXTENDING AT LEAST 36" OUT FROM EQUIPMENT PAD.
3.8.16 MAINTAIN MINIMUM 12 INCHES OF SPACING HORIZONTALLY AND VERTICALLY AT CROSSINGS BETWEEN MV CONDUITS OR DUCT BANKS AND LOW-VOLTAGE OR COMMUNICATIONS CONDUITS.
3.8.17 MAINTAIN MINIMUM 4 FOOT SPACING BETWEEN MEDIUM VOLTAGE CONDUCTORS AND POWER CIRCUITS OF OTHER SYSTEMS WHEN RUN PARALLEL, UNLESS THE DUCT BANK SECTIONS INDICATE CLOSER SPACINGS WHICH HAVE BEEN CONSIDERED IN AMPACITY CALCULATIONS.
3.8.18 MAINTAIN ALL CONDUIT ENTRIES TO EQUIPMENT WITHIN MANUFACTURER'S DESIGNATED CONDUIT ENTRY SPACE AND ARRANGE CONDUITS TO PERMIT THE MOST DIRECT ROUTING OF CABLES TO TERMINALS AND TO ALLOW ADEQUATE SLACK FOR DISCONNECTION AND PARKING OF MV ELBOW CONNECTORS.
3.8.19 ALL CONDUITS STUBBED OR ENTERING EQUIPMENT TO BE EQUIPPED WITH BUSHINGS OR APPROVED EQUAL TO PREVENT ABRASION.
3.8.20 ALL CONDUIT PASSING THROUGH FIRE-RATED ASSEMBLIES SHALL BE SEALED WITH A FIRE-RATED, LISTED FIRE STOPPING PRODUCT.
3.8.21 ALL CONDUIT PASSING THROUGH WATER-TIGHT ASSEMBLIES SHALL BE SEALED WITH A LISTED WATERPROOFING PRODUCT.
3.8.22 ALL SPARE OR EMPTY CONDUITS SHALL BE PROVIDED WITH A NYLON DRAG LINE, SHALL BE CAPPED ON BOTH ENDS, AND LABELED AS SPARE.
3.8.23 ALL CONDUITS AND RACEWAYS INSIDE BUILDINGS/INTERIOR LOCATIONS SHALL BE EMT.
3.8.24 ALL EMT FITTINGS SHALL BE STEEL COMPRESSION TYPE, NOT SET SCREW TYPE. CAST COMPRESSION FITTING SHALL NOT BE USED.
3.8.25 ALL RACEWAY FITTINGS IN OUTDOOR LOCATIONS SHALL BE RAIN-TIGHT COMPRESSION TYPE, UNLESS OTHERWISE NOTED.
3.8.26 SCHEDULE 40 PVC SHALL BE USED FOR BURIED CONDUITS (NOT UNDER ROADS) OR FOR CONDUITS ENCASED IN CONCRETE UNLESS OTHERWISE NOTED ON THE DRAWINGS.
3.8.27 RACEWAYS IN EXPOSED EXTERIOR LOCATIONS OR UNDER ROADS SHALL BE SCHEDULE 80 PVC.
3.8.28 PVC INSTALLED IN EXPOSED EXTERIOR LOCATIONS SHALL BE MARKED AS UV RESISTANT.
3.8.29 "L" AND "T" CONDUIT BODIES SHALL NOT BE USED. MOGUL-TYPE CONDUIT BODIES SHALL BE CONSIDERED BY OWNER UPON REQUEST.
3.8.30 HDPE COUPLINGS WITH OTHER TYPES OF CONDUIT SHALL BE LISTED FOR THOSE CONDUIT TYPES.
3.8.31 USE MEYERS (OR APPROVED EQUAL) HUB LISTED TO PROVIDE MOISTURE PROTECTION FOR CONDUIT ENTRANCES IN ALL APPLICABLE LOCATIONS UNLESS CONDUIT ENTERS FROM THE BOTTOM SIDE OF ENCLOSURE.
3.8.32 ALL VERTICAL MV CONDUIT SWEEPS SHALL HAVE MINIMUM 36 INCH RADIUS.
3.8.33 HORIZONTAL MV CONDUIT SWEEPS SHALL HAVE MINIMUM 60 INCH RADIUS.
3.8.34 CABLE INSTALLED IN CONDUIT SHALL USE RMC SWEEPS AT 90 DEGREE BENDS CLOSEST TO WHICH IT IS BEING PULLED.
3.8.35 DIRECT BURIED CABLES MAY USE SCHEDULE 80 PVC SWEEPS AND RISERS.
3.8.36 METAL SWEEPS LESS THEN 18" BELOW GRADE SHALL BE BONDED.
3.8.37 CONDUIT SLOPE ABOVE ENCLOSURE ELEVATION SHALL NEED MEANS TO RELIEF WATER PRESSURE BUILDUP IN BURIED CONDUIT.
3.8.38 INTENTIONALLY LEFT BLANK
3.8.39 ALL ELECTRICAL EQUIPMENT SHALL BE INSTALLED IN A NEAT AND WORKMAN LIKE MANNER. CONTRACTOR SHALL ENSURE THAT ALL INSTALLATIONS COMPLY WITH THE CLEARANCE REQUIREMENTS OF THE NATIONAL ELECTRICAL CODE (NEC) AND THE OCCUPATIONAL HEALTH AND SAFETY ADMINISTRATION (OSHA).
3.8.40 DOORS OR REMOVABLE PANELS PROVIDING ACCESS TO PARTS NORMALLY ENERGIZED SHALL BE PAD-LOCKABLE CLOSED OR SHALL REQUIRE TOOLS FOR REMOVAL.
3.8.41 ALL ENCLOSURE SHALL BE MOUNTED PER MANUFACTURER'S REQUIREMENTS TO MINIMIZE STRUCTURAL STRESSES.
3.8.42 ENCLOSURES SHALL BE INSTALLED A MINIMUM OF 24" ABOVE GRADE.
3.8.43 ENCLOSURES SHALL BE INSTALLED ON A CROSS BRACE WITH A MINIMUM OF TWO SUPPORT MEMBERS OR AN EXTERIOR EQUIPMENT CABINET WALL AS APPROVED BY OWNER.
3.8.44 ENCLOSURES SHALL BE INSTALLED AND OPENINGS SEALED TO MAINTAIN NEMA RATING.

3.9 DC AND LOW VOLTAGE AC OVERCURRENT PROTECTION DEVICES

- 3.9.1 ALL OVERCURRENT PROTECTION DEVICES SHALL BE INSTALLED BASED ON THE ASSOCIATED EQUIPMENT MANUFACTURERS' INSTRUCTIONS, AND THE ENGINEER OF RECORD'S ASSIGNED APPLICATION.
3.9.2 ALL LOW-VOLTAGE AC AND DC MOLDED CASE OR ELECTROMAGNETIC CIRCUIT BREAKERS SHALL BE BOLT-IN TYPE, POP OUT OR QUICK RELEASE TYPES ARE NOT ACCEPTABLE.
3.9.3 ALL FUSES SHALL BE INSTALLED IN MANUFACTURER APPROVED FUSE HOLDERS, AND SHALL BE DEEMED NON-LOAD BREAK RATED. FUSES RATED 100A AND GREATER SHALL BE SECURELY FASTENED TO THE FUSE HOLDERS WITH THE USE OF NUTS AND BOLTS, PER MANUFACTURER APPROVED MEANS.
3.9.4 ALL FUSES SHALL BE INSTALLED SO RATING LABELS ARE VISIBLE.
3.10 MEDIUM & HIGH VOLTAGE OVERCURRENT PROTECTION DEVICES

- 3.10.1 ALL OVERCURRENT PROTECTION DEVICES SHALL BE INSTALLED BASED ON THE ASSOCIATED EQUIPMENT MANUFACTURERS' INSTRUCTIONS, AND THE ENGINEER OF RECORD'S ASSIGNED APPLICATION.
3.10.2 MEDIUM VOLTAGE CIRCUIT BREAKERS SHALL BE RACK-ABLE TYPE ENCLOSED IN METAL CLAD SWITCHGEAR, OR OUTDOOR SUBSTATION TYPE.
3.10.3 POLE MOUNTED RECLOSERS SHALL BE USED FOR OVERHEAD APPLICATIONS WHERE REQUIRED BY UTILITY OR CONTRACT DRAWINGS.
3.10.4 ALL MEDIUM VOLTAGE CIRCUIT BREAKERS AND RECLOSERS SHALL BE CONTROLLED BY A CONTROL RELAY.
3.10.5 ALL FUSES SHALL BE INSTALLED IN MANUFACTURER APPROVED FUSE HOLDERS. FUSED CUT OUTS MAY BE USED FOR OVERHEAD APPLICATIONS ONLY.
3.11 SWITCHES
3.11.1 SWITCHES SHALL BE INSTALLED PER MANUFACTURER'S SPECIFICATIONS, INSTALLATION MANUALS, AND CONTRACT DRAWINGS.
3.11.2 SWITCHES SHALL BE INSTALLED IN THE ELECTRICAL CIRCUITS WHERE INDICATED ON THE CONTRACT PLANS.
3.11.3 ALL SWITCHES INTENDED TO BE USED FOR LOAD BREAK APPLICATIONS SHALL BE MARKED AS SUCH, OTHERWISE CONTRACTOR SHALL LABEL THE DEVICE AS NON-LOAD BREAK RATED.
3.12 RELAYS
3.12.1 RELAYS SHALL BE MOUNTED IN A SCADA RACK OR PURPOSE-BUILT ENCLOSURE SUITABLE FOR THE ENVIRONMENT IN WHICH IS BEING USED.
3.12.2 RELAY SETTINGS SHALL BE DETERMINED BY THE ENGINEER OF RECORD DURING THE DESIGN PROCESS.
3.12.3 RELAY COMMISSIONING AND TESTING SHALL BE PERFORMED BY QUALIFIED TESTING FIRM.
3.13 RECLOSERS
3.13.1 RECLOSERS SHALL BE INSTALLED PER MANUFACTURER'S SPECIFICATIONS, INSTALLATION MANUALS, AND CONTRACT DRAWINGS.
3.14 INSTRUMENT TRANSFORMERS
3.14.1 CURRENT TRANSFORMERS (CT) AND POTENTIAL TRANSFORMERS (PT) SHALL BE INSTALLED SUCH THAT THEY ARE PROTECTED FROM TRANSIENT OVER VOLTAGE AND OVERCURRENT EVENTS ON THE PRIMARY CIRCUIT.
3.14.2 IT IS THE CONTRACTOR'S RESPONSIBILITY TO ENSURE THAT ALL CTS AND PTS ARE INSTALLED WITH THE CORRECT POLARITY WITH RESPECT THE DIRECTION THE CURRENT IN THE PRIMARY CIRCUIT.
3.14.3 TEST SWITCHES SHALL BE INSTALLED FOR ALL CTS AND PTS.
3.14.4 CT SECONDARY CIRCUITS SHALL INCLUDE SHORTING BLOCKS FOR TESTING AND DISCONNECTING THE CIRCUITS.
3.14.5 ALL PT SECONDARY CIRCUITS SHALL BE OF A GROUNDED-WYE CONFIGURATION, WITH FUSES AND DISCONNECTING MEANS PROVIDED ON THE PRIMARY SIDE OF THE TRANSFORMERS.
3.14.6 CTS AND PTS SHALL BE REVENUE GRADE ACCURACY FOR METERING AND MUST MEET UTILITY REQUIREMENTS.
3.14.7 CTS AND PTS SHALL BE RELAY GRADE ACCURACY FOR RELAYS AND MUST MEET UTILITY REQUIREMENTS.
3.15 BATTERIES AND BATTERY CHARGERS
3.15.1 BATTERIES AND BATTERY CHARGERS SHALL BE INSTALLED PER MANUFACTURER'S SPECIFICATIONS, INSTALLATION MANUALS, AND CONTRACT DRAWINGS.
3.16 DATA ACQUISITION SYSTEM (DAS)
3.16.1 DAS EQUIPMENT SHALL BE INSTALLED PER MANUFACTURER SPECIFICATIONS, INSTALLATION MANUALS, AND CONTRACT DRAWINGS.
3.17 WEATHER STATION
3.17.1 WEATHER STATION ENCLOSURES AND ASSOCIATED SENSOR EQUIPMENT SHALL BE INSTALLED PER MANUFACTURER SPECIFICATIONS, INSTALLATION MANUALS, AND CONTRACT DRAWINGS.
3.17.2 BACK OF CELL (BOC) TEMPERATURE SENSORS SHALL USE THERMAL ADHESIVE TO ATTACH TO UNDERSIDE OF MODULE.
3.17.3 AMBIENT TEMPERATURE SENSORS SHALL HAVE A SUNSHADE INSTALLED OVER THEM.
3.17.4 PLANE OF IRRADIANCE (POI) PYRANOMETERS SHALL BE INSTALLED AT THE SAME TILT ANGLE AS A FIXED TILT MOUNTING SYSTEM. FOR TRACKER SYSTEMS, PYRANOMETER SHALL BE INSTALLED TO ROTATE WITH TRACKER SYSTEM.
3.17.5 GLOBAL HORIZON IRRADIANCE (GHI) PYRANOMETERS SHALL BE INSTALLED AT A 0° TILT ANGLE.
3.17.6 ANEMOMETERS SHALL BE INSTALLED ABOVE EQUIPMENT TO ENSURE THEY ARE NOT SHIELDED FROM AIR CURRENTS.
3.18 FIBER OPTIC CABLES
3.18.1 FIBER OPTIC TERMINATIONS SHALL BE MADE VIA FUSION SPLICE. CONTRACTOR SHALL FOLLOW CABLE MANUFACTURER'S AND FUSION SPLICER MANUFACTURER'S INSTRUCTIONS FOR EACH APPLICATION.
3.18.2 FIBER OPTIC CABLE SPLICES SHALL BE KEPT TO A MINIMUM, AND WHERE REQUIRED THESE SPLICES SHALL BE LOCATED IN A FLUSH-WITH-GRADE UNDERGROUND HAND HOLE ADJACENT TO A MV JUNCTION BOX OR PAD MOUNT TRANSFORMER AND SHALL NOT BE ALLOWED MID-SPAN.
3.18.3 THE HAND HOLE SHALL BE PERMANENTLY IDENTIFIED AS A FIBER OPTIC HAND HOLE. A MINIMUM LOOP OF 10 FEET FOR EACH CABLE END SHALL BE COILED IN

- HAND HOLE AND THE SPLICE SHALL UTILIZE TYCO FOSC 450 TYPE SPLICE ENCLOSURE (T06322-000 FOSC450-A4-4-12-1-A1V" WITH SMOUV SPLICE PROTECTION SLEEVES "693979-000 SMOUV 1120-01-US") OR EQUAL APPROVED BY OWNER. OUTDOOR, PEDESTAL TYPE FIBER OPTIC SPLICE ENCLOSURE SHALL BE APPROVED BY OWNER.
3.18.4 FIBER OPTIC CABLES SHALL BE INSTALLED IN SEPARATE, DEDICATED CONDUITS FOR ENTERING AND LEAVING EQUIPMENT, MINIMUM 2" CONDUIT.
3.18.5 FIBER OPTIC CABLES TO BE INSTALLED AFTER INNER DUCT HAS BEEN INSTALLED, TO REDUCE THE AMOUNT OF FIBER SPLICES.
3.18.6 ALL FIBER SHALL BE FULLY TESTED AFTER TERMINATION, WITH AN OTDR TO CONFIRM ATTENUATION IS WITHIN MANUFACTURER TOLERANCE AND LOSS BUDGET.
3.19 ETHERNET CABLES
3.19.1 ALL TERMINATIONS SHALL BE MADE VIA EITHER PIN TERMINALS OR RJ45 CONNECTORS.
3.19.2 DATA CABLES SHALL BE INSTALLED IN SEPARATE, DEDICATED CONDUITS FOR ENTERING AND LEAVING EQUIPMENT.
3.19.3 ALL DATA CABLES SHALL BE FULLY TESTED AFTER TERMINATION, TO CONFIRM ATTENUATION IS WITHIN MANUFACTURER TOLERANCE AND LOSS BUDGET.
3.19.4 ALL COMMUNICATION CABLES SHALL BE SUBMITTED FOR OWNER APPROVAL. CABLES SHALL BE PROVIDED WITH APPROPRIATE SHIELDS, DRAIN WIRES, AND COMMON WIRES PER COMMUNICATION EQUIPMENT MANUFACTURER RECOMMENDATIONS.
3.19.5 RS-485 CABLES SHALL BE BELDEN 9842 OR APPROVED EQUAL WITH MINIMUM 2 PAIRS AND SHIELD AND DRAIN WIRES.

3.20 MEDIUM VOLTAGE TERMINATION REQUIREMENTS

- 3.20.1 ELBOWS, BUSHINGS, AND TEST CAPS MUST BE CLEAN AND PROPERLY LUBRICATED PER MANUFACTURER'S INSTRUCTIONS BEFORE FINAL CONNECTION.
3.20.2 POWER CABLE, ELBOW, AND MV TERMINATION DRAINS SHALL BE INSTALLED IN A MANNER THAT WILL ALLOW FOR THE REMOVAL, STANDING OFF, AND/OR LANDING OF ELBOWS WITH MINIMUM BENDING RADIUS PER NEC 300.34.
3.20.3 TAPE SHIELD ADAPTER KITS ARE TO BE USED WITH POWER CABLE THAT HAS TAPE SHIELDING.
3.20.4 MOUNT MV FAULT INDICATORS SUCH THAT INDICATOR WINDOW IS READILY VISIBLE WITHOUT THE NEED TO ENTER THE CABLE COMPARTMENT OR MOVE CONDUCTORS OR OTHER COMPONENTS. LABEL FAULT INDICATORS WITH CIRCUIT ID.
3.20.5 ALL MV WORK SHALL COMPLY WITH THE LATEST EDITION OF ANSI C2 - NATIONAL ELECTRICAL SAFETY CODE (NEC) AND UTILITY CONSTRUCTION STANDARDS.
3.20.6 ARRANGE PHASES IN ALL MV EQUIPMENT AS A-B-C FROM LEFT TO RIGHT OR TOP TO BOTTOM AS VIEWED FROM THE FRONT.

3.21 GROUNDING AND BONDING

- 3.21.1 AFTER INSTALLATION, ALL BARE COPPER WIRES SHALL NOT BE IN CONTACT WITH GALVANICALLY REACTIVE METALS, SUCH AS ALUMINUM MODULE FRAMES AND RACKING.
3.21.2 GROUNDING ELECTRODE CONDUCTORS (GEC'S) WILL HAVE AS SHORT A DISTANCE TO THE GROUNDING ELECTRODE AS POSSIBLE AND A MINIMUM NUMBER OF TURNS.
3.21.3 ALL GROUNDING SPLICES AND CONNECTIONS SHALL BE IRREVERSIBLE CRIMP.
3.21.4 FOR EQUIPMENT PAD GROUND RING CONNECTIONS, ONE GROUNDING ELECTRODE SHALL BE INSTALLED IN AN ACCESSIBLE HAND HOLE. THE CONNECTION OF THE GEC TO THIS ELECTRODE SHALL BE REVERSIBLE SUCH THAT THE GROUND RING MAY BE TESTED WITHOUT CONNECTION TO THE ELECTRODE.
3.21.5 ALL NON-CURRENT CARRYING METAL PARTS SHALL BE PROPERLY GROUNDED. IF THE EQUIPMENT GROUNDING POINT OF CONTACT IS PAINTED, THE PAINT/FINISH AT THAT LOCATION SHALL BE PROPERLY REMOVED.
3.21.6 RACKING COMPONENTS AND STRUCTURAL SUPPORTS MUST BE ELECTRICALLY BONDED TOGETHER BY A LISTED MEANS.
3.21.7 INTER-RACK BONDING JUMPERS, IF REQUIRED, SHALL BE FLEXIBLE TIN COATED COPPER BRAIDING (E.G., WILEY WEEBS) OR SOLID COPPER WIRE OF SIZE, TYPE, AND TERMINATION METHOD SPECIFIED.
3.21.8 MODULES SHALL BE GROUNDED TO RACKING SUPPORTS WITH A METHOD APPROVED AND LISTED BY THE RACKING MANUFACTURER. GROUNDING CLIPS OR WASHERS SHALL BE ARRANGED PER THE MANUFACTURER INSTRUCTIONS SO THAT THE REMOVAL OF A MODULE DOES NOT INTERRUPT THE RACKING GROUNDING CONNECTION OF ANY OTHER MODULE.
3.21.9 BARE COPPER EQUIPMENT GROUND JUMPER SHALL BE IN CONDUIT AND SHALL EXTEND AT LEAST 6" OUT FROM EQUIPMENT PAD.

3.22 LABELS AND IDENTIFICATION

- 3.22.1 ALL EQUIPMENT SHALL BE LABELED ON THE FRONT EXTERIOR TO CORRESPOND TO THE IDENTIFICATION SHOWN ON THE CONTRACT DRAWINGS.
3.22.2 ALL CABLES SHALL BE LABELED AT EACH END AND AT SPLICE LOCATIONS, AT AN ACCESSIBLE POINT INSIDE EQUIPMENT ENCLOSURE, IF POSSIBLE, WITH CIRCUIT AND PHASE IDENTIFICATION CORRESPONDING TO THE CONTRACT DRAWINGS.
3.22.3 MV CABLE SHALL BE LABELED. THESE LABELS SHALL BE VISIBLE FROM OUTSIDE THE ENCLOSURE WITHOUT REACHING INSIDE OR MOVING CABLES.
3.22.4 PROVIDE ARC FLASH HAZARD WARNING LABELS COMPLYING WITH ANSI Z535.4 AND NFPA 70E ON ALL EQUIPMENT PER DRAWINGS. LABELS SHALL BE APPLIED ON ACCESSIBLE DOORS OR BARRIERS OF OUTDOOR EQUIPMENT.
3.22.5 ALL WIRES AND CABLE SHALL HAVE WRAP-AROUND LAMINATING VINYL MACHINE PRINTED ID LABELS OR OTHER APPROVED LABELING METHOD INDICATING DESIGNATION AND POLARITY/PHASE. FOR DC STRING CIRCUITS, DESIGNATION SHALL BE THE CIRCUIT NUMBER. FOR DC FEEDER CONDUCTORS FROM COMBINER BOXES TO INVERTERS, DESIGNATION SHALL BE THE COMBINER BOX

- NUMBER.
3.22.6 FOR DIAGNOSTIC AND TROUBLESHOOTING PURPOSES, ALL CABLES SHALL BE UNIQUELY TAGGED AND IDENTIFIED WITH SUCH TAGGING ON THE RECORD CONSTRUCTION DRAWINGS. THESE CABLES SHALL HAVE A LABEL AFFIXED TO THE OUTER JACKET AT EACH TERMINATION OF TYPE AND REASONABLY ACCEPTABLE TO OWNER.
3.22.7 ALL ELECTRICAL EQUIPMENT, PANELS, COMBINER BOXES, AND ASSOCIATED EQUIPMENT SHALL BE CLEARLY LABELED WITH WEATHERPROOF, ENGRAVED NAMEPLATES UTILIZING OWNER SPECIFIED NAMING CONVENTIONS.
3.22.8 ENGRAVED SIGNS AND APPROPRIATE WARNING LABELS SHALL BE PROVIDED IDENTIFYING THAT A PHOTOVOLTAIC SYSTEM IS IN OPERATION AND THAT THERE MAY BE MULTIPLE POWER SOURCES ON SITE. PLAQUES OR DIRECTORIES SHOWING THE LOCATIONS OF OTHER SERVICE DISCONNECTING MEANS SHALL BE PROVIDED WHERE REQUIRED BY THE LOCAL UTILITY AND NEC.
3.23 DISCONNECTING MEANS
3.23.1 CONTRACTOR SHALL NOT BOND POSITIVE OR NEGATIVE SOURCE OR OUTPUT CONDUCTORS TO GROUND AT ANY LOCATION. FOR A GROUNDED SYSTEM, THE ONLY CURRENT CARRYING CONDUCTOR CONNECTION TO GROUND SHALL BE THE INTERNAL INVERTER MANUFACTURER PROVIDED CONNECTION.
3.23.2 UNLESS THE DISCONNECTING MEANS IS SERVICING A LINE-SIDE TAP, THE DISCONNECTING MEANS SHALL NOT BE REQUIRED TO BE SUITABLE AS SERVICE EQUIPMENT AND SHALL BE RATED IN ACCORDANCE WITH NEC SECTION 690.17.
3.23.3 IF THE EQUIPMENT IS ENERGIZED FROM MORE THAN ONE SOURCE, THE DISCONNECTING MEANS SHALL BE GROUPED AND IDENTIFIED.
3.23.4 A SINGLE DISCONNECTING MEANS SHALL BE PERMITTED FOR THE COMBINED AC OUTPUT OF ONE OR MORE INVERTERS IN AN INTERACTIVE SYSTEM - PROVIDED EACH INVERTER ASSOCIATED WITH THE DISCONNECT HAS ITS OWN INTERNAL AC DISCONNECT.
3.23.5 ALL DISCONNECTS AND COMBINERS SHALL BE SECURED FROM UNAUTHORIZED AND UNQUALIFIED PERSONNEL BY PADLOCK OR UTILITY SEAL AND LOCATION.
3.24 HARDWARE
3.24.1 ALL HARDWARE IN EXPOSED LOCATIONS SHALL BE STAINLESS STEEL AND MEET ANY UTILITY CONSTRUCTION STANDARDS.
3.24.2 ALL HARDWARE USED FOR GROUNDING & BONDING ABOVE GRADE SHALL BE STAINLESS STEEL, UNLESS OTHERWISE APPROVED BY OWNER.
3.24.3 ANTI-SEIZE LUBRICANT MUST BE USED ON STAINLESS HARDWARE.
3.24.4 ALL ELECTRICAL AND MECHANICAL HARDWARE TO BE TORQUED PER DEVICE LISTING, OR MANUFACTURERS RECOMMENDATIONS USING A CALIBRATED TORQUE WRENCH. CONNECTORS ARE TO BE MARKED WITH PERMANENT MARKING PAINT, AFTER TORQUEING.
3.24.5 DISSIMILAR METALS ARE NOT TO BE BONDED TOGETHER TO AVOID CORROSION.

3.25 WIRE MANAGEMENT

- 3.25.1 ALL WIRE MANAGEMENT METHODS AND MATERIALS SHALL BE APPROVED BY OWNER PRIOR TO INSTALLATION.
3.25.2 CONTRACTOR TO CREATE A MOCK UP OF PV AND DC WIRE MANAGEMENT, TAKE PHOTOS OF EVERY DETAIL AND SUBMIT FOR OWNER APPROVAL.
3.25.3 ALL EXPOSED CABLES, SUCH AS MODULE LEADS AND PV SOURCE CIRCUIT WIRING SHALL BE SECURED WITH MECHANICAL OR OTHER APPROVED SUNLIGHT RESISTANT MEANS. UV RATED TIES MUST BE SUBMITTED FOR REVIEW AND APPROVAL.
3.25.4 PV SOURCE AND OUTPUT CONDUCTOR CABLE CLIPS SHALL BE STAINLESS STEEL (E.G. ACC CLIPS BY WILEY OR CABLE CLIPS BY COOPER INDUSTRIES).
3.25.5 PV SOURCE CIRCUIT WIRING SHALL BE SUPPORTED ADEQUATELY IN LENGTHS NOT TO EXCEED 48". MODULE TO MODULE INTERCONNECTIONS SHALL BE SUPPORTED AT A MAXIMUM OF 12" FROM THE J-BOX AND THE MODULE TO MODULE CONNECTION POINT.
3.25.6 PROTECT WIRE FROM SHARP EDGES WITH UV RATED SPIRAL WRAP, EDGE-GUARD, OR SPLIT LOOM.



