Loom Solar

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TIMING

16th Session

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EVERY SATURDAY

10 - 11 AM

SOLAR SYSTEM

What is solar system?

A photovoltaic system, also PV system or solar power system, is a power system designed to supply usable solar power by means of photovoltaics. ... Nowadays, most PV systems are grid-connected, while off-grid or stand-alone systems account for a small portion of the market.

Types of solar system.

1. Off grid system
2. On grid system / grid tie solar system
3. Hybrid solar system

How to design off grid system

- **What is an off grid system ?**

Off-grid solar systems require specialised off-grid inverters and battery systems large enough to store energy for required time.

Main components of off grid solar system:-

1. Off grid inverter
2. Batteries
3. Pv modules
4. DCDB
5. DC wire
6. MC4 connectors
7. Earthing
8. Lighting arrestor
9. Panels structure

Luminous 6 kw off grid inverter:-

important specifications :-

maximum pv power = 6 kw

input Voc range = 160-240 v

maximum input current = 46 amp

nominal battery voltage = 96v

nominal output current = 43 amp

SPECIFICATIONS

MODEL	4KW	5KW	6KW
Photovoltaic			
Solar Input Voltage range (Voc)	160V – 240 VDC		
Solar Input Voltage range (Vmp)	120 - 210 VDC		
Maximum PV power	4KW	5KW	6KW
Maximum I/P Current (Array)	30A	40A	46A
Maximum MPPT Output current	40A	50A	60A
Grid Input			
Input Supply Phase	Single Phase		
Grid Voltage range	180V - 270V		
Nominal Grid Current (import)	29A	36A	43A
Battery			
Nominal Battery Voltage	96 VDC		
Charging Stages	Boost, Absorption, Float		
Inverter			
Switching Element	IGBT		
Control	32 Bit DSP controlled		
Nominal Output Voltage (V) & Voltage range	230V ± 2%		
Output Supply Phase	1 Phase 2 Wire		
Output Waveform	Pure Sine Wave		
Nominal Frequency	50 Hz ± 1%		
Nominal Output Current	17.2A	21.5A	26A
Output Voltage Distortion(THD)	<4%		
Overload at nominal output voltage for 10 min	110%		
Overload at nominal output voltage for 1 min	125%		
Overload at nominal output voltage for 5 sec	200%		

How many panels?

- Howmany no. of panel:-

no. of panels = maximum pv power / one panel wattage

= 6000/375 = 16 nos

i.e. that we should not connect more than 16 panels with this system.

Note:- actual no. of panels depend on the panels string.

