

Technical Requirements of the 35 KW Solar system

Hybrid Solar PV system with Energy Storage of 35 kWp with 4 hour back up (DC Capacity at STC) on PPA Basis to be installed at locations as per Annex B-1 with roof mounted PV modules

Installations as per following minimum technical requirements.

1. Photovoltaic Module

Parameters	Min. Specifications required
Module Make	Brand should be verifiable , Tier 1
PV Module	Model No Verifiable
PV Module Capacity	480 watt or above (as per design)
PV Module Type	Mono/ Perc
Cell Quality	A Grade
Power tolerance	3%
Certification	TUV certified as per IEC 61215, IEC 61730 or equivalent Modules should be free of PID and must include PID free certificate from TUV.
Junction Box	IP 66 with 1000 V (IEC) insulation class or above (must comply safety standards concerning to system i.e. connecting wire insulation class etc.
Cable	1000 V (IEC) insulation class or applicable
Warranty	10 years' product replacement warranty 10years for 90% of warranted min. power 25years for 80% of warranted min. power.

2. Solar Grid inverters and control

Overall system must have reverse power blocking feature as power junction point i.e. Grid, Gen-Set coupling point, that can be controlled/ configured. Gen-Set Synchronization, stability and overload/under load protection must be kept in view while installation.

Parameters	Min. Specifications required
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Inverter Make	Brand should be verifiable, Critical components used in inverter like capacitor must be used from Tire 1 rated brand by Bloomberg
Operating Conditions	String Type preferred IP 65 or more , Having must Anti Islanding feature Maximum efficiency of 98.0 % DC input voltage of up to 1500 V(IEC compliance) or as per design Multi string capability for optimum system design Multiple MPP ranges Data logging Remote access
Performance guarantee	5 years Replacement + 5 extended warranty= 10 years
Certification	Equaling or applicable standards such as IEC 62109-1/-2, IEC 62116, IEC 61727,

3. Cabling

1. All exposed wiring (with the possible exception of the module interconnects) must be covered in conduits/duct. Wiring through roofing, walls and other structures must be protected through the use of bushings. Wiring through roofing must form a waterproof seal (applicable for wiring only).
2. Field installed wiring must be joined using terminal strips or screw connectors. Soldering or crimping in the field must be avoided if at all possible. Wire nuts are not allowed. The rated current carrying capacity of the joint must not be less than the circuit current rating. All connections must be made in junction boxes with IP 66 Rated if open and IP 65 Rated if used under shed. Fittings for light switches, and polarity sensitive socket outlets may be used as junction boxes where practical.
3. Installation including wiring shall meet the requirement and recommendations given in 8.3 of IEC 62124 ed.1
4. The commissioning and acceptance will be subject to the fulfillment of all requirements specified in the above mentioned paragraphs of IEC 62124 ed.1 and additional requirement as detailed below.

- a. No conduit or fitting shall be attached directly to thatch or any other non-supportive surface
- b. Especially avoid installing the conduit direct over the roof; there must be distance not less than 3 inches between the roof surface and conduit/duct..
- c. All wires must be terminated with proper end sleeves and wire thimbles with different colors for positive and negative polarity.
- d. The rated current carrying capacity of the joint must not be less than the circuit current rating.
- e. Fittings for PV must be with polarity sensitive socket outlets to avoid short circuiting.
- f. Size, voltage grade and manufacturer name should be printed on every cable

5. Cable specifications are as followed with BS/IEC standards compliance.

Item	Requirement
1. PV to inverter:	99.9% pure copper (Stranded and flexible) with voltage drop less than 2%, UV resistive cladding
2. Grid to Inverter	99.9% pure copper (Stranded) with voltage drop less than 2% , UV resistive cladding
3. Inverter to Load D.B:	99.9% pure copper (Stranded) with voltage drop less than 2%, UV resistive cladding

4. Breakers for AC and DC Power:

- Circuit Breaker Voltage rating must be greater than the maximum circuit voltage and current rating must be between 125% - 150% of the maximum design current for the circuit.
- Breakers Must have a clear visual indication of their state (ON/OFF or I/O) and marking.

5. Surge Arrester

Parameters	min. Specifications required
Impulse current (Iimp)	min. 25kA (10/350µsec.)
Response time	≤ 50nsec
Leakage current	≤ 1 mA
Dielectric strength	2000 V AC @ 1 minute

Protection Class Class	1(Type1)
Discharge voltage	As per design
Ingress Protection	IP20 or above
Short circuit withstand capacity	min. 30kA

6. Lightning arresters & Surge Protection System accessories

Calculation must be done in accordance with rolling sphere method or equaling (share the calculation at the time of execution)

