

#### 4 POWER CONDITIONING UNIT/INVERTERS:

4.1 The Power Conditioning Unit/Inverters must conform to the latest edition of IEC/ equivalent BIS Standards as specified below:

Efficiency Measurements	-	IEC 61683	Equivalent BIS
Environmental Testing	-	IEC 60068 2 (1,2,14,30)/	Equivalent BIS Std

4.2 The PCUs required shall be of 5 KVA rating designed to operate as a multifunction power conditioning system.

#### 4.3 Common Technical Specification:

Control Type : Voltage source, microprocessor assisted, output regulation  
Output voltage : single phase, 230 V ac adjustable up to 250V (+12.5 %, - 20 % V ac)  
Frequency : 50 Hz ( +0.5 Hz, -0.5 Hz)  
Continuous rating:5 KVA  
Total Harmonic Distortion: less than 3%  
Operating temperature Range: 0 to 55 deg C  
Housing cabinet:PCU to be housed in suitable switch cabinet, Within IP 20  
PCU efficiency : 90 % and above at full load

#### 4.4 Other important Features/Protections of PCU :

- (a) The PCU shall be self commuted and shall utilize a circuit topology/DSP technology and components suitable for meeting the specifications listed above at high conversion efficiency and with high reliability.
- (b) The PCU shall be Hybrid One and shall give the preference to feed the Loads such a way that when load is light with battery in full charge conditions the available solar power will supply the load via the inverter ,under medium load and heavy load condition all available solar power is used to charge the battery. Any excess solar power is used to handle the site load via inverter .The balance of the power needed by the site load is drawn from the grid or battery bank as per priority. In the event of low solar power being available the system configures itself as grid charger and the grid commences the charging of the batteries in addition to supporting the load. In the event of failure or extreme fluctuation of grid the PCU automatically disconnect the load and transfer the load to battery power with the available solar energy.
- (c) The 5 KVA PCU with optional features to export excess solar power after full charging the battery bank.
- (d) Since the PCU is to be used in solar photo voltaic energy system, it should have high operational efficiency.
- (e) The idling current -if no load, must not exceed 2 percent of the full-load current.
- (f) The PCU shall have an appropriate display on the front panel to display the instantaneous AC power output and the DC voltage, current and power input. The display shall be visible from outside the PCU enclosure. Operational status of the PCU, alarms, trouble indicators and AC and DC disconnect switch positions shall also be communicated by appropriate messages or indicator lights on the front of the PCU enclosure.

#### 4.5 Electrical safety, earthing and protection:

- a. Internal Faults: In built protection for internal faults including excess temperature, commutation failure, overload and cooling fan failure (if fitted) is obligatory.
- b. Over Voltage Protection: Over Voltage Protection against atmospheric lightning discharge to the PV array is required. Protection is to be provided against voltage fluctuations in the grid itself and internal faults in the power conditioner, operational errors and switching transients.