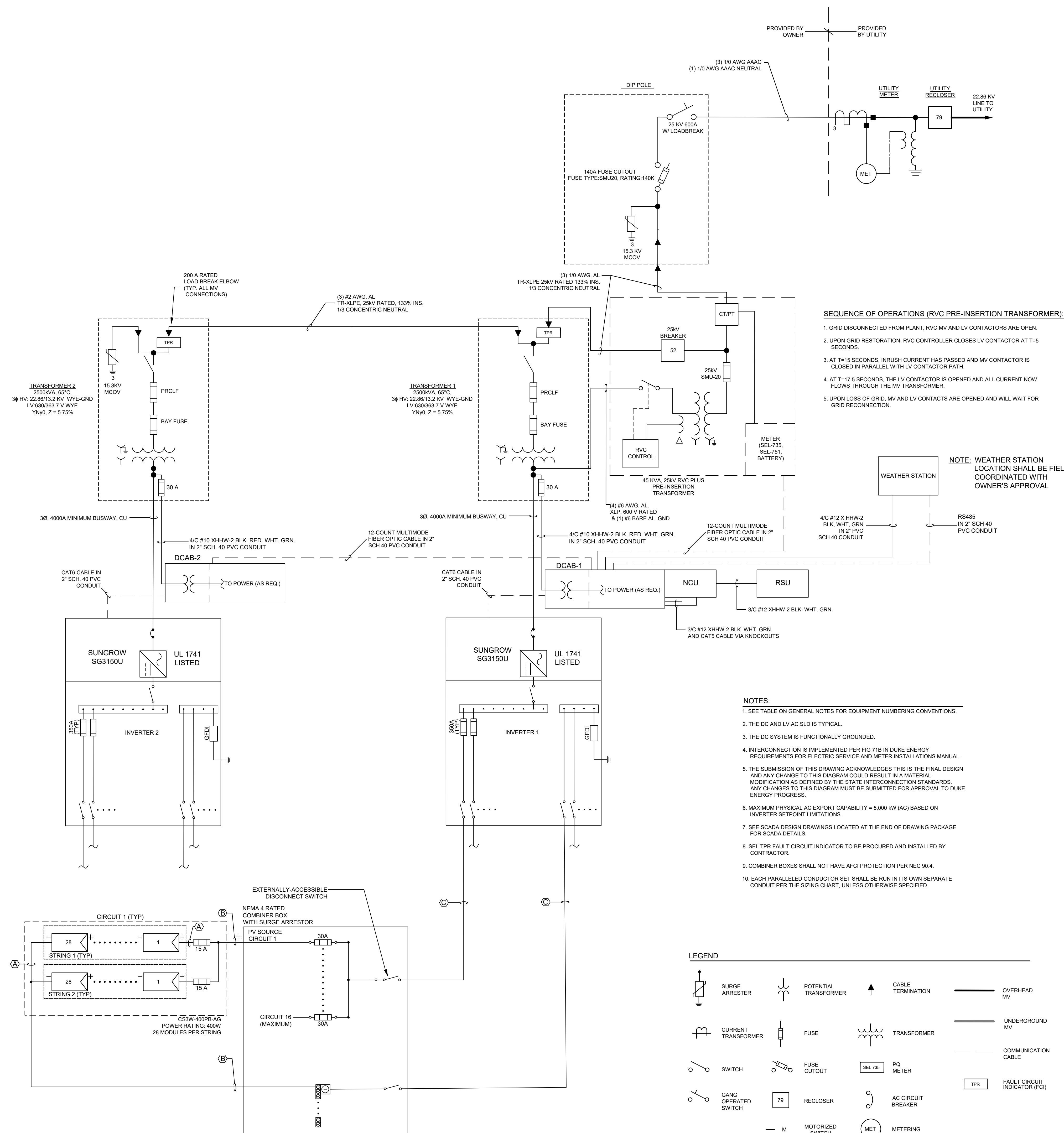
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Table with columns: NO., DATE, ENG., REVISIONS, ISSUED FOR PERMIT, NO. OF SHEETS

STATION NAME: CLOVELLY SOLAR ELECTRIC POWER PLANT
DRAWING TITLE: SYMBOLS & NOTES
DRAWN BY: ALH
CHECKED BY: EDR
APPROVED BY: JEH
DATE: 05/01/2020
SCALE: NTS
FILE NUMBER: 69965
SHEET: E-013

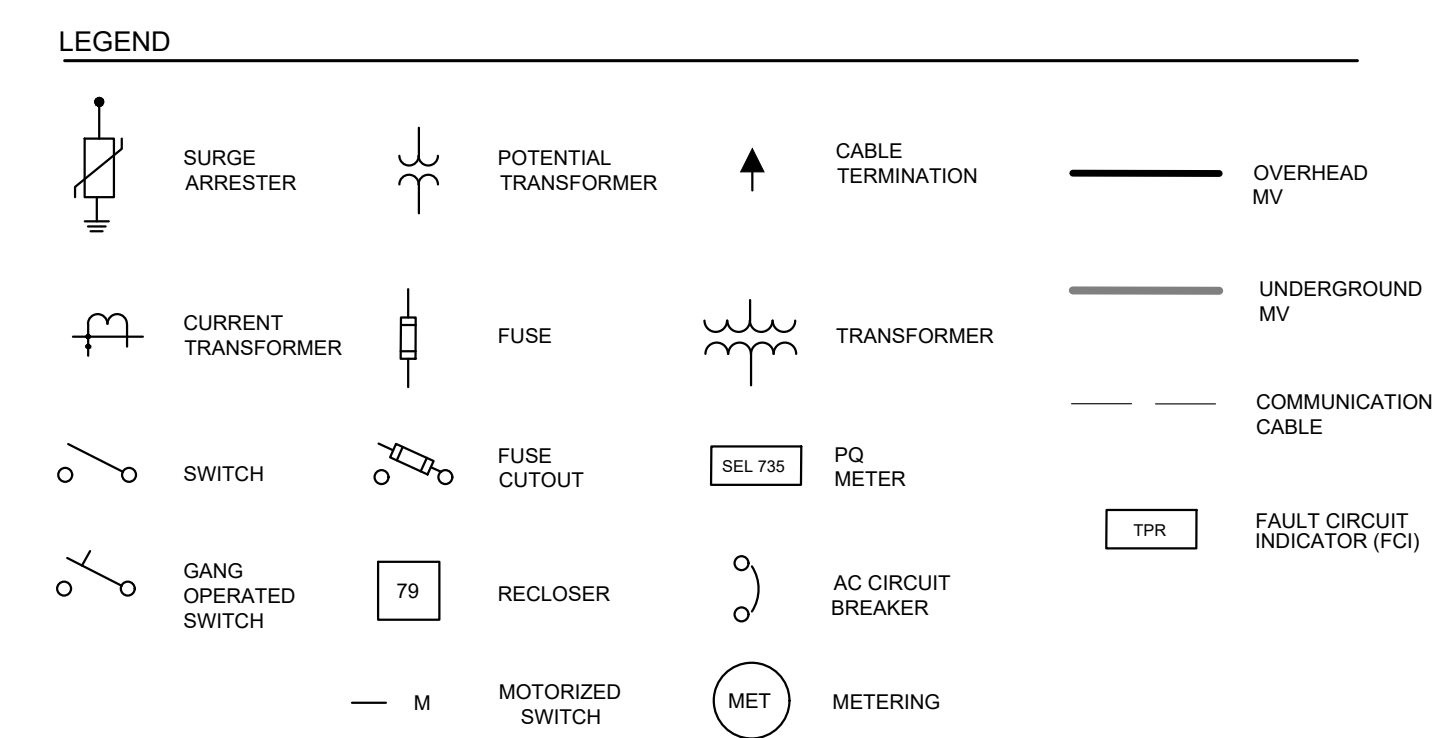


SEQUENCE OF OPERATIONS (RVC PRE-INSERTION TRANSFORMER):

1. GRID DISCONNECTED FROM PLANT, RVC MV AND LV CONTACTORS ARE OPEN.
2. UPON GRID RESTORATION, RVC CONTROLLER CLOSES LV CONTACTOR AT T=5 SECONDS.
3. AT T+15 SECONDS, INRUSH CURRENT HAS PASSED AND MV CONTACTOR IS CLOSED IN PARALLEL WITH LV CONTACTOR PATH.
4. AT T+17.5 SECONDS, THE LV CONTACTOR IS OPENED AND ALL CURRENT NOW FLOWS THROUGH THE MV TRANSFORMER.
5. UPON LOSS OF GRID, MV AND LV CONTACTORS ARE OPENED AND WILL WAIT FOR GRID RECONNECTION.

NOTES:

1. SEE TABLE ON GENERAL NOTES FOR EQUIPMENT NUMBERING CONVENTIONS.
2. THE DC AND LV AC SLID IS TYPICAL.
3. THE DC SYSTEM IS FUNCTIONALLY GROUNDED.
4. INTERCONNECTION IS IMPLEMENTED PER FIG 71B IN DUKE ENERGY REQUIREMENTS FOR ELECTRIC SERVICE AND METER INSTALLATIONS MANUAL.
5. THE SUBMISSION OF THIS DRAWING ACKNOWLEDGES THIS IS THE FINAL DESIGN AND ANY CHANGE TO THIS DIAGRAM COULD RESULT IN A MATERIAL MODIFICATION AS DEFINED BY THE STATE INTERCONNECTION STANDARDS. ANY CHANGES TO THIS DIAGRAM MUST BE SUBMITTED FOR APPROVAL TO DUKE ENERGY PROGRESS.
6. MAXIMUM PHYSICAL AC EXPORT CAPABILITY = 5,000 kW (AC) BASED ON INVERTER SETPOINT LIMITATIONS.
7. SEE SCADA DESIGN DRAWINGS LOCATED AT THE END OF DRAWING PACKAGE FOR SCADA DETAILS.
8. SEL TPR FAULT CIRCUIT INDICATOR TO BE PROCURED AND INSTALLED BY CONTRACTOR.
9. COMBINER BOXES SHALL NOT HAVE AFCI PROTECTION PER NEC 90.4.
10. EACH PARALLELED CONDUCTOR SET SHALL BE RUN IN ITS OWN SEPARATE CONDUIT PER THE SIZING CHART, UNLESS OTHERWISE SPECIFIED.



LEGEND	A	B	C
FROM EQUIPMENT:	SINGLE STRING	CIRCUIT	DC COMBINER OUTPUT
TO EQUIPMENT:	CIRCUIT	DC COMBINER INPUT	INVERTER INPUT
NUMBER OF STRINGS:	1	2	26 (MAX)
WIRE RATING:	90	90	90
TERMINAL RATING:	90	90	90
CONDUCTOR MATERIAL:	COPPER	COPPER	ALUMINUM
WIRE INSULATION:	PV-WIRE (2000V), EXPOSED, WET, UV RATED	PV-WIRE (2000V), EXPOSED, WET, UV RATED	PV-WIRE (2000V), EXPOSED, WET, UV RATED
TEMPERATURE CORRECTION FACTOR:	0.96	0.96	0.96
MAXIMUM CIRCUIT CURRENT 690.8(A)(1)(1), (A):	10.9 A	21.8 A	283.4 A
MAXIMUM CIRCUIT CURRENT PER PVSYST STUDY 690.8(A)(1)(2), (A):	10.01 A	20.03 A	260.37 A
METHOD A: 125% OF MAX CIRCUIT CURRENT 690.8(B)(1), (A):	12.52 A	25.04 A	325.47 A
METHOD B: MAX CIRCUIT CURRENT WITH CONDITIONS 690.8(B)(2), (A):	10.43 A	20.86 A	271.22 A
MIN. AMPACITY REQUIRED:	12.52 A	25.04 A	325.47 A
FUSE SIZE:	15 A	30 A	350 A
CHOSEN WIRE SIZE:	#10	#8	500 MCM
NUMBER OF UNGROUNDED (PHASE) CONDUCTORS:	2	2	2
NUMBER OF GROUNDED (NEUTRAL) CONDUCTORS:	0	0	0
EQUIPMENT GROUND CONDUCTOR (EGC):	#6 PV TYPE CU	#6 PV TYPE CU	#3 PV TYPE CU OR #1 PV TYPE AL
NUMBER OF EGC IN EACH SET:	1	1	1
NUMBER OF PARALLELED SETS:	1	1	1
MAX CONDUIT FILL DERATING:	35%	50%	100%
MINIMUM CONDUIT SIZE:	2"	2"	3"
MAX NUMBER OF SETS PER CONDUIT:	9	6	1

PV MODULE INFORMATION

MANUFACTURER	CANADIAN SOLAR
MODEL	CS3W-400PB-AG
POWER	400 W
V _{mpp} (V)	38.7 V
I _{mpp} (A) **	10.86 A
V _{oc} (V)	47.2 V
I _{sc} (A, NAMEPLATE MAX) **	11.45 A
V _{oc} TEMP COEFFICIENT	-0.0029
NOCT	41°C
MAX FUSE (A)	25 A
TOTAL MODULES	17,472
TOTAL DC CAPACITY (KW)	6,988.80

PV STRING INFORMATION

MODULES IN SERIES	28
STC POWER	11,200 W
V _{oc} (STC)	1,321.6 V
V _{oc} (MIN TEMP)	1,455.7
V _{mpp} (STC)	1,083.6 V
I _{mpp} (STC) **	10.86 A
I _{sc} (STC, NAMEPLATE MAX) **	11.45 A
I _{max} PER NEC 690.8	14.3125 A
DESIGN TEMP (HIGH/LOW)	35°C / -10°C
TOTAL SYSTEM STRINGS	624

INVERTER

MANUFACTURER	SUNGROW
MODEL NUMBER	SG3150U
NUMBER OF INVERTERS	2
STC RATED POWER OUTPUT	3150 KWAC
INVERTER OUTPUT SETPOINT	2500 KWAC
MAX DC VOLTAGE	1,500 V
AC OUTPUT VOLTAGE	630 V
MAX AC CURRENT	2,886 A
CEC WEIGHTED EFFICIENCY	98.5%

** BASED ON ESTIMATED 5% ADDITIONAL GAIN FROM BIFACIAL PANEL PROPERTIES.

NO.	DATE	REVISIONS
A	04/09/2020	INTERCONNECTION
B	04/15/2020	INVERTER UPDATE
C	05/09/2020	ISSUED FOR PERMIT

DEVICE NAME	RATED POWER SETTING
INVERTER 1 (TRANSFORMER 1)	2,500 kW
INVERTER 2 (TRANSFORMER 2)	2,500 kW

INTERCONNECTION SETTING	INVERTER PROGRAMMED SETPOINT
UNDERVOLTAGE #1 (27-1)	0.90 PER UNIT (567 V), 10 CYCLE DELAY (0.1667 SECONDS)
UNDERVOLTAGE #2 (27-2)	0.90 PER UNIT (567 V), 10 CYCLE DELAY (0.1667 SECONDS)
OVERVOLTAGE #1 (59-1)	1.10 PER UNIT (693 V), 10 CYCLE DELAY (0.1667 SECONDS)
OVERVOLTAGE #2 (59-2)	1.10 PER UNIT (693 V), 10 CYCLE DELAY (0.1667 SECONDS)
UNDERFREQUENCY (81U)	57.0 Hz, 10 CYCLE DELAY (0.1667 SECONDS)
OVERFREQUENCY (81O)	60.5 Hz, 10 CYCLE DELAY (0.1667 SECONDS)
POWER FACTOR	1.0 (UNITY)

TRANSFORMER	INVERTER	COMBINER	STRING QUANTITY
TRANSFORMER 1	INVERTER 1	CB1-1	26
		CB1-2	26
		CB1-3	26
		CB1-4	26
		CB1-5	26
		CB1-6	26
		CB1-7	26
		CB1-8	26
		CB1-9	26
		CB1-10	26
		CB1-11	26
		CB1-12	26
TRANSFORMER 2	INVERTER 2	CB2-1	26
		CB2-2	26
		CB2-3	26
		CB2-4	26
		CB2-5	26
		CB2-6	26
		CB2-7	26
		CB2-8	26
		CB2-9	26
		CB2-10	26
		CB2-11	26
		CB2-12	26

VOLTAGE DROP

From	To	Maximum Distance (ft)	Maximum % Voltage Drop	Average % Voltage Drop
Strings	DC Combiner Box	TBD	TBD	TBD
DC Combiner Box	Inverter	TBD	TBD	TBD
Inverter	Transformer	TBD	TBD	TBD
Transformer	DIP Pole	TBD	TBD	TBD



Booth & Associates, LLC
 5811 Glenwood Avenue
 Raleigh, NC 27612
 NC F-0221



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NO.	ISSUED FOR PERMIT	REVISIONS	ENG.	DATE
A			JEH	05/09/2020

STATION NAME: CLOVELLY SOLAR ELECTRIC POWER PLANT
 DRAWING TITLE: EQUIPMENT SCHEDULE AND SETTINGS

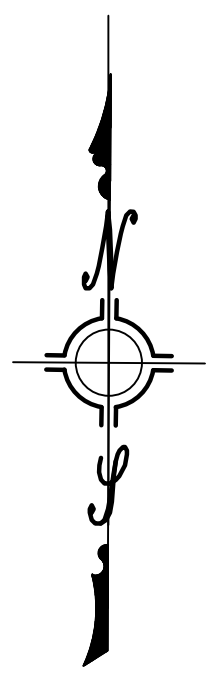
DRAWN BY: ALH
 CHECKED BY: EDR
 APPROVED BY: JEH
 DATE: 05/01/2020
 SCALE: NTS
 FILE NUMBER: 69965
 SHEET: E-101

NO.	DATE	ENC.	REVISIONS
A	05/20/2020	JEH	ISSUED FOR PERMIT

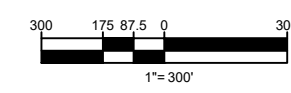
STATION NAME:
CLOVELLY SOLAR
ELECTRIC POWER PLANT

DRAWN BY:	ALH
CHECKED BY:	EDR
APPROVED BY:	JEH
DATE:	05/01/2020
SCALE:	1"=300'
FILE NUMBER:	69965
SHEET:	E-110

DRAWING TITLE:
ELECTRICAL SITE PLAN

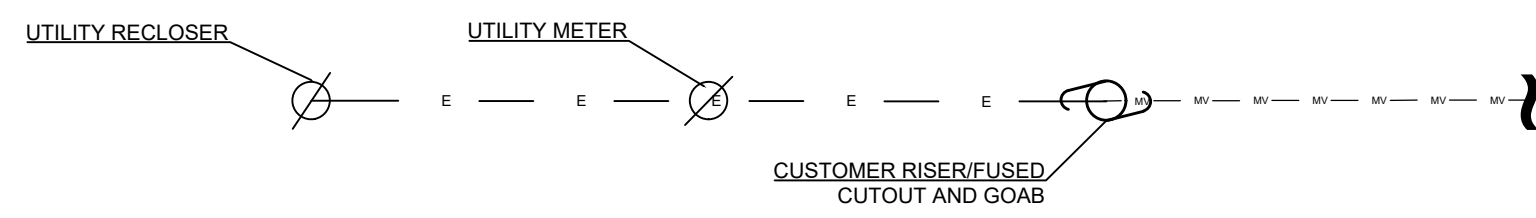


ELECTRICAL SITE PLAN
1" = 300'



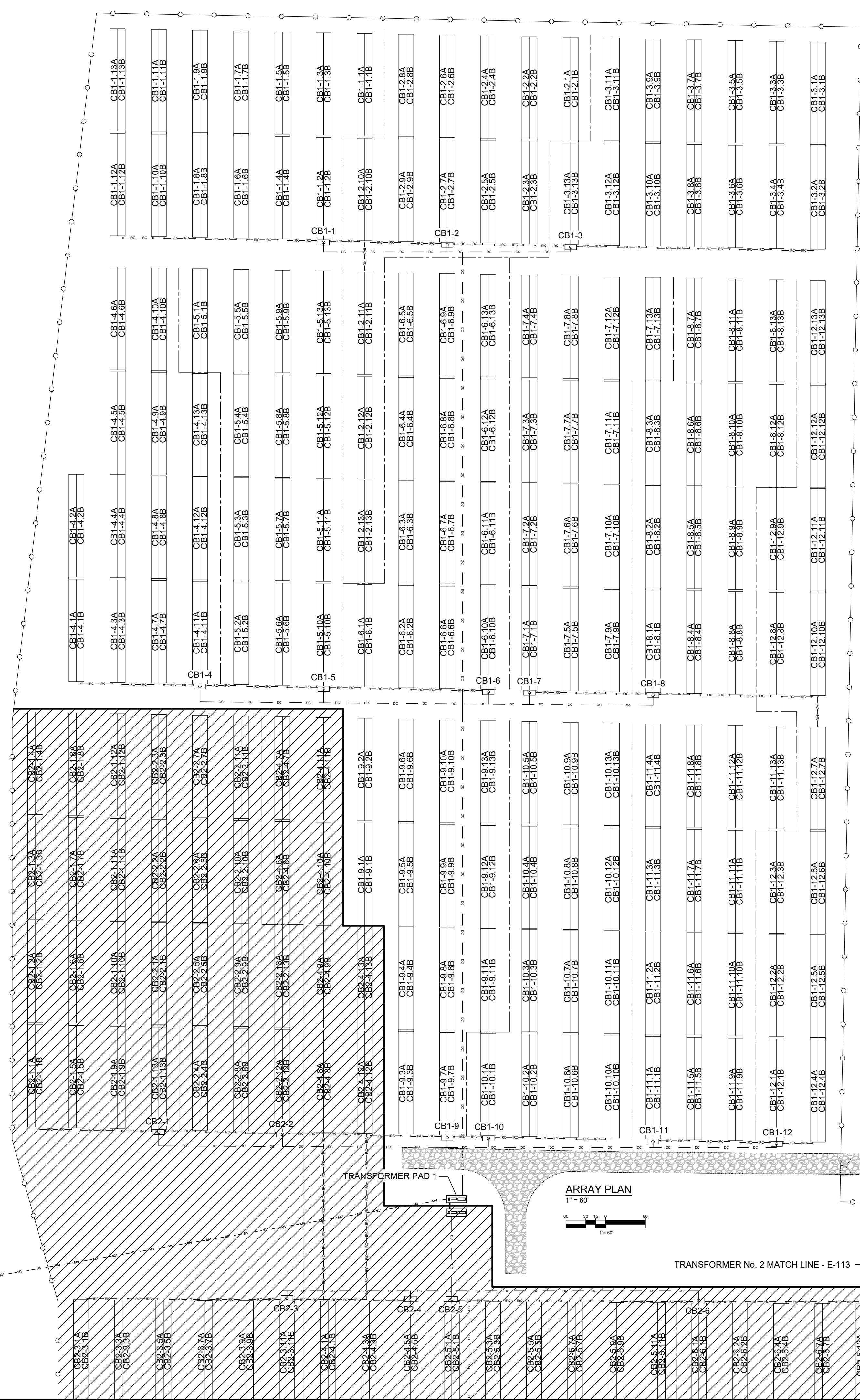
- NOTES:**
1. AZIMUTH = 180.0°
 2. ALL CONDUIT ROUTING IS DIAGRAMMATIC. FINAL CONDUIT ROUTING SHALL BE FIELD COORDINATED BY CONTRACTOR AND APPROVED BY OWNER.
 3. ALL CONDUIT SLEEVES SHALL BE FOAMED BEFORE CLOSE OF CONSTRUCTION USING POLYWATER FST-250 SEALANT. POLYWATER FST-250 SEALANT SHALL NOT EXCEED DEPTH OF 4" FROM THE CONDUIT OPENING.
 4. POWER POLES, OVERHEAD LINES AND MV CABLE TERMINATIONS INSTALLED BY MV CONTRACTOR.
 5. INTER-ROW CONDUIT SHALL BE RUN FROM END OF EACH INDIVIDUAL RACK TO CORRESPONDING SECTION COMBINER BOX. EACH ROW SHALL HAVE ITS OWN CONDUIT TO COMBINER BOX.

- LEGEND:**
- IRC — IRC — IRC — IRC — IRC — INTER-ROW CONDUIT TRENCH
 - E — E — E — E — E — UTILITY OVERHEAD
 - OHE — OHE — OHE — OHE — OHE — OVERHEAD MV
 - OH-FO — OH-FO — OH-FO — OH-FO — OH-FO — OVERHEAD FIBER OPTIC
 - RS — RS — RS — RS — RS — RS485 AND AUX POWER TRENCH
 - MV-FO — MV-FO — MV-FO — MV-FO — MV-FO — MV AND FIBER OPTIC TRENCH
 - MV-FO-AC — MV-FO-AC — MV-FO-AC — MV-FO-AC — MV-FO-AC — MV, FIBER OPTIC, AND AC POWER TRENCH
 - DC — DC — DC — DC — DC — DC TRENCH
 - MV — MV — MV — MV — MV — MEDIUM VOLTAGE BORING
 - MV — MV — MV — MV — MV — MEDIUM VOLTAGE TRENCH
 - — — — — SECTIONALIZING LINE
 - — — — — PERIMETER FENCE
 - COMBINER BOX
 - ▭ ARRAY MODULE
 - CUSTOMER INSTALLED POLE
 - ⊗ UTILITY INSTALLED POLE



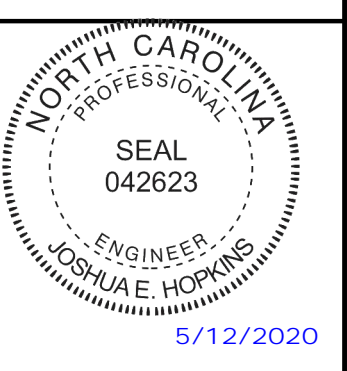
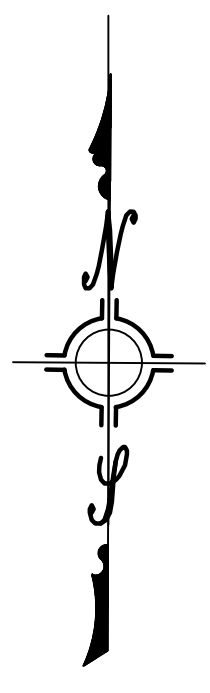
1 ENLARGED POI AREA
NOTE

THE DESIGN WORK BY BOOTH & ASSOCIATES, LLC WITHIN THIS DRAWING CONSISTS OF THE PROPOSED MEDIUM VOLTAGE GEN-TIE ROUTE. ALL OTHER SITE FEATURES ARE TAKEN FROM AN AUTOCAD DRAWING ENTITLED '2020-02-27 EASEMENT LINE AND SITE'; PREPARED FOR PINE GATE RENEWABLES BY SACKS SURVEYING & MAPPING, FIRM LICENSE #C-2741.



- NOTES:**
1. AZIMUTH = 180.0°
 2. ALL CONDUIT ROUTING IS DIAGRAMMATIC. FINAL CONDUIT ROUTING SHALL BE FIELD COORDINATED BY CONTRACTOR AND APPROVED BY OWNER.
 3. ALL CONDUIT SLEEVES SHALL BE FOAMED BEFORE CLOSE OF CONSTRUCTION USING POLYWATER FST-250 SEALANT. POLYWATER FST-250 SEALANT SHALL NOT EXCEED DEPTH OF 4" FROM THE CONDUIT OPENING.
 4. POWER POLES, OVERHEAD LINES AND MV CABLE TERMINATIONS INSTALLED BY MV CONTRACTOR.
 5. INTER-ROW CONDUIT SHALL BE RUN FROM END OF EACH INDIVIDUAL RACK TO CORRESPONDING SECTION COMBINER BOX. EACH ROW SHALL HAVE ITS OWN CONDUIT TO COMBINER BOX.

