

Annexure – A: Technical Parameter of PV Module and various other components for use in Grid Connected Solar Power Plants

All components of the PV plant shall be in accordance with technical specifications given in relevant IS/IEC Standards. The design and commissioning also shall be as per latest IEC/IS standards. The following are some of the technical measures required to ensure quality of the major components used in grid connected solar power Projects.

1. PV Module Qualification

The PV modules used in the grid connected solar power Projects must qualify to the latest edition of any of the following IEC PV module qualification test or equivalent BIS standards.

Crystalline Silicon Solar Cell Modules	IEC 61215
Thin Film Modules	IEC 61646
Concentrator PV modules	IEC 62108

In addition, PV modules must qualify to IEC 61730 for safety qualification testing @1000 V DC or higher. For the PV modules to be used in a highly corrosive atmosphere throughout their lifetime, they must qualify to IEC 61701.

2. Power Conditioners/ Inverters

The Power Conditioners/Inverters of the SPV power plants must conform to the latest edition of IEC/ equivalent BIS Standards as specified below:

Efficiency Measurements	IEC 61683
Environmental Testing	IEC 60068-2/ IEC 62093
Electromagnetic Compatibility (EMC)	IEC 61000-6-2, IEC 61000-6-4
Electrical Safety	IEC 62103/ 62109-1&2
Protection against Islanding of Grid	IEEE1547/IEC 62116/ UL1741 or equivalent EN/BIS Standards
LVRT Compliance	As per the latest GERC/ CERC Guidelines/ Order/ Regulations
Grid Connectivity	Relevant GERC/ CERC Regulations (including LVRT compliance) and Grid Code as amended and revised from time to time.

Rated capacity	Nominal/ Rated output power of the inverter (if different power ratings are mentioned at different temperatures, then power rating at 50 ⁰ C shall be considered) in kW will be considered as inverter rated capacity.
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3. Cables and connectors:

All cables and connectors for used for installation of solar field must be of solar grade which can withstand harsh environment conditions for 25 years from the SCOD of the project and voltages as per latest IEC standards. (**Note:** IEC Standard for DC cables for PV systems is under development. It is recommended that in the interim, the Cables of 600-1800 Volts DC for outdoor installations should comply with the EN50618/ TUV 2pfg 1169/08/07 or equivalent IS for service life expectancy of 25 years).

4. Other Sub-systems/Components

Other subsystems/components used in the SPV power plants (Cables, Connectors, Junction Boxes, Surge Protection Devices, etc.) must also conform to the relevant international/national Standards for Electrical Safety besides that for Quality required for ensuring Expected Service Life and Weather Resistance

5. Authorized Test Centres

The PV modules / Power Conditioners deployed in the power plants must have valid test certificates for their qualification as per above specified IEC/ BIS Standards by one of the NABL Accredited Test Centres in India. In case of module types/ equipment for which such Test facilities may not exist in India at present, test certificates from reputed ILAC Member body accredited Labs abroad will be acceptable.

6. Warranty

- a. PV modules used in grid connected solar power plants must be warranted for peak output wattage, which should not be less than 90% at the end of 10 years and 80% at the end of 25 years from the SCOD of the project.
- b. The modules shall be warranted for at least 10 years for failures due to material defects and workmanship.
- c. The mechanical structures, electrical works and overall workmanship of the grid solar power plants must be warranted for a minimum of 5 years.
- d. The Inverters/PCUs installed in the solar power plant must have a warranty for 5 years.

7. Identification and Traceability

Each PV module used in any solar power Project must use a RF identification tag. The following information must be mentioned in the RFID used on each module (This can be inside or outside the laminate, but must be able to withstand harsh environmental conditions):

- i) Name of the manufacturer of PV Module
- ii) Name of the Manufacturer of Solar cells
- iii) Month and year of the manufacture (separately for solar cells and module)
- iv) Country of origin (separately for solar cells and module)
- v) I-V curve for the module at Standard Test Condition (1000 W/m², AM 1.5, 25⁰C)
- vi) Wattage, Im, Vm and FF for the module
- vii) Unique Serial No. and Model No. of the module
- viii) Date and year of obtaining IEC PV module qualification certificate
- ix) Name of the test lab issuing IEC certificate
- x) Other relevant information on traceability of solar cells and module as per ISO 9000

Site owners would be required to maintain accessibility to the list of Module IDs along with the above parametric data for each module.

8. Performance Monitoring:

All grid solar PV power projects must install necessary equipment to continuously measure solar radiation, ambient temperature, wind speed and other weather parameters and simultaneously measure the generation of DC power as well as AC power generated from the plant. They will be required to submit this data to GUVNL and MNRE or GEDA on line and/or through a report on regular basis every month for the entire duration of PPA. In this regard they shall mandatorily also grant access to GUVNL and MNRE or GEDA to the remote monitoring portal of the power plants on a 24X7 basis.

9. Safe Disposal of Solar PV Modules:

The Bidder will ensure that all Solar PV modules from their plant after their 'end of life' (when they become defective/ non-operational/ non-repairable) are disposed in accordance with the "e-waste (Management and Handling) Rules, 2011" notified by the Government and as revised and amended from time to time.