

FORMAT NO. : CEL/FR/MMD/03(01)

**CENTRAL ELECTRONICS LIMITED**  
(A Public Sector Enterprise)



**TENDER DOCUMENT**

**for**

**“Design, Engineering, Supply, Construction, Erection,  
Testing, Commissioning and Warranty/AMC (5 years)  
for Solar Power Generating System (SPGS) in the Union  
Territory of Jammu & Kashmir”**

**Tender No. C-2(b)/RC/0700/4673/2022 dated 25.03.2022**

Asstt. General Manager  
Materials Management Division  
Central Electronics Limited,  
4, Industrial Area, Saur Urja Marg, Sahibabad 201010 (UP) INDIA  
Fax No. 0091-120-2895148  
Email: [mmd@celindia.co.in](mailto:mmd@celindia.co.in) Website: [www.celindia.co.in](http://www.celindia.co.in)



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**TENDER NOTICE**

**Tender No. C-2(b)/RC/0700/4673/2022**

**Date: 25.03.2022**

Central Electronics Limited invites **OFFLINE** single bid from eligible bidder valid for a minimum period of 15 days from the date of receipt of quotation for “**Design, Engineering, Supply, Construction, Erection, Testing, Commissioning and Warranty/AMC (5 years) for Solar Power Generating System (SPGS) in the Union Territory of Jammu & Kashmir**”.

<b>Scope of Tender</b>	<b>Design, Engineering, Supply, Construction, Erection, Testing, Commissioning and Warranty/AMC (5 years) for Solar Power Generating System (SPGS) in the Union Territory of Jammu &amp; Kashmir</b>
<b>Earnest Money Deposit</b>	<b>NIL (Declaration as per Annexure - E to be submitted)</b>

Bidder may view and download the tender document containing the detailed terms & conditions, free of cost from the website [www.celindia.co.in](http://www.celindia.co.in).

**This is a proprietary tender. Bid to be submitted through OFFLINE Only.**

**Please see document control Sheet at Annexure - I.**

**FOR CENTRAL ELECTRONICS LIMITED**

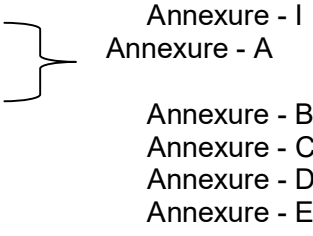
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**Assistant General Manager  
Materials Management Division**

FORMAT NO. : CEL/FR/MMD/03(01)

TENDER DOCUMENT for Tender notice no. **C-2(b)/RC/0700/4673/2022**

**Important Instructions: -**

1. The following documents/Annexures are part of tender document:
  - a. Tender notice
  - b. Document Control Sheet -
  - c. Project Scope and Special Conditions of Contract
  - d. Price bid format
  - e. Commercial terms & conditions
  - f. Format for Vendor Data Form
  - g. Format for Tender acceptance letter
  - h. Format of Declaration in lieu of EMD/Bid Security

Annexure - I  
Annexure - A  
Annexure - B  
Annexure - C  
Annexure - D  
Annexure - E
2. Quotations shall be liable to be rejected if there is/are any deviation(s) from the specifications.
3. Escalation in price (except where price variation clause is applicable), deviation from delivery schedule, terms and conditions will not be permitted in your quotation. Statutory Taxes & Duties should be shown separately from the price.
4. Catalogue, literature, specification details should accompany the quotation. Incomplete quotations are liable to be rejected.
5. **Any deviations whether technical or commercial stated anywhere in the bid shall not be taken into account and may render the bid ineligible and liable to be rejected.**
6. Quotation should be submitted in **SINGLE Bid System**.
7. Bids should be submitted in OFFLINE only. Following are to be submitted in your bid:
  - i. Filled up Format for Submission of Vendor Data as per format at **Annexure - C**.
  - ii. Tender acceptance letter as per format at **Annexure - D**.
  - iii. Undertaking for Earnest Money Deposit/ Bid Security as per **Annexure - E**.
  - iv. Prices to be submitted on a letter head as per price bid format given in **Annexure - A**.

**Annexure - I****Document Control Sheet & Important dates**

Tender Reference No.	C-2(b)/RC/0700/4673/2022
Name of Organization	Central Electronics Limited
Tender Type (Open/Limited/EOI/Auction/Single)	Single
No. of Packets	One
Tender Category (Services/Goods/Works)	Goods
Type/Form of Contract (Work/Supply/ Auction/Service/Buy/Empanelment/Sell)	Supply
Payment Mode (Online/Offline)	Online
Date of Issue/Publishing	25.03.2022 (15:00 Hrs)
Document Download/Sale Start Date	25.03.2022 (15:00 Hrs)
Document Download/Sale End Date	26.03.2022 (11:00 Hrs)
Bid submission Start Date	25.03.2022 (15:00 Hrs)
Last Date and Time for Submission of Bids	26.03.2022 (11:00 Hrs)
Date and Time of Opening of Bids	26.03.2022 (11:00 Hrs)

**THIS IS A PROPRIETARY TENDER FOR M/S BNK ENERGY  
ALTERNATIVES PVT. LTD.**

**BIDS ARE TO BE SUBMITTED OFFLINE ONLY**

**OTHER BIDDERS WHO WISH TO QUOTE IN SIMILAR  
TENDERS IN FUTURE MAY APPLY FOR THEIR  
EMPANELMENT AGAINST OUR EOI No. C-2(b)/EOI/704/286/19  
AVAILABLE IN OUR WEBSITE IN TENDER/EOI SECTION.**

**Design, Engineering, Supply, Construction, Erection, Testing, Commissioning and Warranty/AMC (5 years) for Solar Power Generating System (SPGS) in the UT of Jammu****a) Project Scope and Special Conditions of Contract**

This scope of tender is limited only to “**Design, Engineering, Supply, Construction, Erection, Testing, Commissioning and AMC (5 years) for 500 KW Solar Power Generating System (SPGS) in the Union Territory of Jammu & Kashmir**”. Project should be in accordance to the technical specification as mentioned in the Specifications part.

**1. Site Description**

- a) The requisite land for implementation of proposed solar PV power plants, in the Union Territory of Jammu will be provided to the bidder(s) for development. Site details are as:
1. Nagrota, Jammu or
  2. Palli, Jammu
- b) Plant has to be installed at any one site i.e. Nagrota or Palli. PO shall be placed for both the sites. NTP (notice to proceed) of the site shall be issued after placement of PO.

**CEL reserves the right, to effect variation in districts, quantity and capacity of power plants as mentioned above. Bidders are required to carry out physical site surveys for the estimation.**

**2. Project Scope**

The Scope of Work includes site surveys, design & engineering, procurement & supply of equipment and materials, testing at manufacturers works, inspection, packing and forwarding, supply, receipt, unloading and storage at site, associated civil works, services, permits, licenses, installation and incidentals, insurance at all the stages, erection, testing and commissioning of Grid Interactive Decentralised Solar Power Generating System and performance demonstration with associated equipment and materials along with associated transmission system up to 11 kV/415 V termination points (as per site requirement) on turnkey basis in the Union Territory of Jammu, India and 5 (Five) years Annual Maintenance Contract (AMC) of the plant thereafter.

