

April 2023

**Example 8.16KW solar array (1KW load) 2000 AH battery backup
Solar Installation instructions**

Table of Contents

1	Requirements	2
2	Solution components	2
2.1	Solar panels.....	2
2.2	Solar array structure	2
2.3	Each 12-panel structure as per drawing below	3
2.4	MPPT Solar Controller.....	4
2.5	Battery Cabinet.....	4
2.6	Equipment Cabinet.....	5
2.7	Combiner Box.....	5
2.8	Batteries	6
3	Detail of installation	7
3.1	Handling and Installing Solar Rack.....	7
3.2	Tools required.....	7
3.3	Solar array components identification.....	8
3.4	Mounting brackets detail.....	8
3.5	Layout of PV structure	9
3.6	Layout of foundations	9
3.7	Installation of legs (front and back).....	10
3.8	Installation of tilt beam.....	10
3.9	Installation of rail.....	10
3.10	Installation of solar panels using mid clamp and end clamp kits.....	11
3.11	Wiring between photovoltaic modules	12
3.12	Combiner Box.....	12
3.13	Wiring schematic	13
3.14	Surge Arrestor installation	13
3.15	Combiner box / MPPT Controller / Batteries connections.....	13
3.16	Equipment cabinet specifications	14
3.17	Battery cabinet specifications (one cabinet of 24 batteries).....	15
3.18	Battery cabinet cable provisioning	15
3.19	Battery connections	16
3.20	Cable protection	17
3.21	Battery cabinet free-cooling fans	17
3.22	Surge Arrestors and Grounding.....	18

1 Requirements

1000W/48V load work 24 hours every day, 3.2 days battery autonomy,DOD=80%

Tilt 15° , Azimuth 0°

8160W Solar Array, total 8 strings, each string has 3 pcs ESM340-156 in series, 48V2000Ah battery bank.

2 Solution components

2.1 Solar panels

24 x ESM340-156 (340W/37.6V) Polycrystalline panels

340 Watt

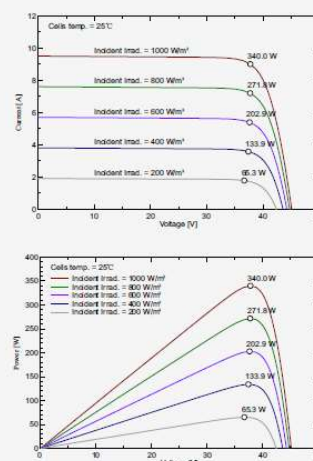
Electrical Characteristics

Type of Cell	Polycrystalline silicon
Cell Size(mm)	156x156mm
Module Efficiency	17.52%
Cell Configuration	72(6x12)
Size of module (mm)	1956x992x35mm
Weight per piece (Kg)	21Kg
Maximum power (Wp)	340W
Maximum power voltage (V)	37.6V
Maximum power current (A)	9.04A
Open circuit voltage (V)	45.1V
Short circuit current (A)	9.51A
Tolerance of Pmax	0~+5W

Standard Operating Conditions

Maximum system voltage (V)	1000V
Temperature coefficients of Isc (%)	0.053%/°C
Temperature coefficients of Voc (%)	-0.33%/°C
Temperature coefficients of Pm (%)	-0.42%/°C
NOCT(°C)	45°C±2°C
Temperature range	-40°C to +85°C
Surface maximum load capacity	60m/s (200kg/sq.m)
Series fuse rating	15A

Characteristics(Module I-V Graph 340W)



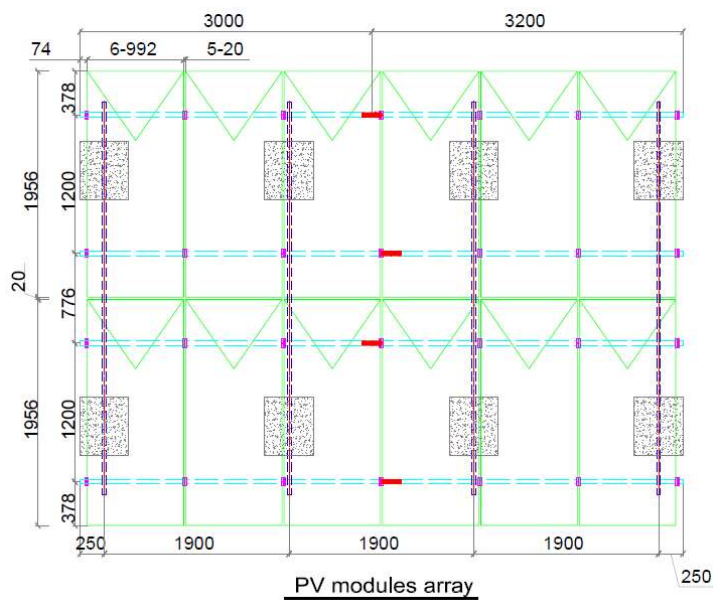
STC: Irradiance 1000W/m², Module temperature 25°C, AM1.5 spectrum.

2.2 Solar array structure

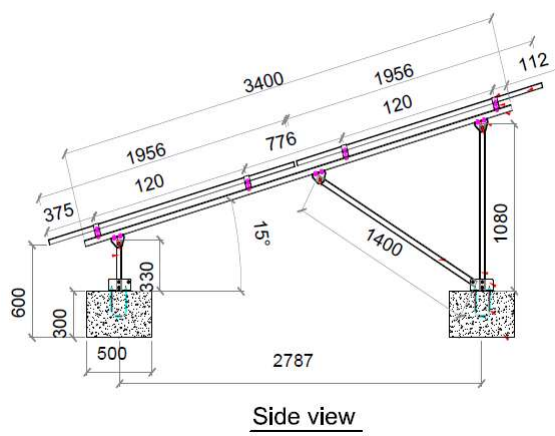
2 x 12-Panel structures as per below.



