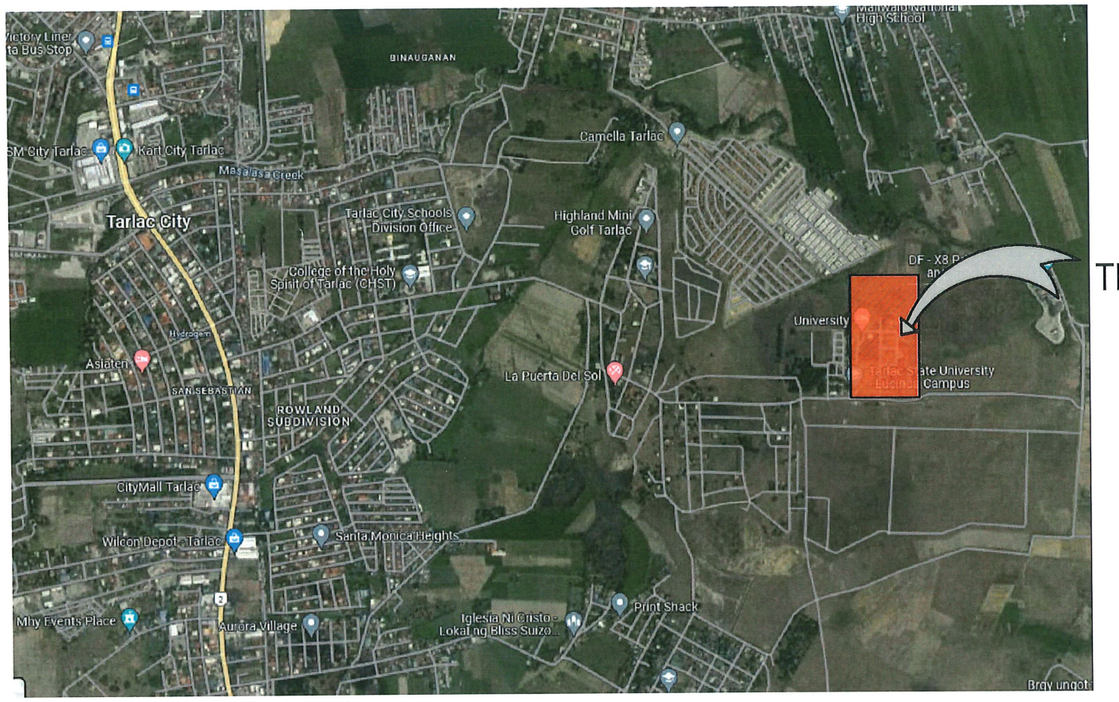
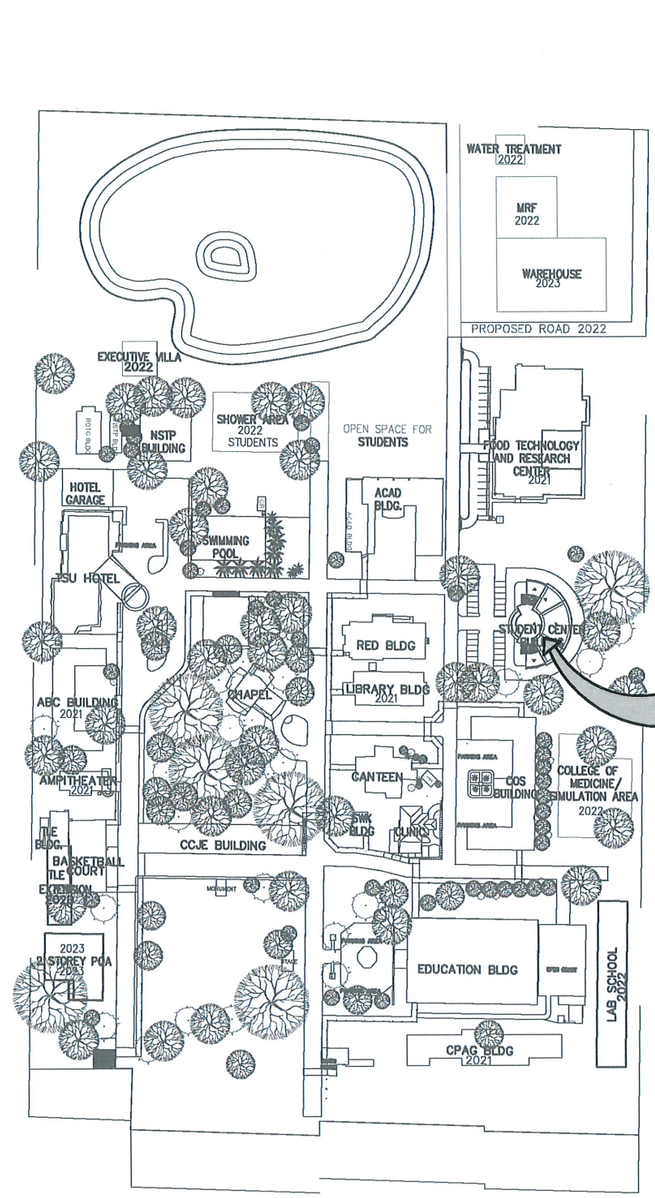


THE SITE

VICINITY MAP

SCALE: NTS



STUDENT CENTER BUILDING

LUCINDA EXTENSION CAMPUS

SCALE: NTS

TARLAC STATE UNIVERSITY Facilities Development and Management Office Romulo Boulevard, Tarlac City, Philippines 2300	PROJECT TITLE: INSTALLATION OF SOLAR HARVESTING SYSTEM AT LUCINDA EXTENSION CAMPUS (STUDENT CENTER AND CFTR BUILDING) PROJECT LOCATION: TSU LUCINDA EXTENSION CAMPUS	REQUESTING OFFICE: PROF. GHEROLD C. BENITEZ DIRECTOR, OSAS	PREPARED BY: ENGR. MISAEL REIGH MIEL V. CABANSAG ELECTRICAL ENGINEER, OFDM	CHECKED BY: AR. CHERRY L. FABIANES HEAD, OFDM-PDU	CERTIFIED BY: AR. ARLEN M. GUIEB DIRECTOR, OFDM	RECOMMENDING APPROVAL: ATTY. WILMARK J. RAMOS, DBA VP FOR ADMINISTRATION	APPROVED: DR. ARNOLD E. VELASCO PRESIDENT	SHEET CONTENTS: AS SHOWN DATE: OCTOBER 2024	SHEET NO: 1 PAGE NO: 01/14

GENERAL NOTES AND SPECIFICATIONS

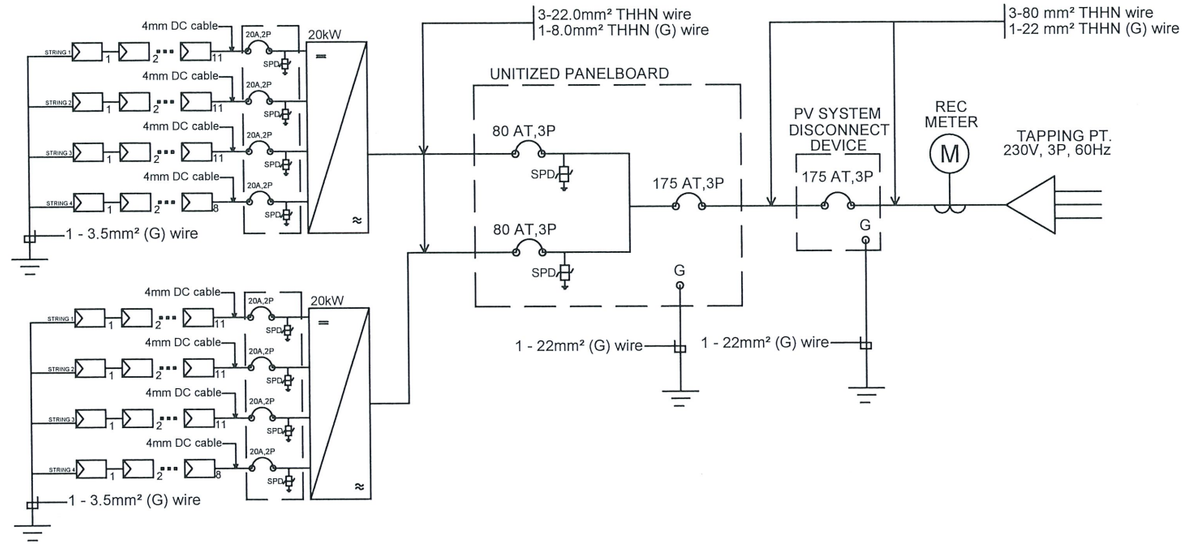
1. ALL WORKS SHALL COMPLY WITH THE APPROVED EDITION OF THE LATEST PHILIPPINE ELECTRICAL CODE, WITH THE RULES AND REGULATIONS OF THE NATIONAL AND LOCAL AUTHORITY CONCERNED IN THE ENFORCEMENT OF THE UTILITY COMPANY CONCERNED.
2. ALL ELECTRICAL WORKS HEREIN SHALL BE DONE UNDER THE DIRECT SUPERVISION OF A DULY QUALIFIED REGISTERED ELECTRICAL ENGINEER OR REGISTERED MASTER ELECTRICIAN.
3. SERVICE VOLTAGE SHALL BE 230VOLTS, 3- PHASE, 60Hz. A.C.
4. ALL MATERIALS PRIOR TO INSTALLATION, FABRICATION OR ORDER CONTRACTOR SHALL SECURE APPROVAL FROM DESIGN ENGINEER OR PROJECT MANAGER BASED ON MATERIAL STANDARD SPECIFICATION. ALL MATERIALS SHALL BE BRAND NEW AND DELIVERED TO SITE WITH THEIR ORIGINAL PACKAGING.
5. ALL WIRES SHALL BE COPPER WITH 99.9% CONDUCTIVITY, SOFT-DRAWN AND ANNEALED.
6. ALL WIRES SHALL BE COLOR CODED AS FOLLOWS:

DC +	-	RED	LINE2	-	YELLOW
DC -	-	BLACK	LINE3	-	BLUE
LINE1	-	RED	GROUND	-	GREEN

7. CONDUIT SHALL BE PROPERLY SEALED TO AVOID ENTRY OF FOREIGN OBJECT, DUST, MOISTURE, WATER ETC.
8. PANELS SHALL BE FABRICATED BY A REPUTABLE FABRICATOR. ONLY ONE BRAND OF CIRCUIT BREAKER WILL BE ALLOWED FOR THE ENTIRE PROJECT. USING MULTIPLE OR COMBINATION OF BRAND WILL BE REJECTED.
9. STANDARD ENCLOSURE AND MOUNTING FOR PANELS AND CABINET AS PER LOAD SCHEDULE. FOR INDOOR PANEL SHALL BE NEMA-1 ENCLOSURE AND FOR OUTDOOR IT SHOULD BE NEMA-4X OR AS INDICATED ON THE PLANS. AND IT SHALL MEET NEMA AND UL SPECIFICATIONS.
10. ALL NON-CURRENT CARRYING METALLIC PARTS OR FRAMES OF ELECTRICAL EQUIPMENT SHALL BE ELECTRICALLY CONNECTED TO FEEDER / CIRCUIT GROUND WIRE WITH SUITABLE TERMINAL LUGS.
11. ALL CONNECTIONS FOR MAIN CIRCUIT BREAKER TO BRANCHES SHALL BE SOLID COPPER BUS BAR, WIRE JUMPERS ARE NOT ALLOWED.
12. 1.5 METER SHOULD BE THE SPACING FROM ONE CONDUIT SUPPORT TO ANOTHER SUPPORT BY MEANS OF C-CHANNEL CLAMPS OR BY U-BOLT.
13. WHENEVER REQUIRED AND NECESSARY PVC PULL BOXES AND JUNCTION BOXES SHALL BE INSTALLED AT CONVENIENT SPACE AND LOCATION.
14. UPON COMPLETION OF ELECTRICAL CONSTRUCTION WORK, THE FOLLOWING TESTS SHALL BE PERFORMED BY THE CONTRACTOR INCLUSIVE OF THE INSTALLATION TO BE REPORTED IN DETAILS ON FORMS APPROVED BY THE OWNER'S REPRESENTATIVE.