It shall be the responsibility of the contractor to operate and AMC of the plant to deliver the DC power output as defined in the Project scope and Special Conditions of Contract for a period of 5 years from the date of commissioning of plant. The contractor shall be responsible for making all the requisite arrangements for the same.

Bidder is required to design and erect the project considering project life of 25 years.

**Modules having capacity minimum 330 Wp shall be supplied by CEL at designated site.** However, storage of Solar PV modules shall be in scope of bidder.

The equipment and materials for Grid Interactive Solar Power Generating System (s) with associated system (typical) shall include but not be limited to the receipt, unloading, storage, erection, testing and commissioning of all supplied material for the following:

- i. Solar PV Modules – Supply of Solar PV Modules shall be in the scope of CEL.
- ii. Module mounting structures, Module mounting and fixing of SPV Modules (supplied by CEL) on the installed structures, fasteners, array foundation and module interconnection.
- iii. Array Junction boxes, distribution boxes and fuse boxes: MCBs, Surge Arrestors with string monitoring capabilities and with proper lugs, glands, ferrules, terminations and mounting structures.
- iv. DC and AC cables of appropriate sizes with adequate safety and insulation.

- v. Power Conditioning Units (PCU)/Inverter (String or Central grid-tie) with SCADA compatibility, LT & HT Power Interfacing Panels (if required), Plant Monitoring Desk, AC & DC Distribution boards.
- vi. Step up transformers in relevance with state grid code and inverter manufacturer requirements.
- vii. Suitable protection system.
- viii. LT Power and Control Cables including end terminations and other required accessories for both AC & DC power.
- ix. Internal 415V interconnection & indoor feeder panels to cater auxiliary needs of Plant.
- x. 11 kV/415V indoor/ outdoor panels (as per site requirements) having incoming and outgoing feeders with VCBs, CTs, PTs, Bus bars, cables terminals kits and Main Bus. Each bay shall consist of VCB, CT, Isolators with earth switch, LAs and PT's etc.
- xi. Data acquisition system with remote monitoring facilities. Provision for specific data transfer to the State Load Dispatch Centre (SLDC) may be provided as per the DISCOMs/End Customer requirement. Data shall also be provided to CEL/CEL Customer's server (details will be shared with successful bidder(s) only). Bidder must support for "Data PUSH to CEL/CEL's Customer cloud (Data Pull from Bidder's cloud) using REST API. The protocol handshake should have mutual X.509 certificate authentication. For SLDC requirement, bidder shall follow the State Govt./Regulatory guidelines.
- xii. Weather Monitoring shall include but not limited to the following:
  - Pyranometers - For horizontal and tilted plane
  - Ultrasonic Anemometer (for wind speed and direction)
  - Temperature Sensor- Ambient and Module surface
  - Power source to all the sensors
  - Data logger
- xiii. Lightning arrestors for entire plant area.
- xiv. PVC pipes, cable conduits, cable trays and accessories/trenches.
- xv. Earthing of the entire plant as per relevant standards.
- xvi. Control room if required for Solar Power Generating Systems (SPGS)
- xvii. Testing, maintenance and monitoring of equipment(s). Spares & consumables, as required, for 5 years AMC period.
- xviii. Necessary CCTV cameras at suitable locations in the plant area in order to capture any trespassing, theft & pilferage etc.
- xix. Fire detection & protection system in the plant area. Adequate number & types of fire extinguishers. All safety gadgets during Construction including but not limited to, anti-static rubber mats of appropriate grade, PPE, rubber gloves and shoes etc.
- xx. Design of Solar Power Generating System (s) and its associated civil, structural, electrical & mechanical auxiliary systems includes preparation of single line diagrams and installation drawings, manuals, electrical layouts, erection key diagrams, electrical and physical clearance diagrams, design calculations for Earth- mat, Bus Bar & Spacers indoor and outdoor lighting/ illumination etc. design memorandum, GTP and GA drawings for the major equipment & facilities, design basis & calculation sheets, and other relevant drawings and documents required for engineering of all facilities within the fencing to be provided under this contract, are covered under contractor's scope of work. The contractor has to provide the project design document with all the necessary technical details including simulation reports for approval.

- xxi. Any other equipment/material/service, not mentioned but essentially required to complete the Decentralised Solar Power Generating System in all respects. It shall be the responsibility of the contractor to operate and AMC of the plant to deliver the output for a period of 5 years from the date of handing over of plant. The contractor shall be responsible for making all the requisite arrangements for the same. Bidder is required to submit the vendor list to CEL for approval before starting the work at site.
  - xxii. Contractor has to carry out the site survey of the open land allocated to the contractor and install the solar PV power plant of suitable capacity based on the shadow free area.
  - xxiii. Requisite testing facilities at site, safety requirements and provision for other things that may require for successful operation and maintenance of plant and equipment.
  - xxiv. Submission of daily work progress report by the contractor through email/Whatsapp Group.
  - xxv. In case of absence of the standards for any of the equipment, the contractor may comply to the latest CEA/CERC/State Grid code.
  - xxvi. Provision of solar material storage area.
  - xxvii. Arrangement of topographical, Geological, soil test & water test report.
  - xxviii. If required, Provision for HT cable (with trenching) from solar power plant HT panel to 11kV termination point (as per site requirement)
  - xxix. Arrangement of Water and Electricity during construction.
  - xxx. Security of the system during construction & installation of power plant.
  - xxxi. All approvals, permits and clearances are in bidder's scope. However, CEL shall facilitate for all such approval. But the prime responsibility of all such approvals shall be solely with bidder.
- b) The items of civil design and construction work shall include all works required for solar power generating system and should be performed specifically with respect to following but not limited to:
- i. Conducting Soil testing of the allocated plot area.
  - ii. Conduction of contour survey and mapping of the whole plot area, Ground leveling and clearance. Final Site Survey format shall be provided by EIC after award of contract.
  - iii. Construction of foundation for mounting structures for SPV panels, considering life of Plant & existing soil/ natural conditions.
  - iv. Construction of foundation for transformers, switchgears, buildings (if any), equipment etc.
  - v. Chain link fencing of the designated area where the plant shall be installed
  - vi. Necessary arrangement for module cleaning shall be made available in SPV array yard.
  - vii. Suitable Communication System
  - viii. Perimeter lighting: Fabrication, supply & erection along with required GI Poles, junction boxes, support, brackets, accessories & LED lights as required.
  - ix. Supply of ferrules, lugs, glands, terminal blocks, galvanized sheet steel junction boxes with powder coating paint for internal fixtures, cable fixing clamps, nuts and bolts etc. of appropriate sizes as required in the Plant.
  - x. Power Cables laying underground / over ground with proper cable tray arrangements.
  - xi. Entire GI cable tray with proper support and accessories
- c) The contractor shall carry out the site surveys and submit the report to CEL for the allotted substation (s) as per the time lines and formats given by CEL Project Incharge. The report shall contain the details of the solar power generating system, proposed capacity of the Decentralised Solar Power Generating System etc.
- d) The contractor shall arrange for Land Development as per the requirement on his own cost. The land development and LT/HT cable upto 11 kV/415V termination point shall be as per specifications of DISCOM.