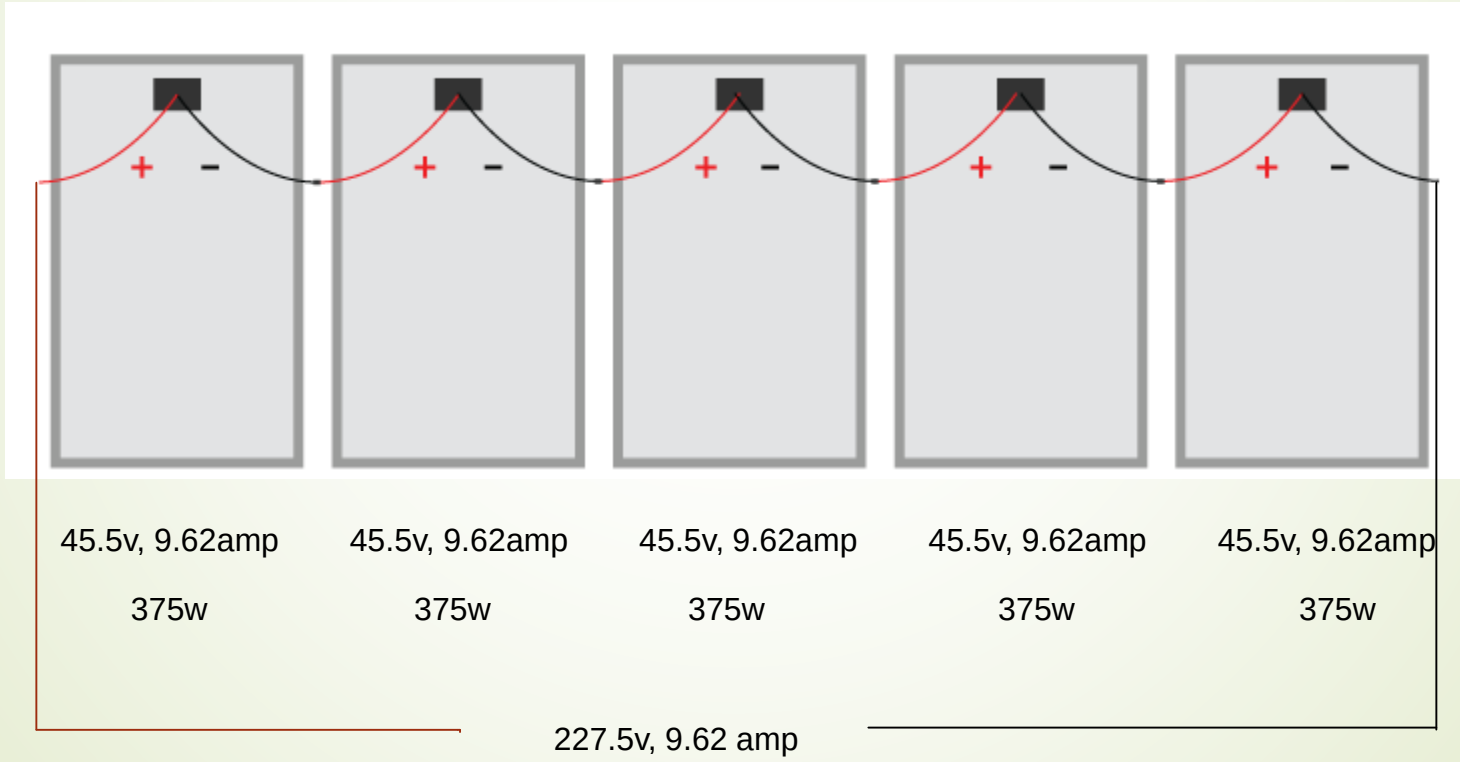
Panel string:- panel string is a combination of panels connected in series.

There are two types of connections for panels

1. Series connection
2. Parallel connection

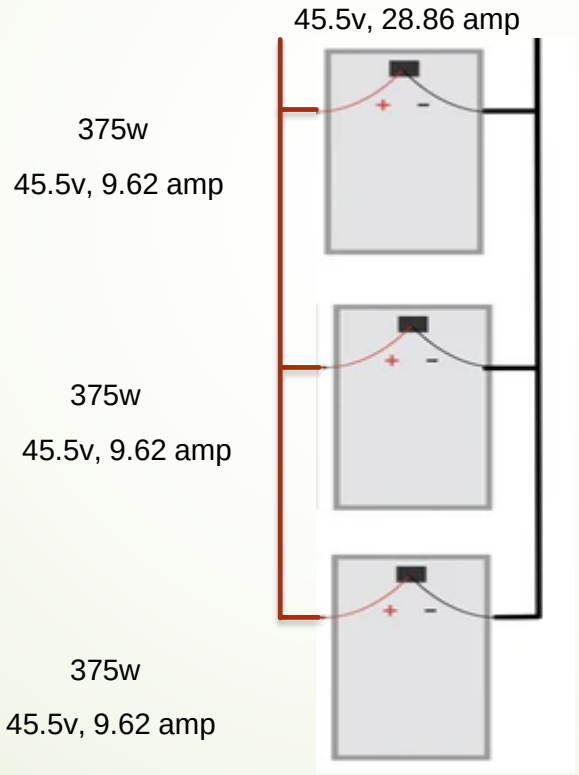
Series connection

- When an installer connects your solar panels in a series, he is wiring each panel to the next. This creates a string circuit. The wire running from the panel's negative terminal is connected to the next panel's positive terminal and so forth down the line for one path of current for a continuous, closed loop.