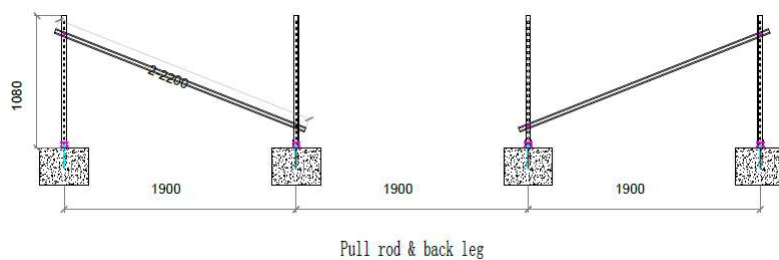
2.3 Each 12-panel structure as per drawing below



PV array elevation



Side elevation



Rear elevation showing sideways stabilisers

Total of 2 of the above arrays (each containing 12 PV panels)(total 24 panels)

2.4 MPPT Solar Controller

2 x TP80 High Conversion Efficiency MPPT Solar Controllers



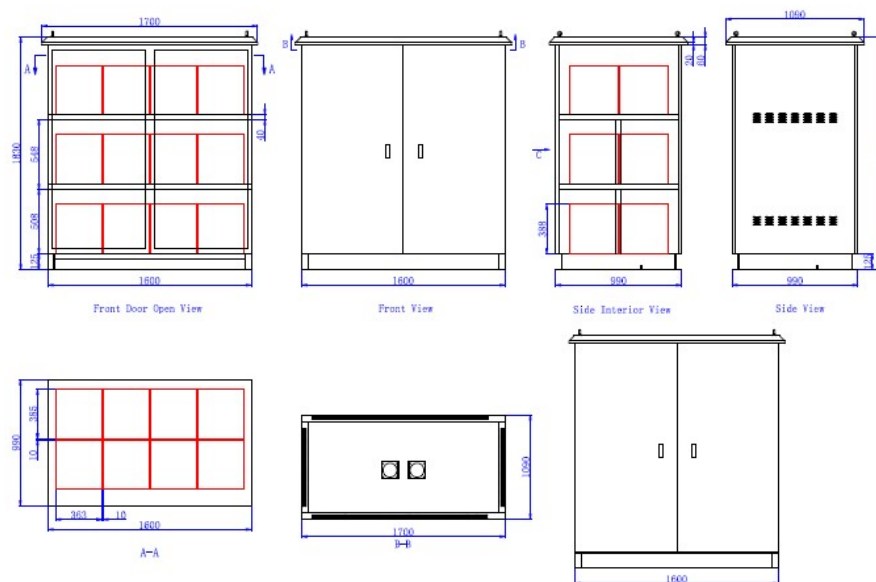
2.5 Battery Cabinet

1 x Battery Cabinet

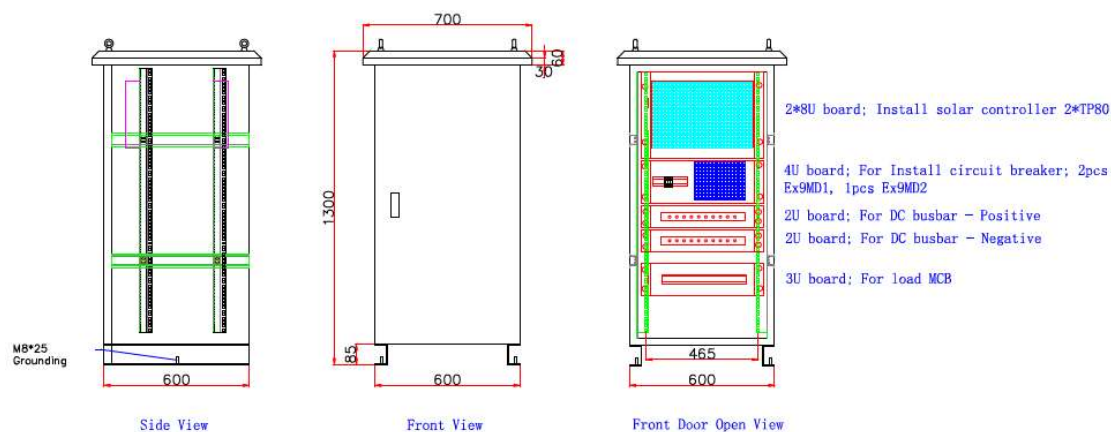
Battery Model: MR 2-2000 GEL

Battery Quantity: 24PCS

Cabinet Model: EC-24-MR2000 GEL-3T2L



2.6 Equipment Cabinet



2.7 Combiner Box

2 x Combiner Boxes (SCB5 – 5 In / 1 Out)



- ✦ Equipped with PV dedicated arrestor
- ✦ With function of arrestor failure alarm
- ✦ RS485 communication port (optional)
- ✦ The polarity reverse protection(optional)
- ✦ High voltage miniature circuit breaker control output



Combiner box

Internal Surge Arrestor

Technical Specification

Specification	Model	SCB3	SCB4	SCB5	SCB6	SCB8	SCB10
Input	Voltage Range (VDC)	0~500V					
	PV Array Input String No.	3	4	5	6	8	10
	Rated Current (A) of Each Circuit	10					
	Positive and negative fuse	15A(Optional circuit breaker)					
Output	Anti-reverse diode	Optional					
	Voltage Range (VDC)	0~500V					
	Output No.	1					
	Max. Voltage Fall	300mV					
	Max. Current (A)	30	40	50	60	80	100
	Breaker	Yes					
Others	Protection Level	IP65					
	Arrester Index	It can endure 20KA surge strike at the 8/20us					
	Insulation Resistance	Under the 15℃~35℃ temperature environment, insulation resistance between input or output circuit and ground ≥2MΩ.					
	Insulation Intensity	After removing the arrester, it can endure the AC 50Hz/1500V/60s without the phenomenon of breakdown and flashover between input or output circuit and ground, and the leakage current <30mA.					
	Safety	Breaker handle is short enough to prevent the operator from touching the electrified body and breaker operating handle during the operation.					
	SPD Protection	Yes					
	Dimension (LxWxH)	400*300*160mm			420*560*170mm		
	Weight (KG)	8.5	9	9.5	10	15	15
Working Environment	Radiation Shield	Antiultraviolet					
	Salt Spray Shield	Salt Spray Proofing					
	Mildew Shield	2 Grades					
	Relative Humidity	≤95% (Non Condensation)					
	Work Temperature	-30℃~70℃					
	Cooling Way	Natural Cooling					

2.8 Batteries

24 x 2000 Ah 2 volt batteries



MR 2-2000 GEL

**VALVE REGULATED LEAD ACID
2 VOLT FLAT PASTED PLATE BATTERY
GELLED ELECTROLYTE TECHNOLOGY**

Innovative Features

Valve regulated Lead Acid (V.R.L.A.) design;
Sulfuric acid thixotropic gel, electrolyte in solid gel form will not stratify – no equalization charge required. Gel powder from Europe leading supplier to ensure the unique performance of gel battery;

Microporous rubber and corrugated PVC SiO₂ separator, the special design increase the high porosity and anti-corrosion and decrease the internal resistance;

Virgin Pure Lead Tin and thick positive plate technology design for maximum service float life - 18 years design life @20°C(68°F);

Thickness positive plate plus optimized plate alloy to anticorrosion;

Unique performance against high temperature;

Non-gassing;

Never needs addition of water;

Spill-proof and leak-proof;

Operates at a low internal pressure;

For use in vertical or horizontal position;

Each cell has a low pressure safety release venting system;

Flame Retardant material V-D optional.