- e) All approvals as necessary for setting up of a Solar Power Plant including CEIG/CEA/DISCOM, connectivity, power evacuation etc. as per the latest regulations / guidelines for which DISCOM will facilitate the bidder. However, complete responsibility of getting approvals shall be in the scope of contractor.
- f) The Contractor shall arrange deployment of qualified and suitable manpower and required necessary tools, logistics, spares & consumables during construction, commissioning of the power plant. The Contractor shall provide necessary tools, spares & consumables during AMC of the power plant.
- g) Complete responsibility of AMC of Solar Power Generating Systems including the entire infrastructure developed as a part of EPC Contract for 5 years from Operational Acceptance/ Commissioning of the Plant(s), including deployment of necessary staff on quarterly basis for AMC (5years from the date of commissioning of power plant) shall be in the scope of Contractor. Any cost(s) associated with the project for successful commissioning and AMC during the project period shall be borne by the contractor.
- h) All approvals, equipment, item and works which are not specifically mentioned in this document but are required for successful completion of work including construction, commissioning, AMC of Solar PV Power Plant (s) in every respect and for safe and efficient construction & erection, operation and guaranteed performance are included in the scope of the Contractor.
- i) Submission of following documents, drawings, data design, and engineering information to CEL or its authorized representative for review and approval in hard copy and soft copy from time to time as per project schedule.
  - i. Contour map of the complete land area.
  - ii. General arrangement, array layout diagrams and assembly drawings of all major equipment.
  - iii. Design basis criteria along with relevant standards (list of standards and respective clause description only).
  - iv. Design calculations and sheets with expected power loss at each stage and backup sheets, if any. Lightning arrestor with area coverage also to be provided.
  - v. Detailed technical specifications of all the equipment.
  - vi. Schematic diagram for entire electrical system including single line diagrams (SLD)
  - vii. GTP & G.A. drawings for all types of structures/ components, 11 kV/415V switchgears & other interfacing panels.
  - viii. Relay setting charts.
  - ix. Quality assurance plans for manufacturing (MQP), Standard Operating Procedures (SOP) and field activities (FQP).
  - x. Test reports (for type, acceptance, and routine tests).
  - xi. O&M Instruction's manuals and its drawings.
  - xii. As-built drawings / documents and deviation list from good for construction (GFC).
  - xiii. AMC plans, schedules and operational manuals for all equipment etc.
  - xiv. Daily progress update.
  - xv. Weekly site work progress report with catch-up plan(s), as necessary to monitor actual timelines of the project during construction period along with the real time snap shots during the time of construction.
  - xvi. Quarterly AMC reports after commissioning of the project.
- j) Estimation of plant generation based on solar radiation and other climatic conditions prevailing at site.



- k) All drawings shall be fully corrected to agree with the actual "as built" site conditions and submitted to CEL after commissioning of the project for record purpose. All as- built drawings must include the Good for Construction deviation list.
- l) The Contractor shall provide a detailed training plan for all operation, maintenance procedures, which shall after approval by CEL form the basis of the training program. The contractor shall also provide training to DISCOM's nominated staff and team in co-ordination with CEL Project incharge.
- m) The Contractor shall employ and coordinate the training of CEL's customer personnel to operate and monitor the facility and to coordinate operations of the facility with the grid system.
- n) Establishing a system to maintain an inventory of spare parts, tools, equipment, consumables and other supplies required for the facility's hassle-free operation.
- o) Adequate and seamless insurance coverage during construction period to cater all risks related to construction of Plant to indemnify the CEL/CEL's Customer/DISCOM.
- p) Maintain at the facility accurate and up-to-date operating logs, records and monthly reports regarding the generation, AMC of facility.
- q) Perform or contract for and oversee the performance of periodic overhauls or maintenance required for the facility in accordance with the recommendations of the original equipment manufacturer (OEM).
- r) Procurement for spares parts, overhaul parts, tools, equipment, consumables, etc. required to operate and maintain the project in accordance with the prudent utility practices and having regarded to warranty recommendations during entire AMC period.
- s) Maintain and keep all the equipments in workable conditions.

All the type test reports along with Material Dispatch Clearance Certificate (MDCC) and Material Safety Data Sheet (MSDS) for all applicable product & equipment and cables are to be submitted by the Contractor prior to the dispatch of the same. Contractor has to provide the type test report for all the equipment used under this contract. If the equipment is not type tested, the Contractor has to ensure conduction of such test and supply the type test Report to the CEL without any additional cost.

### **Required Documentation**

Complete documentation shall be provided for the design, manufacturing/assembling, testing, installation, commissioning, start-up, operation, maintenance, repair and disposal of the De-centralised Solar Power Generating System components.

The bidder shall provide the following minimum documentation:

1. Project design document containing detailed engineering calculations, losses, drawings, simulation reports, performance guarantee etc.
2. Technical data sheets
3. Test reports and commissioning protocols
4. Installation, AMC manual

However, CEL at its own discretion may ask for any documentation related to Scope of Work mentioned hereunder, as and when required for any purpose.

### **3. Annual Maintenance Contract**

The contractor shall be entrusted to carry out the AMC of the Solar Power Generating System(s) upto power evacuation point as per the scope of work for the 5 (Five) years with immediate effect from the date of operational acceptance.

- a) Contractor is fully responsible for the trouble-free maintenance and is liable to rectify/remove any defect noticed within the aforesaid period free of cost for the materials supplied by them.
- i. Co-ordination with DISCOM/other statutory organizations as per the requirement on behalf of CEL for revising schedules as necessary and complying with grid requirements updated time to time.
  - ii. This includes repair /replacement of all spares (including LEDs, Fuse) and consumable supplied by the contractor during warranty period.
  - iii. The contractor shall undertake the periodical maintenance work of complete solar power plant on the 10<sup>th</sup> of every succeeding quarter which includes clearing of all equipments and submit report to CEL project team.
  - iv. The contractor should be in readiness to attend to the defects of any Monitoring, controlling, troubleshooting maintaining of logs & records, registers.
  - v. Maintenance including free replacement/repairing of spare parts during AMC period of 5 years from the date of handing over of sites.
  - vi. The contractor should be in readiness to attend to the defects of any system, as and when required by the beneficiary and ensure rectification of defects and restore functionality within 3 working days of lodging the complaints. The contractor shall furnish the status report after maintenance work are over, which shall invariably bear the signature of the representative as informed by CEL after award of the contract.
  - vii. It will be liberties of CEL to cross check the system maintained by the contractor. Random verification of the maintenance may be carried out by the CEL where ever necessary.
  - viii. Supply of all spares, consumables and fixing/application as required.
  - ix. Supply & use of spares, consumables, tools, logistics and skilled manpower throughout the maintenance period as per recommendations of the equipment manufacturers and requirement of the Plant & other associated infrastructure developed under the scope of EPC works.
  - x. Conducting periodical checking, testing, overhauling, preventive and corrective action.
  - xi. Up keeping of all equipment, building, roads, Solar PV modules, inverters etc.
  - xii. Arranging & updating any licenses/permits required for successful operation of plant (s).
  - xiii. Submission of periodical reports to CEL on the energy generation & operating conditions of the power plant.
  - xiv. Contractor shall be responsible for making all the payments towards renewal of all the permits / clearances etc. (if required) to the Government bodies /DISCOM /STU for smooth operation of the project.
  - xv. Repair & replacement of components of SPGS including all other associated infrastructure developed as a part of EPC Works which has gone faulty or worn-out components including those which has become inefficient.
- b) Periodically monitoring the performance of the Solar Power Generating Systems and maintenance of the whole system including Modules, PCU's, transformers, outdoor/indoor panels/ kiosks and other infrastructure developed as a part of EPC works in order to extract & maintain maximum energy output from the SPGS & serviceability from the associated infrastructure.
- i. Preventive and corrective maintenance of the complete Solar Power Plant and associated infrastructure developed as a Part of EPC work, including supply of spares, consumables, repair & replacement of wear and tear, overhauling, replacement of damaged modules, invertors, PCU's and insurance covering all risks (Fire & allied perils, earth quake, terrorists, burglary, and others) as required, for a period of 5 (Five) years from the date of start of commissioning of the project.