- LEGEND:**
- IRC — IRC — IRC — IRC — IRC — INTER-ROW CONDUIT TRENCH
 - E — E — UTILITY OVERHEAD
 - OHE — OHE — OVERHEAD MV
 - OH-FO — OH-FO — OVERHEAD FIBER OPTIC
 - RS — RS — RS485 AND AUX POWER TRENCH
 - MV-FO — MV-FO — MV AND FIBER OPTIC TRENCH
 - MV-FO-AC — MV-FO-AC — MV, FIBER OPTIC, AND AC POWER TRENCH
 - DC — DC — DC TRENCH
 - MV — MV — MV MEDIUM VOLTAGE BORING
 - MV — MV — MEDIUM VOLTAGE TRENCH
 - — — SECTIONALIZING LINE
 - — — PERIMETER FENCE
 - — — COMBINER BOX
 - — — ARRAY MODULE
 - — — CUSTOMER INSTALLED POLE
 - — — UTILITY INSTALLED POLE

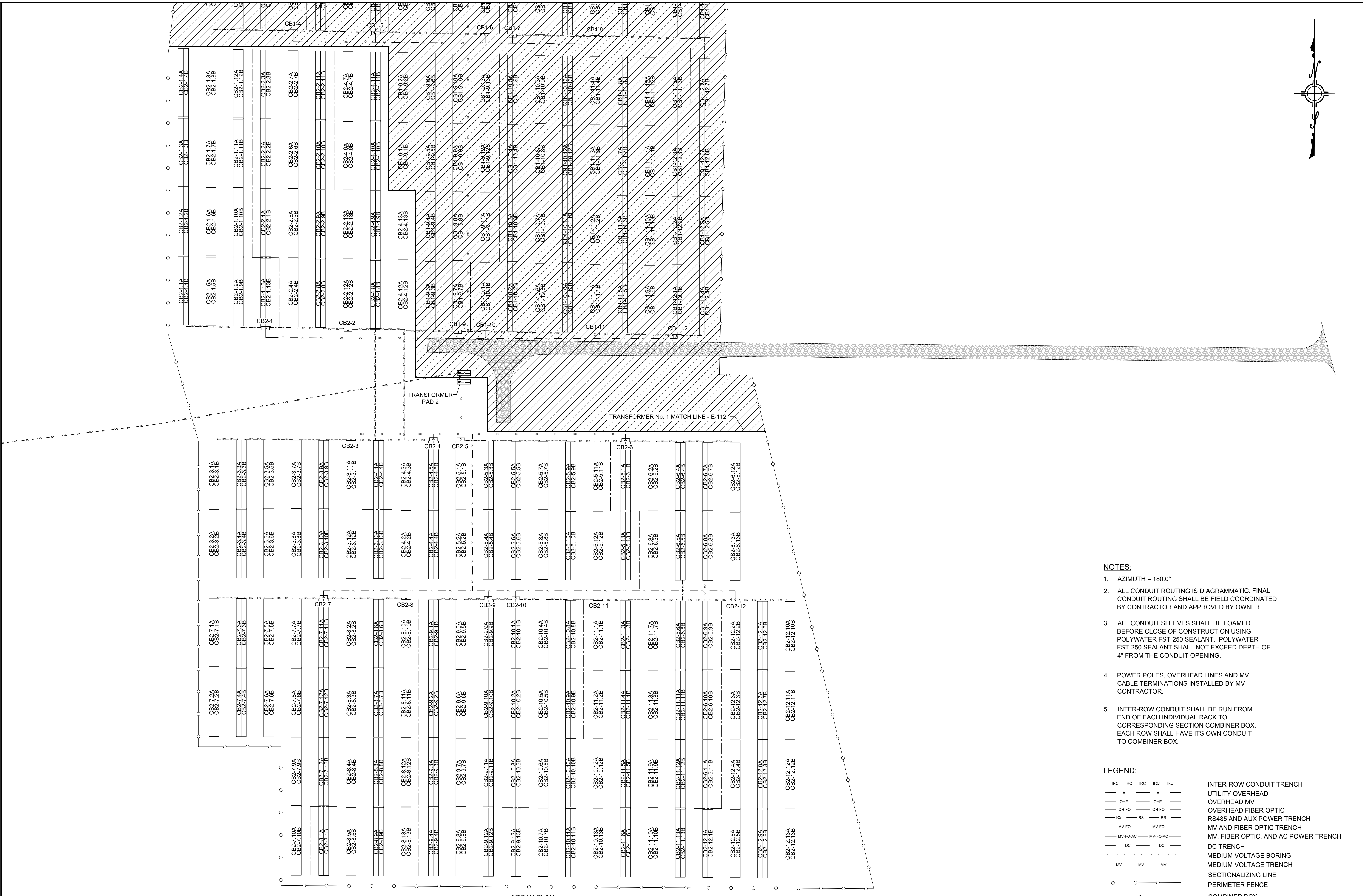


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NO.	DATE	ENC.	REVISIONS
1	05/09/2020	JEH	ISSUED FOR PERMIT

STATION NAME: CLOVELLY SOLAR ELECTRIC POWER PLANT
 DRAWING TITLE: ARRAY PLAN TRANSFORMER No. 1

DRAWN BY:	ALH
CHECKED BY:	EDR
APPROVED BY:	JEH
DATE:	05/01/2020
SCALE:	1"=60'
FILE NUMBER:	69965
SHEET:	E-112



ARRAY PLAN
1"=60'

- NOTES:**
1. AZIMUTH = 180.0°
 2. ALL CONDUIT ROUTING IS DIAGRAMMATIC. FINAL CONDUIT ROUTING SHALL BE FIELD COORDINATED BY CONTRACTOR AND APPROVED BY OWNER.
 3. ALL CONDUIT SLEEVES SHALL BE FOAMED BEFORE CLOSE OF CONSTRUCTION USING POLYWATER FST-250 SEALANT. POLYWATER FST-250 SEALANT SHALL NOT EXCEED DEPTH OF 4" FROM THE CONDUIT OPENING.
 4. POWER POLES, OVERHEAD LINES AND MV CABLE TERMINATIONS INSTALLED BY MV CONTRACTOR.
 5. INTER-ROW CONDUIT SHALL BE RUN FROM END OF EACH INDIVIDUAL RACK TO CORRESPONDING SECTION COMBINER BOX. EACH ROW SHALL HAVE ITS OWN CONDUIT TO COMBINER BOX.

LEGEND:

—IRC—IRC—IRC—IRC—IRC—	INTER-ROW CONDUIT TRENCH
—E—E—E—E—E—E—	UTILITY OVERHEAD
—OHE—OHE—OHE—OHE—OHE—	OVERHEAD MV
—OHFO—OHFO—OHFO—OHFO—OHFO—	OVERHEAD FIBER OPTIC
—RS—RS—RS—RS—RS—RS—	RS485 AND AUX POWER TRENCH
—MVFO—MVFO—MVFO—MVFO—MVFO—	MV AND FIBER OPTIC TRENCH
—MVFO-AC—MVFO-AC—MVFO-AC—MVFO-AC—MVFO-AC—	MV, FIBER OPTIC, AND AC POWER TRENCH
—DC—DC—DC—DC—DC—DC—	DC TRENCH
—MVB—MVB—MVB—MVB—MVB—MVB—	MEDIUM VOLTAGE BORING
—MV—MV—MV—MV—MV—MV—	MEDIUM VOLTAGE TRENCH
—S—S—S—S—S—S—	SECTIONALIZING LINE
—P—P—P—P—P—P—	PERIMETER FENCE
—C—C—C—C—C—C—	COMBINER BOX
—M—M—M—M—M—M—	ARRAY MODULE
—CIP—CIP—CIP—CIP—CIP—CIP—	CUSTOMER INSTALLED POLE
—UIP—UIP—UIP—UIP—UIP—UIP—	UTILITY INSTALLED POLE

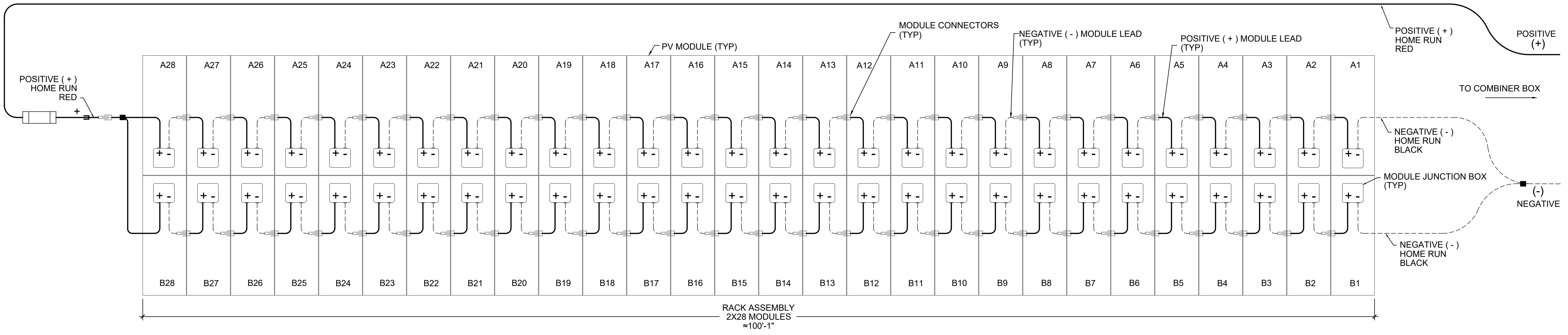
NO.	REVISIONS	ENC.	DATE
1	ISSUED FOR PERMIT	JEH	05/09/2020

STATION NAME: CLOVELLY SOLAR ELECTRIC POWER PLANT
DRAWING TITLE: ARRAY PLAN TRANSFORMER No. 2

DRAWN BY:	ALH
CHECKED BY:	EDR
APPROVED BY:	JEH
DATE:	05/01/2020
SCALE:	1"=60'
FILE NUMBER:	69965
SHEET:	E-113

NO.	REVISIONS	DATE
A	ISSUED FOR PERMIT	05/09/2020

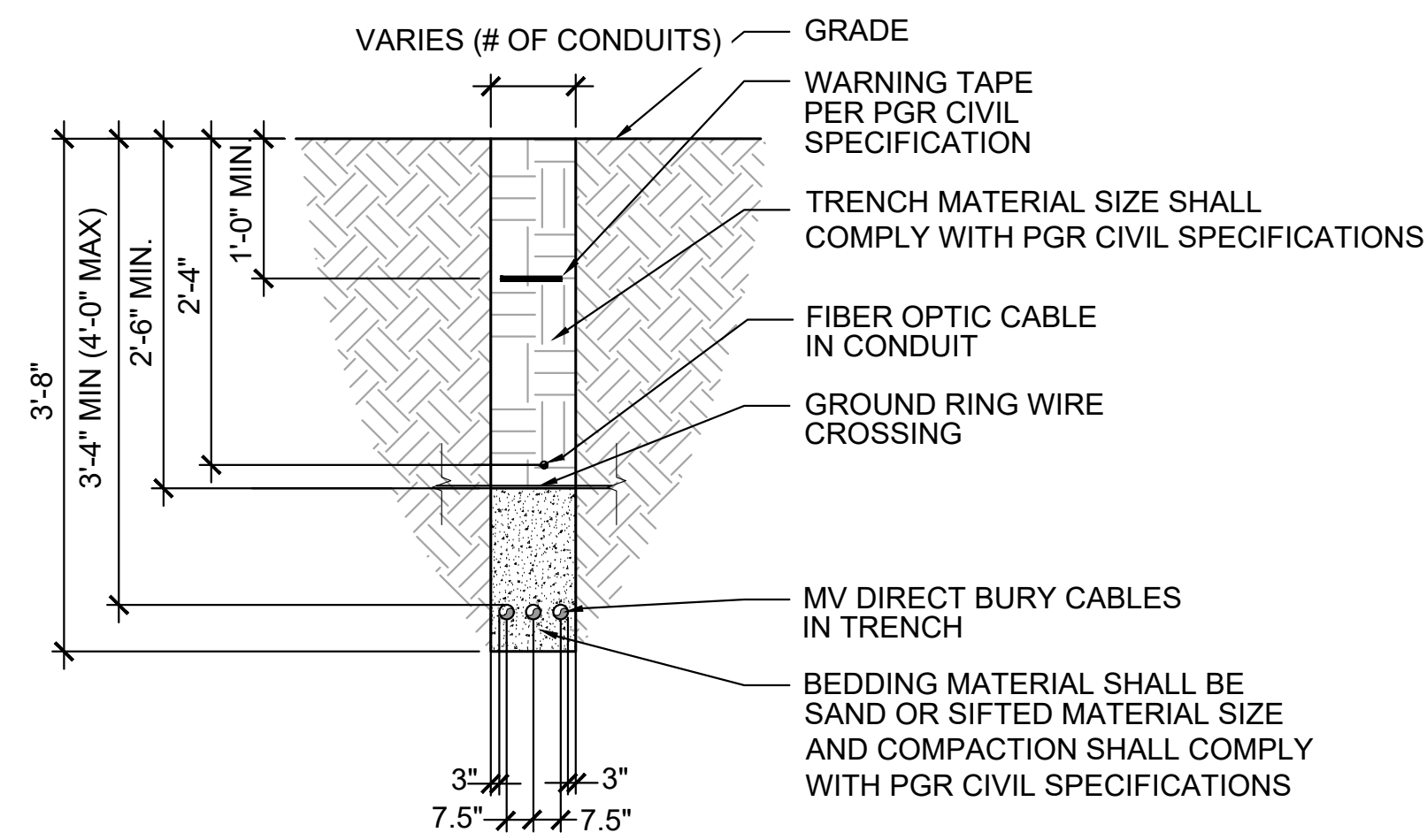
STATION NAME:	CLOVELLY SOLAR
DRAWING TITLE:	ELECTRIC POWER PLANT
DRAWING TITLE:	ELECTRICAL DETAILS
DRAWN BY:	ALH
CHECKED BY:	EDR
APPROVED BY:	JEH
DATE:	05/01/2020
SCALE:	NTS
FILE NUMBER:	69965
SHEET:	E-251



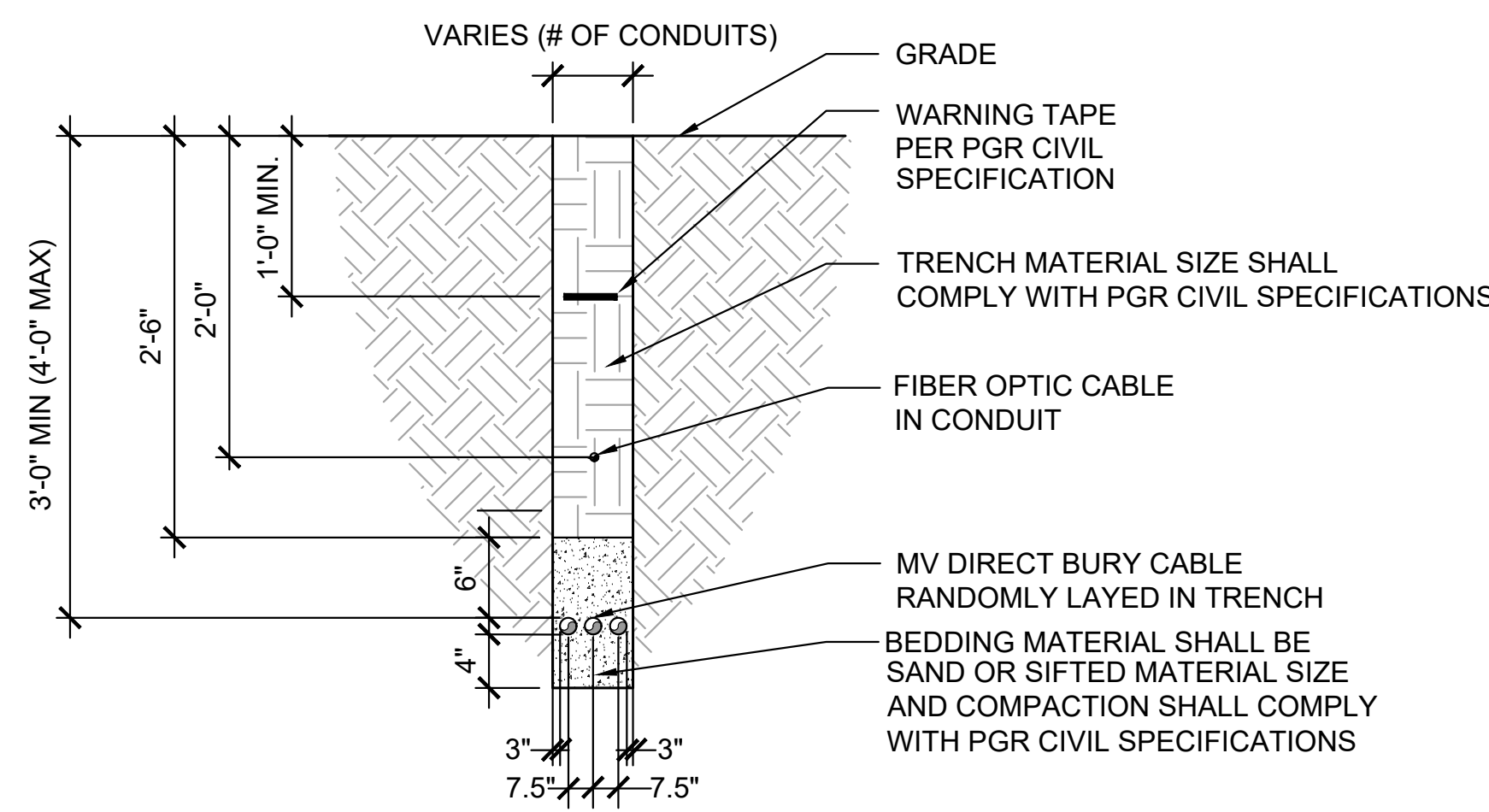
A 2X28 SOURCE CIRCUIT STRINGING DETAIL
SCALE: NTS

NOTES:

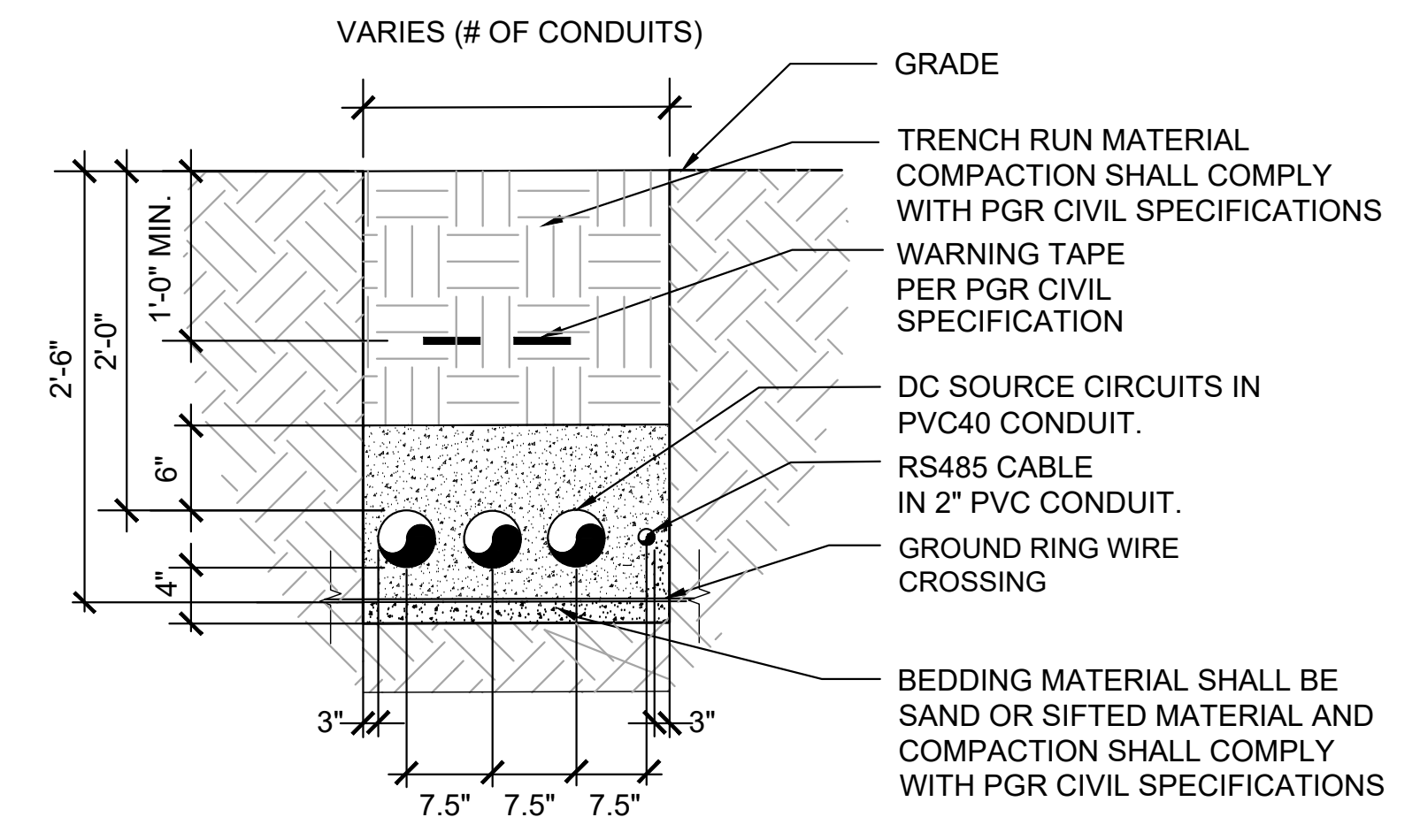
1. DIRECTION OF WIRING MAY CHANGE DEPENDING ON LOCATION OF MODULES RELATIVE TO ASSOCIATED INVERTER LOCATION. INSTALL WIRING DIRECTION ACCORDINGLY.
2. ENSURE MODULE LEADS ARE PROPERLY SECURED.
3. PROVIDE ADEQUATE STRAIN RELIEF AT MODULE JUNCTION BOXES.