HIGH PERFORMANCE

Performance Specifications

Normal Voltage	2V
Normal Capacity	2000Ah @ 10hr to 1.80V per cell @ 20°C (68°F) 2269Ah @ 20hr to 1.75V per cell @ 20°C (68°F)
Weight	Approx. 120 kg (264lbs)
Dimension	Length x Width x Height x Total Height: 385 x 363 x 369 x 388 mm
Internal Resistance	Approx. 0.12 mΩ @ 20°C (68°F)
Maximum Charge Current	400 A
Short Circuit Current	13400 A
Applicable Operating Temperature Range	-40°C (-40°F) to +70°C (+158°F)
Ideal Operating Temperature Range	+20°C (+68°F) to +35°C (+95°F)
Maximum Charge Voltage	2.40 VPC at 20°C /25°C
Float Voltage	2.25 VPC +/- 1% at 20°C /25°C
Cycle service	2.35 VPC +/- 1% at 20°C /25°C
Container & Cover	Standard: Reinforced ABS (UL 94HB) Optional: Flame-retardant reinforced ABS compliant with U.L.94 V-0 with an Oxygen limiting Index of greater than 28%.
NO. of Terminal	8
Terminal Type	F-M8

Cell Type	Discharge Amps Per Cell @ 20°C (68°F)																						
	End VPC	Discharge Time In Minutes						End VPC	Discharge Time In Hours														
		5	10	15	30	45	60			1.5	2	3	4	5	6	8	10	12	20	24	48	100	
MR 2-2000 GEL	1.80	3192	2736	2280	1756	1379	1140	1.85	805	651	491	382	317	280	229	189	161	103	88.0	45.2	23.2		
	1.75	3752	3026	2590	1864	1485	1210	1.80	853	690	520	405	336	297	243	200	170	109	92.8	47.9	24.6		
	1.67	4187	3509	2881	1933	1502	1231	1.75	890	720	543	423	351	310	253	209	177	113	96.9	50.0	25.7		
Cell Type	Discharge Watts Per Cell @ 20°C (68°F)																						
	End VPC	Discharge Time In Minutes						End VPC	Discharge Time In Hours														
		5	10	15	30	45	60			1.5	2	3	4	5	6	8	10	12	20	24			
MR 2-2000 GEL	1.80	5746	4980	4184	3248	2621	2189	1.85	1549	1268	956	750	625	553	455	376	321	180	176				
	1.75	6679	5447	4689	3449	2724	2324	1.80	1629	1325	1007	790	658	583	479	397	338	191	186				
	1.67	7201	6141	5158	3538	2794	2352	1.75	1679	1367	1041	816	681	603	496	411	350	197	192				

3 Detail of installation

Safety and Installer Responsibilities



INSTALLATION OF THIS PRODUCT IS TO BE PERFORMED ONLY BY PROFESSIONALLY TRAINED INSTALLERS. Any attempt by an unqualified person to install this product could result in death or serious injury.



WARNING: indicates a potentially hazardous situation which, if not avoided, could result in death or serious injury. This symbol is not used for hazards relating to property damage unless there is also a risk of personal injury to this level.



CAUTION: indicates a potentially hazardous situation which, if not avoided, may result in minor or moderate injury. It may also be used to draw attention to unsafe practices that may cause damage to property.

3.1 Handling and Installing Solar Rack

It is critically important to observe standard safety practices when installing Solar Racking Components;

- Stop work during stormy weather as Solar modules can be blown in high winds;
- Never step or sit on the glass surface of a solar module. The glass may break, resulting in shock or bodily injury;
- Do not throw or roughly handle any Solar Racking components;
- Do not bring Solar Racking Components into contact with sharp or heavy objects;
- Do not modify Solar Racking components in any way without authorization;
- Products should be installed and maintained by qualified personnel. Keep unauthorized personnel away from solar modules;
- It is the installer's responsibility to verify the integrity of the structure to which Solar Racking is fixed. Roofs or structures with rotten/rusted bearers, undersized bearers, excessively spaced bearers or any other unsuitable substructure cannot be used with Solar Racking Installation or such structures could result in death or serious injury and will void the warranty

3.2 Tools required

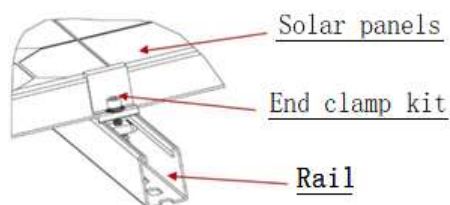
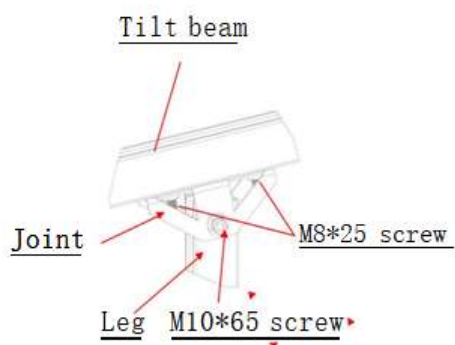
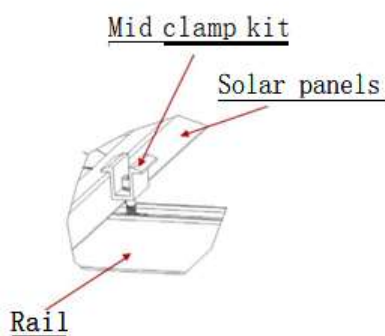
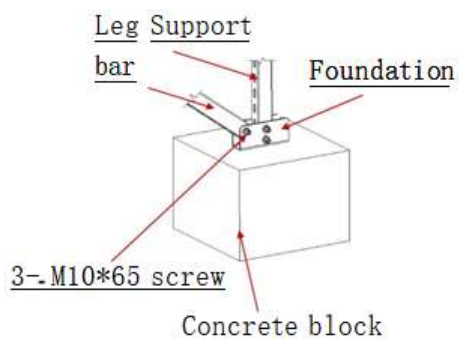
	
6mm metric Allen Key or 6mm hexagonal driver bit.	Drill or impact driver for driving roof material fixings.
	