- ii. The period of Operation and Maintenance will be deemed to commence from the date of Operational acceptance. CEL may extend the AMC period beyond the project duration at mutually agreed terms and conditions.
- iii. All the equipment required for Testing, Commissioning and AMC for the healthy operation of the SPGS must be calibrated, time to time, from the NABL accredited labs and the certificate of calibration must be provided prior to its deployment.

c) Maintenance

- i. The contractor shall carry out the periodical plant maintenance as given in the manufacturer's service manual and perform operations to achieve maximum generation.
- ii. Regular periodic checks of the modules, PCU's and other switchgears shall be carried out as a part of routine corrective & preventive maintenance. In order to meet the maintenance requirements stock of consumables are to be maintained as well as various spare as recommended by the manufacturer.
- iii. Maintenance of other major equipment involved in Solar Photovoltaic Power Generating System are transformers, underground/ overhead cables, indoor/ outdoor VCB, associated switchgears, fire protection system & other infrastructure developed as a part of scope of Work during development of Plant. Particular care shall be taken for outdoor equipment to prevent corrosion. Earth resistivity of plant as well as individual earth pit is to be measured and recorded every quarter. If the earth resistance is high, suitable action is to be taken to bring down the same to required level.
- iv. A maintenance record is to be submitted to operation/engineer-in-charge to record the maintenance work carried out along with the date of maintenance reasons for the break downs steps have taken to attend the breakdown duration of the breakdown including action taken to avoid the same in future.
- v. The Schedules will be drawn such that some of the jobs other than breakdown, which may require comparatively long stoppage of the power plant, shall be carried out preferably during the non-sunny days/night. An information shall be provided to Engineer-in-charge for such operation prior to start.
- vi. The Contractor will attend to any breakdown jobs immediately for repair/replacement /adjustments and complete it at the earliest working round the clock. During breakdowns (not attributable to normal wear and tear) at AMC period, the Contractor shall immediately report the accidents, if any, to the Engineer In-charge showing the circumstances under which it happened and the extent of damage and or injury caused.
- vii. The Contractor shall comply with the provision of all relevant acts of Central or State Governments including but not limited to Payment of Wages Act 1936, Minimum Wages Act 1948, Liability Act 1938, Workmen's Compensation Act 1923, Industrial Dispute Act 1947, Maturity Benefit Act 1961, Mines Act 1952, Employees State Insurance Act 1948, Contract Labour (Regulations & Abolishment) Act 1970, Electricity Act 2003, Grid Code, Metering Code, MNRE guidelines or any modification thereof or any other law relating whereto and rules made there under or amended from time to time.
- viii. The contractor shall at his own expense provide all amenities to his workmen as per applicable laws and rules.
- ix. The Contractor shall ensure that all safety measures are taken at the site to avoid accidents to his or his sub-contractor or CEL's Workmen.

- x. If negligence / mal-operation of the contractor's operator results in failure of equipment such equipment should be repaired replaced by contractor at free of cost.

d) Quality Spares & Consumables

In order to ensure longevity and safety of the core equipment and optimum performance of the system the contractor should use only genuine spares of high-quality standards.

e) Testing Equipment, Tools and Tackles

The Contractor shall arrange for all the necessary testing equipment, tools and tackles for carrying out all the construction, operation and maintenance work covered under this contract. All the instruments are required to be calibrated from NABL accredited lab before put in use. The certificate of the same shall be submitted to CEL for verification.

f) Transfer of Project –After the completion Period of Project, Contractor will hand over the project in operational working condition in all respects to CEL.

i) Connectivity with the Grid:

1. The projects should be designed for delivery of energy at 11kV/415V level of substation of DISCOM.
2. All the necessary permissions from Electrical Inspector, State Electricity Board, CEA, DISCOM etc., as may be required, shall be taken up by the Contractor for the purpose of interconnection of the solar power plant with the grid.
3. The responsibility of getting the grid connectivity with DISCOM shall entirely be of the Contractor.
4. The transmission of power up to the 11kV/415V interconnection point. The AMC of the power plant upto 11kV/415V termination point shall be responsibility of the Contractor.

**j) Clearances required from the Central/State Government and other local bodies**

The Bidders are required to obtain necessary clearances and permits as required for setting up the Solar Power Project.

#### **4. Warranty**

- a) CEL officials reserve the right to carry out the Pre-Dispatch Inspection of all the material at manufacturer facility (ies) before dispatch to site/s. At least 3 days' notice to be given by bidder to CEL for carrying out the PDI.
- b) Standard equipment warranty for PCU/Inverter for 5 years. However, as the project wise AMC is comprehensive for a period of 5 years, hence any repair, replacement etc. required is in the scope of bidder.
- c) The mechanical structures, electrical works and overall workmanship of the grid connected Solar Power Plant must be warranted for a period of 5 years from the date of Commissioning.
- d) The Contractor must ensure that the goods supplied under the contract are new, unused and of most recent or current models and incorporate all recent improvements in design and materials unless provided otherwise in the Contract.
- e) During the period of Warranty / Guarantee the Contractor shall remain liable to replace any defective parts, that becomes defective in the Plant, of its own manufacture or that of its sub-Contractors, under the conditions provided for by the Contract under and arising solely from faulty design, materials, workmanship or any reason attributable to works carried out by the contractor, provided such defective parts are not repairable at Site. After any replacement, the defective parts shall be returned to the Contractors works at the expense of the Contractor unless otherwise arranged.

- f) During the warranty/Guarantee, the Contractor shall be responsible for any defects in the work due to faulty workmanship or due to use of sub-standard materials in the work. Any defects during the AMC period shall therefore, be rectified by the Contractor without any extra cost to the CEL within a reasonable time as may be considered from the date of receipt of such intimation from the CEL failing which the CEL reserves the right to take up rectification work at the risk and cost of the Contractor.
- g) Warranty certificate issued by the manufactures shall be submitted and individual factory test report of manufactures shall also to be submitted along with invoice of the supply order after delivery. Every item should bear serial number provided during the manufacturing process. These serial numbers should be mentioned by manufacturer in all the following documents, while submission of bills after delivery of the order items:-
- Invoice
  - Factory test report (In house test report generated during manufacturing)
  - Warranty certificate
- h) If contractor does not rectify/supply the said problem after written notices than the defected equipment as per BOM noticed shall be rectified/purchased through CPG amount of contractor deposited in CEL.