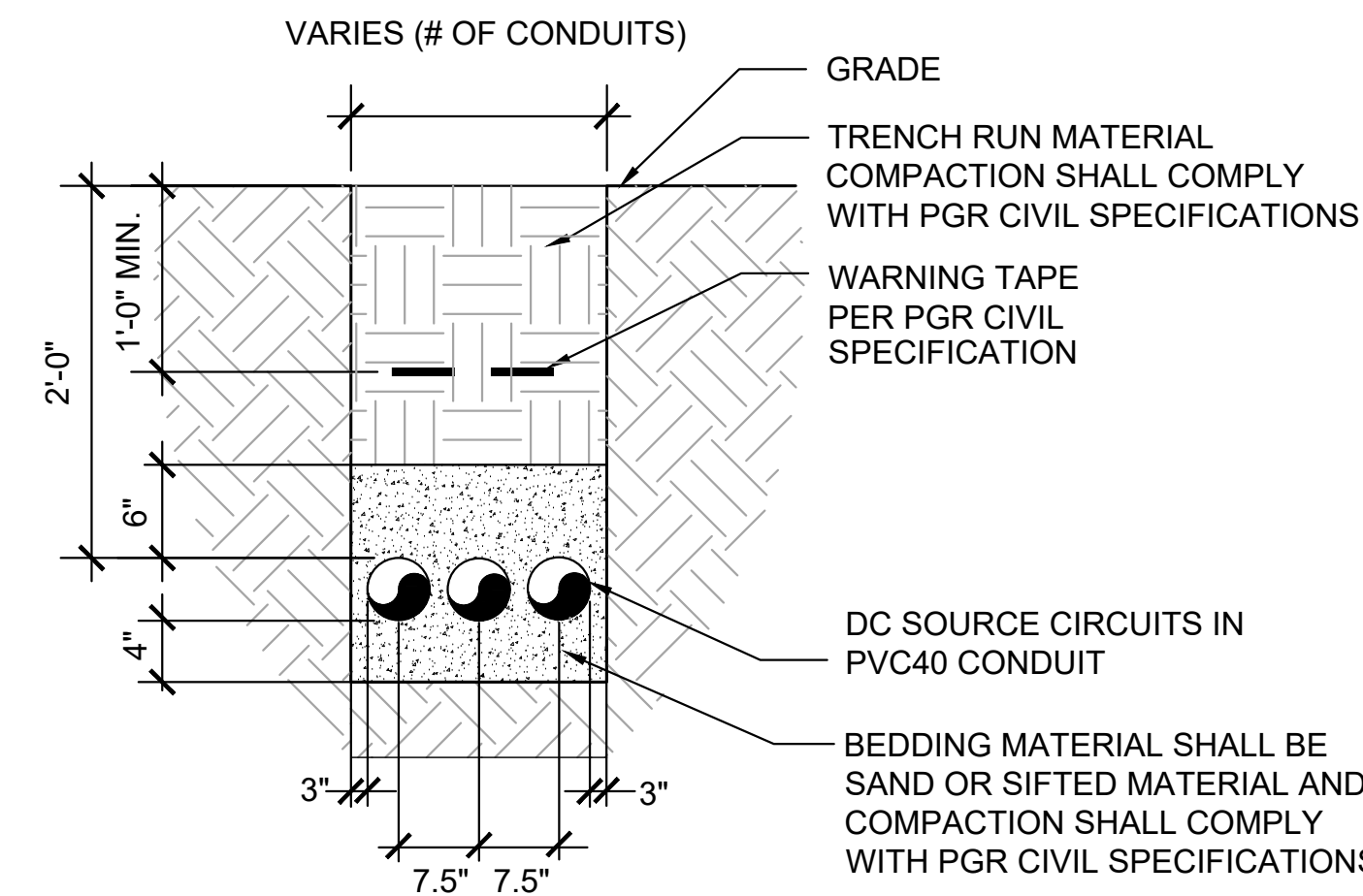
1 MV/FO CROSSING GROUND RING
SCALE: NTS



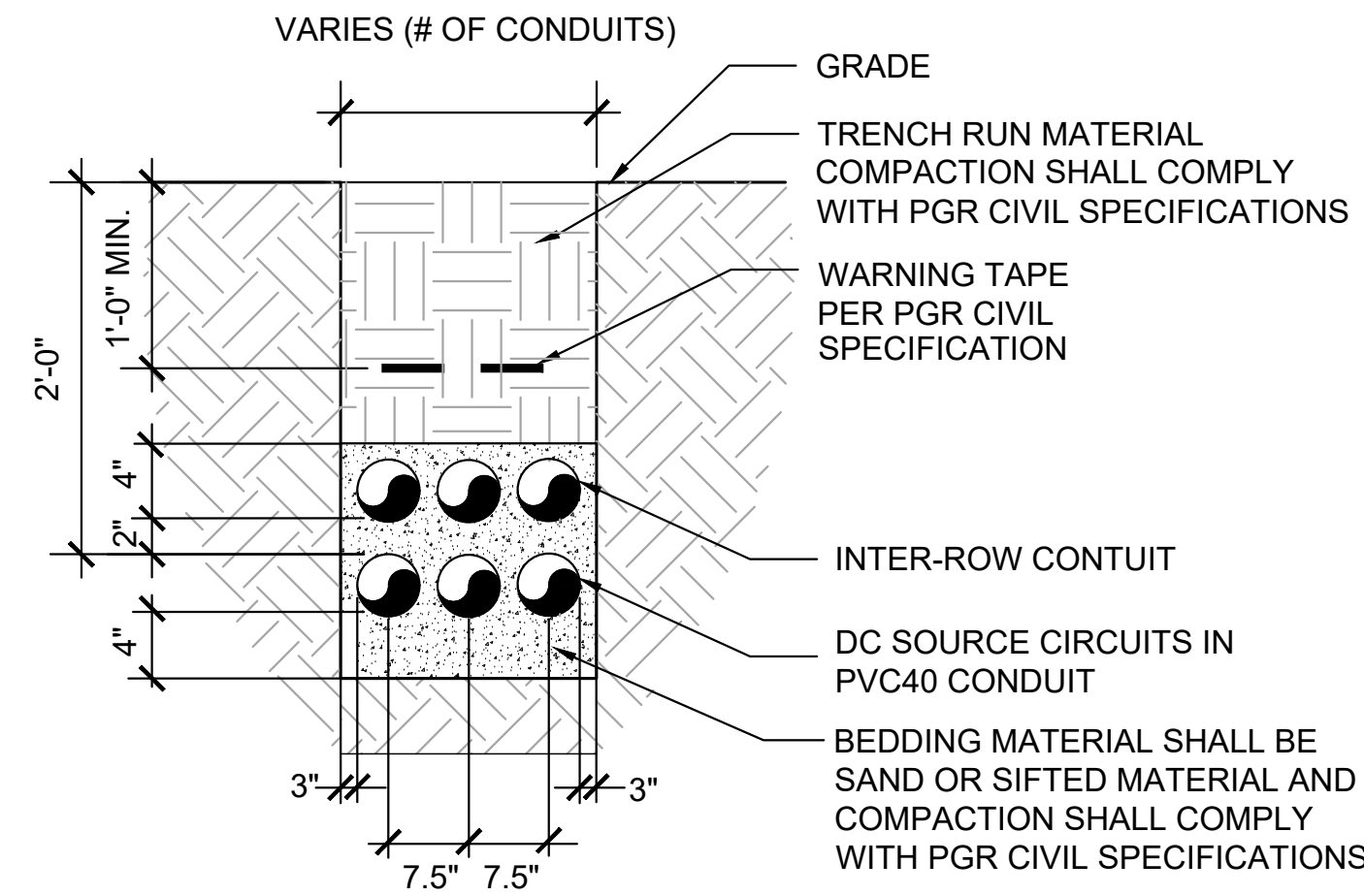
2 RANDOM LAY MV/FO CABLES
SCALE: NTS



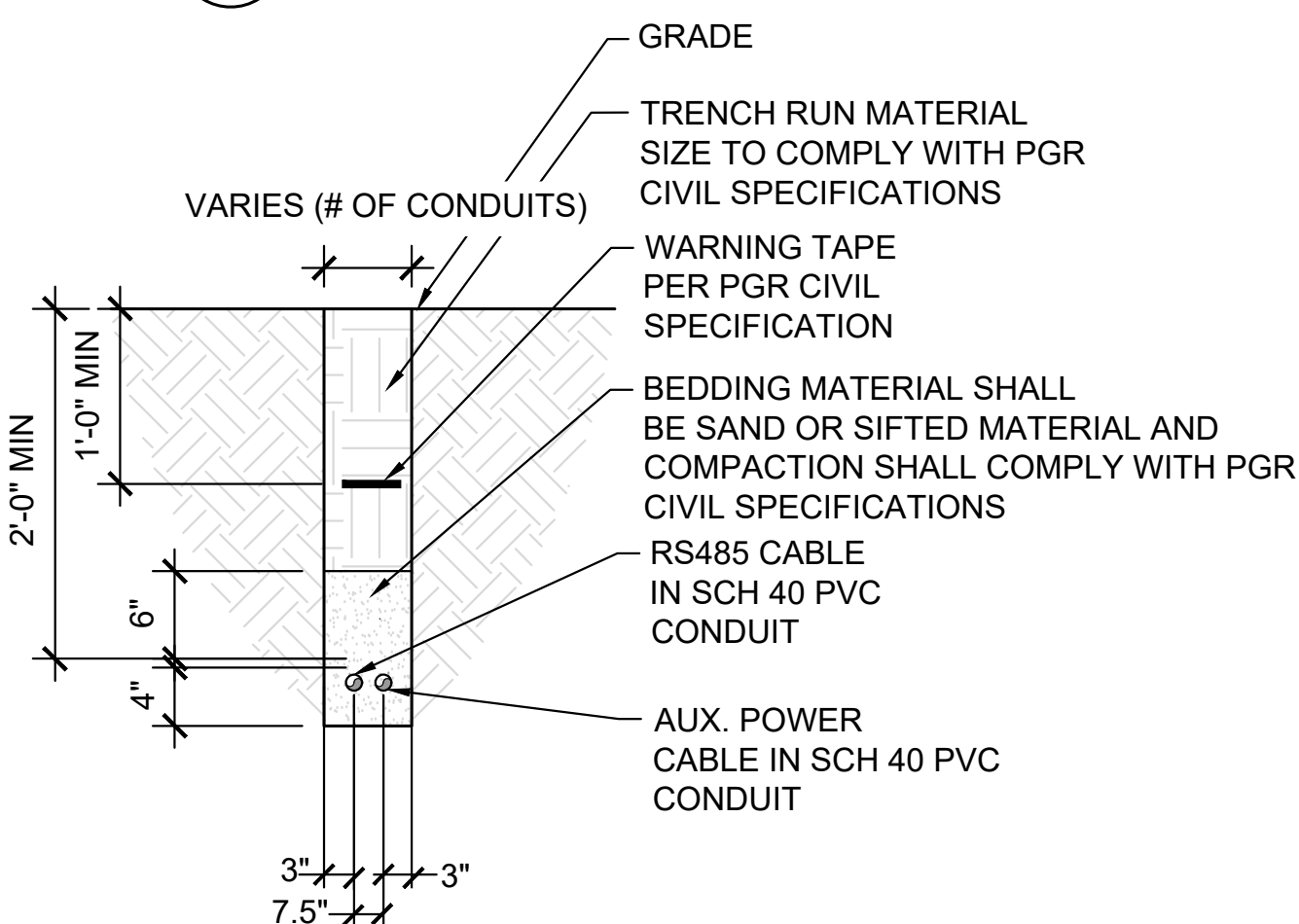
3 DC AND RS485 CONDUITS
SCALE: NTS



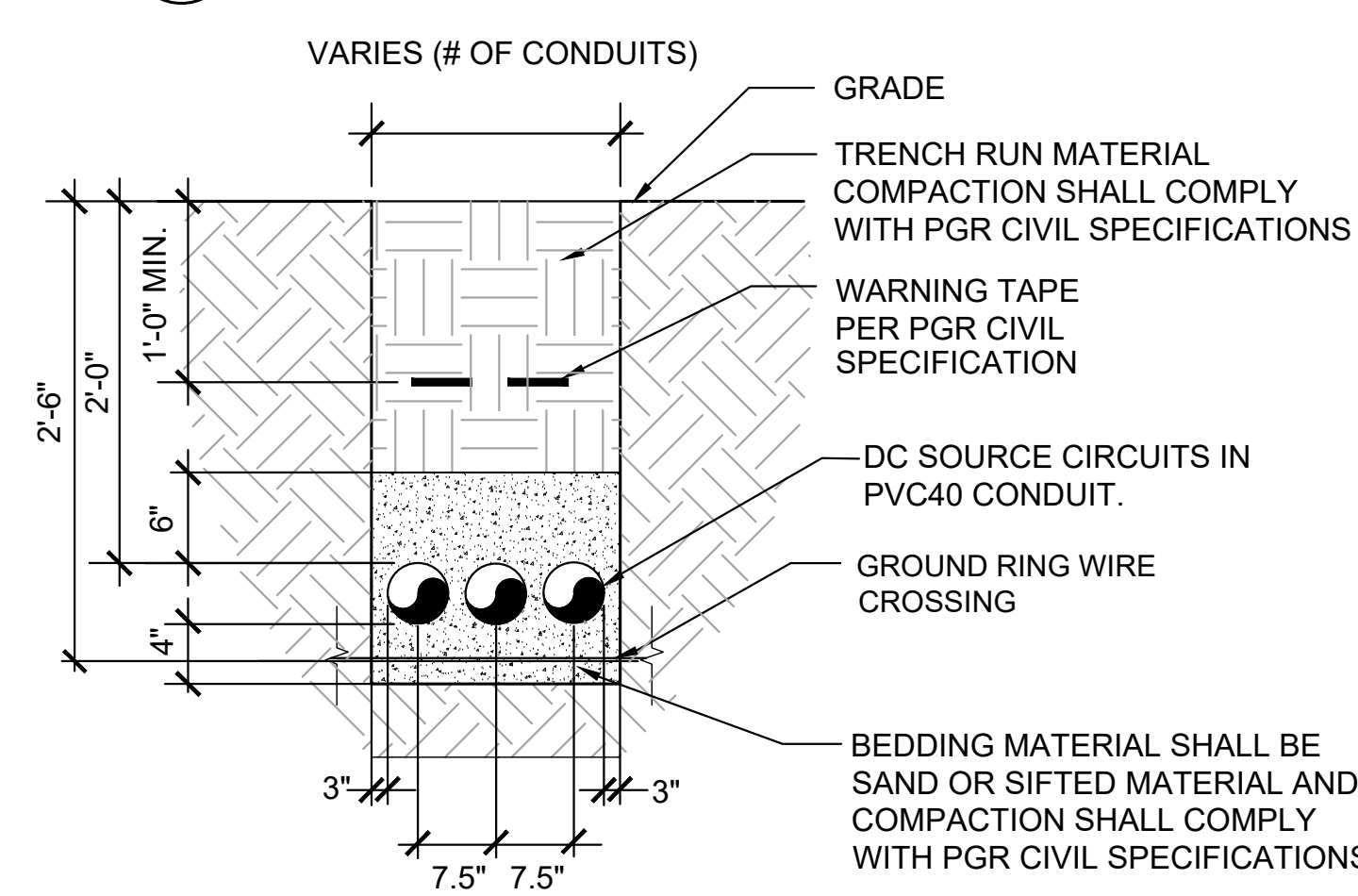
4 DC CIRCUIT TRENCH
SCALE: NTS



5 DC CIRCUIT & INTER-ROW CONDUIT TRENCH
SCALE: NTS



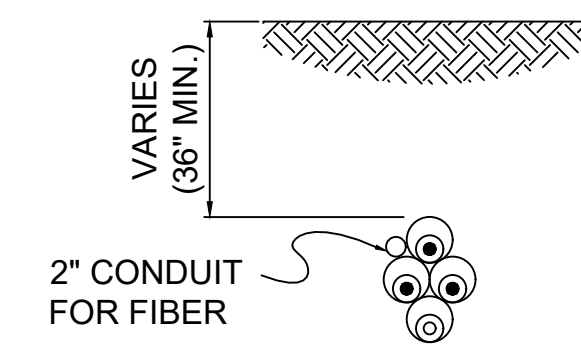
6 RS485 AND AUX POWER CABLE TRENCH
SCALE: NTS



7 DC CIRCUIT CROSSING GROUND RING
SCALE: NTS

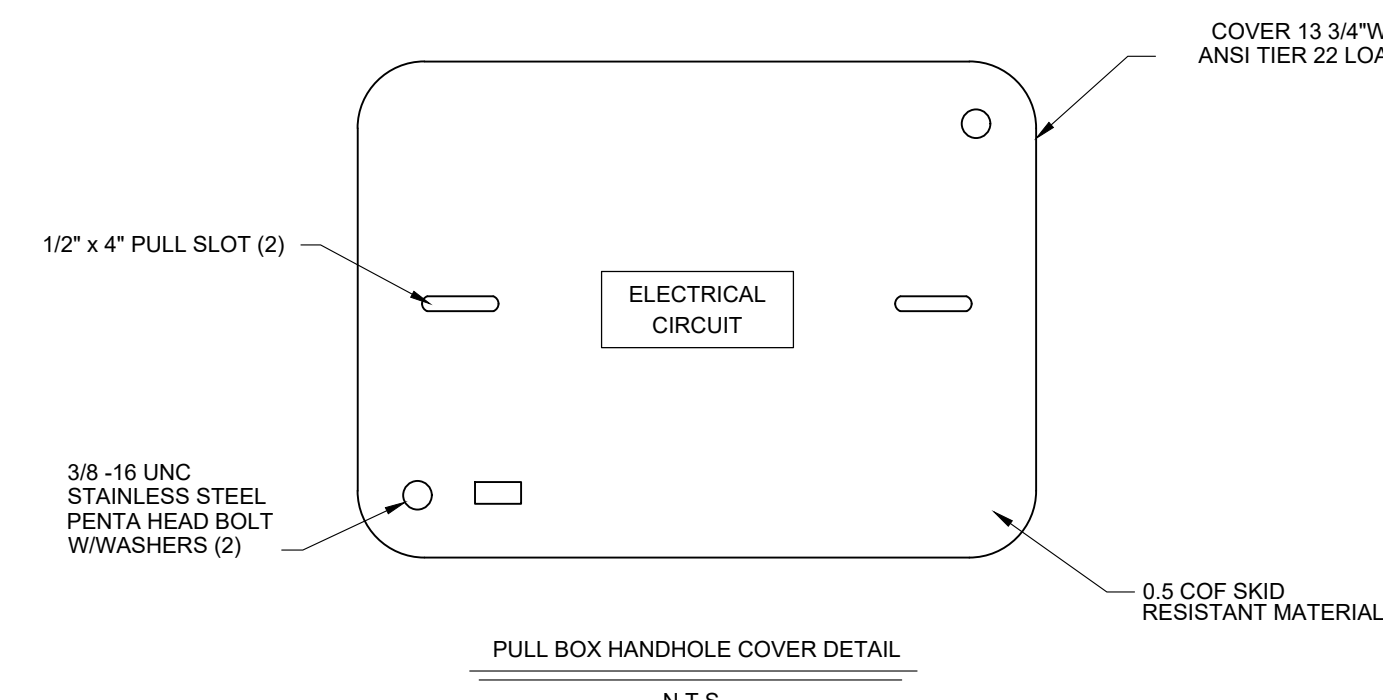
TRENCHING NOTES:

- BACKFILL MATERIAL SHALL BE PER PGR CIVIL SPECIFICATION.
- THE DISTANCE BETWEEN EDGE OF TRENCH AND RACKING SUPPORT PILE SHALL BE 3' OR PER RACKING MANUFACTURER SPECIFICATIONS, WHICHEVER IS GREATER.
- 12" MIN. CLEARANCE SHALL BE MAINTAINED BETWEEN POWER AND CONTROL / COMMUNICATION WIRING.
- NECESSARY COMPACTION OF TRENCHING SHALL OCCUR AFTER A MAXIMUM OF BACKFILL (TYPICALLY 8"-12") HAS BEEN APPLIED AND SHALL BE COMPACTED AND TESTED PER GEOTECH REQUIREMENTS.
- THE NUMBER OF CABLES/CONDUITS SHOWN IS REPRESENTATIVE AND MAY VARY PER THE SITE TRENCHING PLAN.
- EDGE OF TRENCH SHALL BE MIN. OF 36" OFF THE EDGE OF ANY PAD UNLESS APPROVED BY E.O.R.
- SEE GEOTECH REPORT FOR BURIAL DEPTH UNDER ACCESS ROADWAYS. CONDUIT SHALL BE SCHEDULE 80 PVC AND EXTEND 6' PAST EDGE OF ROADWAY.
- SOIL COMPACTION AND MATERIAL SIZE SHALL COMPLY WITH PGR CIVIL SPECIFICATIONS.
- TRENCH BACKFILL MATERIAL REQUIREMENTS (SEE PGR CIVIL SPECIFICATION FOR FULL DESCRIPTION):
 - INITIAL BACKFILL: PLACE AND COMPACT INITIAL BACKFILL FREE OF ANY ANGULAR PARTICLES OF ANY SIZE, ORGANIC OR DELETERIOUS MATERIALS, AND ANY NON-ANGULAR PARTICLES LARGER THAN 3/4-INCH IN ANY DIMENSION FOR UNDERGROUND CONDUIT AND 1/2-INCH IN ANY DIMENSION FOR DIRECT BURIED CONDUCTORS, TO A HEIGHT OF 12-INCHES OVER THE CONDUIT OR CONDUCTORS
 - FINAL BACKFILL: PLACE AND COMPACT FINAL BACKFILL FREE OF ORGANIC OR DELETERIOUS MATERIALS, AND OF ANY PARTICLES LARGER THAN 1" TO FINAL SUBGRADE ELEVATION.
- TRENCH COMPACTION REQUIREMENTS: (SEE PGR CIVIL SPECIFICATION FOR FULL DESCRIPTION):
 - COMPACT SOIL MATERIALS TO NOT LESS THAN THE FOLLOWING PERCENTAGES OF MAXIMUM DRY UNIT WEIGHT ACCORDING TO STANDARD PROCTOR.
 - FOR UTILITY TRENCHES, COMPACT EACH LAYER OF INITIAL AND FINAL BACKFILL SOIL MATERIAL AT 85%
- WARNING TAPE SHALL BE METAL DETECTABLE AND MIN. 6" WIDTH (SEE PGR CIVIL SPECIFICATIONS FOR FULL DESCRIPTION).
- HANDHOLES SHALL BE PROVIDED BY CONTRACTOR. QUANTITY, SIZE AND LOCATION SHALL BE DETERMINED BY CONTRACTOR PER NEC REQUIREMENTS, VENDOR SPECIFICATIONS AND BEST PRACTICES.

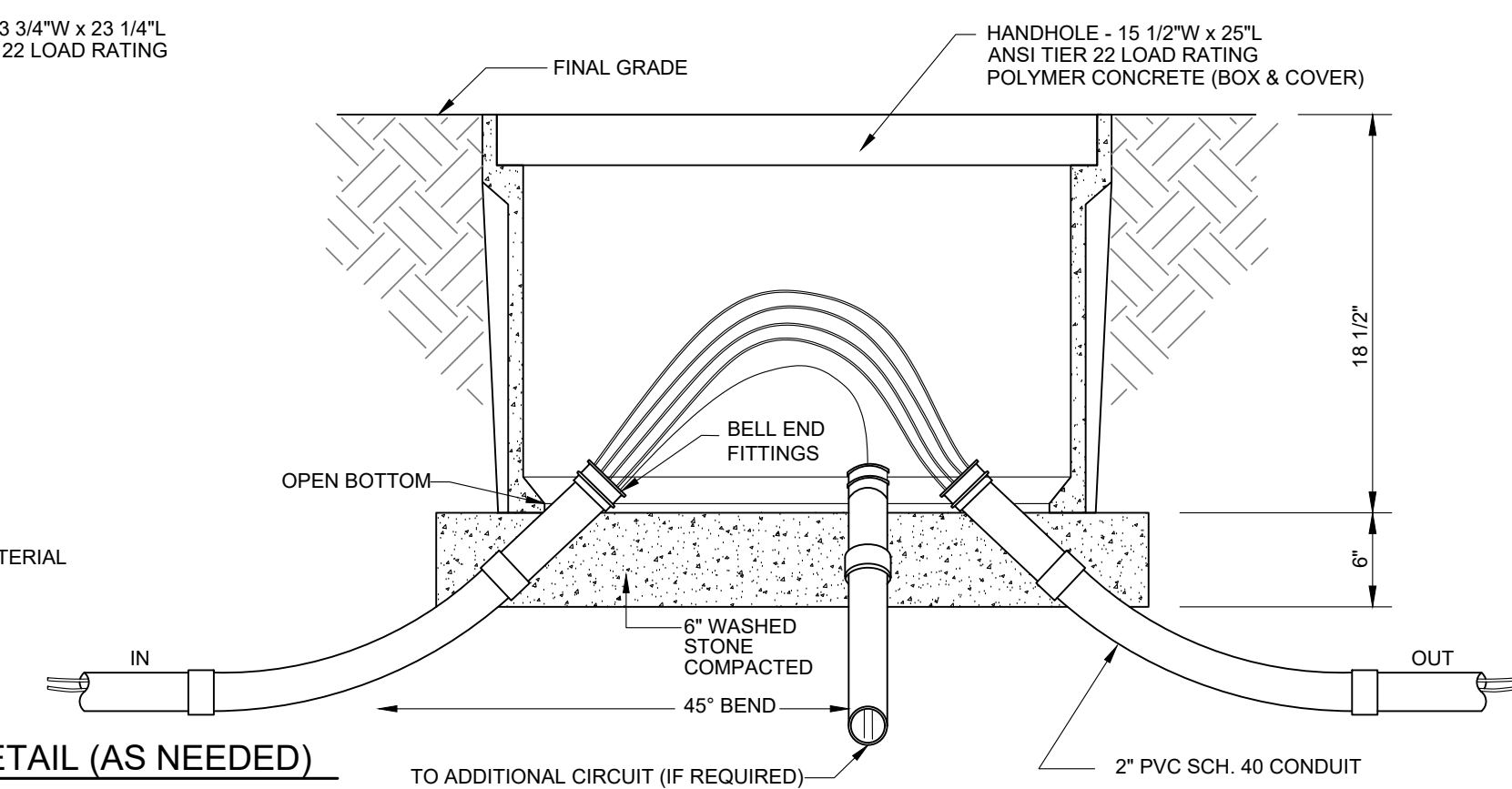


- LEGEND
- ⊙ PROPOSED ACTIVE CIRCUIT CONDUCTOR IN CONDUIT
 - ⊙ PROPOSED SPARE CIRCUIT CONDUCTOR IN CONDUIT
 - PROPOSED GROUNDING CONDUCTOR IN CONDUIT