Measuring tape	Chalk Line Reel
	
Glove	Helmet

3.3 Solar array components identification

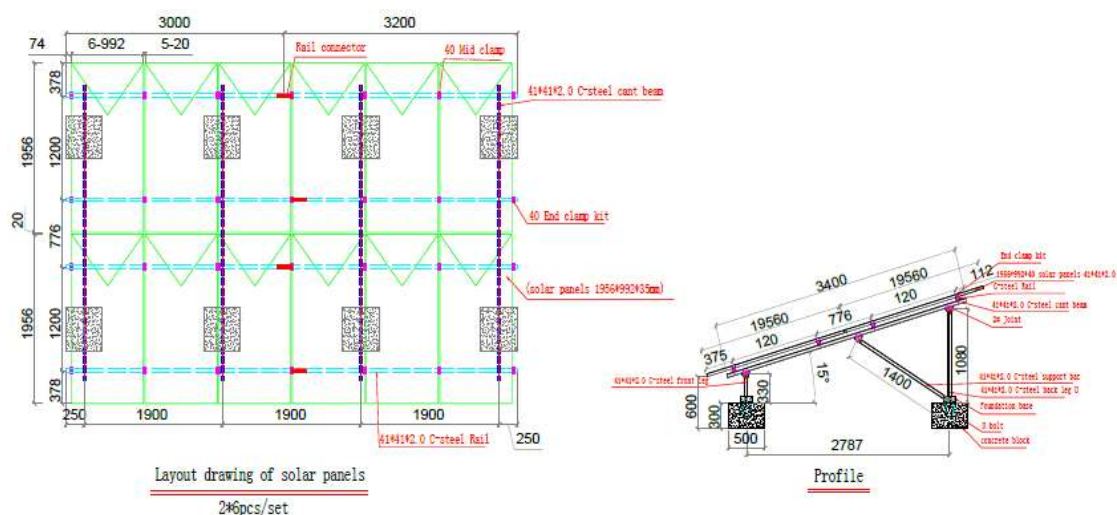
Components Picture	Description
	Front Leg
	Back Leg
	Support Bar
	Tilt Beam
	Rail
	Foundation

	Joint
	connect bolts for rail and tilt beam
	40 Mid Clamps Kits
	40 End Clamp Kits
	U-Ground bolt

3.4 Mounting brackets detail

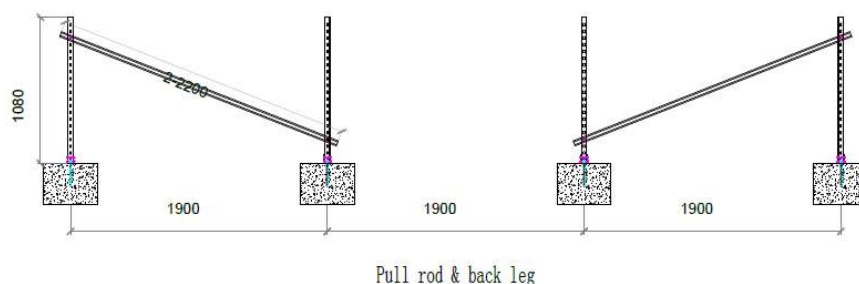


3.5 Layout of PV structure



PV array elevation

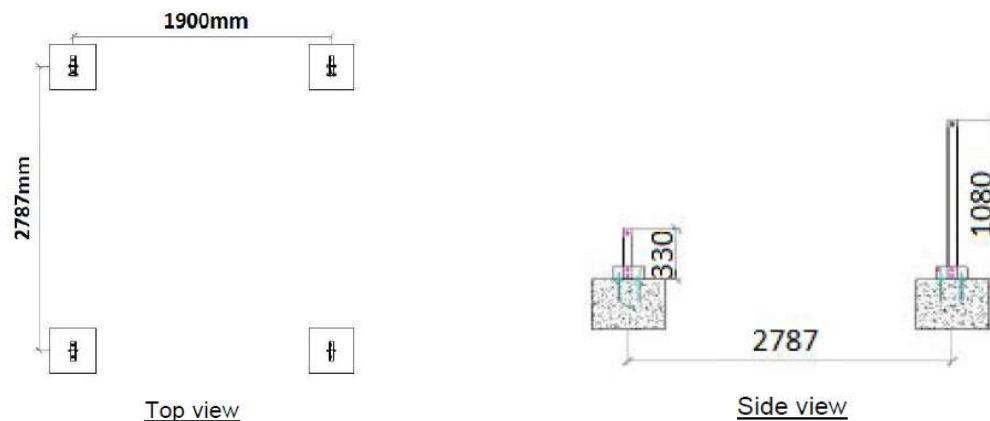
Side elevation



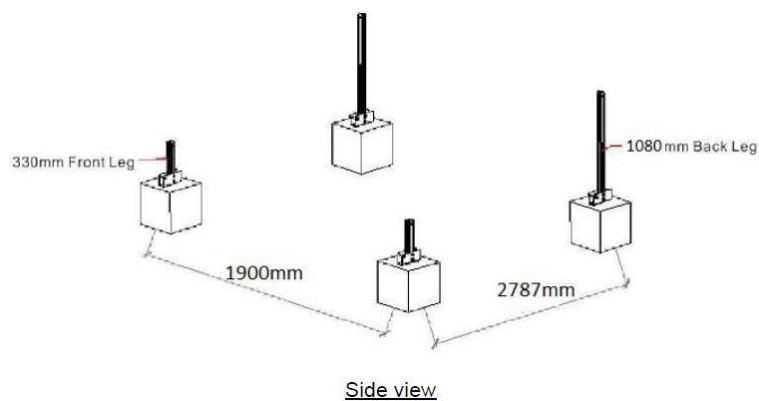
Rear elevation showing sideways stabilisers

2 of the above arrays (each containing 12 PV panels)(total 24 panels)