### 5. TERMS OF PAYMENT:

Payment towards Design, Engineering, Supply, Construction, Erection, Testing, Commissioning and AMC of Grid tied solar PV based power plant shall be made as per the following manner:

All the payments shall be subject to fulfillment of the following prerequisites:

Sr. No.	Details	Milestone
1	20% payment	Shall be released within 7 days from the date of receipt of Module Mounting Structures, Nut-Bolts, Earthing material, LA and its accessories
2	20% payment	Shall be released within 7 days from the date of receipt of Inverters, AC & DC cables and its accessories
3	20% payment	Shall be released within 7 days from the date of receipt of balance of material like Transformer, LT Panel, HT panel and other material required for successful commissioning of the power plant.
4	30% payment	Shall be released within 7 days from the date of installation & commissioning
5	10% payment	Shall be released against 10% PBG of the equivalent value after handing over of the project.

#### Note:

- a) Price will remain firm till the execution of the contract.
- b) The payment will be made to the bidder within 7 days after submission of Invoices complete in all respect i.e. with all the required documents and compliance of relevant terms and conditions of the PO duly accepted and certified by EIC.
- c) If invoice is incomplete in any respect or if there is any non-compliance with relevant terms and conditions of PO, due date of payment shall be counted from the date of submission of all necessary documents provided that relevant terms & conditions of PO have been completed.

### 5. Rejection of Materials

The CEL's decision in regard to the quality of the material and workmanship will be final. The Contractor at its own cost and risk without any compensation shall immediately remove any material rejected by the CEL from the Site.

**6. Labour Engagement**

The Contractor shall be responsible to provide all wages and allied benefits to its labours engaged for execution of the project work and also to carry out Operation & Maintenance service. The Contractor shall remain liable to the authorities concerned for compliance of the respective existing rules and regulations of the government for this purpose and shall remain liable for any contravention thereof. The contractor is encouraged to use local manpower as per the local statutory (labour) requirement, if any.

7. Validity of Prices – 15 days from the date of receipt of quotation.

**8. Training of DISCOM's Personnel**

On successful commissioning of the Plant, the Bidder shall provide training on Plant operations and maintenance to a team (Engineers and Technician/ Operators) as nominated by CEL/Customer, within first three months of Operation of Plant.

9. Performance Bank Guarantee: Successful bidder is required to submit the Performance Bank Guarantee in the form of Bank Guarantee for the 10% of the total invoice value with 7 days from the date of handing over of the project. The **Performance Bank Guarantee** must be valid to cover AMC of the project. The **Performance Bank Guarantee** will be valid for 5 years from the date of handing over of the project. However if required bidder may submit the Performance Bank Guarantee of min. 1 year and will be extendable until 5 years from the date of commissioning. CEL reserves right to invoke Performance Bank Guarantee in case extended Performance Bank Guarantee /fresh Performance Bank Guarantee is not furnished at least 30 days prior to expiry of original Performance Bank Guarantee.

Since the Performance Security shall be against the AMC performance of the projects, hence, BG for less than 10% will not be accepted.

The Bank guarantee shall be from any Nationalized Banks/scheduled commercial banks of RBI. CEL shall at its discretion have recourse to the said Bank Guarantee for the recovery of any or all amount due from the bidder in connection with the contract including any guarantee obligations. This shall include the recovery, if any against the Penalties applicable during AMC period as brought out under Liquidated Damages.

Failure of the Successful Bidder to comply with the requirements of tender documents shall constitute sufficient grounds for the annulment of the award and forfeiture of the Performance Bank Guarantee.

**10. Authorized Test Centers for test certificates**

The transformers/ inverters/ cables and other Balance of system equipment deployed in the solar PV power Plant shall have valid test certificates for their qualification as per above specified IEC/ IS Standards by one of the NABL Accredited Test Centers in India. In case of equipment & material for which such Test facilities may not exist in India, test certificates from reputed ILAC Member body accredited Labs abroad (with proof of accreditation) will be acceptable.

**11. Project Timelines**

Entire job has to be completed within 21 days from the date of receipt of NTP. NTP shall be issued after placement of Purchase order

S. No	Activity	Milestone date
1	Team deputation and Site survey, submission of detailed execution plan	NTP + 3 days

2	Submission of Final Array and SLD	NTP + 3 days
3	Commencement of Civil work	NTP + 3 days
5	Supply of Mounting Structures, Earthing, LA, Power Conditioning Units (PCU)/Inverter, AC /DC cables etc.	NTP + 15 days
6	Supply of Transformer and LT/HT panels & other BOS material	NTP + 15 days
7	Complete installation, testing and commissioning of Solar PV Power Plant/Solar Power Generating System	NTP + 21 days

**12. Liquidated Damages-** In the event of delay in affecting the completion of the project within timelines, a reduction in the prices shall be levied @0.5% of the total order value per week or part thereof subject to maximum of 10% of the total order value. However, extension may be given during extreme conditions after getting approval from competent authority.

### 13. Third Party Inspection Agency

- (a) A third party inspection agency (“Third Party Inspectors” or “TPI”) may be appointed by CEL, at its sole discretion, to conduct any kind of inspection regarding but not limited to procurement, fabrication, installation, hook-up and commissioning during the execution of the Project. The Contractor shall provide necessary access and coordination to conduct such inspections. The extent of third party inspectors’ involvement shall be finalized after mutual discussions between the Contractor and CEL.
- (b) CEL or its authorized representatives, reserve the right to inspect the project components, as per project schedule to ensure compliance of the quality of Components/ material as per the specification and data sheet, before dispatch to site. CEL at its own discretion will visit the premises for inspection with prior intimation to the Contractor. It is the responsibility of the contractor to inform CEL at least 7 days prior to the dispatch of the project equipment. All administrative expenses for CEL or its authorized representatives, will be borne by CEL respectively for above inspections. However, all the expenses related to testing and inspection at manufacturer/ supplier premises or at project site shall be borne by the contractor only. In case contractor fails to show the compliance for the component under inspection as per Technical Specification & approved drawing /design & same is not approved for mass production or dispatch, in such cases Contractor shall bear the expenses towards visit of CEL’s team for subsequent visit/s for inspection of same component.

### 14. Insurance

- (a) **Obtain the insurance policies:** Successful bidder/contractor shall obtain all the policies for all the materials on behalf of CEL. Total prices against which the insurance has to be done shall be provided by CEL after award of contract.
- (b) **Insurance policy expenses:** Successful bidder/contractor shall bear all expenses in relation to obtaining policies for all the materials, as described in this clause.
- (c) **Insurance Policy:** Successful bidder shall obtain the insurance policy as under:
- i. During the Contract period, i.e., during Construction, all insurance related expenses shall be borne by the Contractor. The goods supplied under the Contract shall be fully insured against the loss or damage incidental to manufacture or acquisition, transportation, storage and delivery in such a manner that CEL shall not incur any financial loss, as long as the plant continues to remain under the custody of the Contractor.