Parameters	Min. Specifications Required
Air termination rod material	Copper
Air termination rod length	As per design
Air termination rod diameter	As per design
Air termination rod	As per design
Cable for interconnecting metal structure and SPD*.	16mm ² or higher, 99.99% pure copper or higher (1 core) or equaling strip for grounding
Insulated Spacer	As per design
Cable Bracket	As per design
Stand – Fang Fix system	As per design
	Earthling of 2.5 ohm or less (with standard earthling pit)
Compliance	Applicable standards that may include ICE 62305-3 (EN62305-3) IEC62305-3 (EN 62305-3) DIN VDE 0151 and DIN 18014

7. PV Mounting Structure

Description	Requirement
Wind loading	Mounting system should be able to allow air circulation for cooling in high temperature and withstand wind speed of 150 Km/ hour at 3

	sec gust
Mounting structure	Suitable angle adjustment
	Roof top treatment should be done to avoid seepage and water drainage should be maintained
	Structure, nuts and bolts should be hot dip galvanized
Certification	Vetted by certified structural engineer for roof stability, structure stability, life etc. for all roof all installations
	Life grantee of 25 years

8. Reactive power compensator

At each point of common coupling (meter placement point), Reactive power compensation must be installed to maintain the power factor (PF) of (leading/lagging) 0.92. The calculation and sizing of PF is responsibility of contractor.

9. Monitoring of PV Plant

Online and remote monitoring, data must be available online, locally stored on hard drive, and displayed on 50in LED screen with customized GUI as per site requirement. PC with min core i3, 1 TB HDD, 8 GB RAM & 50 inches HD-LED screen along with networking hub is part of BoQ

Hybrid Solar PV system (Standard 35Kw)

No.	ITEM(s)	Description	Unit	Qty
1	String Inverter	Three Phase Inverter with wireless monitoring data logger	Nos.	1
2	PV Module	Supply of Solar PV modules 35 KW (Monocrystalline panel)	Job	1
3	Iron PV Frames	Supply of PV Mounting Structure with related Accessories for the Installation of 35KW Solar Power System. (Complete in all respect)	Job	1
4	Civil Works	Concrete pads for PV frames	Nos.	
5	Distribution Boxes			
6	AC & DC Distribution Box	Supply of AC Combiner Box, minimum IP 54 with all related accessories. Supply of DC Breaker Box minimum IP 54 with all related accessories (DB for all breakers and SPD placement, DB with capacity of in housing all below mentioned circuit breakers andSPD will be suitable.)	Nos.	1
7	Breaker, SPDs			
8	PV breaker	MCB 1000VDC 16A 2P MCB Make: ABB/equivalent (European)	Nos.	8
9	DC SPD	DC SPD 1000VDC 2P 40KA	Nos.	8
10	Inverter AC Output Breaker	MCCB 400VAC 80A 4P	Nos.	1
11	AC SPD	AC SPD 4P 400VAC 60KA	Nos.	1
12	AC Disconnect switch/Breaker with IP65 DB	Of suitable size as per client connected load and consumption. But should be at least of 100A. AC Breakers Box with all related accessories. AC Breaker 100A, 3P MCCB, 600V, Qty: 01 AC SPD: Make: Schnider /Chint/Equivalent Make: ABB/Equivalent (European)	Nos.	1
13	Electrical Wires			
14	DC Wire for PV	6mm Sq. 1 Core DC Flexible Wire 1000VDC	mtr.	720
15	AC Wire from Inverter to injection point	16mm Sq 4C AC Flexible Wire 600VAC	mtr.	15
16	AC Wire for grounding solar panel	2.5mm Sq. 1 Core AC Flexible Wire	mtr.	50
17	AC Wire for PV frames grounding and frames to DC grounding point	10mm Sq. 1 Core AC Flexible Wire CU/PVC/FLEX {Green} Including PVC Pipe with related accessories	mtr.	352
18	Copper Bare conductor	50mm Sq (From lighting arrestor to DC grounding point)	mtr.	30
19	Pipes & Ducts			
20	PVC Duct for indoor use	80*80 for placing under the inverter and DB (10ft length per duct)	mtr.	24
21	PVC Duct for indoor use	40*40 for indoor wire routing (10ft length per duct)	mtr.	59
22	PVC Coated flexible pipe (G3) for outdoor use	1.5" for external PV wire laying on rooftop and till inverter place	mtr.	392
23	MC4 connectors	IP67/IP68 for pv stringing	Pair.	80
24	Inland Transportation			
25	Complete transportation for PV modules, Iron PV frames, inverters, balance of system (wire coils,	Complete system transportation from installation to commissioning from warehouse to site and other.	Job.	1
26	Net metering charges	Complete Net metering processing charges.	Job.	1
27	DC Earthing	Complete DC earthing with lighting arrestor on rooftop	Job.	1
28	Installation & Commissioning Charges			
29	Total project execution cost	Complete project installation and commissioning charges till handover of the project to client	Job.	1
30	MISC	Cable ties, rawal bolts, pvc tapes, steel and PVC clamps, pvc pipes etc.	Job.	1

31	AC earthing		Job.	1
32	PV-Genset /other source synchronization controller		Job.	1