Parallel connection

- Connect all the positive terminals of all the solar panels together, and all the negative terminals of all the panels together.



String calculation for 6 kw off grid inverter

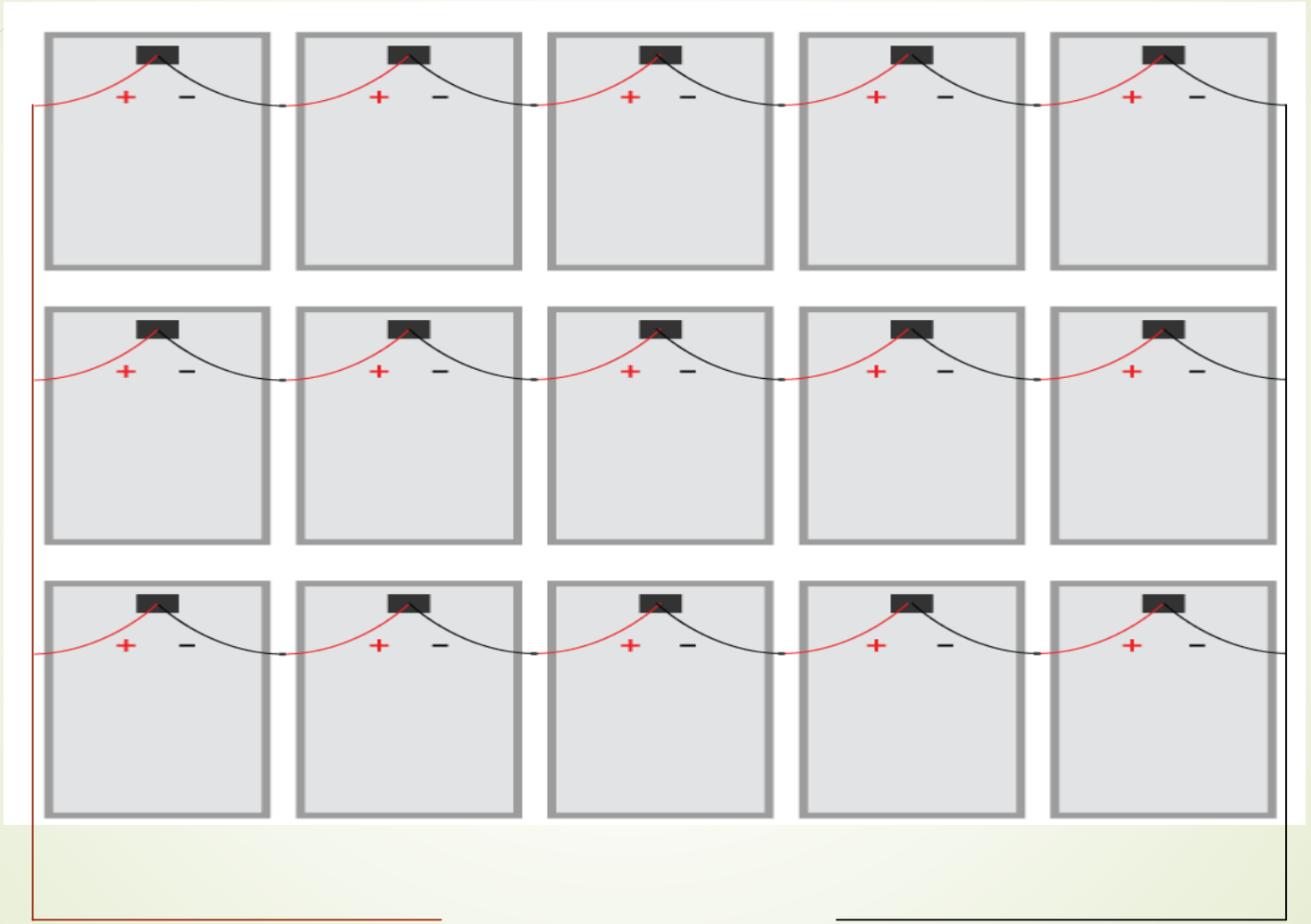
Voc of inverter = 160 - 240 v

best input pv voltage = (160+240) / 2 = 200 v

Note :- if our string voltage is around 200 v.That is best suitable voltage.