A. INSTALLATION RESISTANCE TEST
B. GROUND RESISTANCE TEST
C. OPERATIONAL TEST
D. SYSTEM TEST AND ACCEPTANCE

SINGLE LINE DIAGRAM



LOAD SCHEDULE

DC SCHEDULE OF LOADS

STRING	NO. OF MODULES PER STRING	TOTAL VOLTAGE (V)	CURRENT (A)	CB RATING	WIRE SIZE	CONDUIT
INV 1- STR. 1	11	446.82 V	13.45 A	20A, 2P, 1000V	4mm² DC cable	100mm x 100mm Cable Tray
INV 1- STR. 2	11	446.82 V	13.45 A	20A, 2P, 1000V	4mm² DC cable	100mm x 100mm Cable Tray
INV 1 - STR. 3	11	446.82 V	13.45 A	20A, 2P, 1000V	4mm² DC cable	100mm x 100mm Cable Tray
INV 1 - STR. 4	8	327.20 V	13.45 A	20A, 2P, 1000V	4mm² DC cable	100mm x 100mm Cable Tray
INV 2 - STR. 1	11	446.82 V	13.45 A	20A, 2P, 1000V	4mm² DC cable	100mm x 100mm Cable Tray
INV 2 - STR. 2	11	446.82 V	13.45 A	20A, 2P, 1000V	4mm² DC cable	100mm x 100mm Cable Tray
INV 2 - STR. 3	11	446.82 V	13.45 A	20A, 2P, 1000V	4mm² DC cable	100mm x 100mm Cable Tray
INV 2 - STR. 4	8	327.20 V	13.45 A	20A, 2P, 1000V	4mm² DC cable	100mm x 100mm Cable Tray

AC SCHEDULE OF LOADS

CKT. NO.	LOAD DESCRIPTION	VOLTAGE (V)	Capacity (VA)	CURRENT				CB RATING			WIRE SIZE	CONDUIT
				AB	BC	AC	ABC	AT	AF	P		
1	20kW GRID TIED INV.	230 V	20000 W				78.44A	80A	100AF	3	3 - 22.0mm² THHN + 1 - 8.0mm² (G) wire	100mm x 100mm Cable Tray
2	20kW GRID TIED INV.	230 V	20000 W				78.44A	80A	100AF	3	3 - 22.0mm² THHN + 1 - 8.0mm² (G) wire	100mm x 100mm Cable Tray

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PROJECT LOCATION: TSU LUCINDA EXTENSION CAMPUS							DATE: OCTOBER 2024	PAGE NO: 02/14

DESIGN PARAMETERS AND CALCULATIONS

INVERTER PARAMETERS:
INPUT (DC)

MAX DC POWER:	30000W
MAX INPUT VOLTAGE:	800V
RATED INPUT VOLTAGE:	360V
MAX INPUT CURRENT PER STRING:	26A
NUMBER OF INDEPENDENT MPP:	4

OUTPUT (AC)

RATED POWER:	20000W
MAX APPARENT POWER:	22000VA
NOMINAL AC VOLTAGE / RANGE:	230V
RATED POWER FREQUENCY / RANGE:	60Hz
MAX OUTPUT CURRENT:	58A
POWER FACTOR AT RATED POWER:	0.8 leading–0.8 lagging
FEED IN PHASES:	3

SOLAR PANEL PARAMETERS:

RATED MAX POWER at STC:	550W
OPEN CIRCUIT VOLTAGE:	49.62V
MAXIMUM POWER VOLTAGE:	40.90V
SHORT CIRCUIT CURRENT:	14.03A
MAXIMUM POWER CURRENT:	13.45A

RAPID SHUTDOWN DEVICE PARAMTERS:
RATED MAX POWER : 700W

DC SIDE DESIGN ANALYSIS

$$\text{Total No. of Solar Panels} = \frac{\text{Plant Capacity}}{\text{Solar Power Module Rating}} = \frac{45100\text{W}}{550\text{W}} = \text{82 pcs. Solar Modules rated @ 550W each}$$

$$\text{Total No. of Inverters} = \frac{\text{Plant Capacity}}{\text{Inverter Max. Power}} = \frac{45100\text{W}}{20000\text{W}} = 2.25 \sim 2 \text{ Inverters}$$

Number of Panels per String = 8
Voltage per String = No. of Panels x Open Ckt Voltage = 8 x 49.62V = 396.96 V

Number of Panels per String = 11
Voltage per String = No. of Panels x Open Ckt Voltage = 11 x 49.62V = 545.82 V

Ampere Rating at DC Side: I_S = 14.03 A

DC Cable: 4mm² THHN Cu. WIRE & 3.5mm² THHN WIRE for GRND WIRE IN CABLE TRAY

AC SIDE DESIGN ANALYSIS

FOR INVERTERS

$$\text{Demand Load in Amperes:} \quad \frac{\text{Max. AC Output Power}}{\sqrt{3} \text{ X nominal AC Voltage X Power Factor}}$$

$$\frac{20000\text{w}}{\sqrt{3} \text{ X } 230 \text{ X } .8} = 62.76 \text{ A}$$

CIRCUIT BREAKER RATING: Use 80AT/100AF, 230V, 3P Circuit Breaker
SUB FEEDER: 3 - 22.0mm² THHN Cu. WIRE & 1 - 8.0mm² THHN WIRE for GROUND WIRE IN 100mm x 100mm Cable Tray

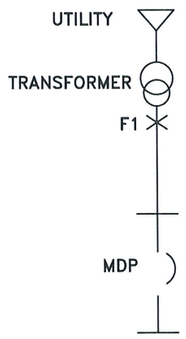
FOR MAIN BREAKER

$$\text{Demand Load in Amperes:} \quad \frac{\text{Max. AC Output Power}}{\sqrt{3} \text{ X nominal AC Voltage X Power Factor}}$$

$$\frac{40000\text{w}}{\sqrt{3} \text{ X } 230 \text{ X } .8} = 125.515 \text{ A}$$

CIRCUIT BREAKER RATING: Use 175AT, 230V, 3P Circuit Breaker
MAIN FEEDER: 3 - 80mm² THHN Cu. WIRE & 1 - 22mm² THHN WIRE for GROUND WIRE IN 100mm x 100mm Cable Tray and 2" Ø RSC PIPE (FOR EXPOSED) and 2" Ø PVC PIPE IN CONCRETE ENCASEMENT (FOR UNDERGROUND)

SHORT CIRCUIT CALCULATION



SHORT CIRCUIT LEVEL FOR UTILITY ASSUMED AS 1000MVA

3 - 50 KVA TRANSFORMER, 13.8/0.23, 3Ø, 60HZ

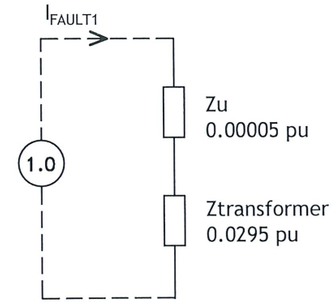
BASE KVA : 50 KVA
BASE V: 230 V

Zutility = 50 / 1,000,000 = 0.00005 pu

Ztransformer = 2.95/100 = 0.0295 pu

Ztotal = 0.00005 + 0.0295 = 0.02955 pu

NOTE: IMPEDANCE OF THE CONDUCTOR IS ASSUME AS NEGLIGIBLE.



FAULT 1

I_{SC}= (1 / Ztotal) X [KVA base / (1.732 x 230)]

= (1 / 0.02955) X [50 x 10^3 / (1.732 x 230)]

= 4.2475 kAIC

USE: 10 KAIC

VOLTAGE DROP FOR DC SIDE

$$Vd = \frac{2 \text{ X L X I X R}}{1000 \text{ ft}} = \frac{2 \text{ X } 100 \text{ ft. X } 13.45 \text{ A x } 1.931 \text{ ohms}}{1000 \text{ ft}}$$

Vd = 5.1944 V

$$= \frac{Vd}{\text{(no. of panel per strings) x Voc}} \text{ x } 100$$

$$= \frac{5.1944 \text{ V}}{11 \text{ x } 49.62 \text{ V}} \text{ x } 100 = 0.95\%$$

VOLTAGE DROP FOR AC SIDE

$$Vd = \frac{1.732 \text{ X L X I X Z}}{305 \text{ m}} = \frac{1.732 \text{ X } 72 \text{ m X } 125.515 \text{ x } 0.094 \text{ ohms}}{305 \text{ m}}$$