8 DIRECTIONAL BORE DETAIL
SCALE: NTS

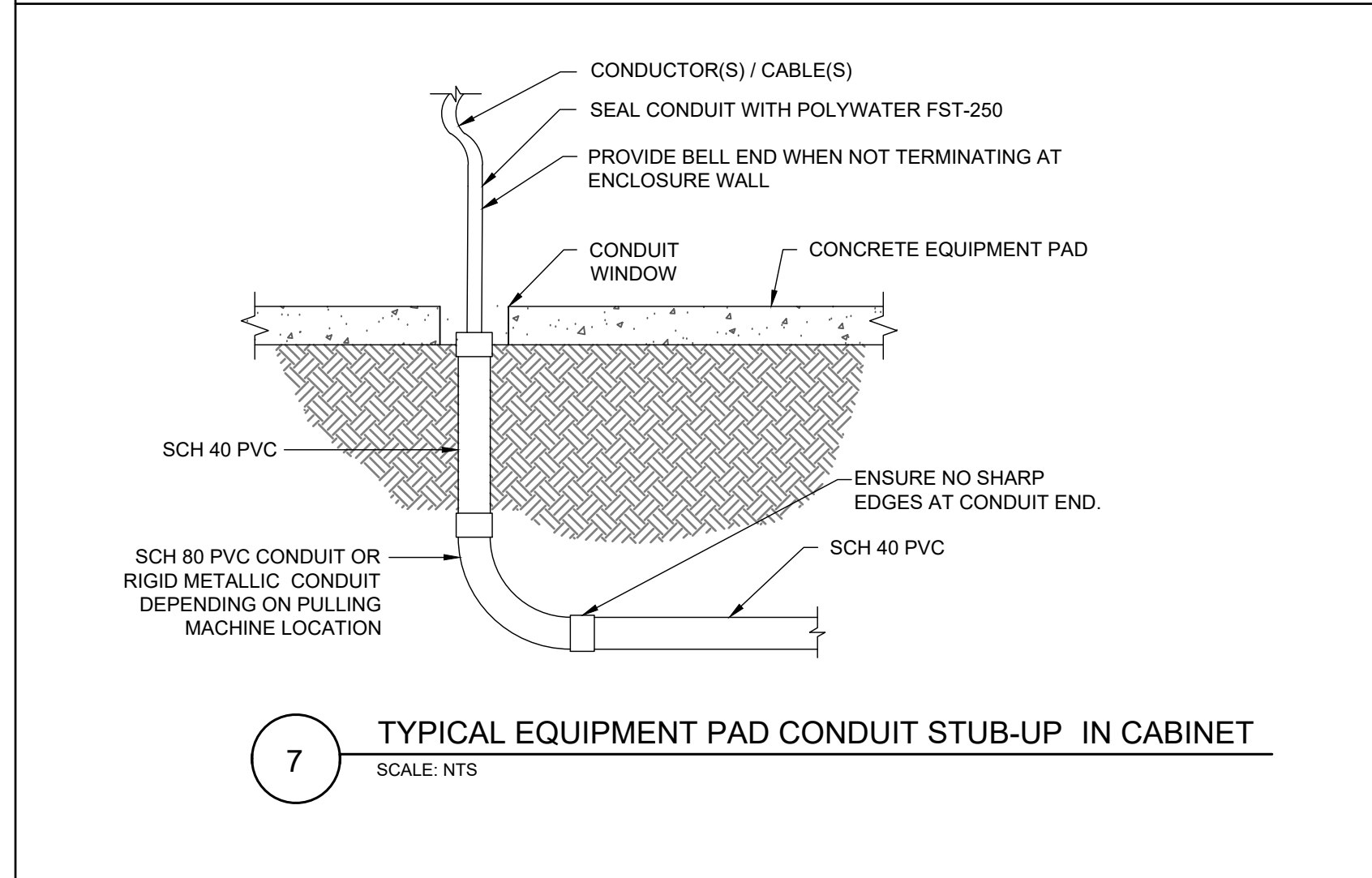
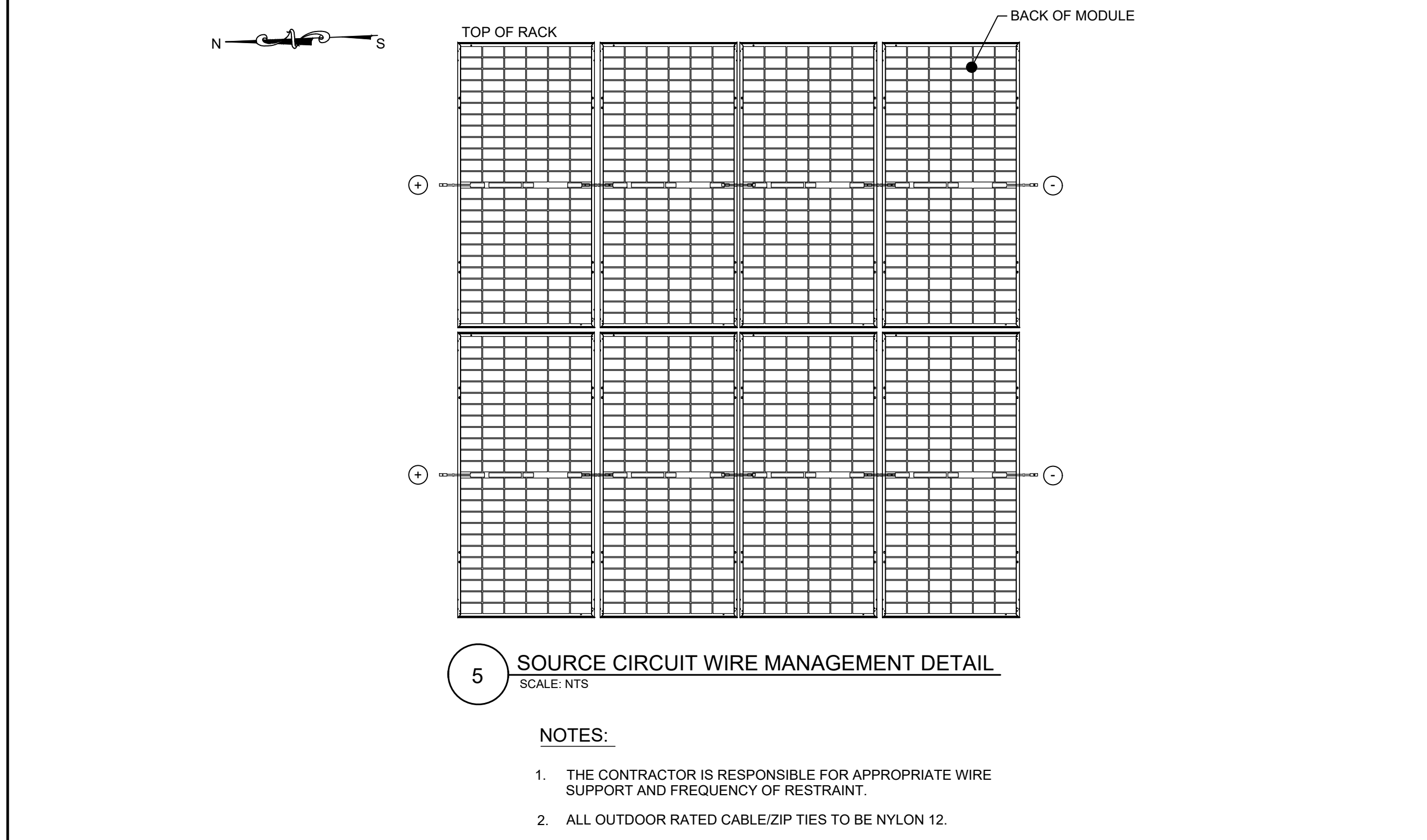
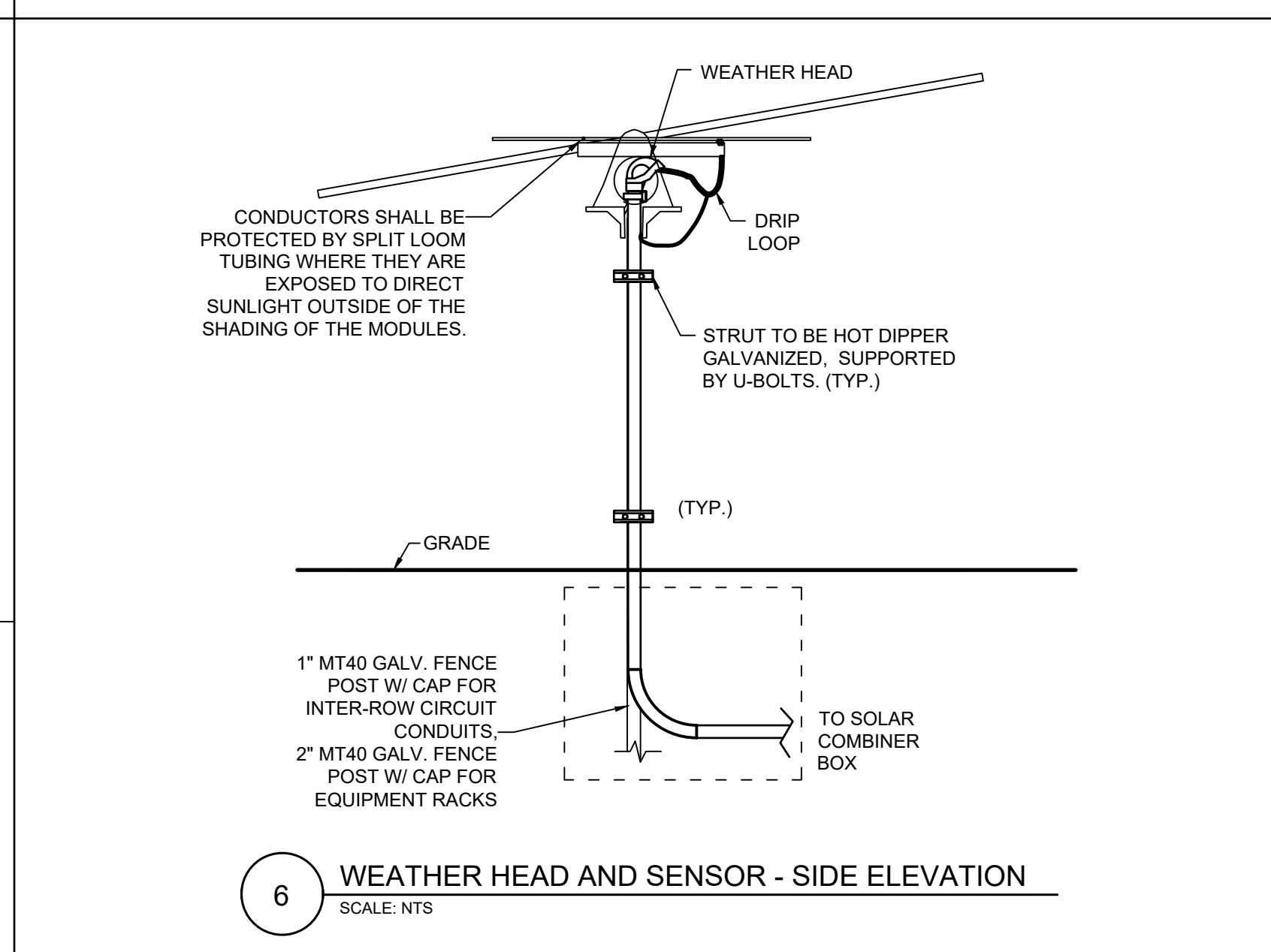
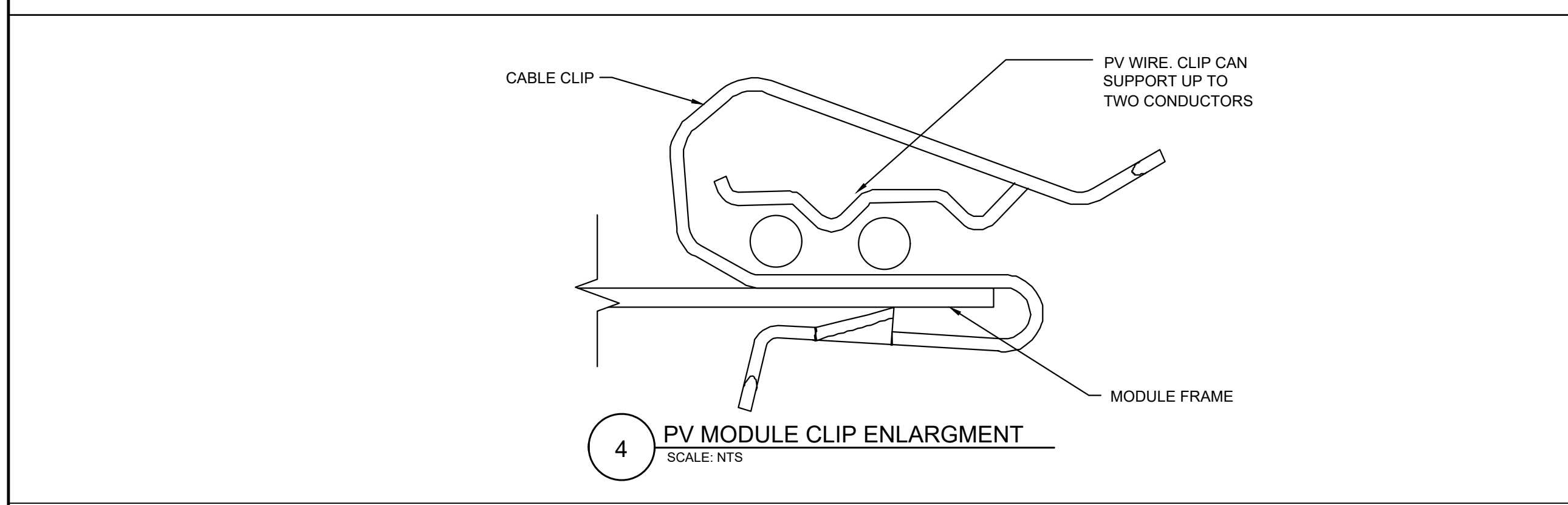
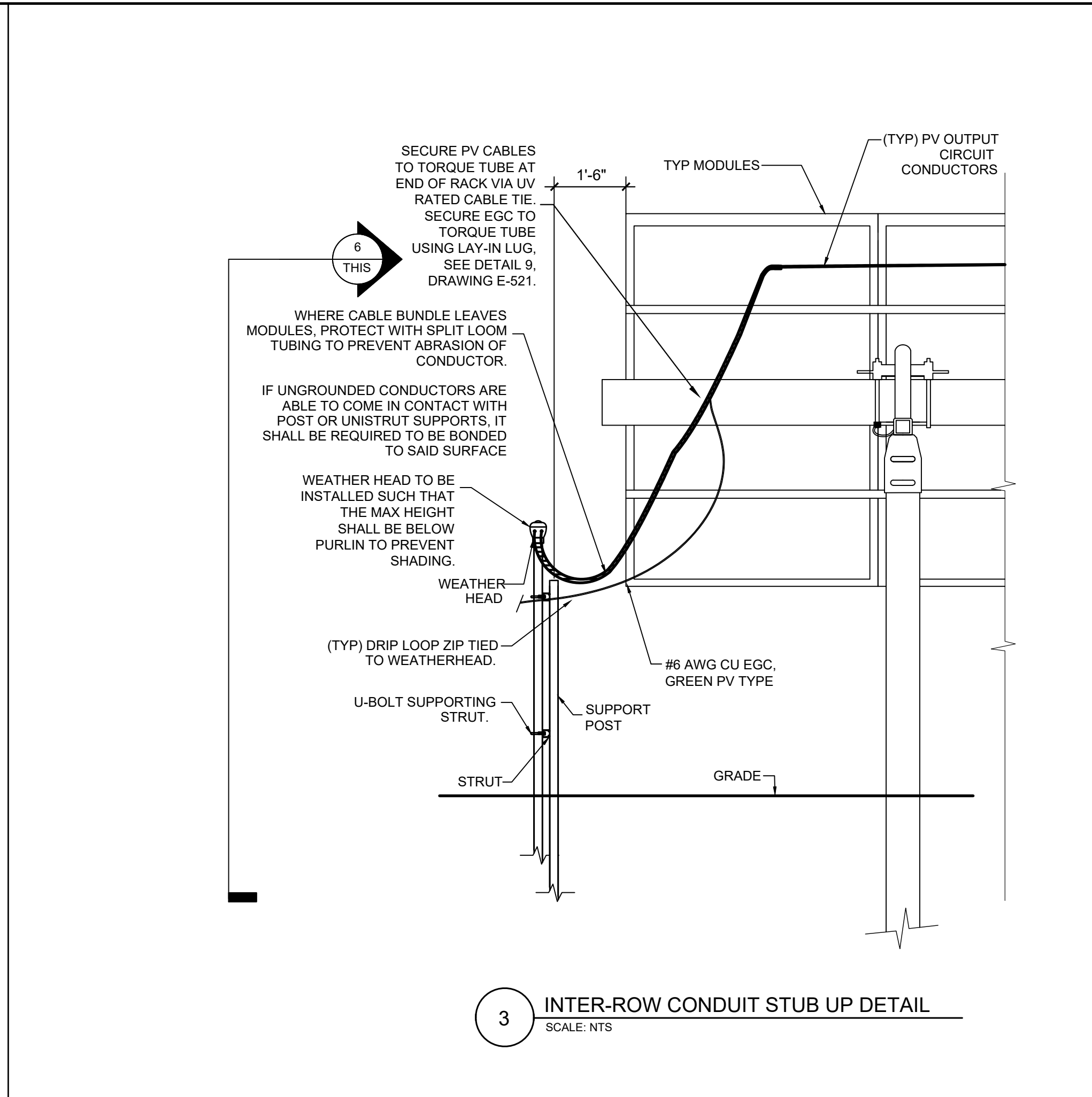
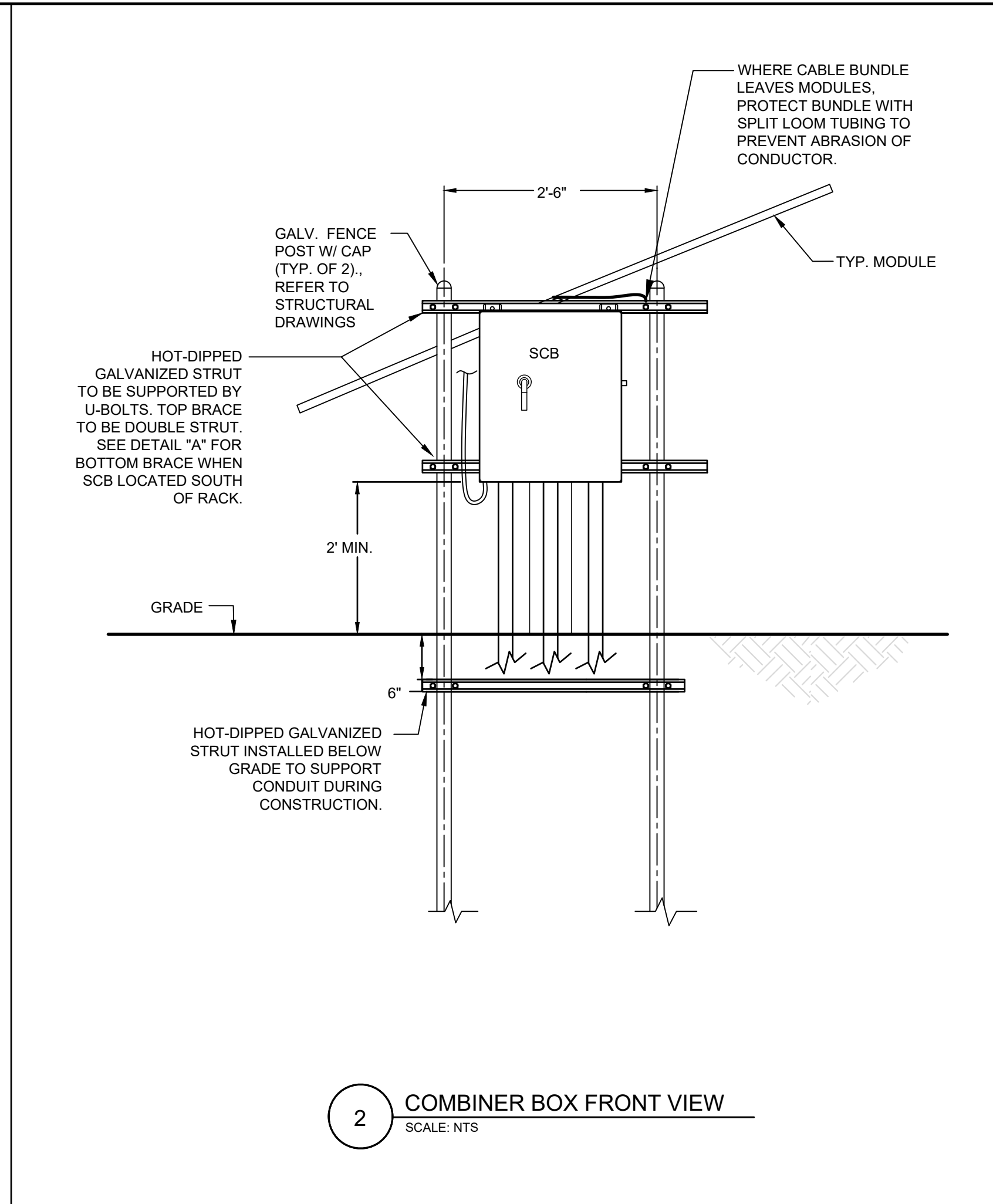
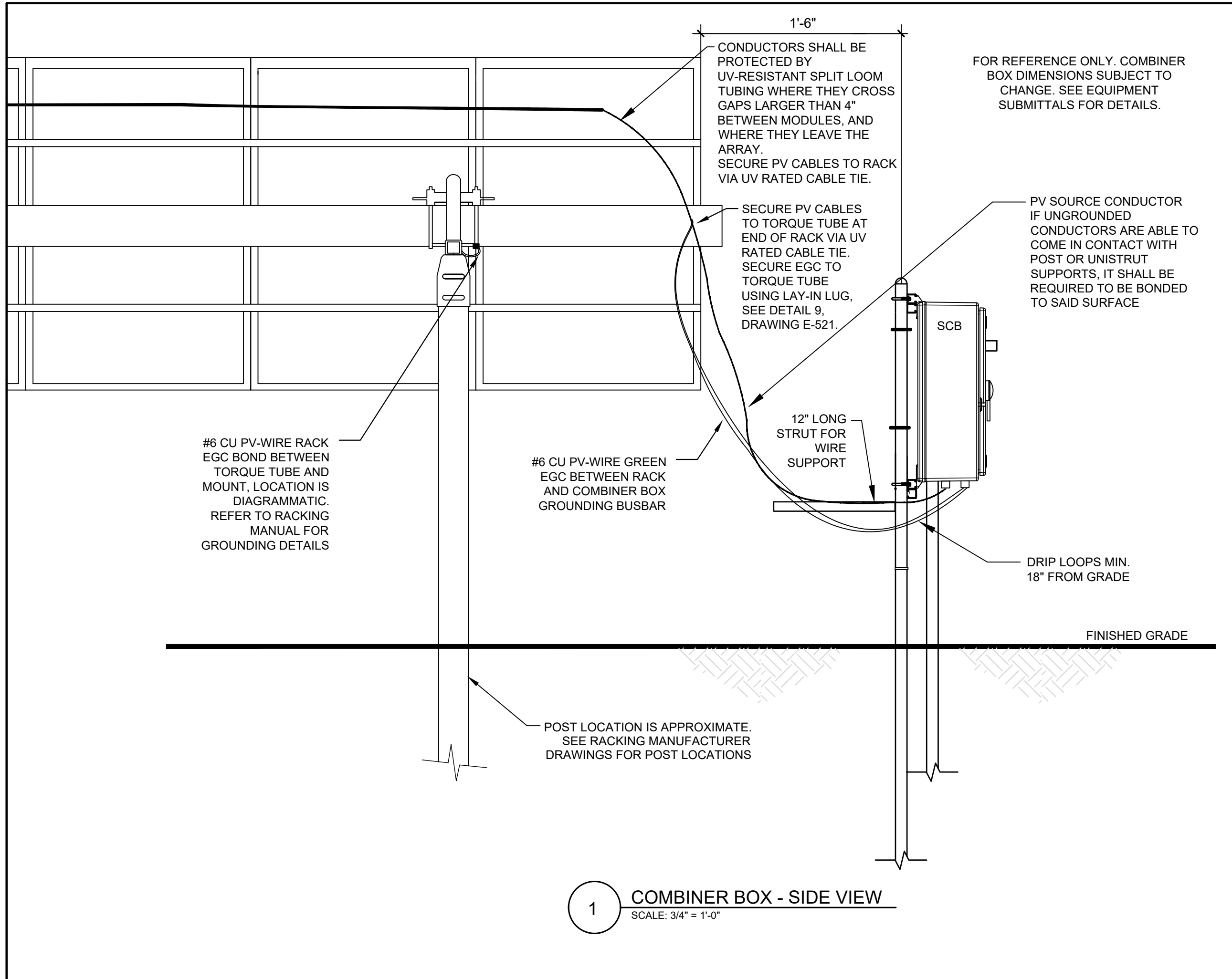


9 PULL BOX HANDHOLE DETAIL (AS NEEDED)
SCALE: N.T.S.



NO.	DATE	ENG.	DATE	REVISIONS
A	05/08/2020	JEH		ISSUED FOR PERMIT

STATION NAME:	CLOVELLY SOLAR ELECTRIC POWER PLANT
DRAWING TITLE:	ELECTRICAL DETAILS
DRAWN BY:	ALH
CHECKED BY:	EDR
APPROVED BY:	JEH
DATE:	05/01/2020
SCALE:	NTS
FILE NUMBER:	69965
SHEET:	E-252



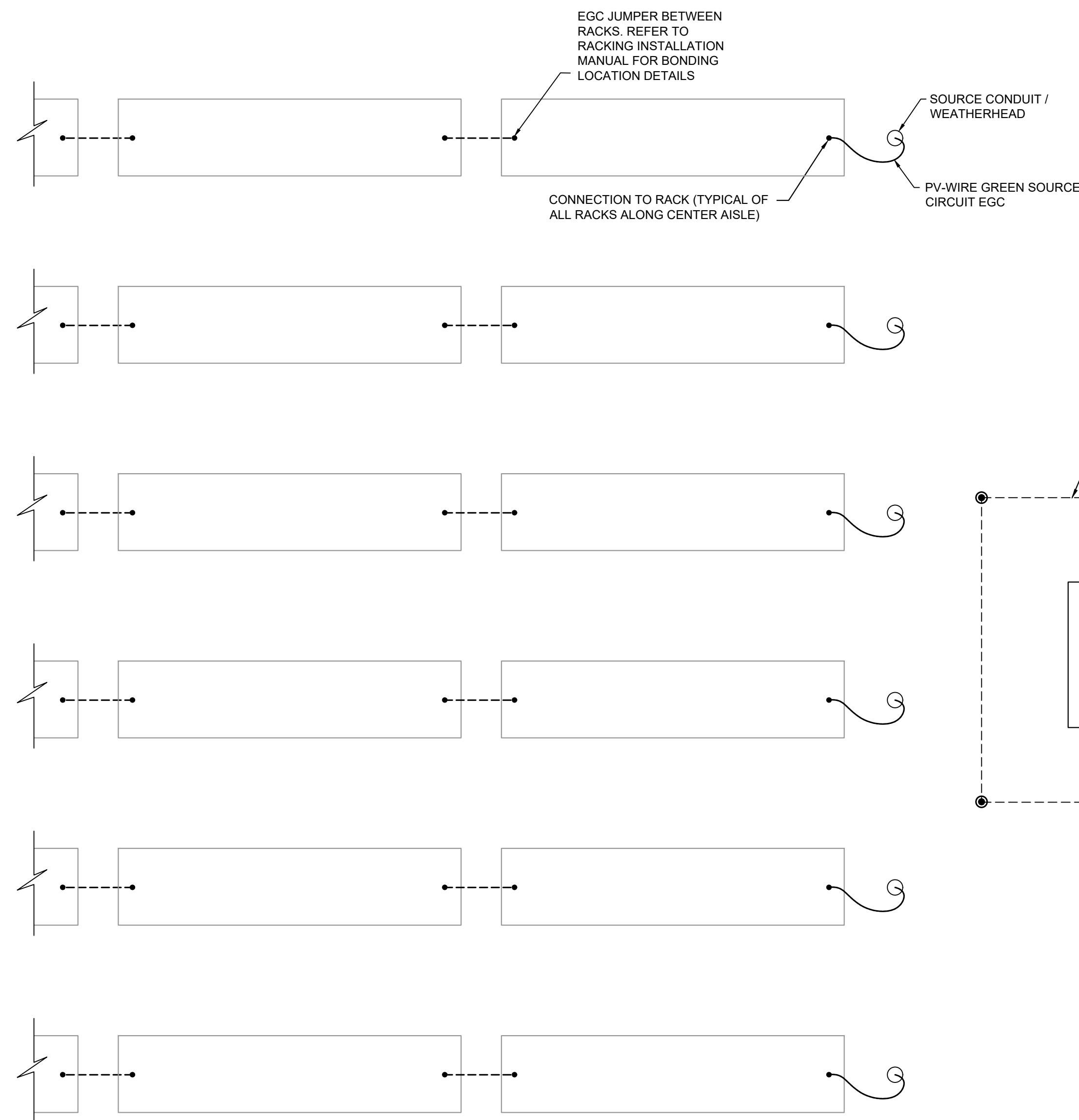
- TRANSITION NOTES:
1. THE WIDTH OF THE UNISTRUT SUPPORT MAY BE ADJUSTED TO SUIT THE NUMBER OF CONDUITS BEING SUPPORTED.
 2. THE 90° ELBOWS MAY BE ROTATED TO SUIT DIRECTION OF TRANSITION.
 3. ABOVE GROUND CONDUIT AND FITTINGS WILL BE SCH 80 WHEN EXPOSED AND SCH 40 WHEN INSIDE CABINET, BELOW GROUND ALL WILL BE SCH 40.
 4. EACH CONDUIT IS TO HAVE ITS OWN INDIVIDUAL GROUNDING CONDUCTOR.

- CONDUIT NOTES:
1. 90° ELBOW SHALL BE INSTALLED WITH THE FLARED END UP.
 2. TRENCHES WILL BE MARKED WITH FLAGS PRIOR TO CONSTRUCTION.
 3. LOCATION OF INTER ROW STUB UP SUPPORTS WILL BE MARKED WITH A STAKE BY SURVEYOR PRIOR TO CONSTRUCTION.
 4. TOTAL DEPTH OF TRENCH TO BE DETERMINED BY THE FIELD.
 5. FIELD TO APPLY TAPE AS NEEDED TO GROUP CONDUCTORS WHILE LAYING IN TRENCH.
 6. ALL CONDUIT SLEEVES SHALL BE FOAMED BEFORE CLOSE OF CONSTRUCTION USING POLYWATER SEALANT.