- No of panels in a string = 200/45.5 = 4.39 (approx. 5)
- No of stings will be in multiplication of 5.
- No of strings = 16/5 = 3 strings (15 panels)
- Max. Output voltage and current in the system = 227.5v, 28.86 amp

String diagram of panels:-



227.5v, 28.86 amp

No. of batteries?

- No of batteries = nominal input voltage / 12

  = 96/12 = 8 nos

Backup of one 150AH battery = 70% of (150x12)

= (70 x 150 x 12)/ 100

= 1260 wh

Total backup = 8 x 1260 = 10080 wh (approx. 10 units)

Note :- battery capacity depends on the required back up time

Selection of DCDB box :-

- DCDB :- component of an electricity supply system which divides an electrical power feed into subsidiary circuits, while providing a protective fuse or circuit breaker for each circuit.

components in DCDB :-

1. DC mcb
2. SPD (surge protection decice)
3. Fuses

Note :- selection of dcdb box depends on the no. of strings in the system.

In this system there are 4 strings

So DCDB type = 4 in 1 out DCDB

Selection of wire :-

Note :- we always prefer DC wire on DC side from panels to inverter and between inverter to battery.

Size of DC wire = max. current / 2.5

= 28.86 /2.5 = 11.5

So the wire should be more than 11.5 mm. we should use 16 sq mm wire because after 10 sq mm we have 16 sq mm wire.

- If we use less diameter of wire than there will be power loss in the system. For maximum efficiency we should use required size wire.

Design of a traditional on grid solar system:-

- On grid:- On-grid means your solar system is tied to your local utility's GRID. This is what most residential homes will use because you are covered if your solar system under or over-produces in regard to your varying energy needs. All this means for you is that your utility system acts as your battery space.

components for on grid system :-

1. Inverter
2. Pv module
3. DCDB
4. ACDB
5. DC wire
6. LA and earthing
7. MC4 connectors
8. Panels structure

Luminous 6 kw on grid inverter:-

max. DC power = 6000kw

max DC voltage = 600 v

no. of MPPT – 2

max AC output current = 23.8

Type	NXi 115	NXi 130	NXi 150
Input (DC)			
Max. DC power [W]	1800	3600	6000
Max. DC voltage [V]	500	600	
Full power MPPT voltage range (volts)	150-400	150-500	180-500
Operating MPPT voltage range (volts)	100-400	100-500	
Start Voltage [V]		120	
Max usable input current per MPPT (Amps)	10	10+10	10+18
Max short circuit input current (Amps)	15.6	15.6+15.6	15.6+ 23.4
Number of MPPT	1	ST Model-1/ Standard-2	
DC switch	Yes		
Output (AC)			
DC Injection current (mAmps)		< 20	
Rated AC power [W]	1500	3000	5000
Max. AC power [W]	1700	3300	5000
Max overcurrent protection device (Amps)	10	20	30
Max. AC current [A]	8.1	15.7	23.8
Nominal AC voltage/ range	220/230/240/ 180-270(adjustable)		
Grid frequency/ range	50(47-52) / 60(57-62) Hz		
Power factor [cos φ]	>0.99		
Total harmonic distortion [THDi]	THD<3%		
Feed-in phase / connection phase	1		