Vd = 4.82 V

$$= \frac{Vd}{\text{Nominal voltage}} \text{ x } 100$$

$$= \frac{4.82 \text{ V}}{230 \text{ V}} \text{ x } 100 = 2.1\%$$

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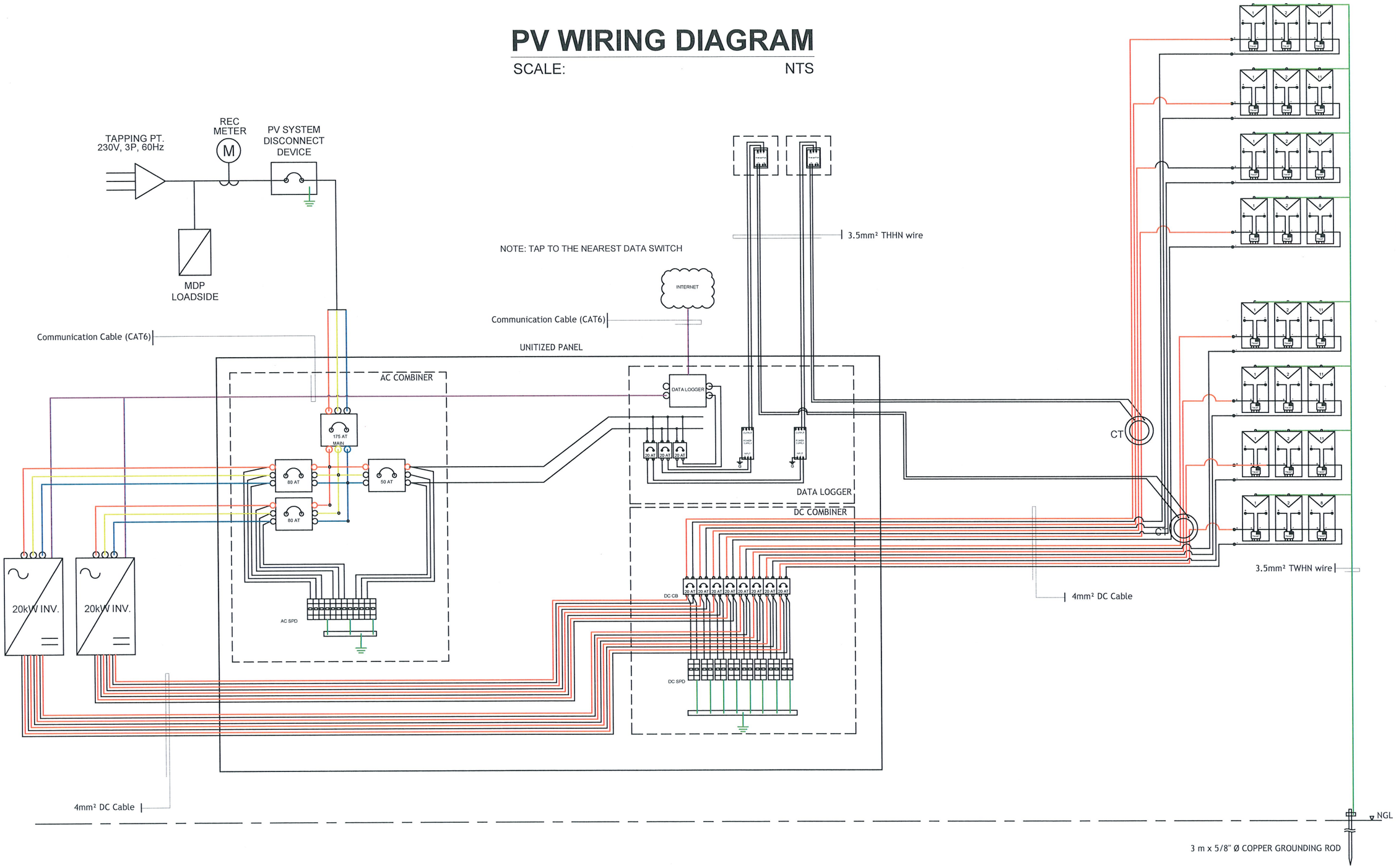
PV WIRING DIAGRAM

SCALE: NTS



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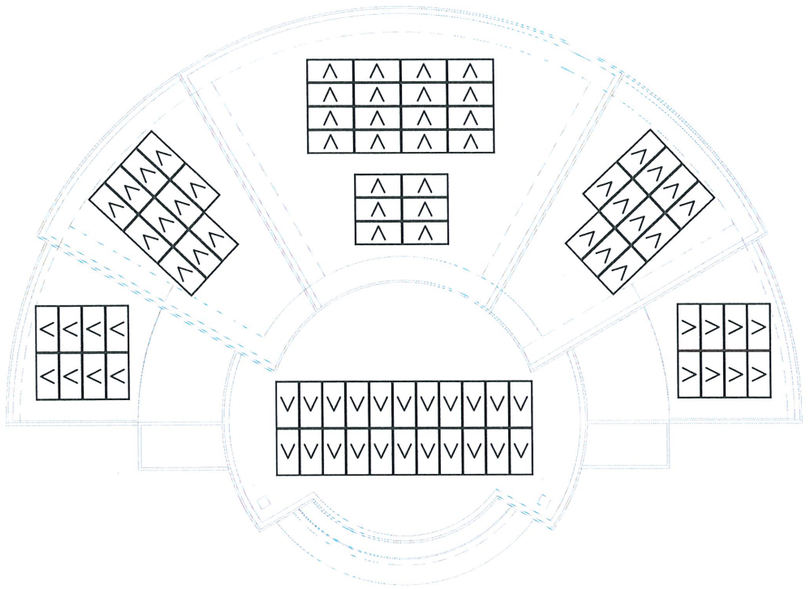
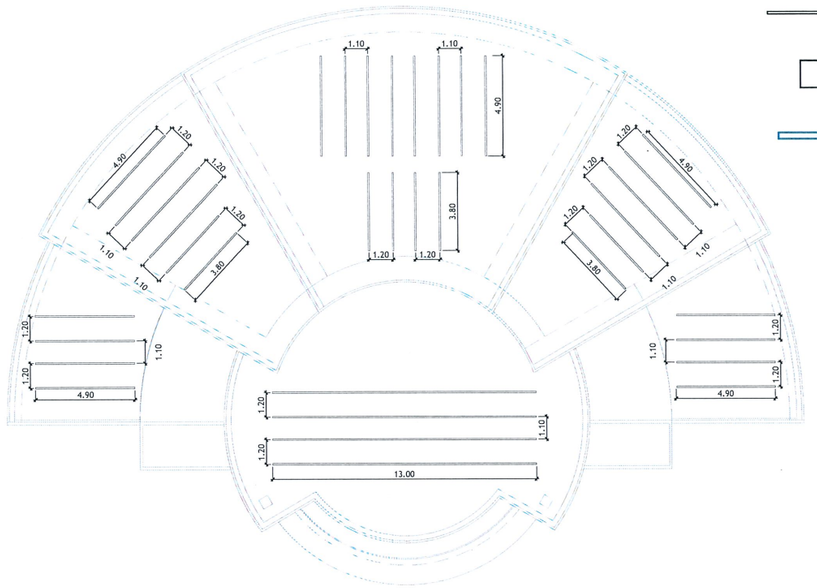


PV ROOF PLAN LAYOUT

SCALE: 1:300M

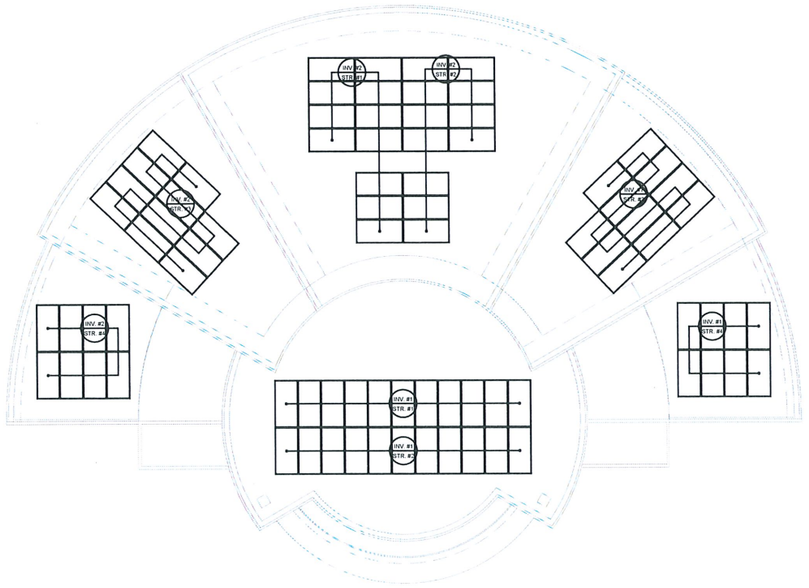


LEGEND

- SOLAR PANEL RAILINGS
- SOLAR PANEL
- 100 X 100 mm GALVANIZED CABLE TRAY

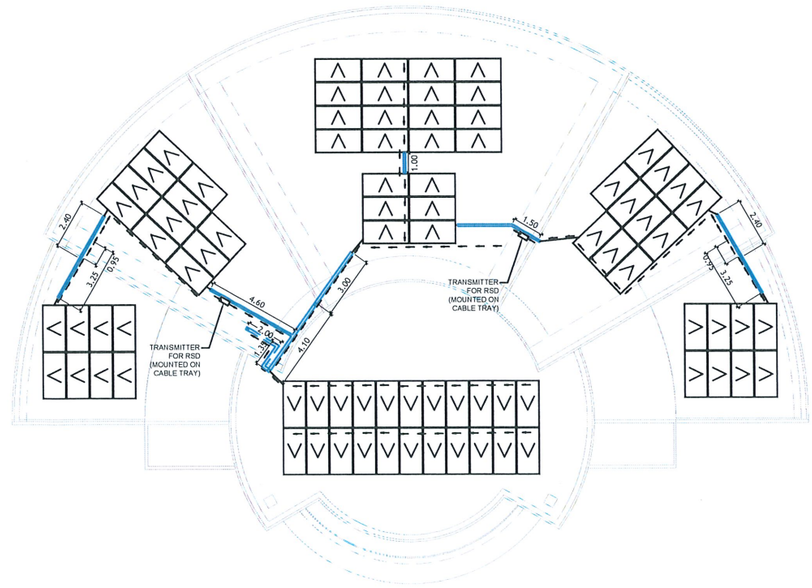
MOUNTING STRUCTURE LAYOUT

SCALE: 1:300M



PANEL DISTRIBUTION LAYOUT

SCALE: 1:300M



ROOF PLAN DC CABLE TRAY LAYOUT

SCALE: 1:300M

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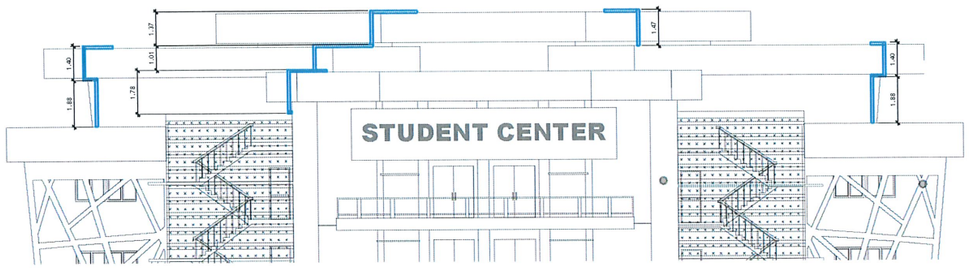
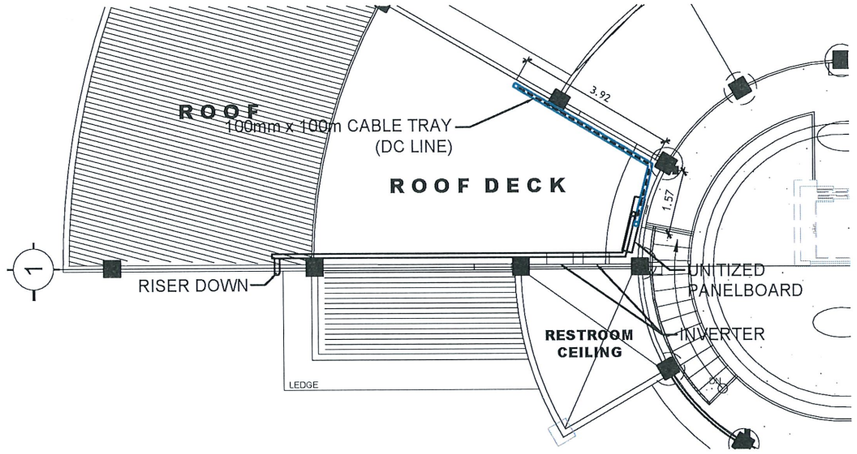


