# MODEL SPECIFICATIONS OF INVERTER

## (As per MNRE Specifications)

As SPV array produce direct current electricity, it is necessary to convert this direct current into alternating current and adjust the voltage levels to match the grid voltage. Conversion shall be achieved using an electronic Inverter and the associated control and protection devices. All these components of the system are termed the "Power Conditioning Unit (PCU)".

Technical features of the inverter to be as follows:

| | |
|---|---|
| Switching devices | IGBT/MOSFET |
| Control | Micro processor /DSP |
| Nominal AC output voltage and Frequency | 415V, 3 Phase, 50 Hz(In case single phase inverters are offered, suitable arrangement for balancing the phases must be made.) |
| Output Frequency | 50 Hz |
| Grid Frequency Synchronization range | + 3 Hz or more |
| Ambient Temperature considered | -20° C to 50° C |
| Humidity | 95 % Non-condensing |
| Protection of Enclosure | IP-20(Minimum) for indoor. |
| | IP-65(Minimum) for outdoor. |
| Grid Frequency Tolerance range | + 3 or more |
| No-load losses | Less than 1% of rated power |
| Inverter Efficiency(minimum) | >93% (In case of 10 kW or above with in-built galvanic isolation)<br>>97% (In case of 10 KW or above without in-built galvanic isolation)<br>> 90% (In case of less than 10 kW) |
| THD | < 3% |
| PF | > 0.9 |

(a) Three phase PCU/ inverter shall be used with each power plant system (10 kW and/or above) but in case of less than 10 kW single phase inverter can be used.

(b) PCU/inverter shall be capable of complete automatic operation including wake-up, synchronization & shutdown.

(c) Inverter should have internal protection arrangement against any sustainable fault in feeder line and against the lightning on feeder.

(d) Built-in meter and data logger to monitor plant performance through external computer shall be provided.

(e) Anti-islanding (Protection against Islanding of grid): The PCU shall have anti islanding protection in conformity to IEEE 1547/UL 1741/ IEC 62116 or equivalent BIS standard.

(f) In PCU/Inverter, there shall be a direct current isolation provided at the output by means of a suitable isolating transformer. If Isolation Transformer is not incorporated with PCU/Inverter, there shall be a separate Isolation Transformer of suitable rating provided at the output side of PCU/PCU units for capacity more than 100 kW.

(g) The PCU/ inverter generated harmonics, flicker, DC injection limits, Voltage Range, Frequency Range and Anti-Islanding measures at the point of connection to the utility services should follow the latest CEA (Technical Standards for Connectivity Distribution Generation Resources) Guidelines.

(h) The PCU / Inverters should comply with applicable IEC/ equivalent BIS standard for efficiency measurements and environmental tests as per standard codes IEC 61683/IS 61683 and IEC 60068-2 (1,2,14,30)/ Equivalent BIS Std.

(i) The MPPT units environmental testing should qualify IEC 60068-2 (1, 2, 14, 30)/ Equivalent BIS std. The junction boxes/ enclosures should be IP 65 (for outdoor)/ IP 54 (indoor) and as per IEC 529 specifications.

(j) The PCU/ Inverters should be tested from the MNRE approved test centers/ NABL/ BIS/ IEC accredited testing- calibration laboratories. In case of imported power conditioning units, these should be approved by international test houses.

# MODEL SPECIFICATIONS OF INVERTER
## (As Per BESCOM Specifications)

| **Parameters** | **Detailed Specifications** |
|---|---|
| Nominal Voltage | 230V /415V |
| Voltage Range | + 10% -20% at nominal voltage |
| Operating Frequency Range | 50 Hz ( 47.5 to 52 Hz) |
| Waveform | Sine Wave |
| Harmonics | AC side total harmonic current distortion < 5% |
| Ripple | DC voltage ripple content shall be not more than 1%. |
| Efficiency | Efficiency shall >95% |
| Losses | Maximum losses in sleep mode: 2W per 5 kW<br>Maximum losses in stand-by mode: 10 W |
| Casing Protection Levels | Degree of protection: Minimum IP-21 for internal units and IP 65 for outdoor units |
| Temperature | Should withstand from -10 to +60 deg Celsius |
| Humidity | Should withstand up to 95% (relative humidity) |
| Operation | Completely automatic including wake up, synchronization (phase-locking) and shut down |
| MPPT | MPPT range must be suitable to individual array voltages in power packs |
| Protections | Over voltage; both input and output |
| | Over current; both input and output |
| | Over/Under grid frequency |
| | Over temperature |
| | Short circuit |
| | Lightening |
| | Surge voltage induced at output due to external source |
| | Anti-islanding |
| Recommended LED Indications | Inverter ON |
| | Grid ON |
| | Inverter Under / Over Voltage |
| | Inverter Overload |
| | Inverter Over Temperature |
| Recommended LCD Display on Front Panel | Accurate displays on the front panel: |
| | DC input voltage |
| | DC current |
| | AC Voltage (all 3 phases) |
| | AC Current (all 3 phases) |
| | Ambient temperature |
| | Instantaneous 8s cumulative output power |
| | Daily DC energy produced |
| Communication Interface | RS485 / RS 232 |