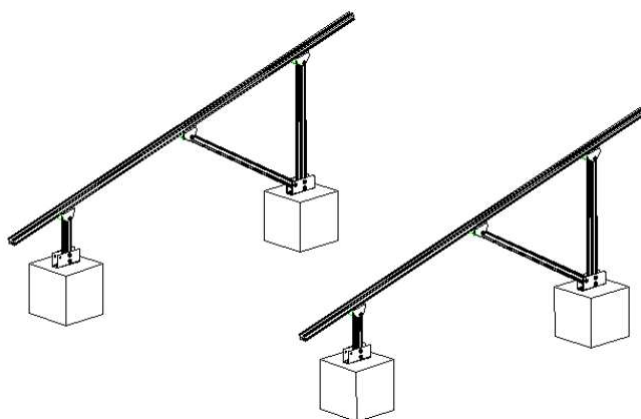
3.6 Layout of foundations



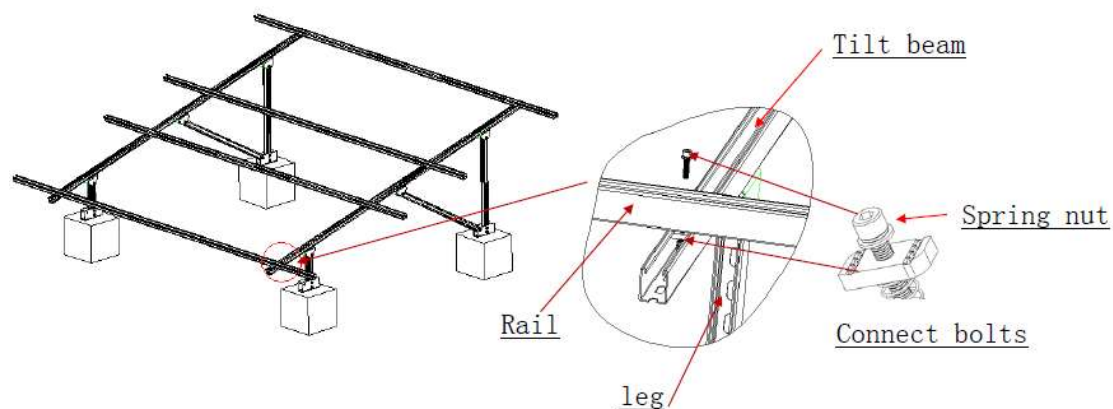
3.7 Installation of legs (front and back)



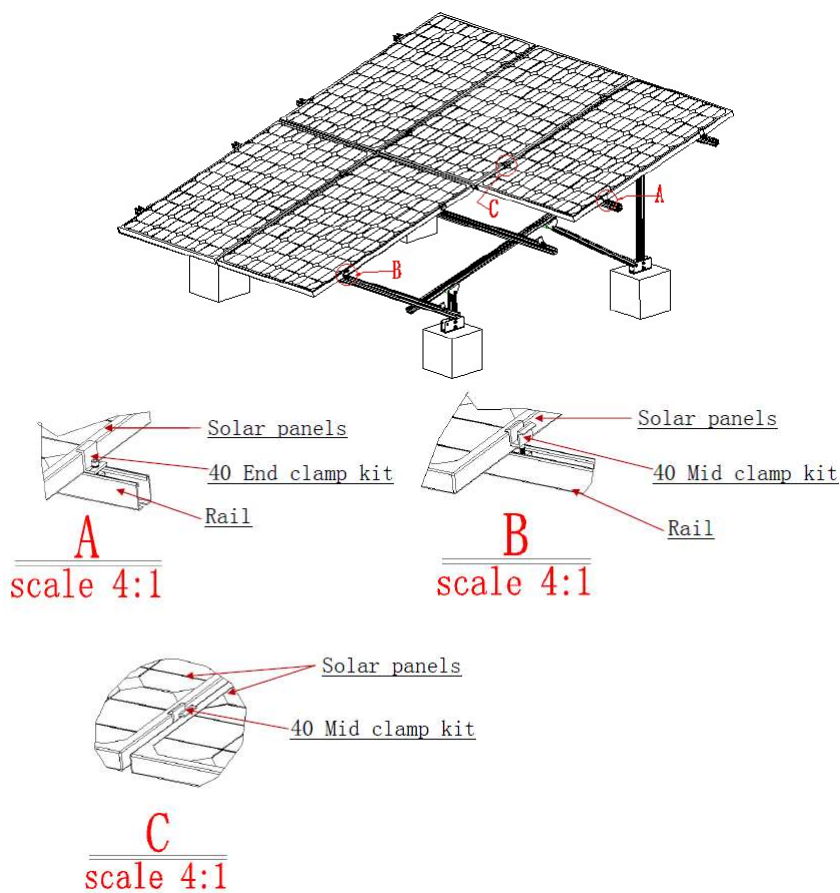
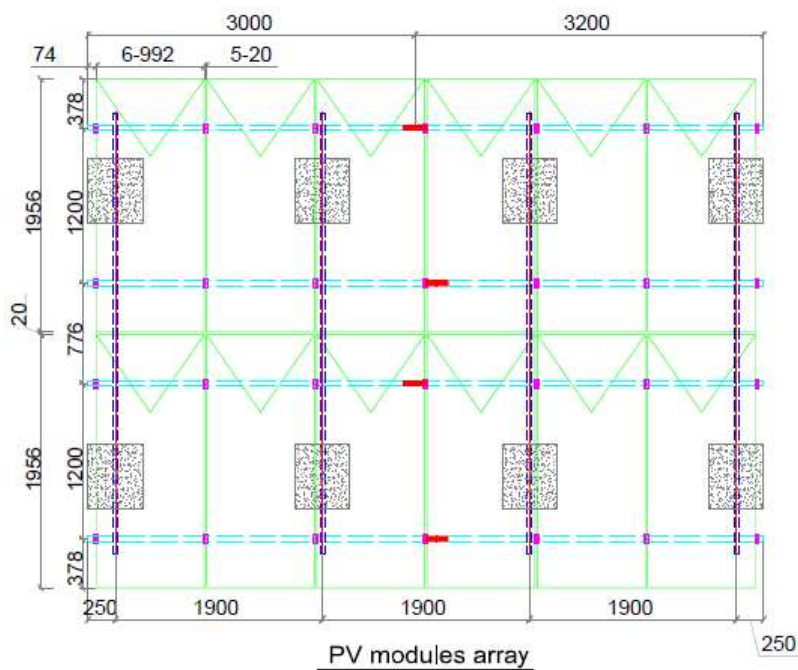
3.8 Installation of tilt beam