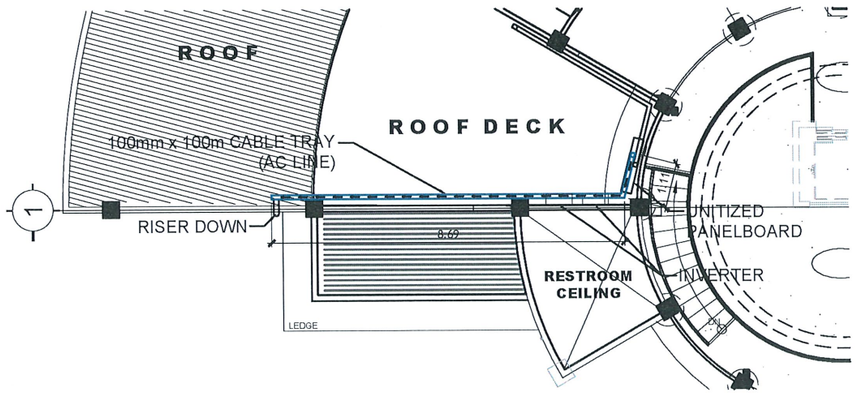
FRONT ELEVATION DC CABLE TRAY LAYOUT

SCALE: 1:250M



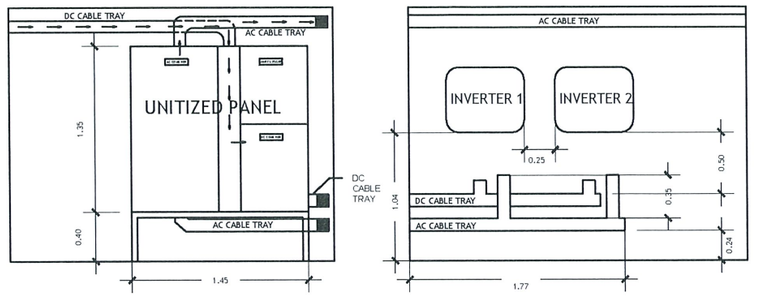
ROOF DECK DC CABLE TRAY LAYOUT

SCALE: 1:150M



ROOF DECK AC CABLE TRAY LAYOUT

SCALE: 1:250M

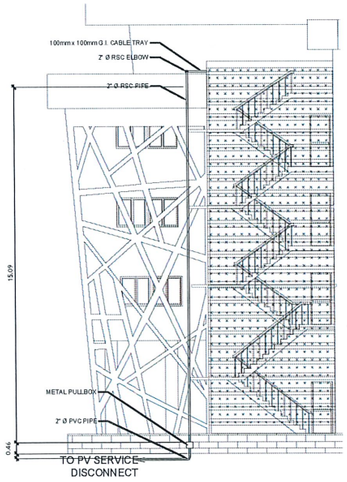


LEGEND

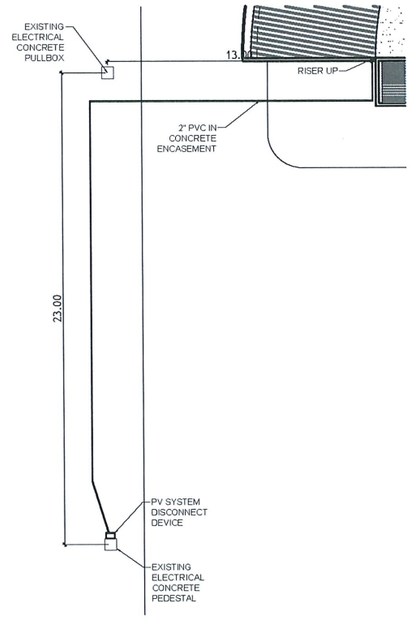
100 X 100 mm GALVANIZED CABLE TRAY

EQUIPMENT LAYOUT

SCALE: 1:50MTS



FRONT ELEVATION



SITE DEVELOPMENT

AC MAIN LINE LAYOUT

SCALE: 1:250M

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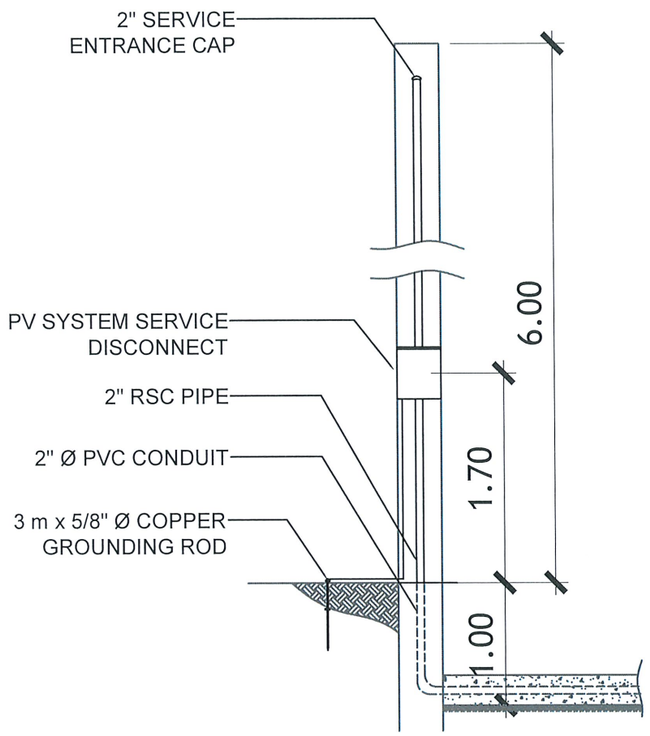
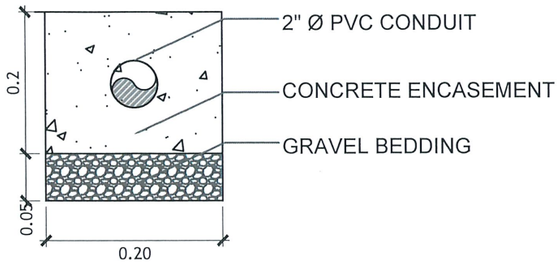


PV SYSTEM DISCONNECT DEVICE

SCALE: NTS



CONCRETE ENCASEMENT DETAIL

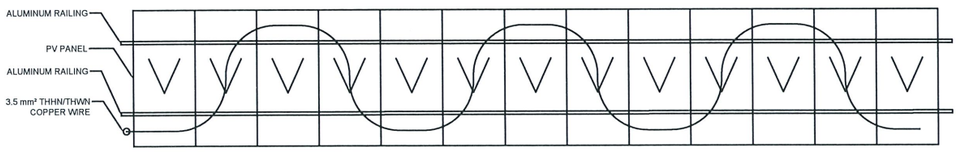
SCALE: 1:10MTS

NOTES FOR GROUNDING SYSTEM:

1. ALL PV PANEL GROUNDING SHALL BE CONNECTED TO THE GROUNDING ROD.

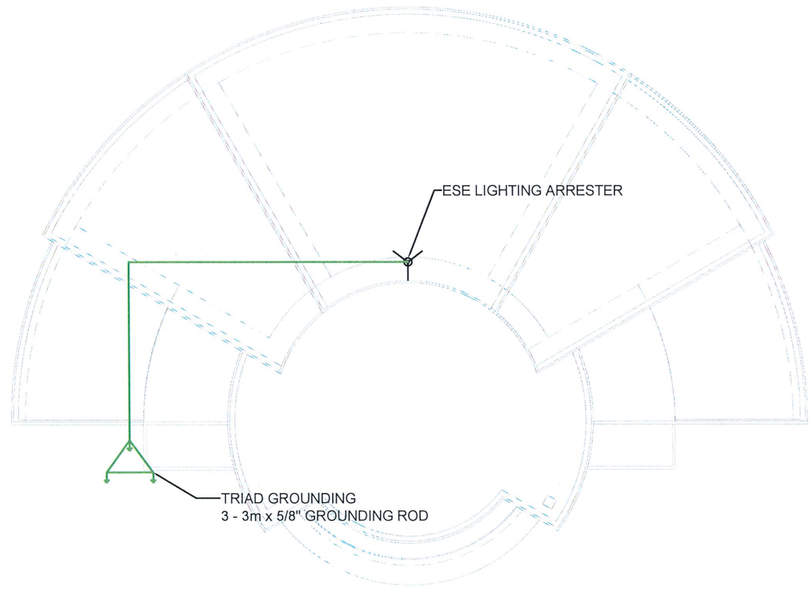
2. PV PANEL GROUNDING AND LIGHTNING LAYOUT SHALL HAVE SEPARATE GROUNDING ROD.