- ii. Adequate and seamless insurance coverage during construction period to cater all risks related to construction of complete power Plant to indemnify the CEL. Insurance certificate of warehouse and / storage facility shall be submitted to CEL before the start of the erection and commissioning work.
- iii. In case of any loss or damage or pilferage or theft or fire accident or combination of the said incidents etc. under the coverage of insurance, the Contractor shall lodge the claim as per rules of insurance. Any FIR required to be lodged to local Police Station shall be the responsibility of the Contractor.
- iv. The Contractor shall arrange to supply/ rectify/ recover the materials even if the claim is unsettled for timely completion of the project. The final financial settlement with the insurance company shall rest upon the Contractor.
- v. In case of any delay of the project attributable to the Contractor, the Contractor himself in consultation with CEL should take the extension of insurance. Any financial implications shall, however, be borne by the Contractor. Any delay not attributable to the bidder shall be considered appropriately on case to case basis.
- vi. The Contractor should arrange for providing insurance coverage to its workmen under Workmen's Compensation Act or similar Rules and Acts as applicable during execution of work for covering risk against any mishap to its workmen. The Contractor shall also undertake a Third Party Insurance. The CEL will not be responsible for any such loss or mishap.
- vii. All other insurance like In – transit insurance (Marine/ Cargo/ others as applicable), Contractor All Risk, Erection All Risk, workmen compensation, third party liability, insurance against theft, fire and acts of GOD and others as required for the Construction and to indemnify the CEL's equipment/ material and resources shall be borne by the Contractor.
- viii. CEL shall be named as co – insured under all insurance policies taken out by the contractor pursuant to 'Arbitration', except for the workmen compensation, third party liability and CEL's liability insurances. Also, Contractors' sub – contractor shall be named as co-insured under all insurances taken out by the contractor pursuant to Arbitration except for Cargo insurance, workmen compensation insurance and CEL's liability insurance. All insurers' rights of subrogation against such co – insured for losses or claims arising out of the performance of the contract shall be waived under such policies.

**15. Transportation, Demurrage, Wharfage, etc.**

Contractor is required under the Contract to transport the Goods to place of destination defined as Site. Transport to such place of destination in India including insurance, as shall be specified in the Contract, shall be arranged by the Contractor, and the related cost shall be included in the Contract Price.

Successful bidder, on whom letter of award is placed, is to ensure all safety guidelines, rules and regulations, labour laws etc. Successful bidder indemnifies CEL/Customer for any accident, injury met by its labour, employee or any other person working for him. Any compensation sought by its labour, employee or any other person working for him shall be paid by successful bidder as per settlement solely. CEL has no role to play in this matter.

**16. Change in Law / Regulations** Change in law shall refer to the occurrence of any of the following events after the last date of the bid submission, including:

- (i) the enactment of any new law; or
- (ii) an amendment, modification or repeal of an existing law; or
- (iii) the requirement to obtain a new consent, permit or license; or
- (iv) any modification to the prevailing conditions prescribed for obtaining a consent, permit or license, not owing to any default of the bidder; or



- (v) any change in the rates of any Taxes, Duties and Cess which have a direct effect on the Project. However, Change in Law shall not include any change in taxes on corporate income or any change in any withholding tax on income or dividends.

Relief for change in law:

- i. In the event a Change in Law results in any adverse financial loss/ gain to the bidder, in order to ensure that the bidder is placed in the same financial position as it would have been had it not been for the occurrence of the Change in Law, the bidder/CEL/Customer shall be entitled to compensation by the other party, as the case may be, subject to the condition that the quantum and mechanism of compensation payment shall be determined and shall be effective from such date as may be decided by CEL customer proportionately on back to back basis.
- ii. If a Change in Law results in the bidder's costs directly attributable to the Project being decreased or increased by one percent (1%), the project/PO cost shall be appropriately increased or decreased proportionately on back-to-back basis subject to due approval of CEL's customer.
- iii. The bidder or CEL or CEL's Customer, as the case may be, shall provide the other Party with a certificate stating that the adjustment in the project cost is directly as a result of the Change in Law and shall provide supporting documents to substantiate the same and such certificate shall correctly reflect the increase or decrease in costs.
- iv. The revised project cost shall be effective from the date of such Change in Law as approved by CEL's Customer, the Parties hereto have caused this Agreement to be executed by their fully authorized officers, and copies delivered to each Party, as of the day and year first above stated.
- v. For the excess amount to be recovered against the approved change in Law events, shall not attract any carrying costs or any other interest on such amount.

Note:

- (a) The contractor/bidder shall not display the photographs & content of the work and also will not take advantage though publicity of the work without written permission of CEL. Non-compliance to this may result in blacklisting of Contractor.
- (b) Price adjustment is not allowed. The prices quoted by the Bidder shall be fixed for the entire duration of the contract period, except in the event of a change in the location of the facilities/sites or as otherwise provided in the contract.

## Specifications

### Minimum Technical Specifications of Solar Power Generating System(s) are as follow:

The main objective of the design philosophy is to construct the plant with in-built Quality and appropriate redundancy to achieve high availability and reliability with minimum maintenance efforts. In order to achieve this, the following principles shall be adopted while designing the system.

Adequate capacity of PCUs, Junction boxes etc. to ensure generation of power as per design estimates. This will be done by applying liberal de-rating factors for the array and recognizing the efficiency parameters of PCUs, transformers, conductor losses, system losses, site conditions etc. Strict compliance with approved and proven quality assurance (QA) systems and procedures during different stages of the project, starting from sizing, selection of make, shipment, storage (at site), during erection, testing and commissioning. System design shall have intelligent protection mechanism which may include very fast responsive microprocessor based relays etc., so that any disturbance from the grid will not cause any damage to the equipment of the Solar Power Plant.

Shadow free plant layout to ensure minimum losses in generation during the day time. Higher system voltage and lower current options to be followed to minimise ohmic losses. Selection of PCUs with proven reliability and minimum downtime. Ready availability of requisite spares.

Careful logging of operational data / historical information from the Data Monitoring Systems, and periodical analysis of the same to identify any abnormal or slowly deteriorating conditions.

Each component offered by the bidder shall be of established reliability. The minimum target reliability of each equipment shall be established by the bidder considering its mean time between failures and mean time to restore, such that the availability of complete system is assured. Bidder's recommendation of the spares shall be on the basis of established reliability.

Bidder shall design, erect and maintain the plant and equipment in order to have sustained life of 25 years with minimum maintenance efforts.

#### 1. Bill of Material:

The equipment and material for Grid Interactive Solar Power Generating System (SPGS) with associate system (typical) shall include, but not limited to the following:

Item Details (along with make & specifications)	Unit
Solar PV Modules (to be supplied by CEL)	Nos.
Module Mounting Structures including fasteners and clamps	Set
Main Junction Boxes with monitoring capabilities	Lot
Solar module array to Junction box Interconnection cable (Cu), MC4 Connectors	RM
Junction box to Inverter Interconnection Cable (Cu/ Al)	RM
Connection accessories – lugs, ferrules, glands, terminations etc.	Lot
AC Cable (LT/ HT) of appropriate sizes	RM
Power Conditioning Units/ Inverters	Nos.
String level monitoring system (SCADA) and ancillaries	Set
Transformer(s)	Set
LT panel with all protection equipments	

11 kV HT panel with Circuit breakers, CT and PT set (at all voltage levels used) or 415V LT Panel with circuit breakers and other protection devices (as per site requirements of termination)	Set
AC & DC distribution panels/ boards, PDB, LDB etc.	Lot
Control and Relay Panel	Lot
Lightning Arresters of suitable ratings	Nos.
Earth mat for switch yard, DC field array and equipment	Lot
Control and power cables	Lot
Surge Protection devices and Fuses	Set
Earth cables, flats and earthing pits	Lot
Equipment and Control room with associated equipment	Lot
Rubber Mats for specific kV ratings and safety gadgets, PPE etc.	Lot
Fire extinguisher - Foam type, CO2 type, ABC type etc., as	Lot
Sand Buckets	Lot
Discharge Rods	Lot
HT/LT cable and its accessories upto 11kV/415V termination point	Lot
Power efficient peripheral lighting arrangement for the Plant safety	Nos.
Fire – Alarm system and signboards	Lot
Danger sign plates, anti-climbing etc.	Lot

All the information shown here is indicative only and may vary as per design and planning by the Contractor. The Contractor must provide the BOM of the Plant as per the design in line with the project requirements.