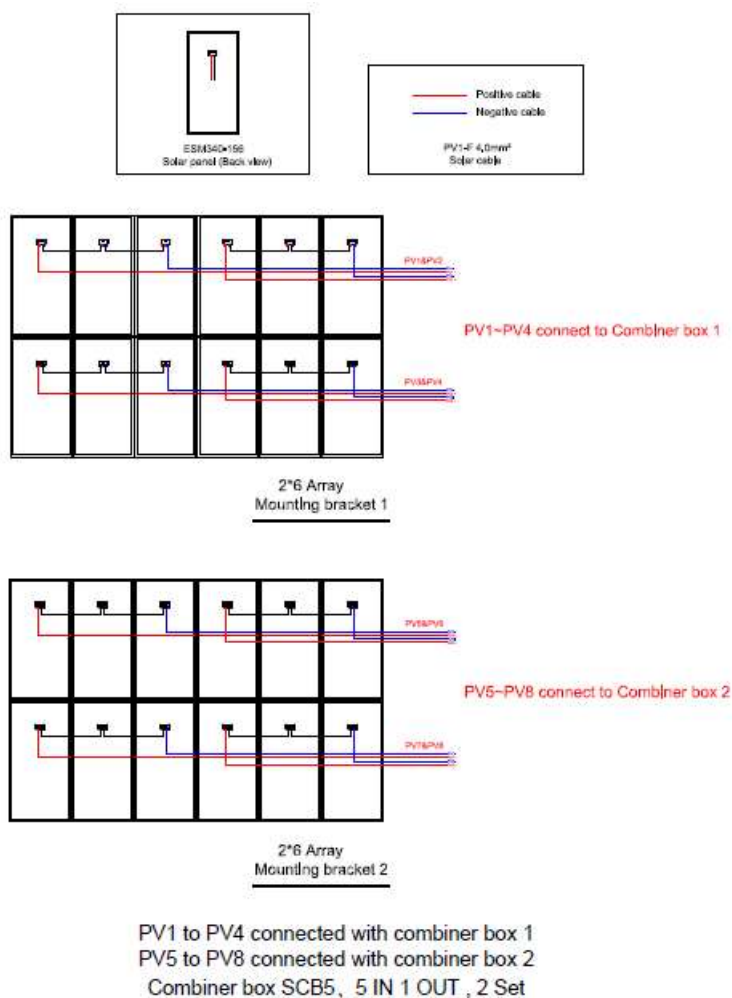
3.9 Installation of rail



3.10 Installation of solar panels using mid clamp and end clamp kits



3.11 Wiring between photovoltaic modules

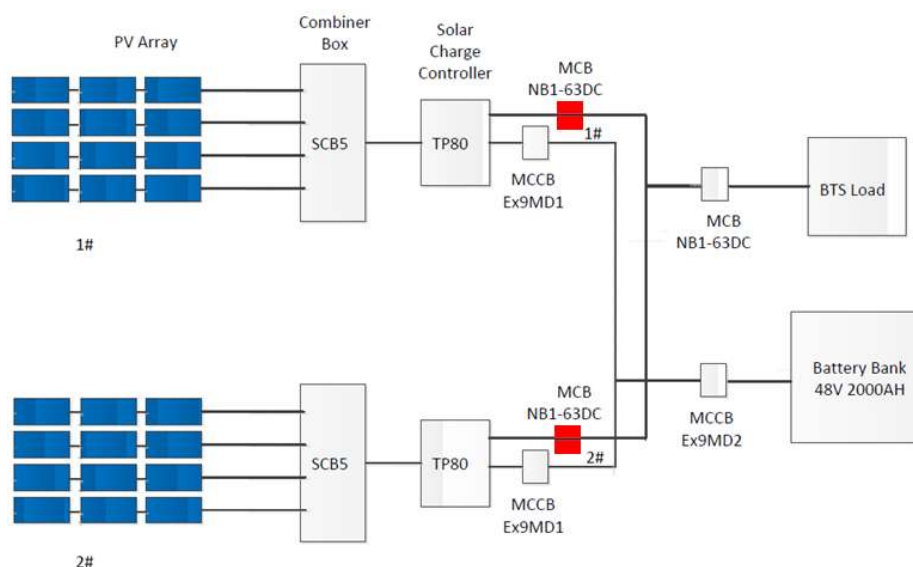


3.12 Combiner Box

There are 2 Combiner Boxes and each Combiner Box can accept up to 5 PV Strings.
Connect 4 PV Strings (PV1 to PV4 to Combiner Box 1).
Connect 4 PV Strings (PV5 to PV8 to Combiner Box 2).



3.13 Wiring schematic



Note:

- 2pcs * TP80 is connected in parallel to charge battery bank 48V 2000Ah;
- 2pcs * TP80 is connected in parallel to supply power to the DC telecom load;

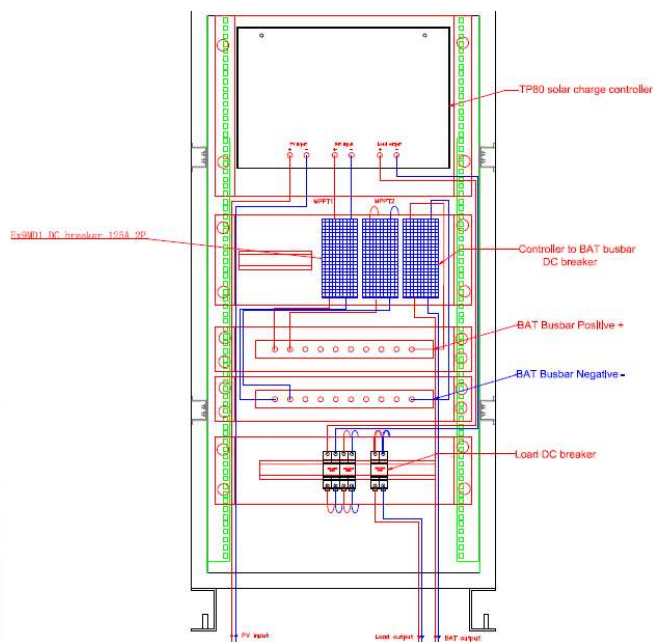
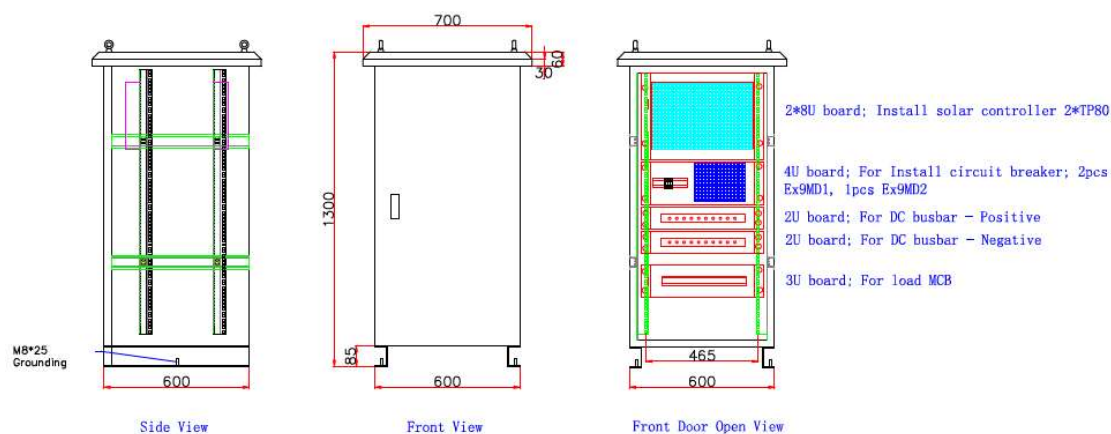
3.14 Surge Arrestor installation

A Surge Arrestor is already provided integrated inside each Combiner Box.
It is essential that this is well grounded.