3. GROUNDING RESISTANCE FOR LIGHTNING TERMINAL VALUE SHALL BE 5 OHMS OR LESS.



PV PANEL GROUNDING DETAIL

SCALE: NTS



LIGHTNING TERMINAL LAYOUT

SCALE: 1:300MTS

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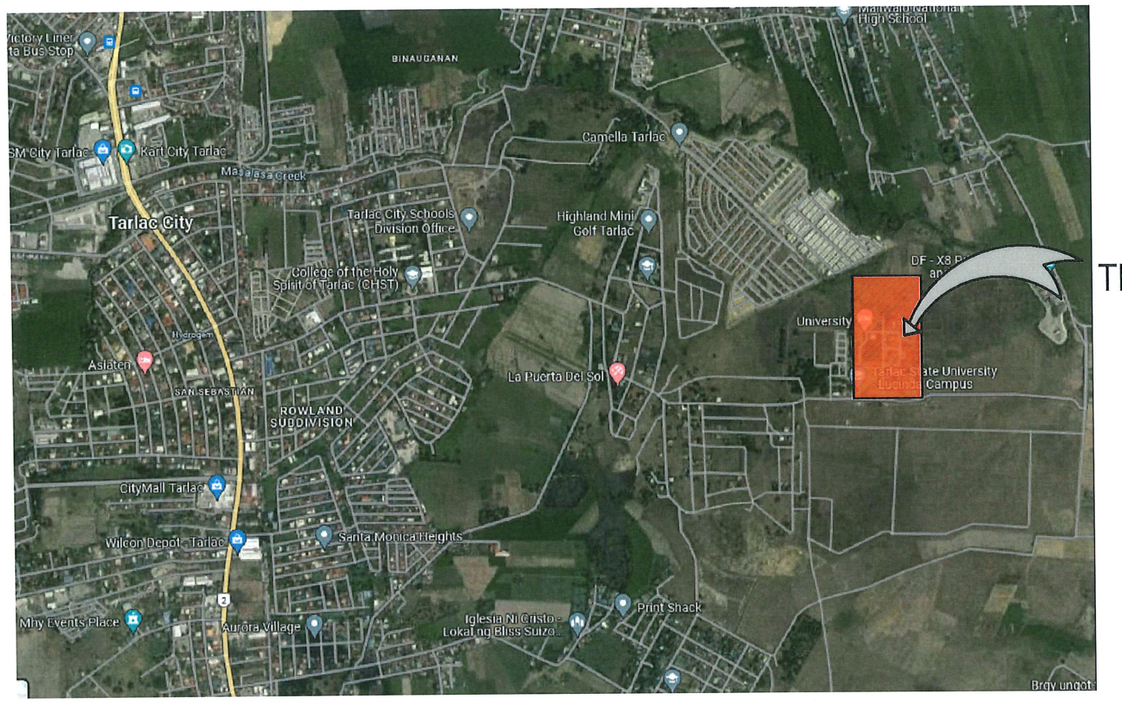
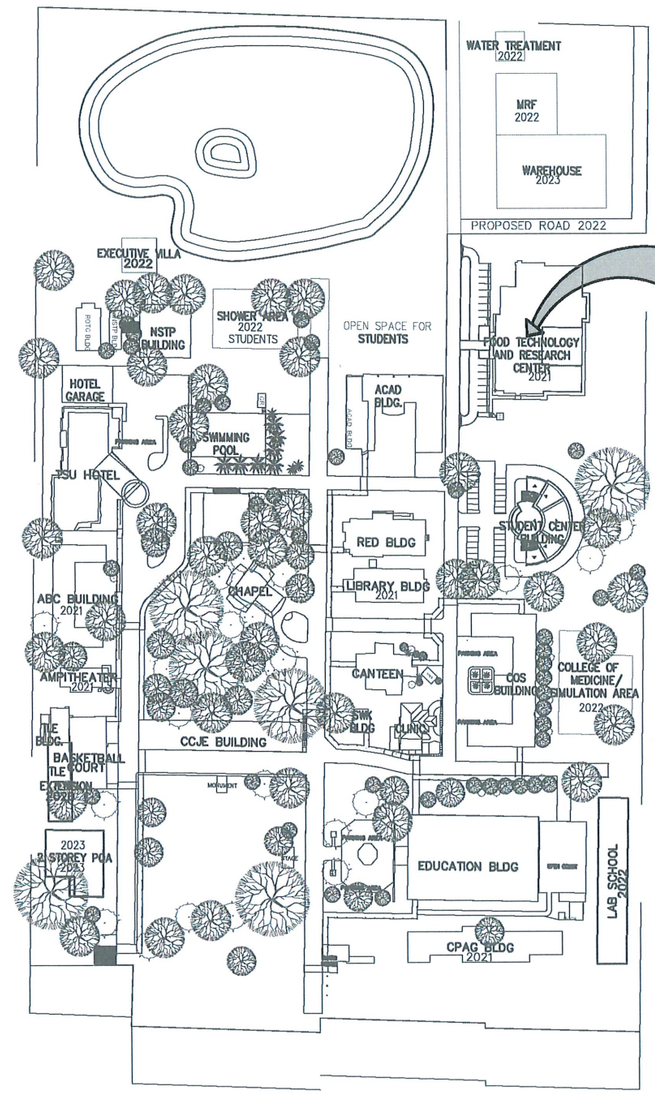
PROJECT LOCATION: TSU LUCINDA EXTENSION CAMPUS							DATE: OCTOBER 2024	PAGE NO: 07/14



THE SITE

VICINITY MAP

SCALE: NTS



CENTER FOR FOOD TECHNOLOGY AND RESEARCH BUILDING

LUCINDA EXTENSION CAMPUS

SCALE: NTS

TARLAC STATE UNIVERSITY Facilities Development and Management Office Romulo Boulevard, Tarlac City, Philippines 2300	PROJECT TITLE: INSTALLATION OF SOLAR HARVESTING SYSTEM AT LUCINDA EXTENSION CAMPUS (STUDENT CENTER AND CFTR BUILDING) PROJECT LOCATION: TSU LUCINDA EXTENSION CAMPUS	REQUESTING OFFICE: DR. LEAH T. MATIAS DIRECTOR, CFTR	PREPARED BY: ENGR. MISAEL REIGH MIEL V. CABANSAG ELECTRICAL ENGINEER, OFDM	CHECKED BY: AR. CHERRY L. FABIANES HEAD, OFDM-PDU	CERTIFIED BY: AR. ARLEN M. GUIEB DIRECTOR, OFDM	RECOMMENDING APPROVAL: ATTY. WILMARK J. RAMOS, DBA VP FOR ADMINISTRATION	APPROVED: DR. ARNOLD E. VELASCO PRESIDENT	SHEET CONTENTS: AS SHOWN DATE: OCTOBER 2024	SHEET NO: 8 PAGE NO: 08/14

GENERAL NOTES AND SPECIFICATIONS

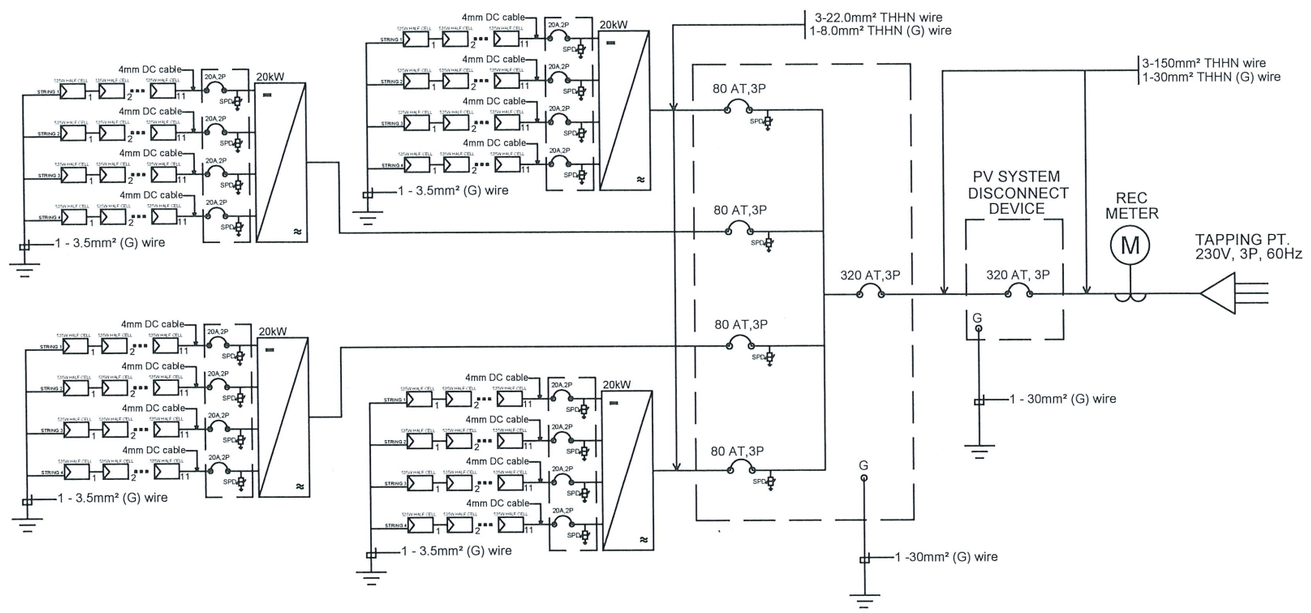
1. ALL WORKS SHALL COMPLY WITH THE APPROVED EDITION OF THE LATEST PHILIPPINE ELECTRICAL CODE, WITH THE RULES AND REGULATIONS OF THE NATIONAL AND LOCAL AUTHORITY CONCERNED IN THE ENFORCEMENT OF THE UTILITY COMPANY CONCERNED.
2. ALL ELECTRICAL WORKS HEREIN SHALL BE DONE UNDER THE DIRECT SUPERVISION OF A DULY QUALIFIED REGISTERED ELECTRICAL ENGINEER OR REGISTERED MASTER ELECTRICIAN.
3. SERVICE VOLTAGE SHALL BE 230VOLTS, 3- PHASE, 60Hz. A.C.
4. ALL MATERIALS PRIOR TO INSTALLATION, FABRICATION OR ORDER CONTRACTOR SHALL SECURE APPROVAL FROM DESIGN ENGINEER OR PROJECT MANAGER BASED ON MATERIAL STANDARD SPECIFICATION. ALL MATERIALS SHALL BE BRAND NEW AND DELIVERED TO SITE WITH THEIR ORIGINAL PACKAGING.
5. ALL WIRES SHALL BE COPPER WITH 99.9% CONDUCTIVITY, SOFT-DRAWN AND ANNEALED.
6. ALL WIRES SHALL BE COLOR CODED AS FOLLOWS:

DC +	-	RED	LINE2	-	YELLOW
DC -	-	BLACK	LINE3	-	BLUE
LINE1	-	RED	GROUND	-	GREEN

7. CONDUIT SHALL BE PROPERLY SEALED TO AVOID ENTRY OF FOREIGN OBJECT, DUST, MOISTURE, WATER ETC.
8. PANELS SHALL BE FABRICATED BY A REPUTABLE FABRICATOR. ONLY ONE BRAND OF CIRCUIT BREAKER WILL BE ALLOWED FOR THE ENTIRE PROJECT. USING MULTIPLE OR COMBINATION OF BRAND WILL BE REJECTED.
9. STANDARD ENCLOSURE AND MOUNTING FOR PANELS AND CABINET AS PER LOAD SCHEDULE. FOR INDOOR PANEL SHALL BE NEMA-1 ENCLOSURE AND FOR OUTDOOR IT SHOULD BE NEMA-4X OR AS INDICATED ON THE PLANS. AND IT SHALL MEET NEMA AND UL SPECIFICATIONS.
10. ALL NON-CURRENT CARRYING METALLIC PARTS OR FRAMES OF ELECTRICAL EQUIPMENT SHALL BE ELECTRICALLY CONNECTED TO FEEDER / CIRCUIT GROUND WIRE WITH SUITABLE TERMINAL LUGS.
11. ALL CONNECTIONS FOR MAIN CIRCUIT BREAKER TO BRANCHES SHALL BE SOLID COPPER BUS BAR, WIRE JUMPERS ARE NOT ALLOWED.
12. 1.5 METER SHOULD BE THE SPACING FROM ONE CONDUIT SUPPORT TO ANOTHER SUPPORT BY MEANS OF C-CHANNEL CLAMPS OR BY U-BOLT.
13. WHENEVER REQUIRED AND NECESSARY PVC PULL BOXES AND JUNCTION BOXES SHALL BE INSTALLED AT CONVENIENT SPACE AND LOCATION.
14. UPON COMPLETION OF ELECTRICAL CONSTRUCTION WORK, THE FOLLOWING TESTS SHALL BE PERFORMED BY THE CONTRACTOR INCLUSIVE OF THE INSTALLATION TO BE REPORTED IN DETAILS ON FORMS APPROVED BY THE OWNER'S REPRESENTATIVE.