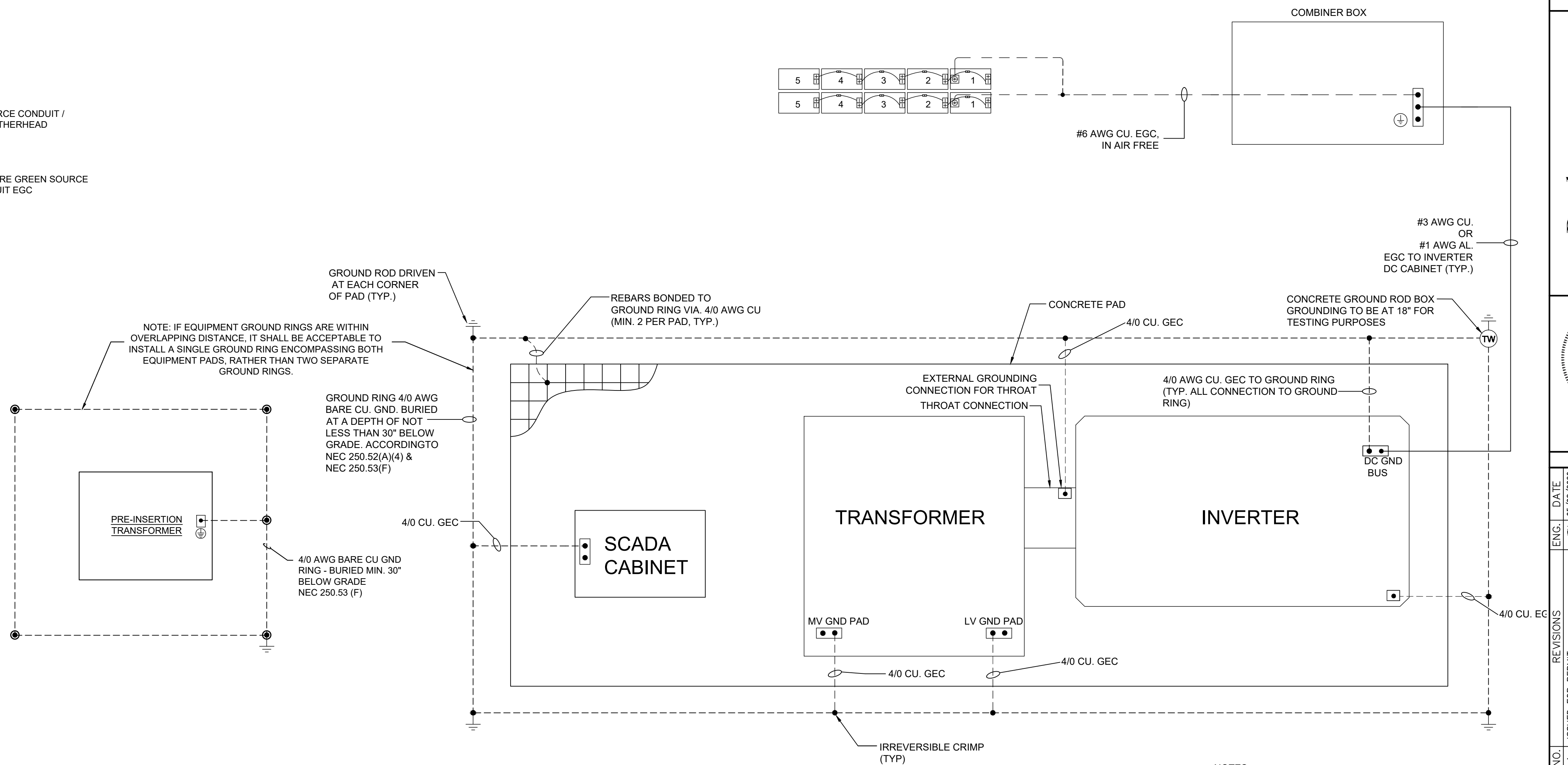
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NO.	DATE	ENG.	DATE
A	05/08/2020	JEH	

NO.	REVISIONS
A	ISSUED FOR PERMIT



1 PV ARRAY FIELD GROUNDING DIAGRAM
SCALE: NTS



2 EQUIPMENT PAD LAYOUT GROUNDING
SCALE: NTS

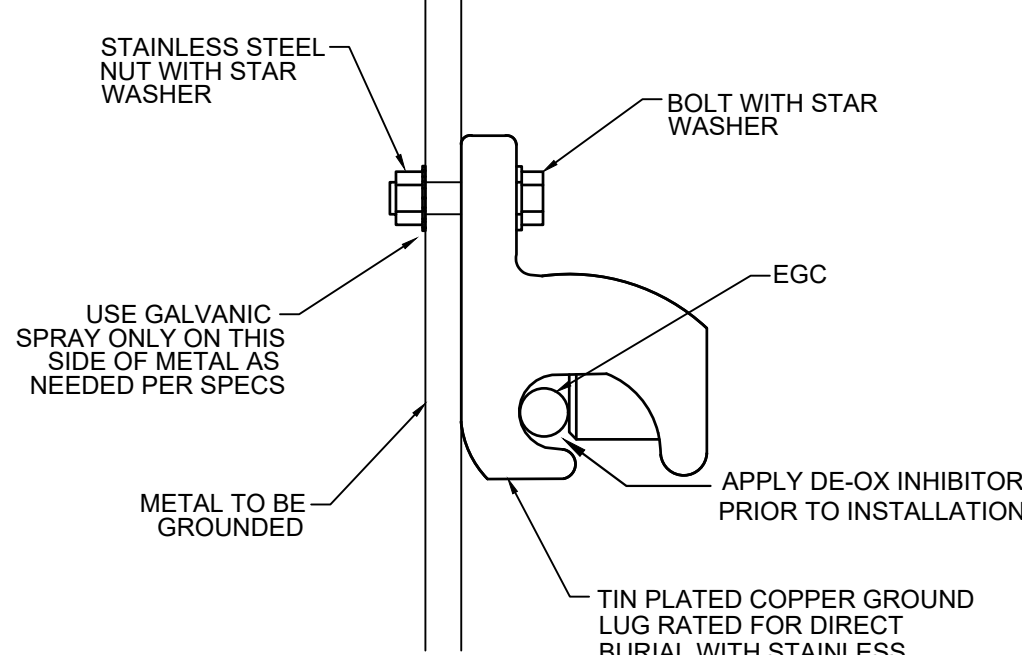
NOTES
1. REFER TO SUNGROW OPERATING MANUAL FOR GROUNDING INSTRUCTIONS.

NO.	DATE	ENG.	DATE
A	05/08/2020	JEH	
REVISIONS			
ISSUED FOR PERMIT			

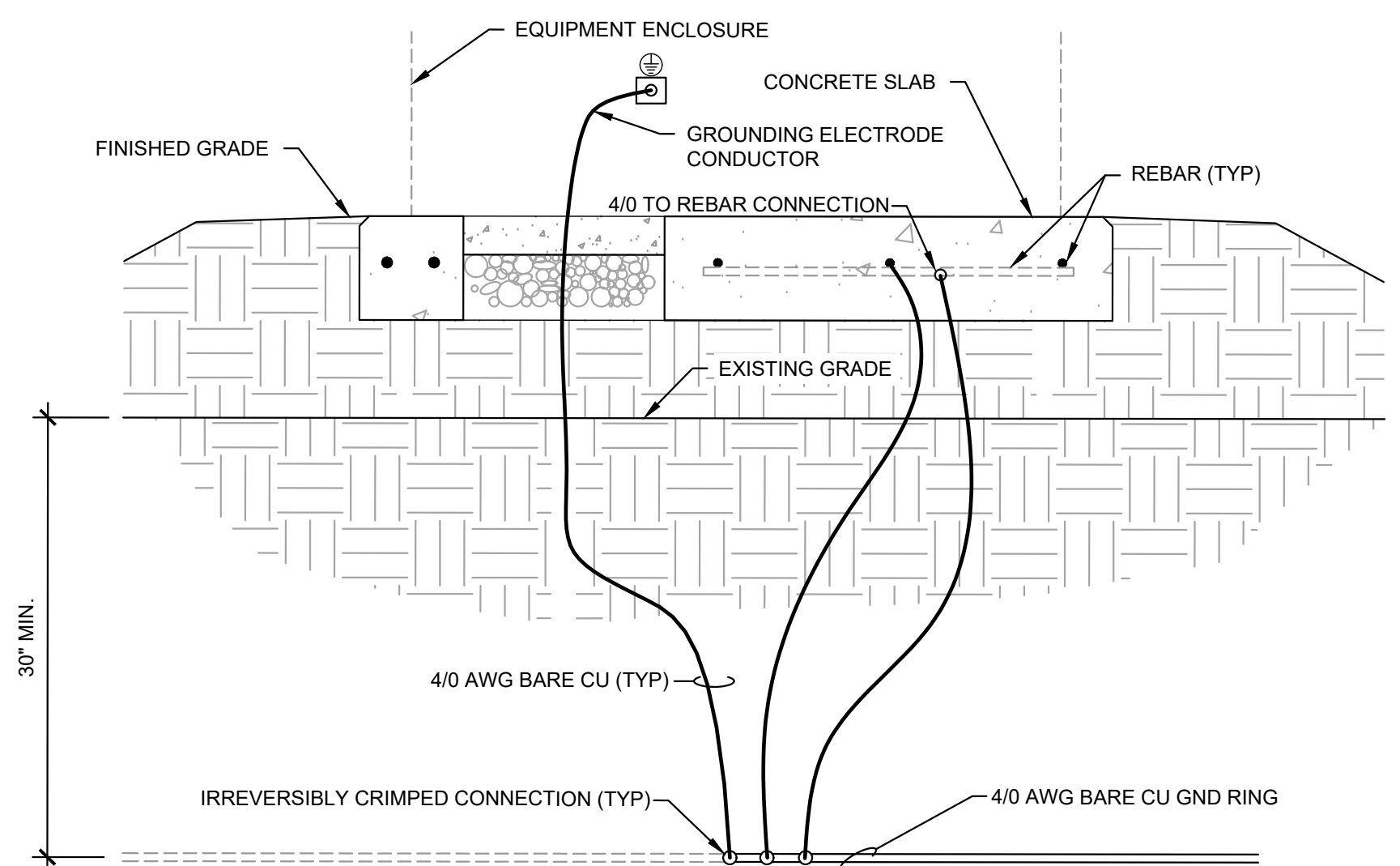
STATION NAME:	CLOVELLY SOLAR ELECTRIC POWER PLANT
DRAWING TITLE:	ELECTRICAL GROUNDING DETAILS
DRAWN BY:	ALH
CHECKED BY:	EDR
APPROVED BY:	JEH
DATE:	05/01/2020
SCALE:	NTS
FILE NUMBER:	69965
SHEET:	E-260

NO.	DATE	ENG.	DATE	REVISIONS
A	05/08/2020	JEH		ISSUED FOR PERMIT

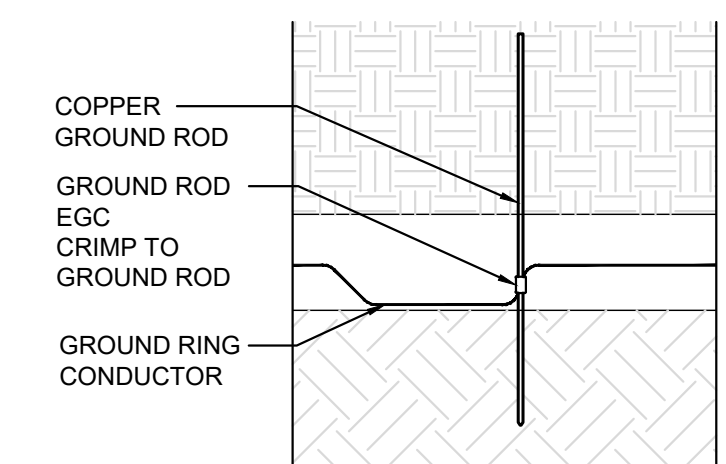
STATION NAME:	CLOVELLY SOLAR ELECTRIC POWER PLANT
DRAWING TITLE:	ELECTRICAL GROUNDING DETAILS
DRAWN BY:	ALH
CHECKED BY:	EDR
APPROVED BY:	JEH
DATE:	05/01/2020
SCALE:	NTS
FILE NUMBER:	69965
SHEET:	E-261



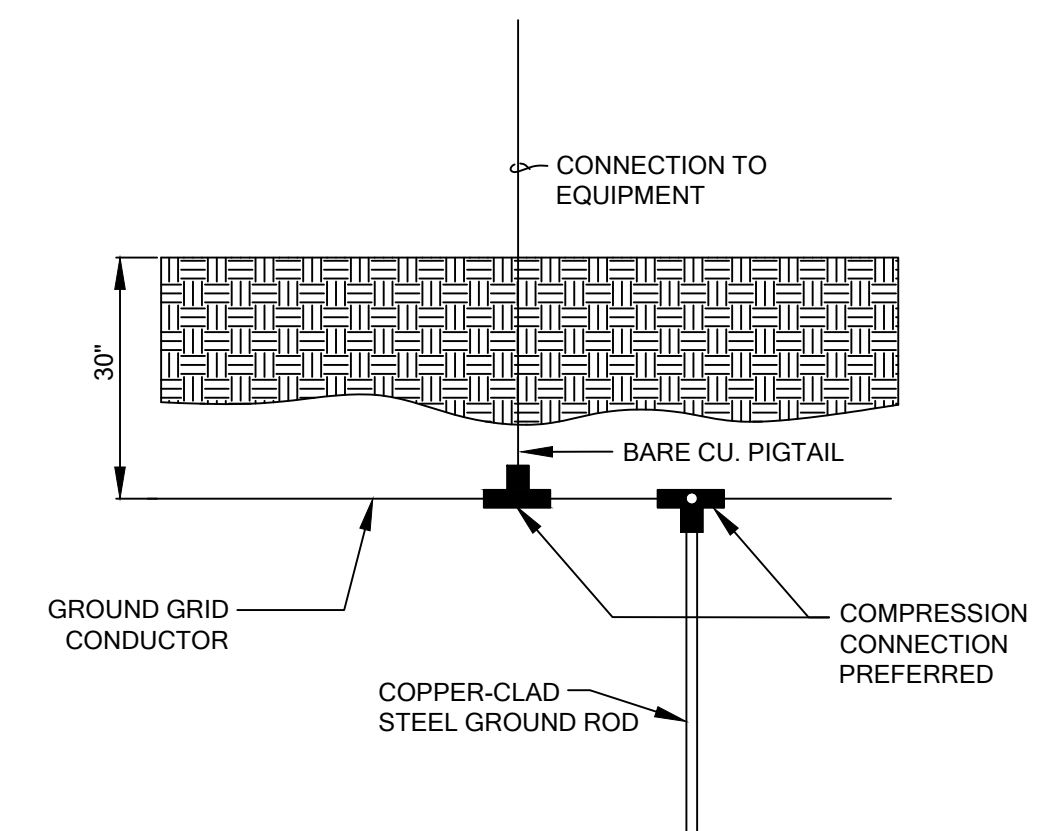
9 LAY-IN LUG GROUNDING DETAIL
SCALE: 3/4" = 1'-0"



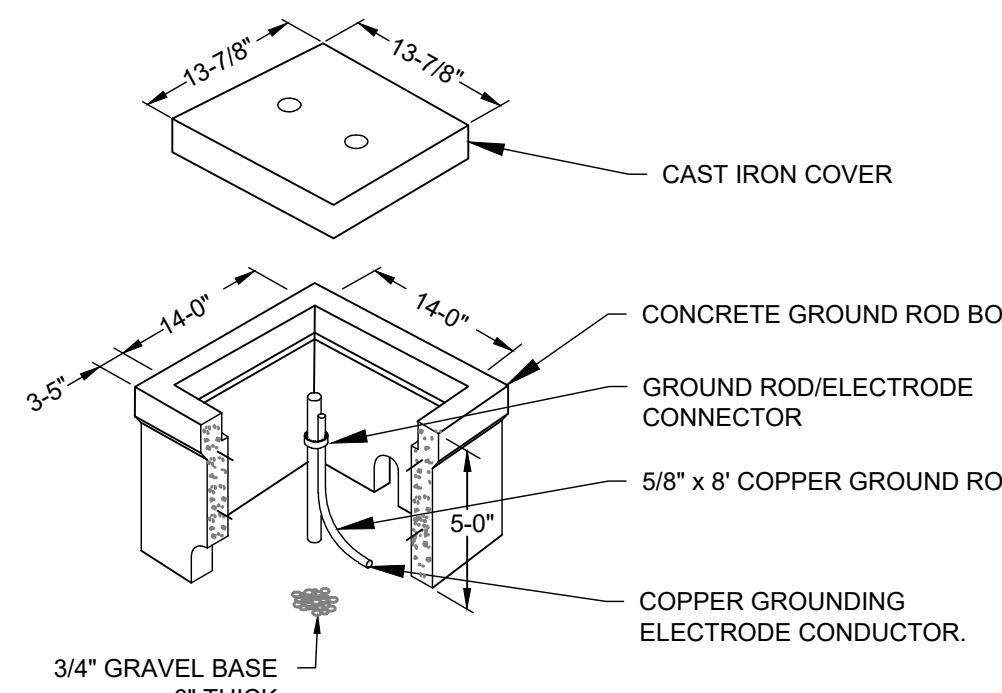
7 EQUIPMENT GROUNDING DETAIL
SCALE: 1" = 1'-0"



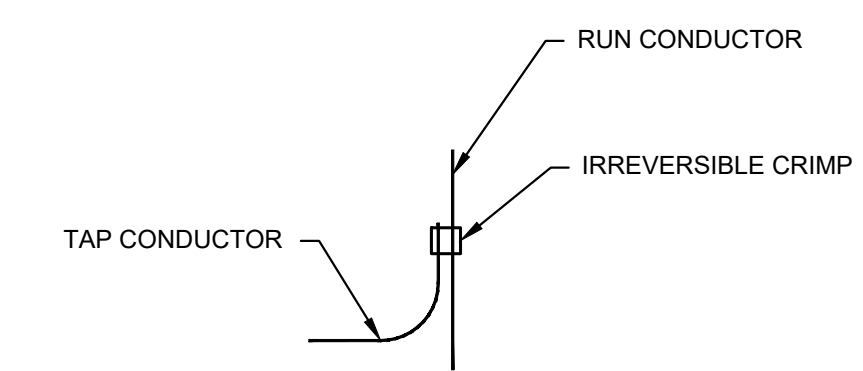
4 GROUND RING GROUND ROD DETAIL
SCALE: 1/2" = 1'-0"



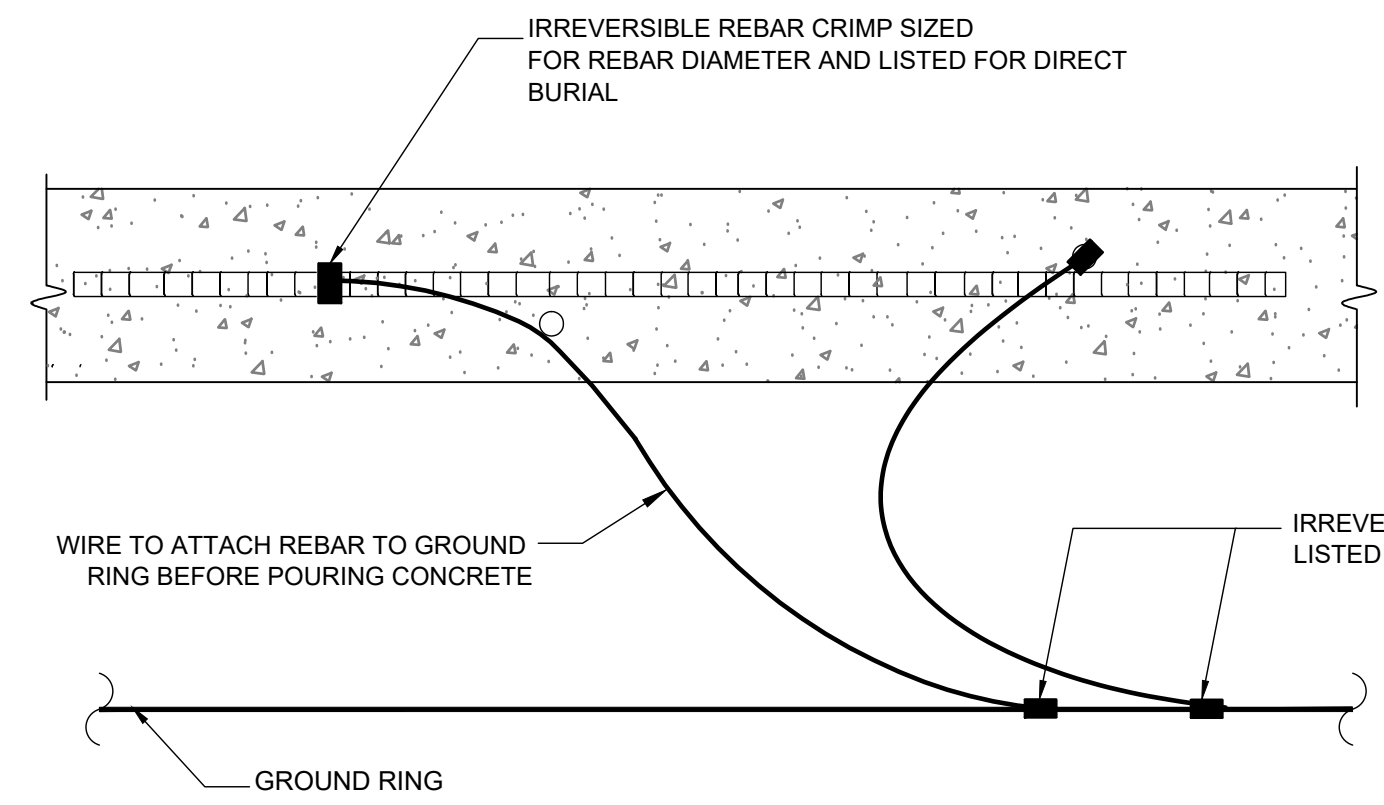
3 GROUND ROD DETAIL
SCALE: 1/2" = 1'-0"



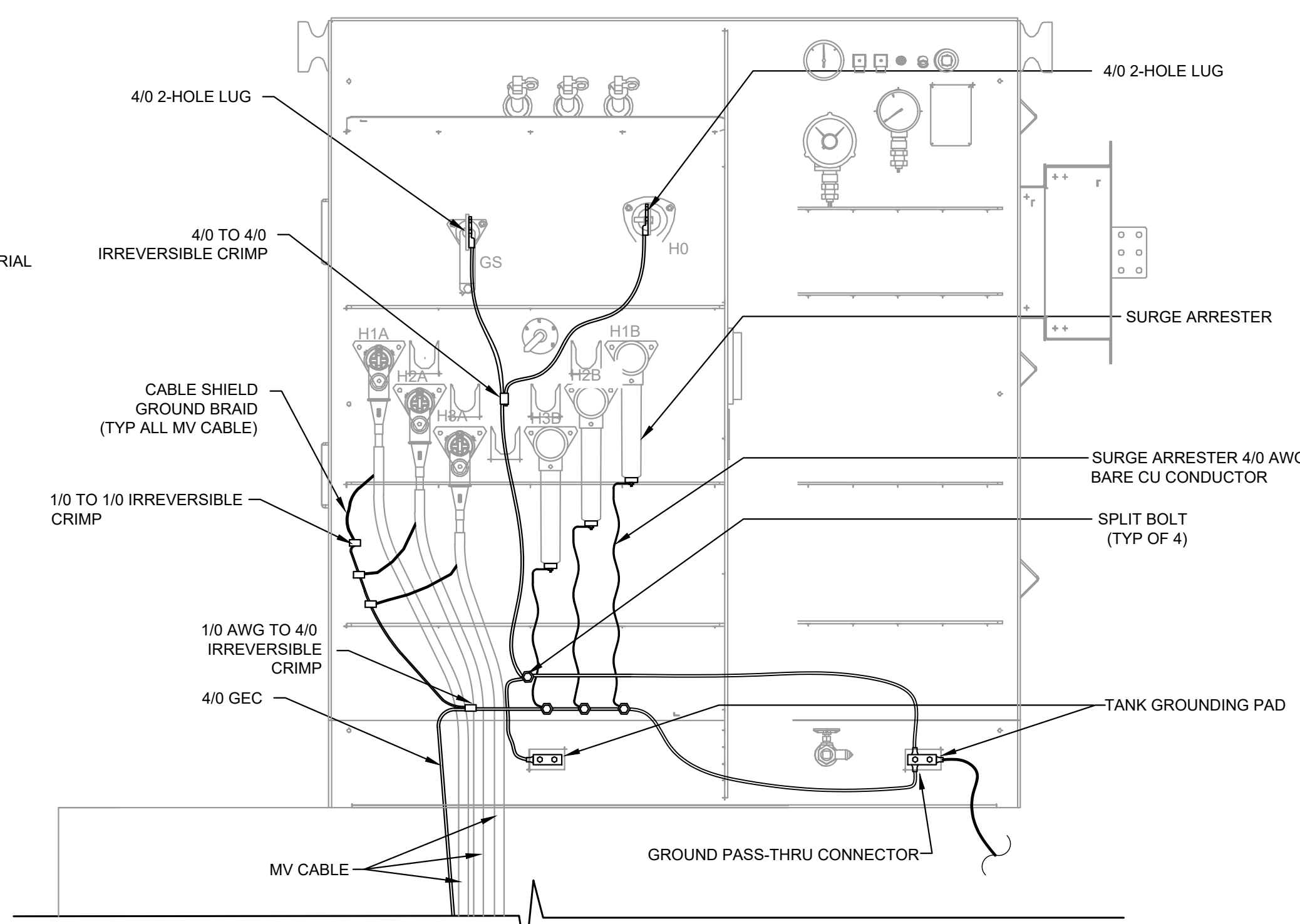
5 CONCRETE GROUND ROD BOX
SCALE: NTS



2 IRREVERSIBLE CRIMP GROUND ROD DETAIL
SCALE: NTS

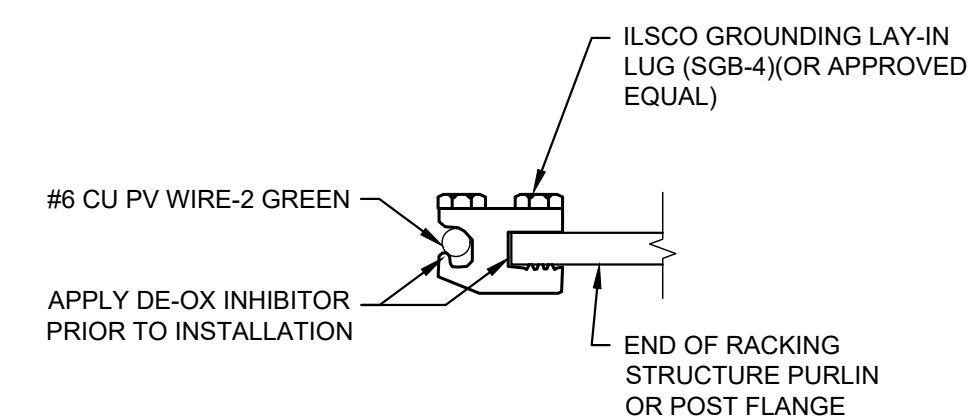


8 EQUIPMENT PAD GROUNDING
SCALE: NTS



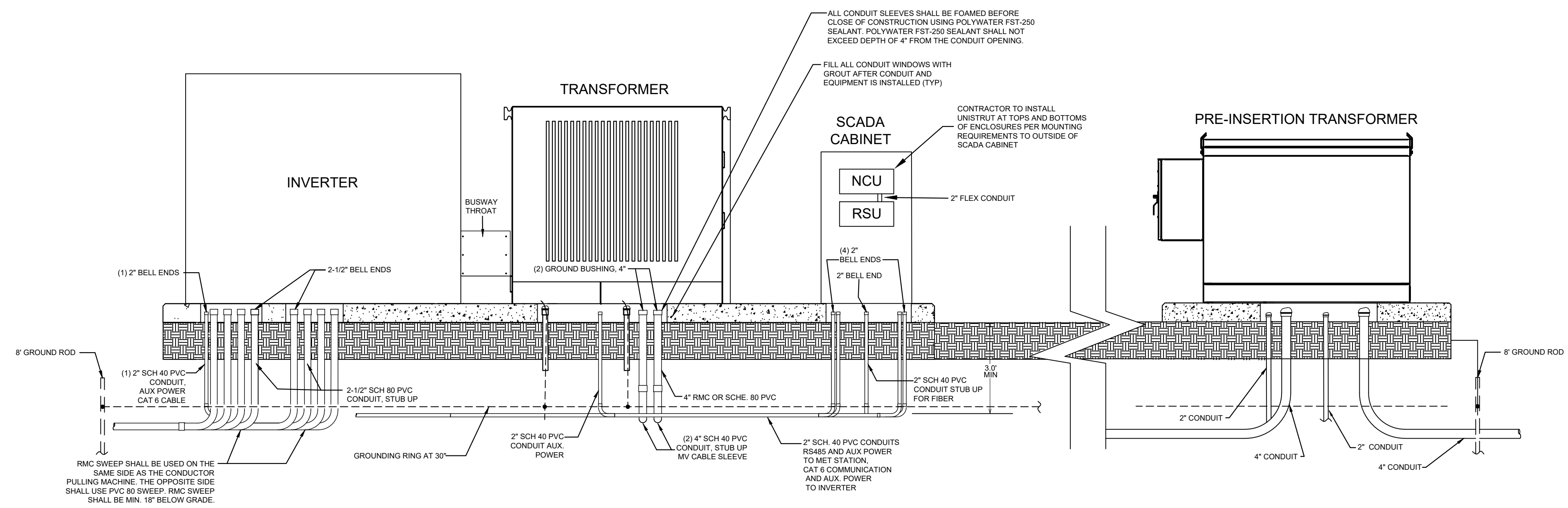
6 EQUIPMENT GROUNDING DETAIL
SCALE: 1" = 1'-0"

NOTE:
1. SURGE ARRESTER INSTALLED ONLY IN LAST TRANSFORMER IN MV CIRCUIT. ALL OTHER TRANSFORMERS WILL HAVE MV ELBOW CONNECTORS TERMINATED ON TRANSFORMER BUSHINGS.