- c. Earth fault supervision: An integrated earth fault device shall have to be provided to detect eventual earth fault on DC side and shall send message to the supervisory system.
  - d. Cabling practice: Cable connections must be made using PVC Cu cables, as per BIS standards. All cable connections must be made using suitable terminations for effective contact. The PVC Cu cables must be run in GL trays with covers for protection.
  - e. Fast acting semiconductor type current limiting fuses at the main bus- bar to protect from the grid short circuit contribution.
- 4.6 The PCU shall include an easily accessible emergency OFF button located at an appropriate position on the unit.
- 4.7 The PCU shall include ground lugs for equipment and PV array grounding.
- 4.8 The PCU enclosure shall be weatherproof and capable of surviving climatic changes and should keep the PCU intact under all conditions in the room where it will be housed. The INVERTER shall be located indoor and should be either wall / pad mounted. Moisture condensation and entry of rodents and insects shall be prevented in the PCU enclosure.
- 4.9 Components and circuit boards mounted inside the enclosures shall be clearly identified with appropriate permanent designations, which shall also serve to identify the items on the supplied drawings.
- 4.10 All doors, covers, panels and cable exits shall be casketed or otherwise designed to limit the entry of dust and moisture. All doors shall be equipped with locks. All openings shall be provided with grills or screens with openings no larger than 0.95 cm. (about 3x8 inch).
- 4.11 **Maximum Power Point Tracker (MPPT)**  
Maximum power point tracker shall be integrated in the PCU to maximize energy drawn from the array. The MPPT should be micro processor based to minimize power losses. The MPPT must have provision (manual setting) for constant voltage operation.
- 4.12 Operation outside the limits of power quality as described in the technical data sheet should cause the power conditioner to disconnect the system. Additional parameters requiring automatic disconnection are: Neutral voltage displacement Over current Earth fault And reverse power
- 4.13 Inverters should be of very high quality having high efficiency and should be capable of running in isolated mode. Capacity of the inverter shall be 5kVA. The inverter should be completely compatible with the charge controller and distribution panel.
- 4.14 The inverter shall be designed for continuous, reliable and prime power supply as specified. The inverter shall have high conversion efficiency from 25 percent load to the full rated load. The efficiency of the inverter shall be minimum 90% at full load and more than 80% at partial load (60%-80%).
- 4.15 The inverter shall have high overload capability. The overload capability of the inverter shall be a minimum of 150% at rated full load for 30 seconds.

- 4.16 The output power factor of the inverter should be of suitable range to supply or sink reactive power.
- 4.17 The output voltage of the inverter shall be sinusoidal with harmonic distortion less than 3% THD.
- 4.18 The Inverter shall have internal protection arrangement against short circuit, over load, AC&DC lines fault & other faults.
- 4.19 The dimension, weight, foundation details etc. of the inverter shall be clearly indicated in the detailed technical specification and the same should be submitted along with the bid.
- 4.20 The Inverter shall have provision for input & output isolation. Each solid-state electronic device shall have to be protected to ensure long life of the inverter as well as smooth functioning of the inverter.
- 4.21 Supplier shall indicate tripping voltage & start up voltage for the inverters & this should be perfectly matched with the recommendation of battery manufacturers.

**4.22 Technical features:**

Input Voltage	96 V, DC (Nominal)
Output Voltage: Wave form	230 V, Single $\Phi$ , 2-wire, Sine Wave. The output voltage should be adjustable up to 250V. Sine wave with less than 3% THD
RFI	To minimize the both conducted and radiated RFI emissions
Reactive Power	0.80 inductive to 0.80 capacitive
Regulation	Maximum 5% against input Voltage and load variation
Frequency	50 Hz $\pm$ 0.5 Hz
Output	5 KVA
Dielectric strength	1.1 kV between input/output with ground with EMI protections & 1.5 kV between input and output.
Instrumentation	Input Voltage & Current, Output Voltage & Current, Frequency.
Status Indication	Input, Output, Inverter (On/Trip/Fault/Off),
Fault indication	Visual indication with blinking super glowing LED audio
Protections	Single Phase Short Circuit Protection, Battery Low Voltage, AC Over Current, Lightning Surge in Output. Sustained Over Load
Cooling	Fan forced
Power Switching	High Efficiency IGBT
Power Control	Phase controlled pulse width modulation
Earthing provisions	AC bypassing to earth on Inverter and DC inputs
Surge rating	150% of rated output for 30 seconds
Grid Acceptable Range	AC Voltage $\pm$ 17% ,Frequency $\pm$ 3

- 4.23 Inverter shall have arrangement for adjusting DC input current and should trip against sustainable fault in the Distribution system and shall not start till the fault is removed.
- 4.24 Inverter output have several settings from 3 KVA to 5 KVA so that it can be set at a particular KVA beyond which the inverter shall trip depending on the system load for the purpose of controlling overdrawn from the predetermined load. Inverter should not start under any fault condition and should trip under severe unbalanced condition.