A. INSTALLATION RESISTANCE TEST
B. GROUND RESISTANCE TEST
C. OPERATIONAL TEST
D. SYSTEM TEST AND ACCEPTANCE

SINGLE LINE DIAGRAM



LOAD SCHEDULE

DC SCHEDULE OF LOADS

STRING	NO. OF MODULES PER STRING	TOTAL VOLTAGE (V)	CURRENT (A)	CB RATING	WIRE SIZE	CONDUIT
INV 1- STR. 1	11	446.82 V	13.45 A	20A, 2P, 1000V	4mm² DC cable	100mm x 100mm Cable Tray
INV 1- STR. 2	11	446.82 V	13.45 A	20A, 2P, 1000V	4mm² DC cable	100mm x 100mm Cable Tray
INV 1 - STR. 3	11	446.82 V	13.45 A	20A, 2P, 1000V	4mm² DC cable	100mm x 100mm Cable Tray
INV 1 - STR. 4	11	446.82 V	13.45 A	20A, 2P, 1000V	4mm² DC cable	100mm x 100mm Cable Tray
INV 2 - STR. 1	11	446.82 V	13.45 A	20A, 2P, 1000V	4mm² DC cable	100mm x 100mm Cable Tray
INV 2 - STR. 2	11	446.82 V	13.45 A	20A, 2P, 1000V	4mm² DC cable	100mm x 100mm Cable Tray
INV 2 - STR. 3	11	446.82 V	13.45 A	20A, 2P, 1000V	4mm² DC cable	100mm x 100mm Cable Tray
INV 2 - STR. 4	11	446.82 V	13.45 A	20A, 2P, 1000V	4mm² DC cable	100mm x 100mm Cable Tray
INV 3 - STR. 1	11	446.82 V	13.45 A	20A, 2P, 1000V	4mm² DC cable	100mm x 100mm Cable Tray
INV 3 - STR. 2	11	446.82 V	13.45 A	20A, 2P, 1000V	4mm² DC cable	100mm x 100mm Cable Tray
INV 3 - STR. 3	11	446.82 V	13.45 A	20A, 2P, 1000V	4mm² DC cable	100mm x 100mm Cable Tray
INV 3 - STR. 4	11	446.82 V	13.45 A	20A, 2P, 1000V	4mm² DC cable	100mm x 100mm Cable Tray
INV 4 - STR. 1	11	446.82 V	13.45 A	20A, 2P, 1000V	4mm² DC cable	100mm x 100mm Cable Tray
INV 4 - STR. 2	11	446.82 V	13.45 A	20A, 2P, 1000V	4mm² DC cable	100mm x 100mm Cable Tray
INV 4 - STR. 3	11	446.82 V	13.45 A	20A, 2P, 1000V	4mm² DC cable	100mm x 100mm Cable Tray
INV 4 - STR. 4	11	446.82 V	13.45 A	20A, 2P, 1000V	4mm² DC cable	100mm x 100mm Cable Tray

AC SCHEDULE OF LOADS

CKT. NO.	LOAD DESCRIPTION	VOLTAGE (V)	Capacity (VA)	CURRENT				CB RATING			WIRE SIZE	CONDUIT
				AB	BC	AC	ABC	AT	AF	P		
1	20kW GRID TIED INV.	230 V	20000 W				78.44A	80A	100AF	3	3 - 22.0mm² THHN + 1 - 8.0mm² (G) wire	100mm x 100mm Cable Tray
2	20kW GRID TIED INV.	230 V	20000 W				78.44A	80A	100AF	3	3 - 22.0mm² THHN + 1 - 8.0mm² (G) wire	100mm x 100mm Cable Tray
3	20kW GRID TIED INV.	230 V	20000 W				78.44A	80A	100AF	3	3 - 22.0mm² THHN + 1 - 8.0mm² (G) wire	100mm x 100mm Cable Tray
4	20kW GRID TIED INV.	230 V	20000 W				78.44A	80A	100AF	3	3 - 22.0mm² THHN + 1 - 8.0mm² (G) wire	100mm x 100mm Cable Tray

TARLAC STATE UNIVERSITY
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PROJECT LOCATION: TSU LUCINDA EXTENSION CAMPUS	DR. LEAH T. MATIAS, DIRECTOR, CFTR	ENGR. MISAEL REIGH MIEL V. CABANSAG, ELECTRICAL ENGINEER, OFDM	AR. CHERRY L. FABIANES, HEAD, OFDM-PDU	AR. ARLEN M. GUIEB, DIRECTOR, OFDM	ATTY. WILMARK J. RAMOS, DBA, VP FOR ADMINISTRATION	DR. ARNOLD E. VELASCO, PRESIDENT	SHEET NO: 9 / PAGE NO: 09/14 / DATE: OCTOBER 2024

DESIGN PARAMETERS AND CALCULATIONS

INVERTER PARAMETERS:
INPUT (DC)
MAX DC POWER: 30000W
MAX INPUT VOLTAGE: 800V
RATED INPUT VOLTAGE: 360V
MAX INPUT CURRENT PER STRING: 26A
NUMBER OF INDEPENDENT MPP: 4

OUTPUT (AC)
RATED POWER: 20000W
MAX APPARENT POWER: 22000VA
NOMINAL AC VOLTAGE / RANGE: 230V
RATED POWER FREQUENCY / RANGE: 60Hz
MAX OUTPUT CURRENT: 58A
POWER FACTOR AT RATED POWER: 0.8 leading–0.8 lagging
FEED IN PHASES: 3

SOLAR PANEL PARAMETERS:
RATED MAX POWER at STC: 550W
OPEN CIRCUIT VOLTAGE: 49.62V
MAXIMUM POWER VOLTAGE: 40.90V
SHORT CIRCUIT CURRENT: 14.03A
MAXIMUM POWER CURRENT: 13.45A

RAPID SHUTDOWN DEVICE PARAMTERS:
RATED MAX POWER : 700W

DC SIDE DESIGN ANALYSIS

$$\text{Total No. of Solar Panels} = \frac{\text{Plant Capacity}}{\text{Solar Power Module Rating}} = \frac{96800W}{550W} = 176 \text{ pcs. Solar Modules rated @ 550W each}$$

$$\text{Total No. of Inverters} = \frac{\text{Plant Capacity}}{\text{Inverter Max. Power}} = \frac{96800W}{20000W} = 4.84 \sim 4 \text{ Inverter}$$

Number of Panels per String = 11
Voltage per String = No. of Panels x Open Ckt Voltage = 11 x 49.62V = 545.82 V
Ampere Rating at DC Side: I_S = 14.03 A
DC Cable: 4mm² THHN Cu. WIRE & 3.5mm² THHN WIRE for GRND WIRE IN CABLE TRAY

AC SIDE DESIGN ANALYSIS

FOR INVERTERS

$$\text{Demand Load in Amperes:} \quad \frac{\text{Max. AC Output Power}}{\sqrt{3} \text{ X nominal AC Voltage X Power Factor}}$$

$$\frac{20000w}{\sqrt{3} \text{ X } 230 \text{ X } .8} = 62.76 \text{ A}$$

CIRCUIT BREAKER RATING: Use 80AT/100AF, 230V, 3P Circuit Breaker
SUB FEEDER: 3 - 22.0mm² THHN Cu. WIRE & 1 - 8.0mm² THHN WIRE for GROUND WIRE IN 100mm x 100mm Cable Tray

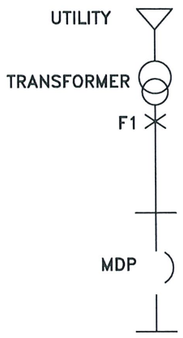
FOR MAIN BREAKER

$$\text{Demand Load in Amperes:} \quad \frac{\text{Max. AC Output Power}}{\sqrt{3} \text{ X nominal AC Voltage X Power Factor}}$$

$$\frac{80000w}{\sqrt{3} \text{ X } 230 \text{ X } .8} = 251.03 \text{ A}$$

CIRCUIT BREAKER RATING: Use 320AT/1000AF, 230V, 3P Circuit Breaker
MAIN FEEDER: 3 - 150mm² THHN Cu. WIRE & 1 - 30mm² THHN WIRE for GROUND WIRE IN 3" Ø RSC Pipe

SHORT CIRCUIT CALCULATION



SHORT CIRCUIT LEVEL FOR UTILITY ASSUMED AS 1000MVA

3 - 167 KVA TRANSFORMER, 13.8/0.23, 3Ø, 60HZ

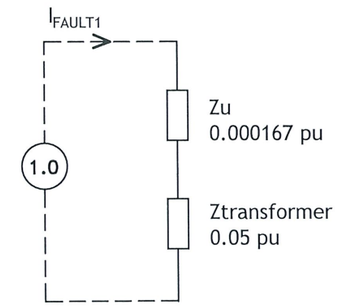
BASE KVA :167 KVA
BASE V: 230 V

Zutility = 167 / 1,000,000 = 0.000167 pu

Ztransformer = 5/100 = 0.05 pu

Ztotal = 0.000167 + 0.05 = 0.050167 pu

NOTE: IMPEDANCE OF THE CONDUCTOR IS ASSUME AS NEGLIGIBLE.