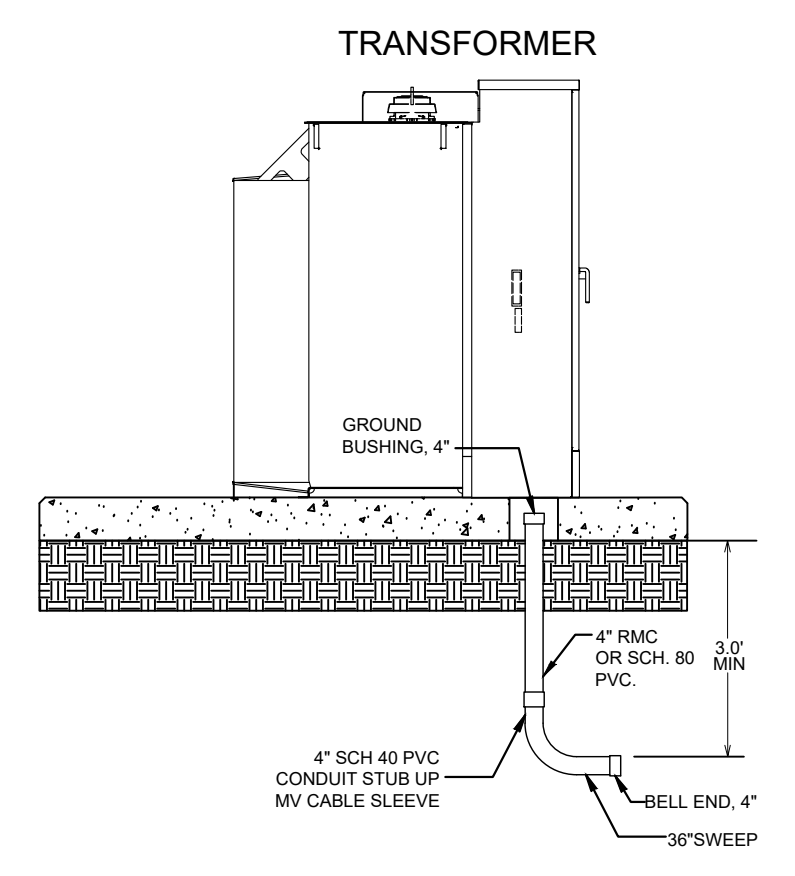


1 PV GROUNDING LAY-IN LUG DETAIL
SCALE: NTS

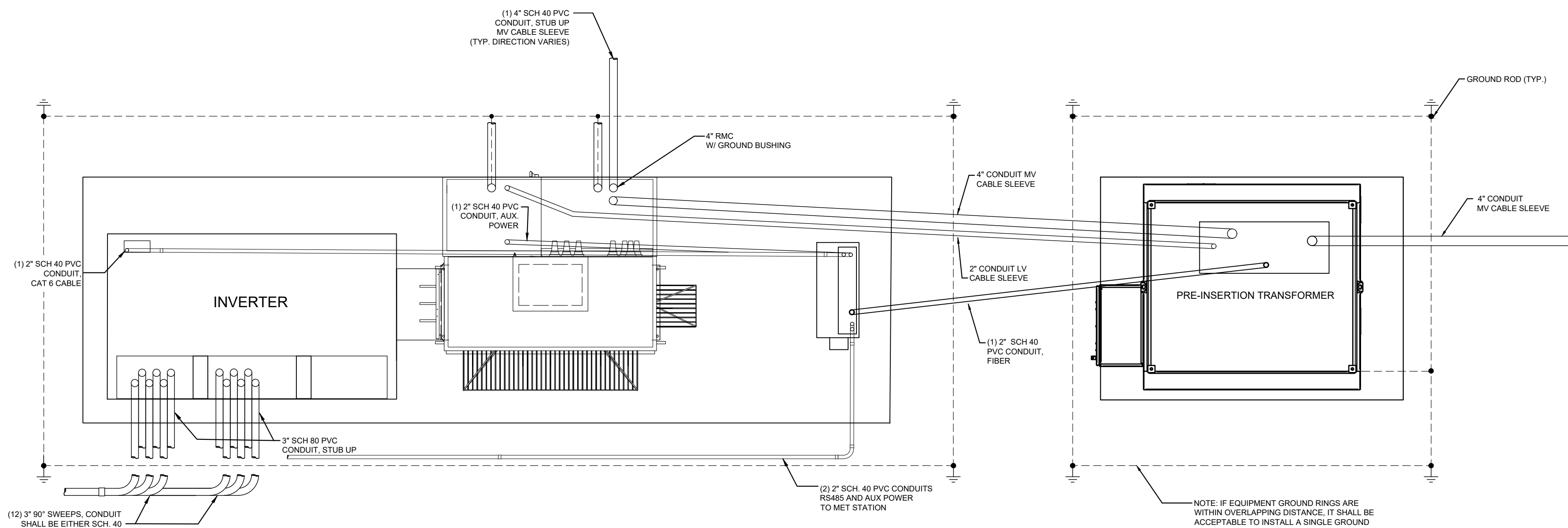
NOTES:
1. ALL IRREVERSIBLY CRIMPED CONDUCTORS SHALL FIRST BE BRUSHED CLEAN OF DIRT AND FOREIGN PARTICLES PRIOR TO CRIMPING.



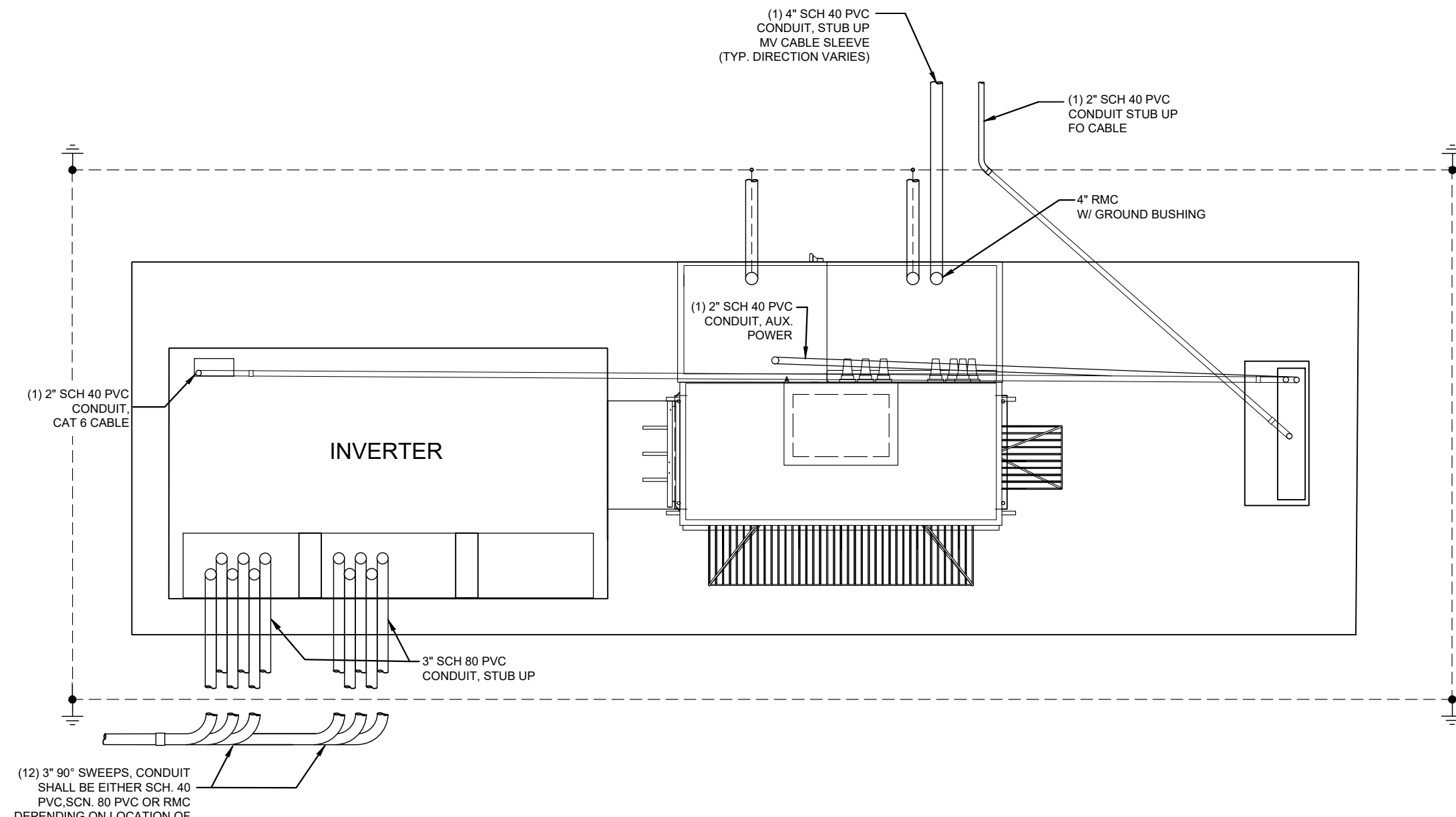
1 EQUIPMENT PAD - FRONT VIEW
SCALE: NTS



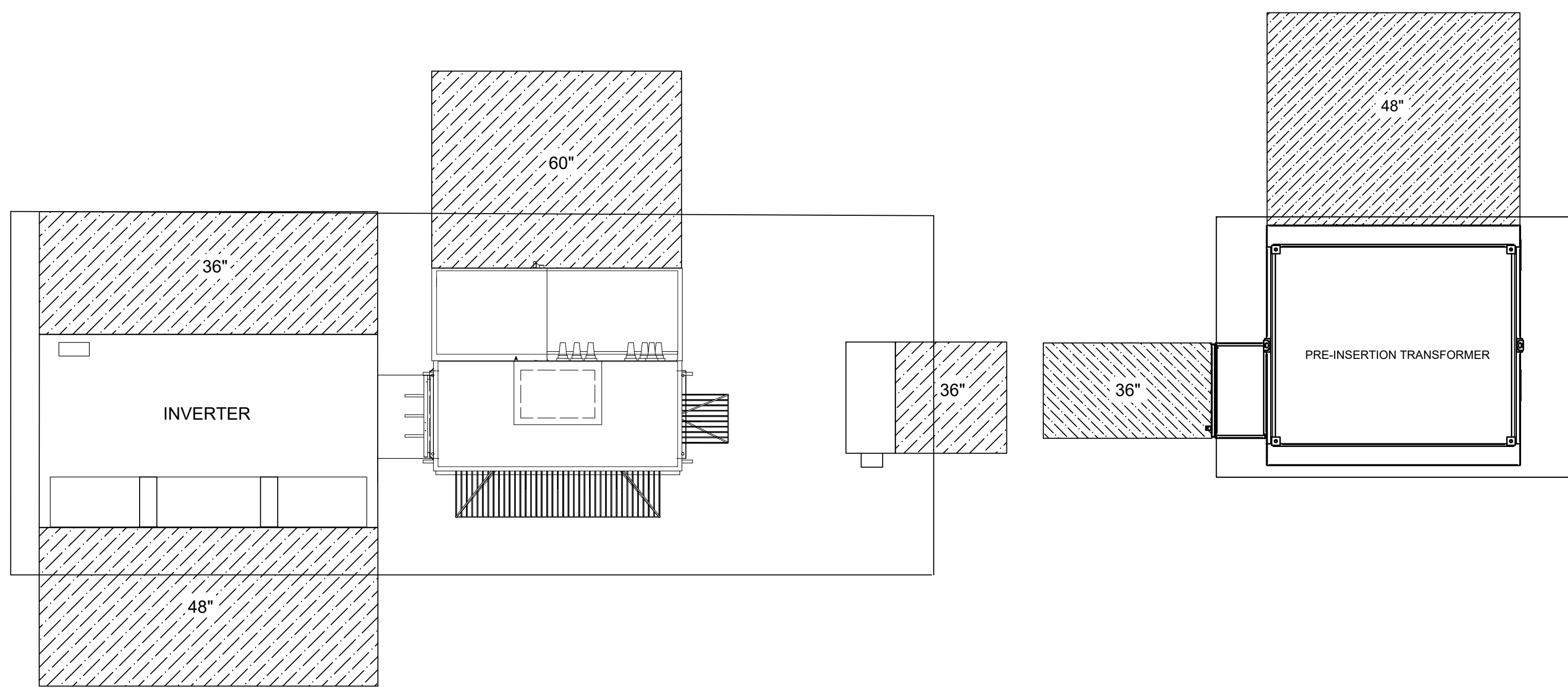
2 EQUIPMENT PAD - SIDE VIEW
SCALE: NTS



3A EQUIPMENT PAD 1 - PLAN VIEW
SCALE: NTS



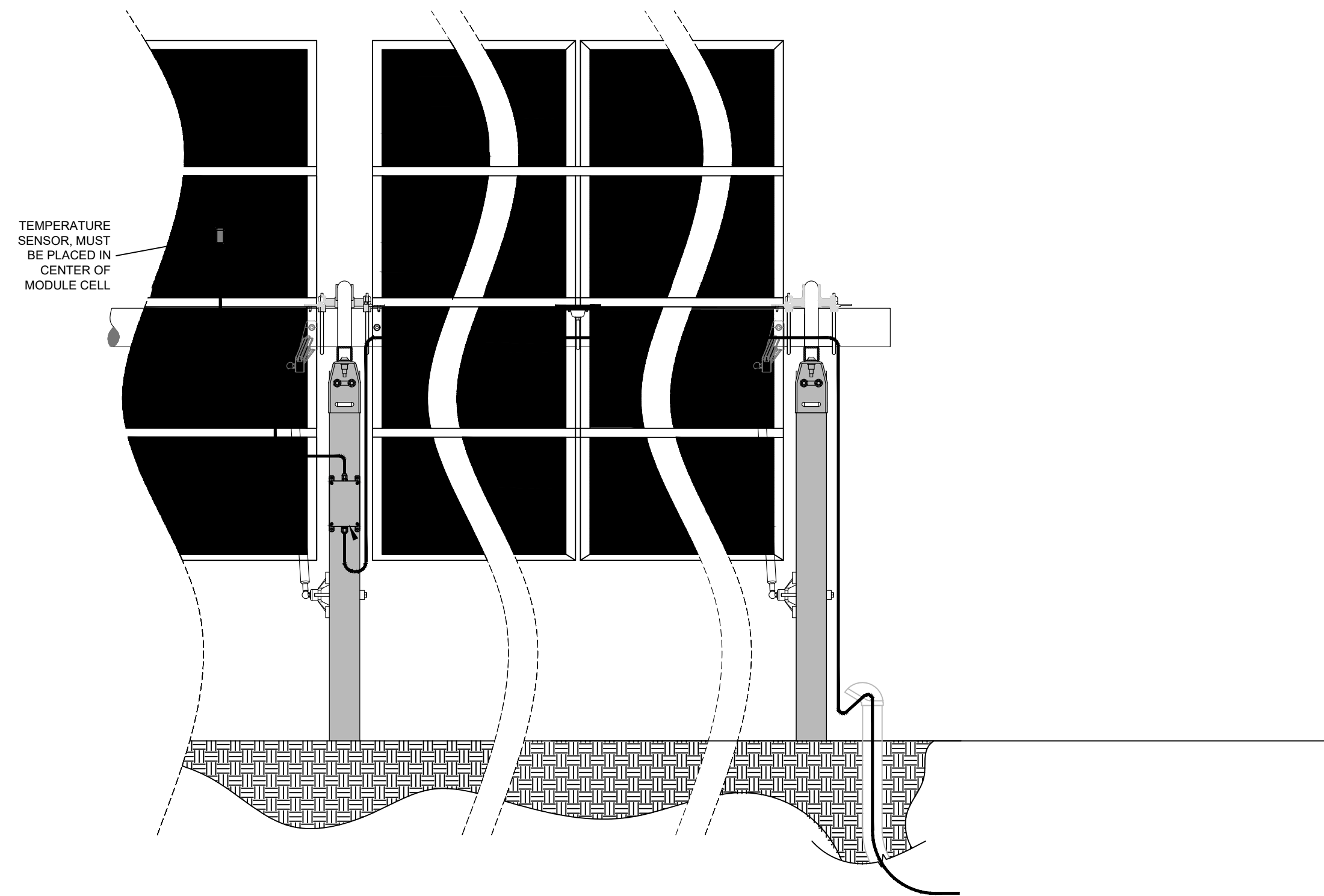
3B EQUIPMENT PAD 2 - PLAN VIEW
SCALE: NTS



4 WORKING CLEARANCE PLAN
SCALE: NTS

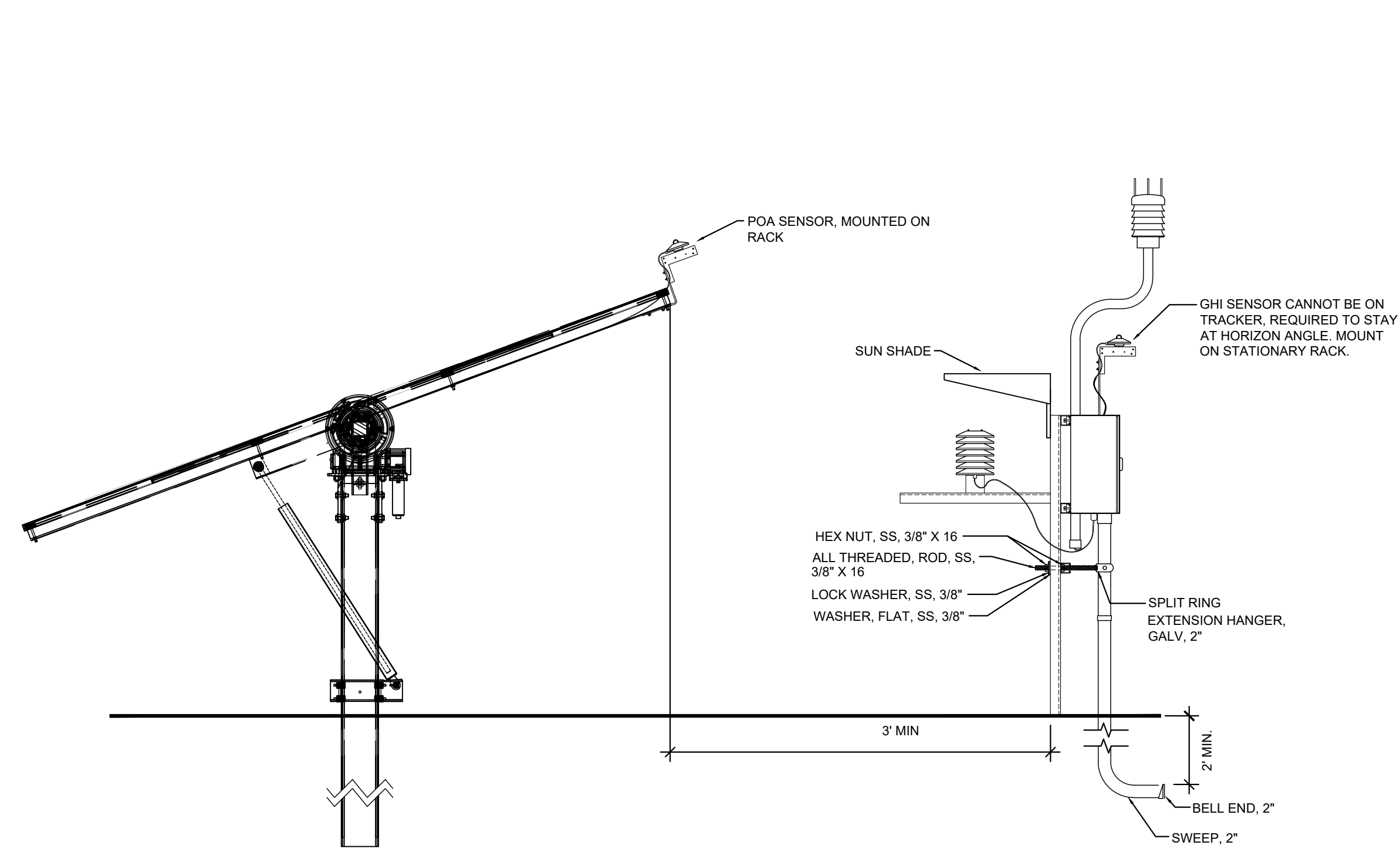
- NOTES:**
- SEE ARRAY WIRING PLAN(S) FOR EQUIPMENT PAD LOCATIONS ON SITE.
 - REFER TO SHEET W-520 FOR GROUNDING DETAILS AND REQUIREMENTS.
 - REFER TO SHEET W-801 FOR FOUNDATION DETAILS.
 - ALL CONDUIT ROUTING IS DIAGRAMMATIC. FINAL CONDUIT ROUTING SHALL BE FIELD COORDINATED BY CONTRACTOR AND APPROVED BY OWNER.
 - REFER TO VENDOR RECORD DRAWINGS FOR ALL EQUIPMENT WINDOWS TO PROPERLY PLACE CONDUIT LOCATIONS ENTERING EQUIPMENT.
 - REFER TO INVERTER MANUAL FOR PROPER DC CONDUCTOR LANDING LOCATIONS IN REGARDS TO DC INPUT MONITOR MAPPING AS APPLICABLE.

NO.	REVISIONS	ENG.	DATE
A	ISSUED FOR PERMIT	JEH	05/09/2020

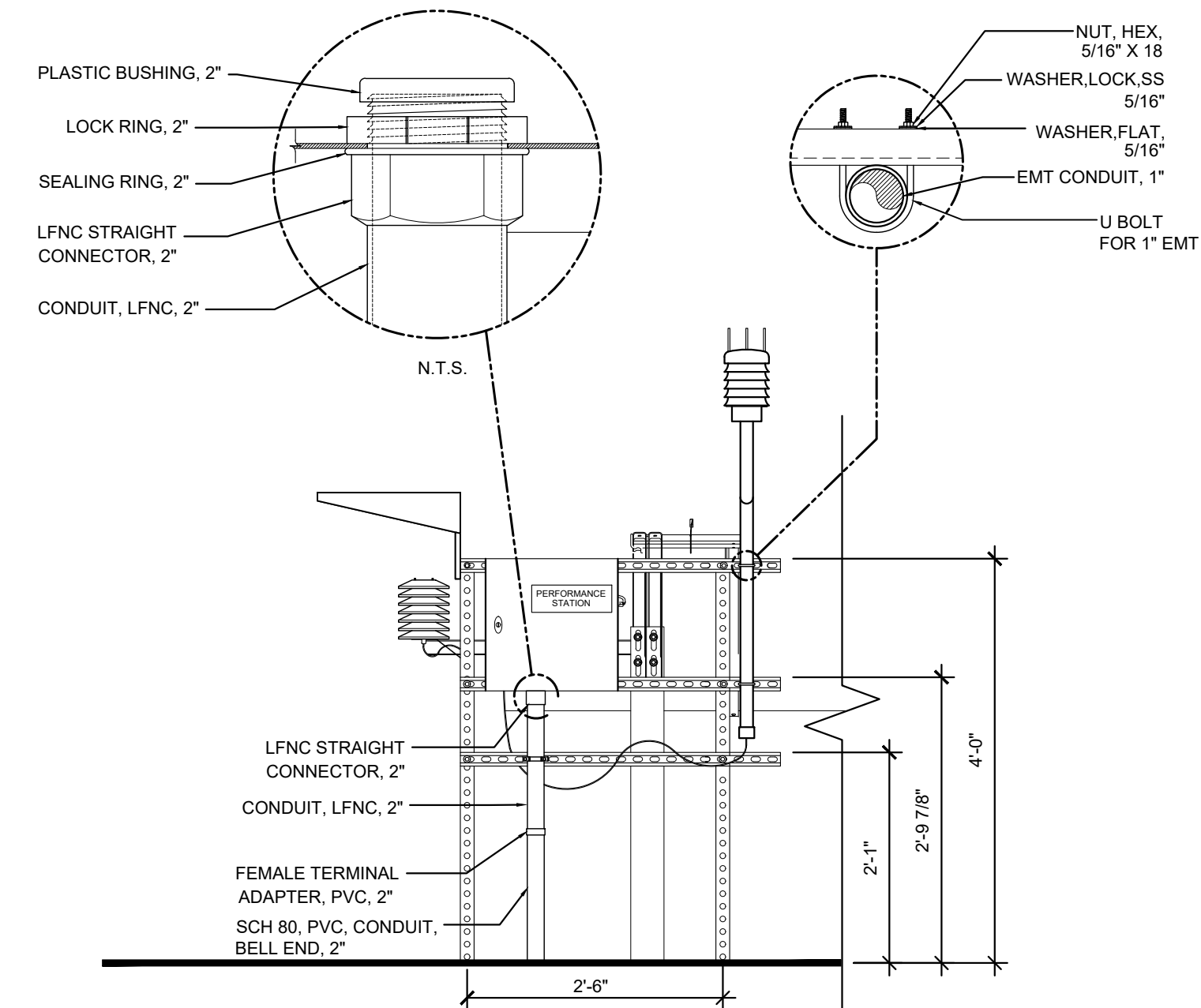


2 TYPICAL BACK OF RACK
MET STATION TEMPERATURE SENSOR INSTALLATION ELEVATION VIEW
SCALE: NTS

- NOTES:
1. INSTALL TEMPERATURE SENSOR IN THE CENTER OF THE CELL NEAREST TO THE INDICATED POSITION.
 2. BACK OF CELL SENSOR SHALL BE MOUNTED AT LEAST 20 MODULES IN FROM EDGE OF ROW.
 3. AMBIENT TEMPERATURE SENSORS MUST BE OUT OF DIRECT SUNLIGHT.



1 MET STATION SIDE ELEVATION
SCALE: NTS



3 MET STATION FRONT ELEVATION
SCALE: NTS

NO.	DATE	ENG.	REVISIONS	
			ISSUED FOR PERMIT	
A	05/08/2020	JEH		

STATION NAME: CLOVELLY SOLAR
ELECTRIC POWER PLANT
DRAWING TITLE: MET STATION DETAILS

DRAWN BY:	ALH
CHECKED BY:	EDR
APPROVED BY:	JEH
DATE:	05/01/2020
SCALE:	NTS
FILE NUMBER:	69965

WARNING

ARC FLASH AND SHOCK HAZARD
APPROPRIATE PPE REQUIRED

ARC FLASH HAZARD PROTECTION	PPE CATEGORY 1	
Incident Energy at 18 inches Nominal System Voltage	XXX	Cal/cm ² VDC
Arc Flash Boundary (PPE Required)	XXX	inches
Limited Approach (Qualified Personnel Only)	XXX	inches
Restricted Approach (PPE Required)	XXX	inches

Equipment Name: Inverter XX-XX

WARNING

ARC FLASH AND SHOCK HAZARD
APPROPRIATE PPE REQUIRED

ARC FLASH HAZARD PROTECTION	PPE CATEGORY 1	
Incident Energy at 15 inches Nominal System Voltage	XXX	Cal/cm ² VAC
Arc Flash Boundary (PPE Required)	XXX	inches
Limited Approach (Qualified Personnel Only)	XXX	inches
Restricted Approach (PPE Required)	XXX	inches

Equipment ID: SCADA CABINET XX

WARNING

ARC FLASH AND SHOCK HAZARD
APPROPRIATE PPE REQUIRED

ARC FLASH HAZARD PROTECTION	PPE CATEGORY 1	
Incident Energy at 15 inches Nominal System Voltage	XXX	Cal/cm ² VAC
Arc Flash Boundary (PPE Required)	XXX	inches
Limited Approach (Qualified Personnel Only)	XXX	inches
Restricted Approach (PPE Required)	XXX	inches

Equipment ID: Inverter XX-XX

**INVERTER
INV XX**

AC VOLTAGE: 630 V AC
AC CURRENT: 2,886 A AC

INVERTER IDENTIFICATION (NOTE 2)
(QTY.2)

DC PHOTOVOLTAIC POWER SOURCE

MAX SYSTEM VOLTAGE: 1455.7 V DC
MAX CURRENT: 260.37 A DC

INVERTER DC DISCONNECT
(QTY.2)

NOTE:
1. DETAILED LABEL TO BE PROVIDED AFTER ARC FLASH STUDY.
2. SEE CORRESPONDING LABEL SCHEDULE FOR LABEL VALUE AND QUANTITY.
3. SEE CORRESPONDING LABEL TAB FOR PRINTING PURPOSES.
4. ALL LABELS SHALL BE ENGRAVED, UNLESS EXPLICITLY APPROVED BY OWNER.