## 2. PV Array Configurations

The Solar array shall be configured in multiple numbers of sub-arrays, providing optimum DC power to auditable number of sub arrays. The Contractor shall submit their own design indicating configuration of PCU and respective sub arrays and associated bill of material.

UV resistant Cable-ties (suitable for outdoor application shall be used to hold and guide the cables/wires from the modules to junction boxes or inverters. All the cables were aesthetically tied to module mounting structure.

In case the string monitoring unit (SMU) is mounted on the module mounting structure, Contractor to take into consideration of the load thus added on the MMS. Accordingly, suitable supporting members for mounting the SMU must be designed and supplied. Separate structure for mounting of SMU can also be proposed.

Every major Component of the Plant should be suitably named/ numbered & marked for ease of traceability, identification and maintenance.

## 3. String Monitoring Unit (SMU):

All SMUs or junction box (if required by CEL's customer or for smooth operation of the plant) should be equipped with appropriate functionality, safety (including fuses, grounding, contacts etc.) and protection.

The terminals will be connected to copper bus-bar arrangement of proper sizes to be provided. The junction boxes will have suitable cable entry points fitted with cable glands of appropriate sizes for both incoming and outgoing cables. Suitable markings shall be provided on the bus- bars for easy identification and weather resistant cable ferrules will be fitted at the cable termination points for identification.

The standards and codes:

Standard/Code	Description
IEC 60529	Enclosure Ingress Protection
IEC 62262	Enclosure Impact Protection
IEC 60296	Fuse
IEC 61643-12	Surge Protection Device
IEC 62852 or EN 50521	Solar cable connector

The Junction Boxes shall have suitable arrangement for the followings

- a) Provide arrangement for disconnection for each of the groups/incomers.
  - Provide a test point for each sub-group for quick fault location and to provide group array isolation.
  - Suitable space for workability and natural cooling.
- b) The junction boxes shall be dust, vermin, and waterproof and made of thermoplastic/ metallic in compliance with IEC 62208, which should be sunlight/ UV resistive as well as fire retardant & must have minimum protection to IP65 (Outdoor) and Protection Class II.
- c) Array Junction Box will also have suitable surge protection. In addition, over voltage protection shall be provided between positive and negative conductor and earth ground such as Surge Protection Device (SPD). The maintenance free earthing shall be done as per the relevant standards.
- d) Array Junction Box should have adequate ratings of solar DC fuses & isolating miniature circuit breakers at both the terminals (+ve or both +ve as well as -ve), provided in recommendation with the inverter manufacturer. The fuses should be so designed that it should protect the modules from the reverse current overload.
- e) At outgoing side DC Disconnecter switches of suitable capacity shall be provided.
- f) Contractor shall submit all the test reports/ test certificates and compliance certificates during Detailed Design Engineering & before installation at site.

#### 4. Power Conditioning Unit (PCU)

- Power Conditioning Unit (PCU)/ Inverter shall consist of an electronic inverter along with associated control, protection and data logging devices.
- String Inverter of appropriate plant DC capacity as per MNRE guidelines may be used.
- The rated power/name plate capacity of the inverters shall be the AC output of the inverter at 50 deg C.
- All PCUs should consist of associated control, protection and data logging devices and remote monitoring hardware and compatible with software used for string level monitoring.
- Dimension, weight, cooling arrangement etc. of the PCU shall be indicated by the Bidder in the offer. Type (in- door & out-door) of installation also to be indicated.
- Contractor has to provide sufficient information about the inverter to be installed at the project site to the satisfaction of the CEL before placing the final order for PCUs/ Inverters. Service center of the PCU manufacturer must be in India.
- The minimum European efficiency of the inverter shall be 98% load as per IEC 61683 standard for measuring efficiency. The Bidder/ Contractor shall specify the conversion efficiency of different loads i.e.

25%, 50%, 75% and 100% in its offer. The Bidder/ Contractor should specify the overload capacity in the bid.

- The inverters shall have minimum protection to IP 65(Outdoor)/IP 21(indoor) and Protection Class II.
- Nuts & bolts and the PCU enclosure shall have to be adequately protected taking into consideration the atmosphere and weather prevailing in the area.
- Grid Connectivity: Relevant CERC regulations and grid code as amended and revised from time to time shall be complied. The system shall incorporate a unidirectional inverter and should be designed to supply the AC power to the grid at load end. The power conditioning unit shall adjust the voltage & frequency levels to suit the Grid.
- All three phases shall be supervised with respect to rise/fall in programmable threshold values of frequency.
- The inverter output shall always follow the grid in terms of voltage and frequency. This shall be achieved by sensing the grid voltage and phase and feeding this information to the feedback loop of the inverter. Thus control variable then controls the output voltage and frequency of the inverter, so that inverter is always synchronized with the grid.
- **Operational Requirements for Inverter/ PCU**
  - i. The PCU must have the feature to work in tandem with other similar PCU's and be able to be successively switched "ON" and "OFF" automatically based on solar radiation variations during the day. Inverters must operate in synergy and intelligently to optimize the generation at all times with minimum losses.
  - ii. The PCU shall be capable of controlling power factor dynamically.
  - iii. Maximum power point tracker (MPPT) shall be integrated in the power conditioner unit to maximize energy drawn from the Solar PV array. The MPPT should be microprocessor based to minimize power losses. The details of working mechanism of MPPT shall be mentioned by the Bidder in its offer. The MPPT unit shall conform to IEC 62093 for design qualification.
  - iv. The system shall automatically "wake up" in the morning and begin to export power provided there is sufficient solar energy and the grid voltage and frequency is in range.
  - v. Basic System Operation (Full Auto Mode): The control system shall continuously monitor the output of the solar power Plant until pre-set value is exceeded & that value to be indicated.
  - vi. PCU shall have provisions/features to allow interfacing with monitoring software and hardware devices.

□ **Protection against faults for PCU**

The PCU shall include appropriate self-protective and self-diagnostic feature to protect itself and the PV array from damage in the event of PCU component failure or from parameters beyond the PCU's safe operating range due to internal or external causes.

The self-protective features shall not allow signals from the PCU front panel to cause the PCU to be operated in a manner which may be unsafe or damaging.

Faults due to malfunctioning within the PCU, including commutation failure, shall be cleared by the PCU protective devices. In addition, it shall have following minimum protection against various possible faults.

- i. Grounding Leakage Faults: The PCU shall have the required protection arrangements against grounding leakage faults.