FAULT 1

I_{SC}= (1 / Ztotal) X [KVA base / (1.732 x 230)]

= (1 / 0.050167) X [167 x 10^3 / (1.732 x 230)]

= 8.3565 kAIC

USE: 10 KAIC

VOLTAGE DROP FOR DC SIDE

$$Vd = \frac{2 \text{ X L X I X R}}{1000 \text{ ft}} = \frac{2 \text{ X } 300 \text{ ft. X } 13.45 \text{ A x } 1.931 \text{ ohms}}{1000 \text{ ft}}$$

Vd = 15.58 V

$$= \frac{Vd}{\text{(no. of panel per strings) x Voc}} \text{ x } 100$$

$$= \frac{15.58 \text{ V}}{11 \text{ x } 49.62 \text{ V}} \text{ x } 100 = 2.86 \%$$

VOLTAGE DROP FOR AC SIDE

$$Vd = \frac{1.732 \text{ X L X I X Z}}{305 \text{ m}} = \frac{1.732 \text{ X } 30 \text{ m X } 251.03 \text{ X } 0.065 \text{ ohms}}{305 \text{ m}}$$

Vd = 2.78 V

$$= \frac{Vd}{\text{Nominal voltage}} \text{ x } 100$$

$$= \frac{2.78 \text{ V}}{230 \text{ V}} \text{ x } 100 = 1.21\%$$

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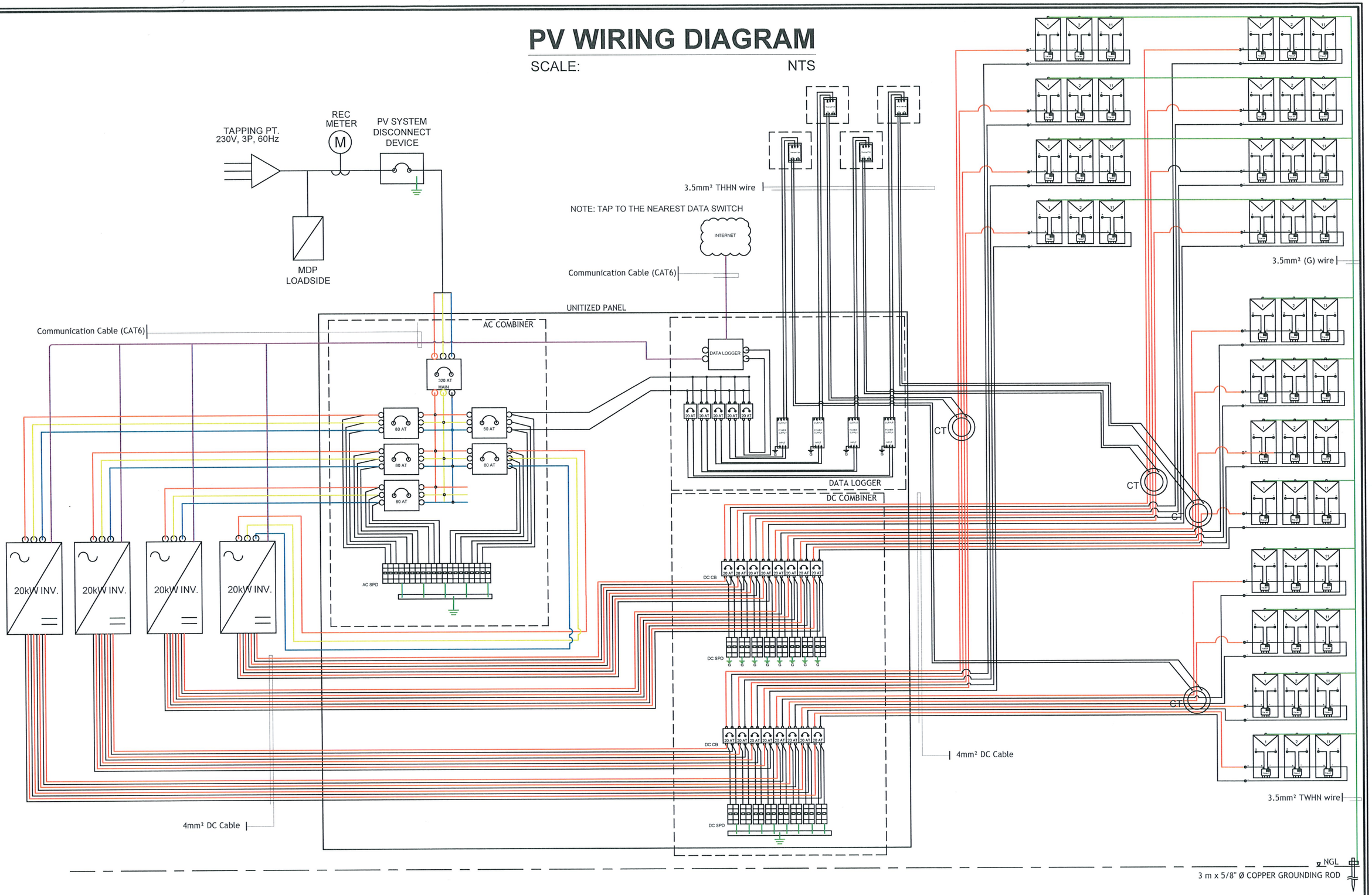
PV WIRING DIAGRAM

SCALE: NTS



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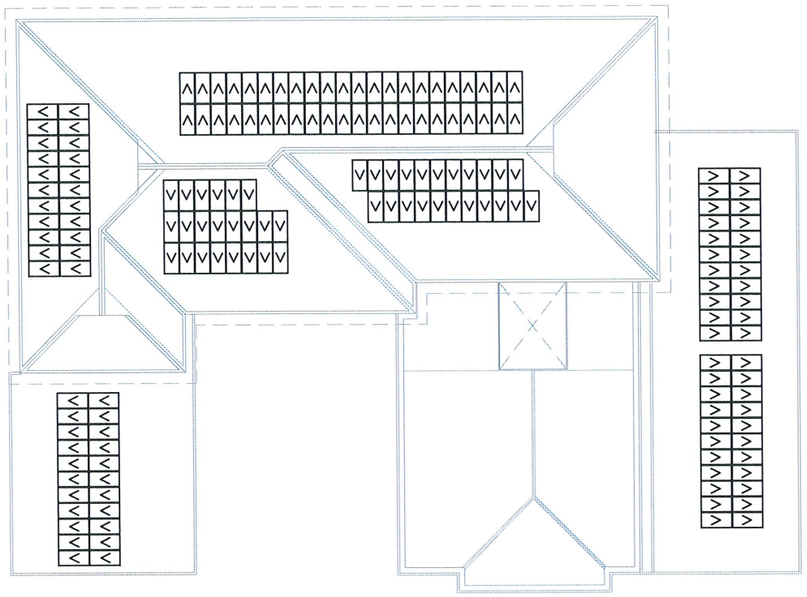
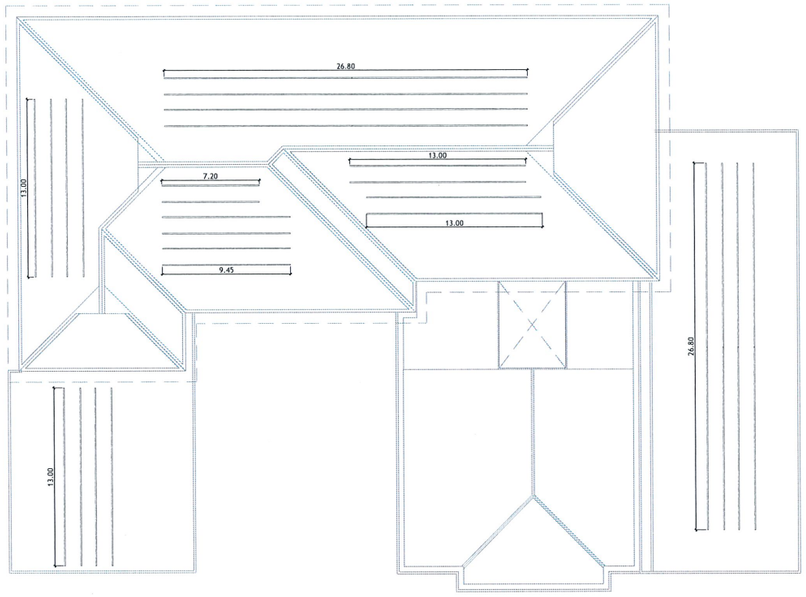