1 **INVERTER
ARC FLASH WARNING LABEL, DC**
SCALE: NTS

NOTE:
1. DETAILED LABEL TO BE PROVIDED AFTER ARC FLASH STUDY.
2. SEE CORRESPONDING LABEL SCHEDULE FOR LABEL VALUE AND QUANTITY.
3. SEE CORRESPONDING LABEL TAB FOR PRINTING PURPOSES.
4. ALL LABELS SHALL BE ENGRAVED, UNLESS EXPLICITLY APPROVED BY OWNER.

2 **SCADA CABINET
ARC FLASH WARNING LABEL, AC**
SCALE: NTS

NOTE:
1. DETAILED LABEL TO BE PROVIDED AFTER ARC FLASH STUDY.
2. SEE CORRESPONDING LABEL SCHEDULE FOR LABEL VALUE AND QUANTITY.
3. SEE CORRESPONDING LABEL TAB FOR PRINTING PURPOSES.
4. ALL LABELS SHALL BE ENGRAVED, UNLESS EXPLICITLY APPROVED BY OWNER.

3 **INVERTER
ARC FLASH WARNING LABEL, AC**
SCALE: NTS

NOTE:
1. TO BE INSTALLED ON COVER OF INVERTER XX-XX ENCLOSURE.
2. SEE CORRESPONDING LABEL SCHEDULE FOR LABEL VALUE AND QUANTITY.
3. SEE CORRESPONDING LABEL TAB FOR PRINTING PURPOSES.
4. ALL LABELS SHALL BE ENGRAVED, UNLESS EXPLICITLY APPROVED BY OWNER.

4 **INVERTER
WITH INTEGRATED DC DISCONNECT, LABELS**
SCALE: NTS

DANGER

ARC FLASH AND SHOCK HAZARD
APPROPRIATE PPE REQUIRED

ARC FLASH HAZARD PROTECTION	PPE CATEGORY >4	
Incident Energy at 15 inches Nominal System Voltage	XXX	Cal/cm ² VAC
Arc Flash Boundary (PPE Required)	XXX	inches
Limited Approach (Qualified Personnel Only)	XXX	inches
Restricted Approach (PPE Required)	XXX	inches

Equipment ID: Transformer XX-LV

WARNING

ARC FLASH AND SHOCK HAZARD
APPROPRIATE PPE REQUIRED

ARC FLASH HAZARD PROTECTION	PPE CATEGORY 1	
Incident Energy at 15 inches Nominal System Voltage	XXX	Cal/cm ² VAC
Arc Flash Boundary (PPE Required)	XXX	inches
Limited Approach (Qualified Personnel Only)	XXX	inches
Restricted Approach (PPE Required)	XXX	inches

Equipment ID: Transformer XX-HV

WARNING

ARC FLASH AND SHOCK HAZARD
APPROPRIATE PPE REQUIRED

ARC FLASH HAZARD PROTECTION	PPE CATEGORY 1	
Incident Energy at 15 inches Nominal System Voltage	XXX	Cal/cm ² VDC
Arc Flash Boundary (PPE Required)	XXX	inches
Limited Approach (Qualified Personnel Only)	XXX	inches
Restricted Approach (PPE Required)	XXX	inches

Equipment ID: DC DISCONNECT XX-XX

NOTES:

1. PLACARDS SHALL BE LOCATED ON THE MAIN SERVICE DISCONNECT AND SHALL CONFORM TO THE FOLLOWING:
MARKING CONTENT: CAUTION: SOLAR ELECTRIC SYSTEM CONNECTED
RED BACKGROUND
WHITE LETTERING
MINIMUM 3/8" LETTER HEIGHT
ALL CAPITAL LETTERS
ARIAL OR SIMILAR FONT, NON-BOLD
REFLECTIVE, WEATHER RESISTANT MATERIAL
SUITABLE FOR THE ENVIRONMENT WITH UV PROTECTIVE LAMINATE

2. PLACARDS SHALL BE PLACED A MINIMUM OF EVERY 10' ALONG DC CONDUIT, RACEWAYS, ENCLOSURES, CABLE ASSEMBLIES, AND JUNCTION BOXES AND SHALL CONFORM TO THE FOLLOWING:
MARKING CONTENT: CAUTION: SOLAR CIRCUIT
RED BACKGROUND
WHITE LETTERING
MINIMUM 3/8" LETTER HEIGHT
ALL CAPITAL LETTERS
ARIAL OR SIMILAR FONT, NON-BOLD
REFLECTIVE, WEATHER RESISTANT MATERIAL
SUITABLE FOR THE ENVIRONMENT WITH UV PROTECTIVE LAMINATE

3. ALL OTHER LABELS AND SIGNAGE NOT COVERED IN NOTES 1 AND 2 ABOVE SHALL CONFORM TO THE FOLLOWING SPECIFICATIONS, OAE:
MATERIAL: 0.010 HP12W
UV LAMINATE
BLACK & COLOR PRINT ON WHITE BACKGROUND

4. ALL LABELS SHALL USE 467MP ADHESIVE, OAE.

5. ALL LABELS SHALL BE PRODUCED AT A UL APPROVED LABEL SHOP, SUCH AS BRADLEY NAMEPLATE, LUSTRECAL, OAE.

NOTE:
1. DETAILED LABEL TO BE PROVIDED AFTER ARC FLASH STUDY.
2. SEE CORRESPONDING LABEL SCHEDULE FOR LABEL VALUE AND QUANTITY.
3. SEE CORRESPONDING LABEL TAB FOR PRINTING PURPOSES.
4. ALL LABELS SHALL BE ENGRAVED, UNLESS EXPLICITLY APPROVED BY OWNER.

5 **TRANSFORMER (LV)
ARC FLASH DANGER LABEL, AC**
SCALE: NTS

NOTE:
1. DETAILED LABEL TO BE PROVIDED AFTER ARC FLASH STUDY.
2. SEE CORRESPONDING LABEL SCHEDULE FOR LABEL VALUE AND QUANTITY.
3. SEE CORRESPONDING LABEL TAB FOR PRINTING PURPOSES.
4. ALL LABELS SHALL BE ENGRAVED, UNLESS EXPLICITLY APPROVED BY OWNER.

6 **TRANSFORMER (HV)
ARC FLASH WARNING LABEL, AC**
SCALE: NTS

NOTE:
1. DETAILED LABEL TO BE PROVIDED AFTER ARC FLASH STUDY.
2. SEE CORRESPONDING LABEL SCHEDULE FOR LABEL VALUE AND QUANTITY.
3. SEE CORRESPONDING LABEL TAB FOR PRINTING PURPOSES.
4. ALL LABELS SHALL BE ENGRAVED, UNLESS EXPLICITLY APPROVED BY OWNER.

7 **DC DISCONNECT CABINETS
ARC FLASH WARNING LABEL, DC**
SCALE: NTS

TRANSFORMER AC DISCONNECT

RATED AC VOLTAGE: 22,860 V AC
RATED AC CURRENT: 63.2 A AC

**TRANSFORMER AC DISCONNECT
(QTY.2)**

NOTE:
PLACE ABOVE TRANSFORMER LOAD BREAK SWITCH ENCLOSURE

**AC DISCONNECT
INTERACTIVE POINT OF INTERCONNECTION**

RATED AC VOLTAGE: 22,860 V AC
RATED AC CURRENT: 126.3 A AC

**GOAB SWITCH
(QTY.1)**

**POWER PLANT
CONTROLLER / DATA
LOGGER**

SCADA CABINET 01
(QTY.1)

ROW XXX

MODULE ROWS (NOTE 1)

CB X-X

COMBINER BOX LABELS (NOTE 1)
(QTY.24)

**METER
AC DISCONNECT**

TRANSFORMER POLE
(QTY.1)

AC LOAD CENTER

SCADA CABINETS
(QTY.1)

CX-XX.XX

PV CIRCUIT LABELS (NOTE 1)

XFMR XX

TRANSFORMER
(QTY.1)

METER

CUSTOMER METER
(QTY.1)

**METEOROLOGICAL
STATION**

METEOROLOGICAL STATION
(QTY.1)

8 **EQUIPMENT LABELS**
SCALE: NTS

NOTE:
1. SEE CORRESPONDING LABEL SCHEDULE FOR LABEL VALUE AND QUANTITY.
2. ROW LABELS SHALL BE VINYL STICKERS. LABEL SHALL BE PLACED ON THE LAST RACK POST OF EVERY ROW ADJACENT TO MAIN AISLE.
3. SEE CORRESPONDING LABEL TAB FOR PRINTING PURPOSES.
4. ALL LABELS SHALL BE ENGRAVED, UNLESS EXPLICITLY APPROVED BY OWNER.

NO.	REVISIONS	DATE
A	ISSUED FOR PERMIT	05/09/2020

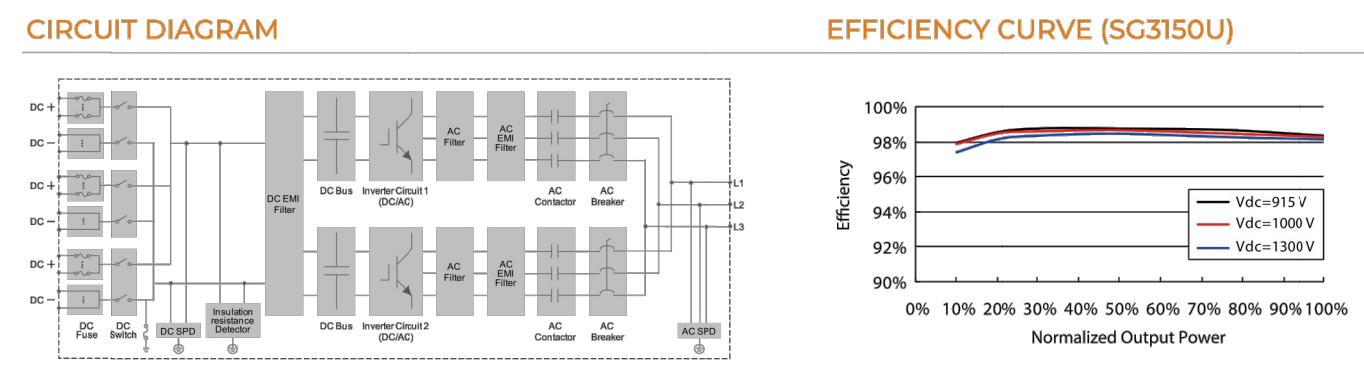
STATION NAME: **CLOVELLY SOLAR
ELECTRIC POWER PLANT**

DRAWING TITLE: **LABELS & MARKINGS**

SG3150U/SG2500U New **SUNGROW**
Clean power for all
Turnkey Station for North America 1500 Vdc System



- HIGH YIELD**
 - Advanced three-level technology, max. efficiency 98.8%, CEC efficiency 98.5 %
 - Max. DC/AC ratio more than 1.5
- EASY O&M**
 - Integrated current and voltage monitoring function for online analysis and fast trouble shooting
 - Modular design, easy for maintenance
 - Convenient external LCD
- SAVED INVESTMENT**
 - Low transportation and installation cost due to 10-foot container design
 - 1500V DC system, low system cost
 - Integrated LV auxiliary power supply
- GRID SUPPORT**
 - Complies with UL 1741, UL 1741 SA, IEEE 1547, Rule 21 and NEC 2014/2017
 - Grid support including L/HVRT, L/HFRT, power ramp rate control, active and reactive power support



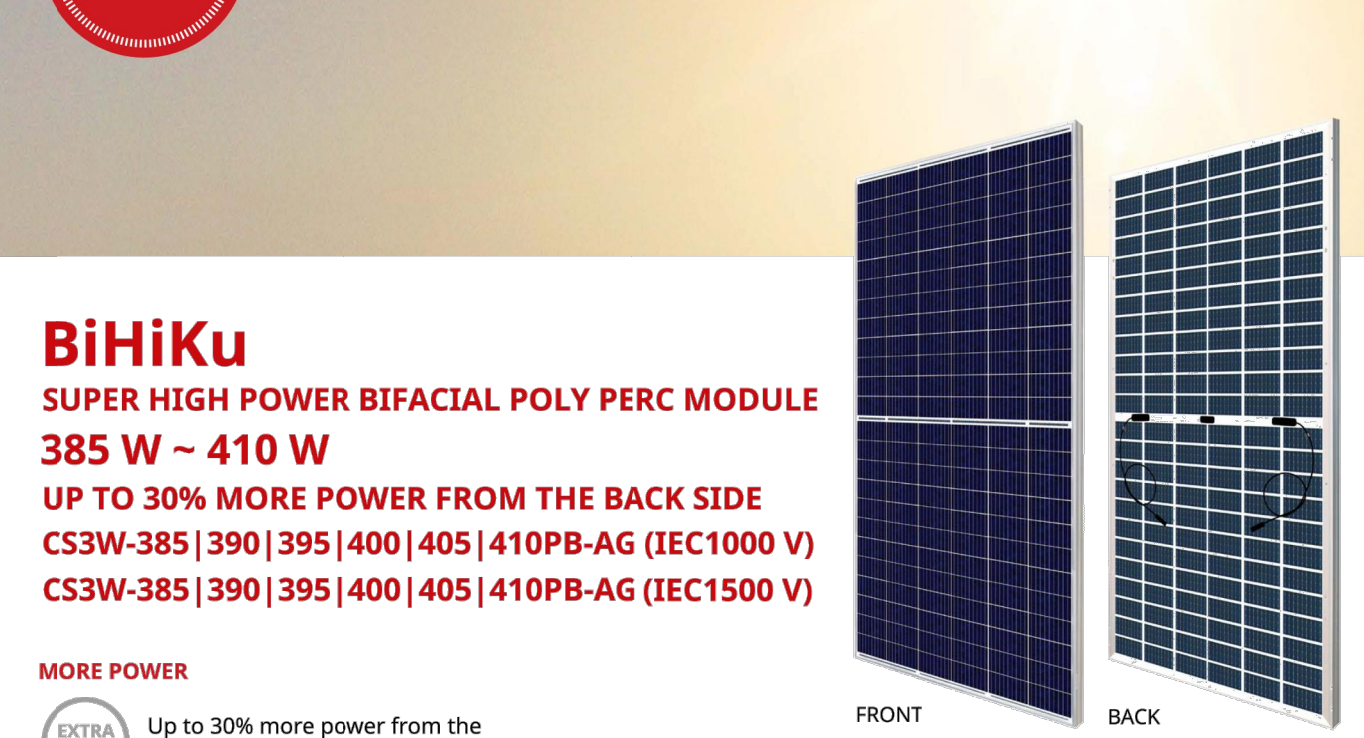
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SG3150U/SG2500U

Type designation	SG3150U	SG2500U
Input (DC)		
Max. PV input voltage	1500V	
Min. PV input voltage / Startup input voltage	915 V / 955 V	800 V / 840 V
MPP voltage range for nominal power	940 - 1300 V	800 - 1300 V
No. of independent MPP inputs	1	1
No. of DC inputs	18 - 24	18 - 21
Max. PV input current	3420 A	3508 A
Max. DC short-circuit current	4800 A	
Output (AC)		
AC output power	3150 kVA @ 45 °C (113 °F)	2750 kVA @ 45 °C (113 °F) / 2500 kVA @ 50 °C (122 °F)
Max. AC output current	2886 A	
Nominal AC voltage	630 V	550 V
AC voltage range	554 - 690 V	484 - 605 V
Nominal grid frequency / Grid frequency range	60 Hz / 55 - 65 Hz	
THD	< 3% (at nominal power)	
DC current injection	< 0.5 % of nominal output current	
Power factor at nominal power / Adjustable power factor	> 0.99 / 0.8 leading - 0.8 lagging	
Feed-in phases / Connection phases	3 / 3	
Efficiency		
Max. efficiency	98.8%	
CEC efficiency	98.5 %	
Protection		
DC input protection	Load break switch + fuse	
AC output protection	Circuit breaker	
Overvoltage protection	DC Type II / AC Type II	
Grid monitoring / Ground fault monitoring	Yes / Yes	
Insulation monitoring	Optional	
Q at night function	Optional	
Overheat protection	Yes	
General Data		
Dimensions (W*H*D)	2991*2896*2438 mm (117.8" *114.0" *96.0")	
Weight	6.9 T (15213 lbs)	
Isolation method	Transformerless	
Degree of protection	NEMA 3R	
Auxiliary power supply	120 Vac, 5 kVA / Optional: 480 Vac, 30 kVA	
Operating ambient temperature range	-30 to 60 °C (> 45 °C derating)	-30 to 60 °C (> 50 °C derating)
Allowable relative humidity range (non-condensing)	0 - 95 %	
Cooling method	Temperature controlled forced air cooling	
Max. operating altitude	4000 m (> 2000 m derating) (13123 ft (> 6561 ft derating))	
Display	Touch screen	
Communication	Standard: RS485, Ethernet; Optional: optical fiber	
Compliance	UL 1741, IEEE 1547, UL1741 SA, NEC 2014 / 2017, CSA C22.2 No.1071-01	
Grid support	L/HVRT, L/HFRT, active & reactive power control and power ramp rate control, Volt-var, Frequency-watt	

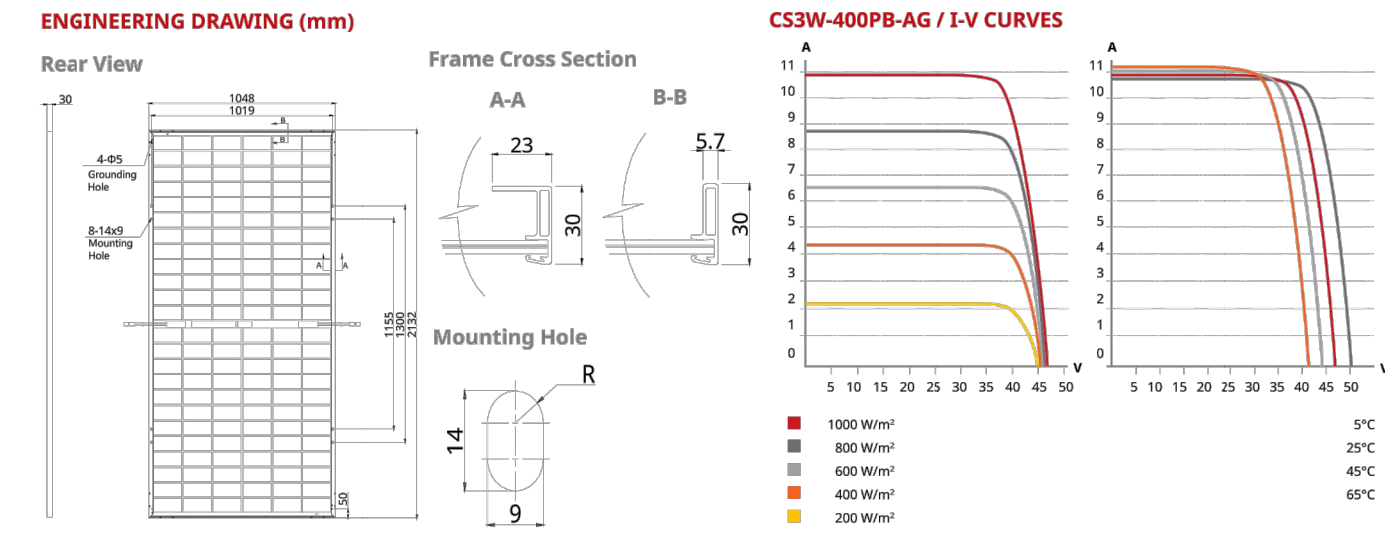
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NEW **CanadianSolar**



- BiHiKu**
SUPER HIGH POWER BIFACIAL POLY PERC MODULE
385 W ~ 410 W
UP TO 30% MORE POWER FROM THE BACK SIDE
CS3W-385 | 390 | 395 | 400 | 405 | 410PB-AG (IEC1000 V)
CS3W-385 | 390 | 395 | 400 | 405 | 410PB-AG (IEC1500 V)
- MORE POWER**
 - Up to 30% more power from the back side
 - 24% more front side power than conventional modules
 - Low NMOT: 41 ± 3 °C
 - Low temperature coefficient (Pmax): -0.37 % / °C
 - Better shading tolerance
 - MORE RELIABLE**
 - Lower internal current, lower hot spot temperature
 - Minimizes micro-cracks and small trails
 - Heavy snow load up to 5400 Pa, wind load up to 2400 Pa *
 - Fire Class A and Type 3 / Type 13
 - 30 years linear power output warranty**
 - 10 years product warranty on materials and workmanship**
 - MANAGEMENT SYSTEM CERTIFICATES***
ISO 9001:2015 / Quality management system
ISO 14001:2015 / Standards for environmental management system
OHSAS 18001:2007 / International standards for occupational health & safety
 - PRODUCT CERTIFICATES***
IEC 61215 / IEC 61730: VDE / CE
UL 1703, CSA
IEC 61701 ED2: VDE / IEC 62716: VDE
Tale-e-wavy
 - CANADIAN SOLAR INC.** is committed to providing high quality solar products, solar system solutions and services to customers around the world. No. 1 module supplier for quality and performance/price ratio in IHS Module Customer Insight Survey. As a leading PV project developer and manufacturer of solar modules with over 33 GW deployed around the world since 2001.

*For detail information, please refer to Installation Manual.
CANADIAN SOLAR INC. Canadian Solar MSZ (Australia) Pty Ltd., 44 Stephenson St, Cremorne VIC 3121, Australia support@canadiansolar.com, www.canadiansolar.com/au



ELECTRICAL DATA STC*						ELECTRICAL DATA NMOT**						
Nominal Power (Pmax)	Opt. Voltage (Vmp)	Opt. Current (Imp)	Open Circuit Voltage (Voc)	Short Circuit Current (Isc)	Module Efficiency (%)	Nominal Power (Pmax)	Opt. Voltage (Vmp)	Opt. Current (Imp)	Open Circuit Voltage (Voc)	Short Circuit Current (Isc)	Module Efficiency (%)	
CS3W-385PB-AG 385 W	38.1 V	10.11 A	46.6 V	10.66 A	17.23%	CS3W-385PB-AG 287 W	35.5 V	8.09 A	43.8 V	8.60 A	16.60%	
Bifacial 5%	404 W	38.1 V	10.62 A	46.6 V	11.19 A	18.08%	CS3W-395PB-AG 295 W	35.9 V	8.21 A	44.2 V	8.72 A	17.24%
Bifacial 20%	462 W	38.1 V	12.13 A	46.6 V	12.79 A	20.68%	CS3W-400PB-AG 299 W	36.1 V	8.27 A	44.4 V	8.79 A	17.45%
Bifacial 30%	501 W	38.1 V	13.15 A	46.6 V	13.86 A	22.42%	CS3W-405PB-AG 302 W	36.3 V	8.33 A	44.6 V	8.85 A	17.68%
CS3W-390PB-AG 390 W	38.3 V	10.19 A	46.8 V	10.74 A	17.45%	CS3W-410PB-AG 306 W	36.5 V	8.39 A	44.8 V	8.92 A	17.91%	
Bifacial 5%	410 W	38.3 V	10.71 A	46.8 V	11.28 A	18.35%						
Bifacial 10%	429 W	38.3 V	11.21 A	46.8 V	11.81 A	19.20%						
Bifacial 20%	468 W	38.3 V	12.23 A	46.8 V	12.89 A	20.95%						
Bifacial 30%	507 W	38.3 V	13.25 A	46.8 V	13.96 A	22.69%						
CS3W-395PB-AG 395 W	38.5 V	10.26 A	47 V	10.82 A	17.68%							
Bifacial 5%	415 W	38.5 V	10.78 A	47 V	11.36 A	18.57%						
Bifacial 10%	435 W	38.5 V	11.3 A	47 V	11.9 A	19.47%						
Bifacial 20%	474 W	38.5 V	12.31 A	47 V	12.98 A	21.21%						
Bifacial 30%	513 W	38.5 V	13.34 A	47 V	14.07 A	22.96%						
CS3W-400PB-AG 400 W	38.7 V	10.34 A	47.2 V	10.9 A	17.90%							
Bifacial 5%	420 W	38.7 V	10.86 A	47.2 V	11.45 A	18.80%						
Bifacial 10%	440 W	38.7 V	11.37 A	47.2 V	11.99 A	19.69%						
Bifacial 20%	480 W	38.7 V	12.41 A	47.2 V	13.08 A	21.48%						
Bifacial 30%	520 W	38.7 V	13.44 A	47.2 V	14.17 A	23.27%						
CS3W-405PB-AG 405 W	38.9 V	10.42 A	47.4 V	10.98 A	18.13%							
Bifacial 5%	425 W	38.9 V	10.94 A	47.4 V	11.53 A	19.02%						
Bifacial 10%	445 W	38.9 V	11.46 A	47.4 V	12.08 A	19.92%						
Bifacial 20%	485 W	38.9 V	12.5 A	47.4 V	13.18 A	21.75%						
Bifacial 30%	527 W	38.9 V	13.56 A	47.4 V	14.27 A	23.59%						
CS3W-410PB-AG 410 W	39.1 V	10.49 A	47.6 V	11.06 A	18.35%							
Bifacial 5%	431 W	39.1 V	11.03 A	47.6 V	11.61 A	19.29%						
Bifacial 10%	451 W	39.1 V	11.54 A	47.6 V	12.17 A	20.18%						
Bifacial 20%	492 W	39.1 V	12.59 A	47.6 V	13.27 A	22.02%						
Bifacial 30%	533 W	39.1 V	13.64 A	47.6 V	14.38 A	23.85%						

ELECTRICAL DATA
Operating Temperature -40°C ~ +85°C
Max. System Voltage 1500 V (IEC/UL) or 1000 V (IEC/UL)
Module Fire Performance TYPE 3 / Type 13 (UL 1703) or CLASS A (IEC61730)
Max. Series Fuse Rating 25 A
Application Classification Class A
Power Tolerance 0 ~ +5 W
Power Bifaciality* 70 %
* Power Bifaciality = Pmax_{back} / Pmax_{front} or Pmax_{back} / Pmax_{total}, both Pmax_{back} and Pmax_{total} are tested under STC. Bifaciality Tolerance: ± 5 %

TEMPERATURE CHARACTERISTICS
Specification Data
Temperature Coefficient (Pmax) -0.37 % / °C
Temperature Coefficient (Voc) -0.29 % / °C
Temperature Coefficient (Isc) 0.05 % / °C
Nominal Module Operating Temperature 41 ± 3 °C

PARTNER SECTION

* This is preliminary data sheet and for reference only. The specifications and key features contained in this data sheet may deviate slightly from actual products due to the on-going innovation and product enhancement. Canadian Solar Inc. reserves the right to make necessary adjustment to the information described herein at any time without further notice.

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NO.	DATE	REVISIONS	ISSUED FOR PERMIT
A	05/08/2020		

STATION NAME: CLOVELLY SOLAR ELECTRIC POWER PLANT
DRAWING TITLE: EQUIPMENT SPECIFICATIONS

DRAWN BY: ALH
CHECKED BY: EDR
APPROVED BY: JEH
DATE: 05/01/2020
SCALE: NTS
FILE NUMBER: 69965
SHEET: E-451