3.15 Combiner box / MPPT Controller / Batteries connections

- Note that the Circuit Breaker (MCB) to isolate the PV Array from the MPPT Controller is situated inside the Combiner box and accessed by opening the front door of the Combiner box.
There is an MCB in Combiner Box 1 and another in Combiner Box 2.
This may also be used manually for maintenance purposes.
Note that a Surge Arrestor is also situated inside each Combiner box.
- Connect Combiner box 1 to MPPT Controller 1 using ZR-YJV 2*10mm² cable provided.
- Connect Combiner box 2 to MPPT Controller 2 using ZR-YJV 2*10mm² cable provided.
- Connect MPPT Controller 1 (Battery input/output) via MCB1 (Ex9MD1) (125 Amp) and onwards to the DC BUS using ZR-YJV 2*16mm² cable provided.
- Connect MPPT Controller 2 (Battery input/output) via MCB1 (Ex9MD1) (125 Amp) and onwards to the DC BUS using ZR-YJV 2*16mm² cable provided.
- Connect the Battery Bank from the Battery Cabinet to the BUS bars using BVR 1*70mm² Red & Black cable provided.
- Connect the Load Output from each MPPT Controller 1 & MPPT Controller 2 to its own load MCB NB1 63DC (32A 2P 10KA)
- Connect the Load Outputs from each MPPT Controller load MCB NB1 63DC (32A 2P 10KA) in parallel to the main load MCB NB1 63DC (32A 2P 10KA)