PV ROOF PLAN LAYOUT

SCALE: 1:450M

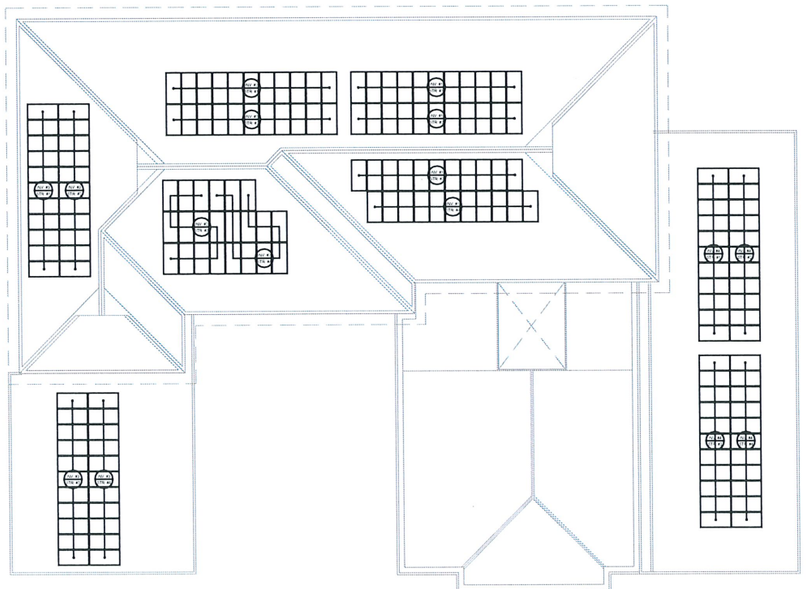


MOUNTING STRUCTURE LAYOUT

SCALE: 1:450M

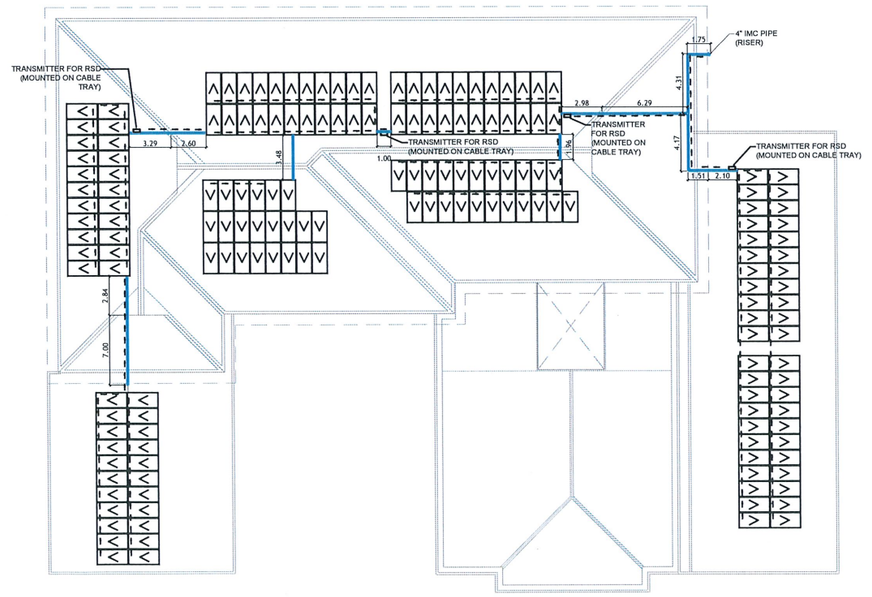
LEGEND

- SOLAR PANEL RAILINGS
- SOLAR PANEL
- 100 X 100 mm GALVANIZED CABLE TRAY



PANEL DISTRIBUTION LAYOUT

SCALE: 1:450M



ROOF PLAN DC CABLE TRAY LAYOUT

SCALE: 1:450M

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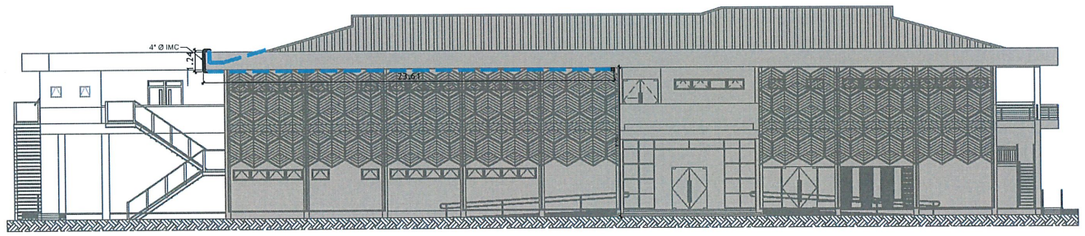
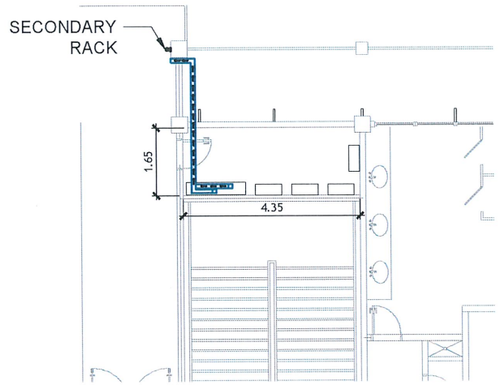
LEGEND

100 X 100 mm GALVANIZED CABLE TRAY

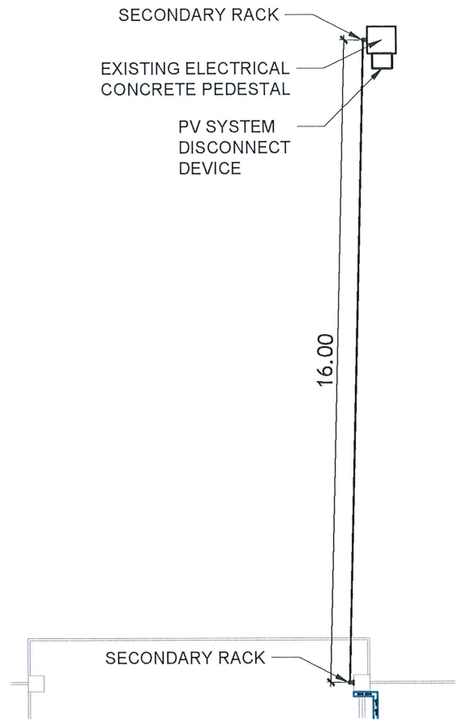


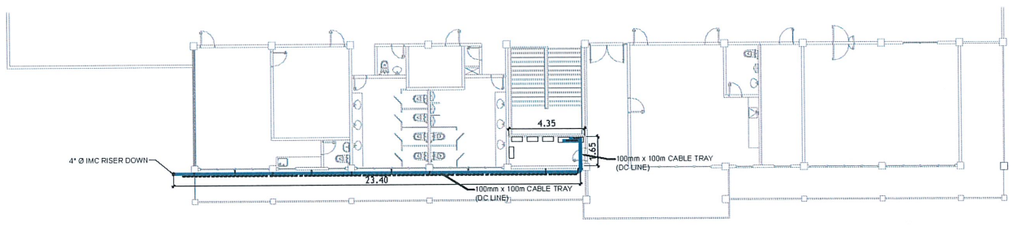
FRONT ELEVATION DC CABLE LAYOUT

SCALE: 1:350M



SECOND FLOOR



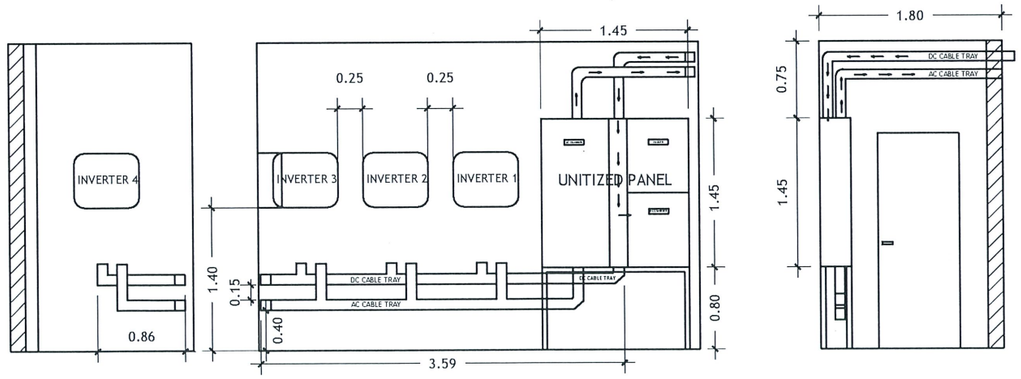


SECOND FLOOR PLAN DC CABLE LAYOUT

SCALE: 1:350M

AC CABLE LAYOUT

SCALE: 1:150 MTS



EQUIPMENT LAYOUT

SCALE: 1:60MTS

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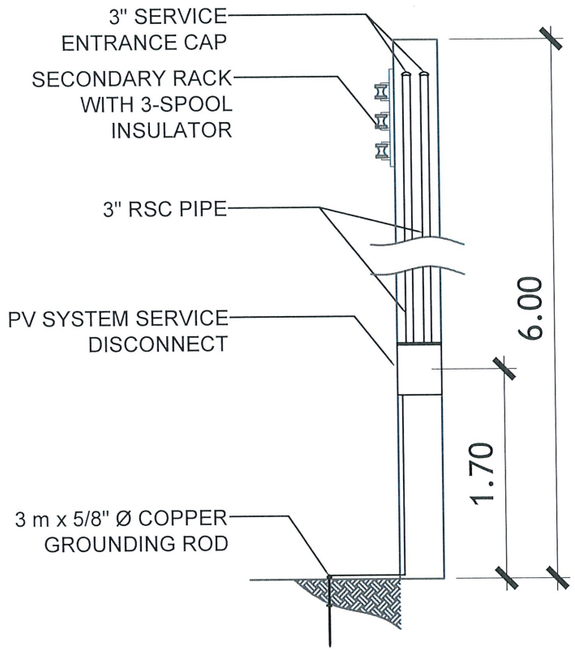
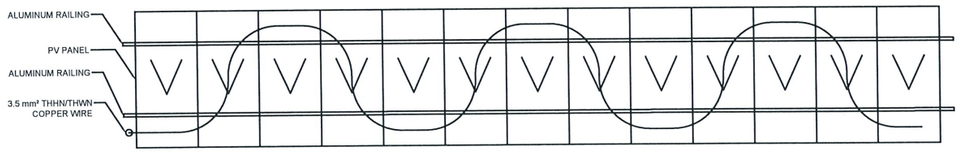


PV SYSTEM DISCONNECT DEVICE

SCALE: NTS



PV PANEL GROUNDING DETAIL

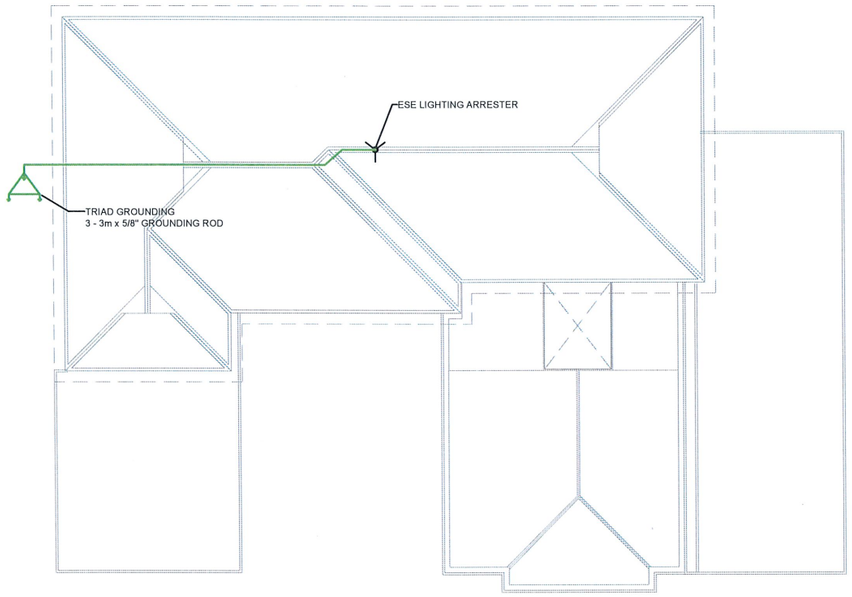
SCALE: NTS

NOTES FOR GROUNDING SYSTEM:

1. ALL PV PANEL GROUNDING SHALL BE CONNECTED TO THE GROUNDING ROD.

2. PV PANEL GROUNDING AND LIGHTNING LAYOUT SHALL HAVE SEPARATE GROUNDING ROD.

3. GROUNDING RESISTANCE FOR LIGHTNING TERMINAL VALUE SHALL BE 5 OHMS OR LESS.



LIGHTNING TERMINAL LAYOUT

SCALE: 1:450MTS

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