No. of panels and string calculation

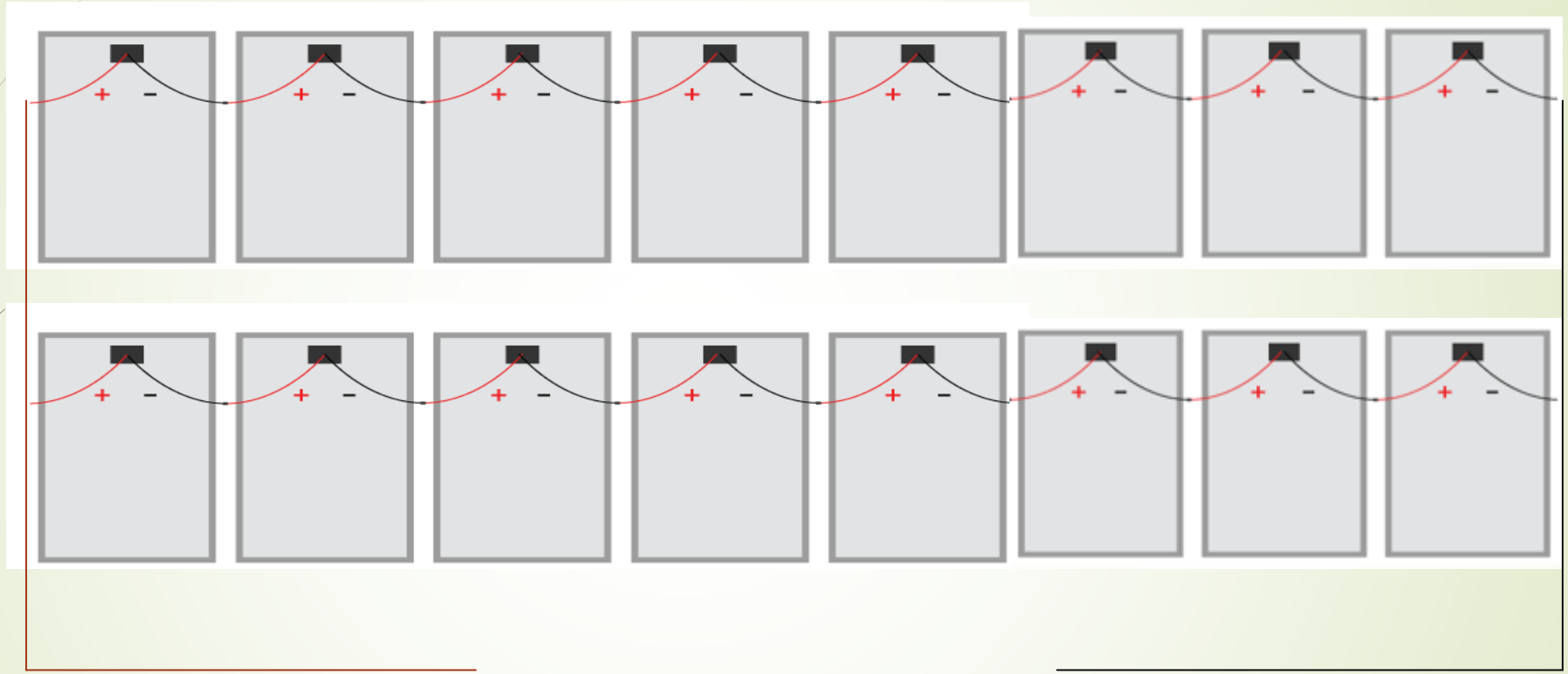
No. of panel = 6000/375 = 16

No. of string = no of MPPT in the inverter

No. of string = 2

Panels in each string = 16/2 = 8 nos

String diagram of panels:-



364v, 19.24 amp

Selection of ACDB box :-

- ACDB :- The ACDB (Alternative Current Distribution Box) receives the AC power from the solar inverter and directs it to AC loads through the distribution board. ACDB includes necessary surge protection device (SPD) and MCB to protect the solar inverter from any type of damage or heavy voltage.

Components in ACDB :-

1. SPD (surge protection device)
2. MCB

Type of ACDB :-

1. 2 pole single phase
2. 4 pole three phase

ness
d/5