3.16 Equipment cabinet specifications

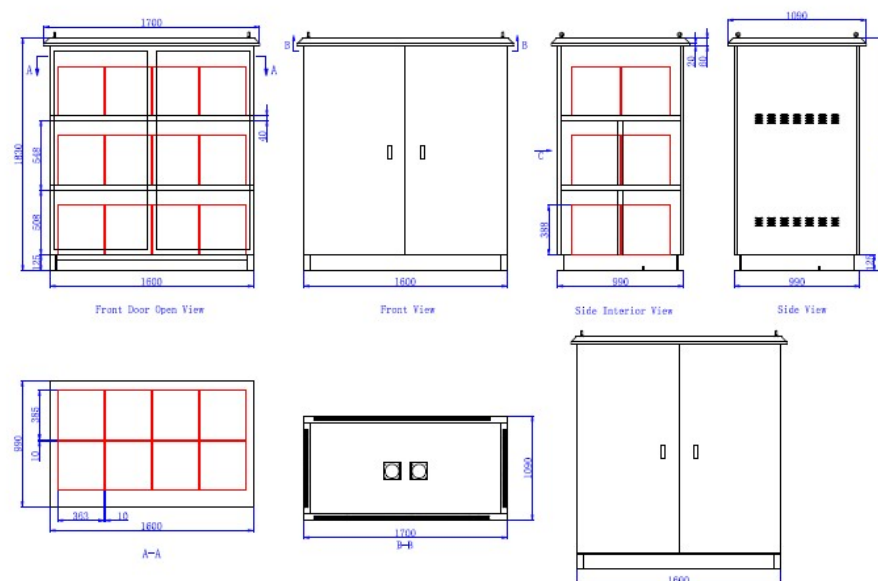


3.17 Battery cabinet specifications (one cabinet of 24 batteries)

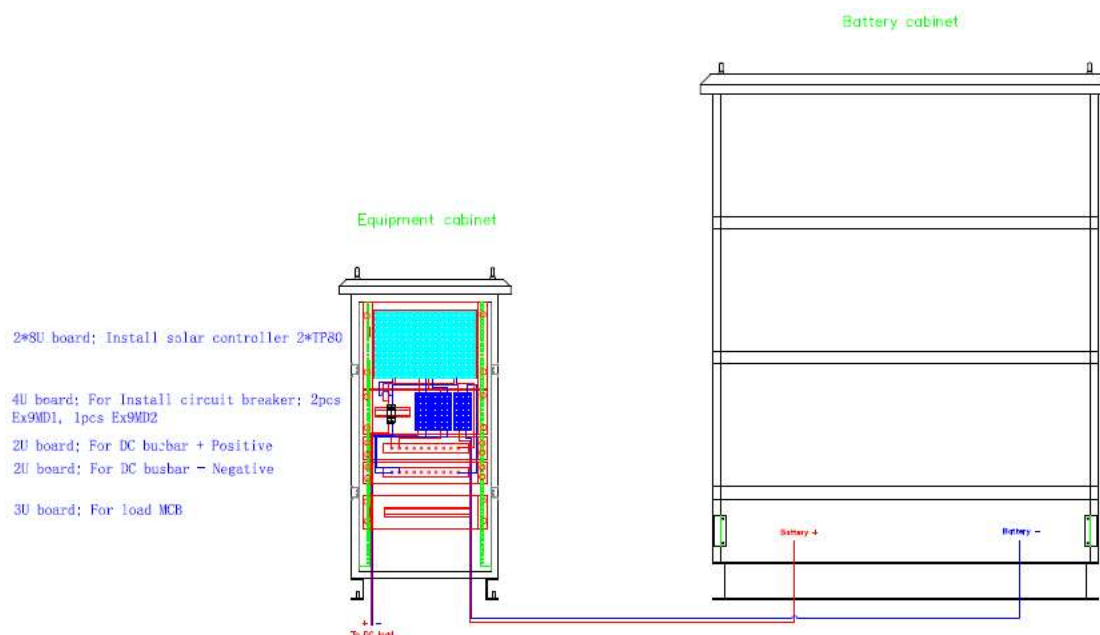
Battery Model: MR 2-2000 GEL

Battery Quantity: 24PCS

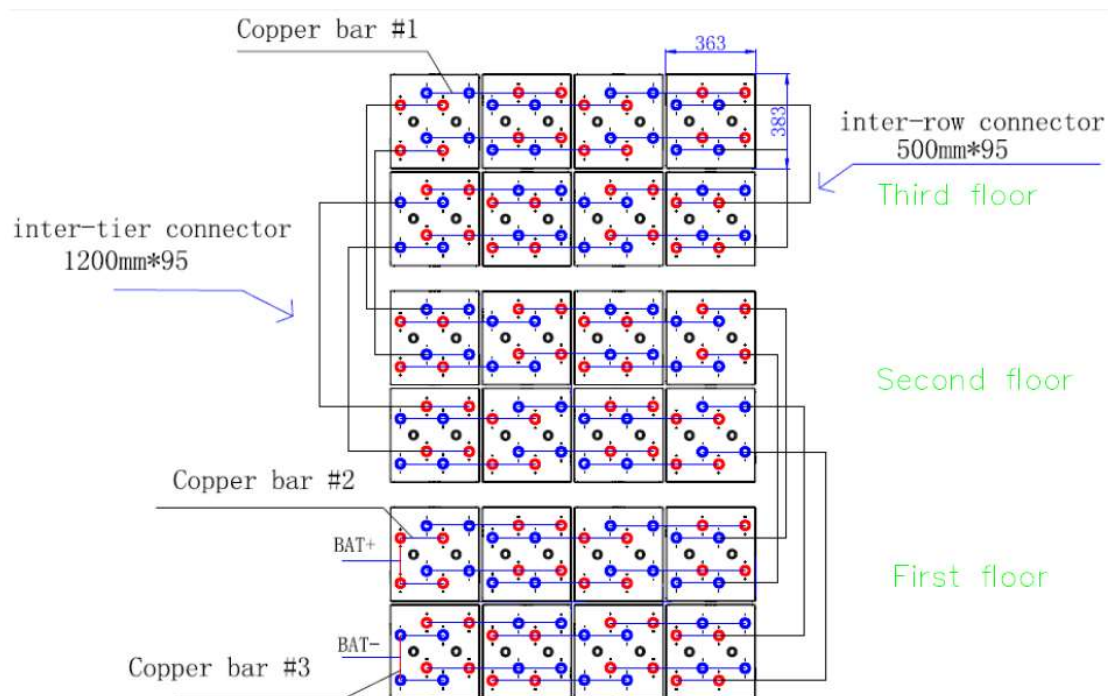
Cabinet Model: EC-24-MR2000 GEL-3T2L



3.18 Battery cabinet cable provisioning



3.19 Battery connections



- 1) There are 8 batteries connected in series per layer.
- 2) Each layer is connected in series.
- 3) The positive and negative terminals of the battery bank are at the bottom of the battery cabinet.
- 4) Total battery bank voltage is 48 volts.
- 5) Note that the power supply to the DC cooling fan is already connected when supplied.

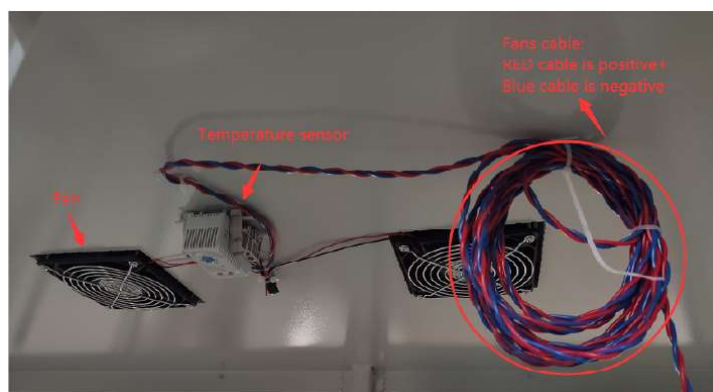
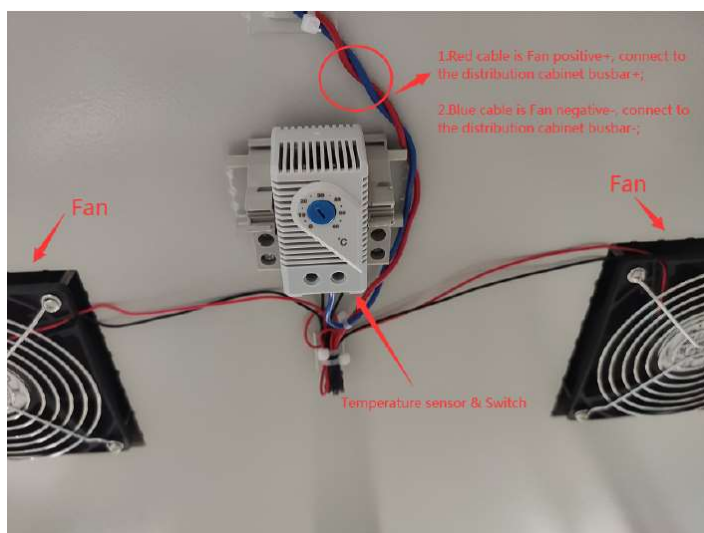
3.20 Cable protection

When passing cables between the cabinets or from cabinets to the PV arrays, then use the PVC Connectors and PVC Tube provided. This provides additional protection to the insulation on the cables against the chassis of the cabinets.

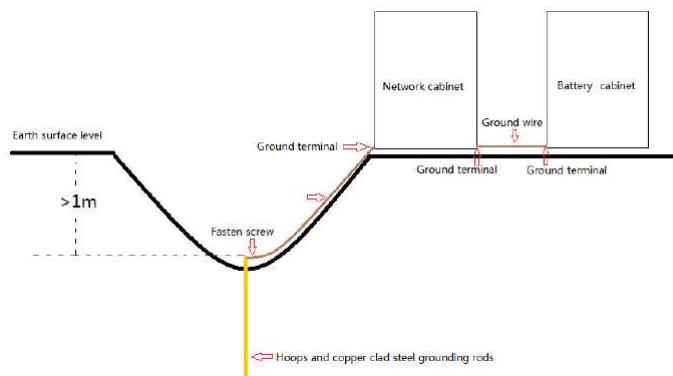


3.21 Battery cabinet free-cooling fans

Thermostatically controlled fans are installed in the Battery Cabinet.



3.22 Surge Arrestors and Grounding



Note: Regarding the Ground terminal on outside of the Network Cabinet & Battery Cabinet. Take care to remove the protection tube before making connection.



Use 16mm² ground wire (yellow/green) to connect the Surge Arrestor Ground and Equipment Cabinet Ground terminals.

Note there are two Surge Arrestors, one in each Combiner Box.



Note the Ground connection on the Surge Arrestor in bottom right hand corner of the Surge Arrestor.

Connect the yellow / green grounding wire to the copper clad steel grounding rod provided or other good site grounding point.