- ii. Over Voltage & Current: In addition, over voltage protection shall be provided between positive and negative conductor and earth ground such as Surge Protection Devices (SPD).
- iii. Galvanic Isolation: The PCU inverter shall have provision for galvanic isolation with external transformer, if required.
- iv. Anti-islanding (Protection against Islanding of grid): The PCU shall have anti-islanding protection. (IEEE 1547/UL 1741/ equivalent BIS standard)
- v. Unequal Phases: The system shall tend to balance unequal phase voltage (with 3- phase systems).
- vi. Reactive Power: The output power factor of the PCU should be of suitable range to supply or sink reactive power. The PCU shall have internal protection arrangement against any sustained fault in the feeder line and against lightning in the feeder line.
- vii. Isolation: The PCU shall have provision for input & output isolation. Each solid- state electronic device shall have to be protected to ensure long life as well as smooth functioning of the PCU.
- viii. PCU shall have arrangement for adjusting DC input current and should trip against sustainable fault downstream and shall not start till the fault is rectified.
- ix. 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.
- x. All inverters/ PCUs shall be three phase using static solid state components. DC lines shall have suitably rated isolators to allow safe start up and shut down of the system. Fuses & Circuit breakers used in the DC lines must be rated suitably.

**Standards & Compliances (PCU)**

- i. PCU shall confirm to the following standards and appropriately certified by the labs:

Efficiency Measurements	IEC 61683
Environmental Testing	IEC 60068-2/ IEC 62093
Electromagnetic Compatibility (EMC)	IEC 61000-6-2, IEC 61000-6-4 & other relevant parts of IEC 61000
Electrical Safety	IEC 62103/ 62109-1&2
Anti-Islanding Protection	IEEE1547/IEC 62116/ UL1741 or equivalent BIS Standards
LVRT compliance	As per latest CERC guidelines/regulations/order
Grid connectivity	Relevant 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 deg. C shall be considered) in kW will be considered as inverter rated capacity.
	Minimum capacity of inverters used in the power plant shall be min. plant DC capacity. For eg. For 500 KWp power plant, total cumulative inverters shall be minimum 500 KW.

- ii. The Bidder/Contractor should select the inverter as per its own system design so as to optimize the power output, however selected inverter must comply with the Technical/functional requirement of Plant as per this Tender Document.

iii. **Desired Technical requirements of PCU.**

Parameter	Specification
Rated AC power	As per design
Maximum input voltage	1000 V
Rated AC output voltage	As per design
Tolerance on rated AC output voltage	+/-10%
Rated frequency	50 Hz
Operating frequency range	47.5 Hz to 52 Hz
Power factor control range	0.9 lag to 0.9 lead
European efficiency	Minimum 98%
Maximum loss in Sleep Mode	0.05% of rated AC power
Total Harmonic Distortion	Less than 3% at 100% load
Degree of protection	IP 20 (Indoor)/IP 54 (Outdoor)

The rated/ name plate AC capacity of the PCU shall be AC power output of the PCU at 50°C.

Maximum power point tracker (MPPT) shall be integrated in the PCU to maximize energy drawn from the Solar PV array. The MPPT voltage window shall be sufficient enough to accommodate the output voltage of the PV array at extreme temperatures prevailing at site.

The PCU output shall always follow the grid in terms of voltage and frequency. The operating voltage and frequency range of the PCU shall be sufficient enough to accommodate the allowable grid voltage and frequency variations.

**Construction:**

- Power Conditioning Unit (PCU) shall consist of an electronic three phase inverter along with associated control, protection, filtering, measurement and data logging devices.
- Every DC input terminal of PCU shall be provided with fuse of appropriate rating. The combined DC feeder shall have suitably rated isolators for safe start up and shut down of the system.
- Type-II surge protective device (SPD) conforming to IEC 61643-12 shall be connected between positive/negative bus and earth.
- In case external power supply is required, standalone UPS shall be used to meet auxiliary power requirement of PCU. It shall have a backup storage capacity of 2 hours.
- Circuit Breaker of appropriate voltage and current rating shall be provided at the output to isolate the PCU from grid in case of faults.

- The PCU shall be tropicalized and the design shall be compatible with conditions prevailing at site. Suitable number of exhaust fan with proper ducting shall be provided for cooling keeping in mind the extreme climatic condition of the site as per the recommendations of OEM to achieve desired performance and life expectancy.
- All the conducting parts of the PCU that are not intended to carry current shall be bonded together and connected to dedicated earth pits through protective conductor of appropriate size. DC negative terminal shall be grounded.
- Dedicated communication interface shall be provided to monitor the PCU from SCADA.
- PCU front panel shall be provided with LCD/ LED to display all the relevant parameters related to PCU operation and fault conditions. It shall include, but not limited to, the following parameters.
  - (i) DC input power
  - (ii) DC input voltage
  - (iii) DC input current
  - (iv) AC output power
  - (v) AC output voltage (all the 3 phases and line)
  - (vi) AC output current (all the 3 phases and line)
  - (vii) Frequency
  - (viii) Power Factor

#### Operating Modes

Operating modes of PCU shall include, but not limited to, the following modes. These operating modes and conditions for transition are indicative only. The Contractor shall provide the detailed flow chart indicating the various operating modes and conditions for transition during detailed engineering.

#### Standby Mode

The PCU shall continuously monitor the input DC voltage and remain on Standby Mode until it reaches the pre-set value.

#### MPPT Mode

When the input DC voltage is above the pre-set value and AC grid connection conditions are fulfilled, the PCU shall enter into MPPT mode.

#### Sleep Mode

When the AC output power/DC input voltage decreases below the pre-set value for pre-set time delay, the PCU shall switch into Sleep Mode.

#### Protection Features

The PCU shall include appropriate self-protective and self-diagnostic feature to protect itself and the PV array from damage in the event of PCU component failure or from parameters beyond the PCU's safe operating range due to internal or external causes. The self-protective features shall not allow signals from the PCU front panel to cause the PCU to be operated in a manner which may be unsafe or damaging. Faults due to malfunctioning within the PCU, including commutation failure, shall be cleared by the PCU protective devices.

The PCU shall provide protection against the following type of faults, among others.

- (i) DC/AC over current
- (ii) DC/AC over voltage



- (iii) DC reverse polarity
- (iv) DC earth fault
- (v) AC under voltage
- (vi) AC under frequency/over frequency
- (vii) Islanding
- (viii) Over temperature
- (ix) Lightning surges
- (x) Cooling fan failure
- (xi) Auxiliary supply failure
- (xii) Grid Support Functions
- (xiii) Active power regulation

- The PCU shall be able to limit the active power exported to the grid based on the set point provided through PCU front control panel. The PCU shall also be able to automatically the limit the active power after an increase in grid frequency above a pre-set value. The ramp rate shall be adjustable during operation and start-up after fault. The applicability of the requirement shall be as per CEA regulation and compliance.

- Reactive Power Control

The PCU shall be able to inject /absorb reactive power to/ from the grid based on the set point provided through PCU front control panel. The same shall be performed automatically with adjustable ramp rate based on dynamic changes in grid voltage or reactive power reference.

- Voltage Ride Through

The PCU shall remain connected to the grid during temporary dip or rise in grid voltage as per the LVRT and HVRT requirements of CEA Technical Standards for Connectivity to the Grid Regulations. The PCU shall also be able to inject reactive power during the period of voltage dip.

Test Certificates/Reports

All the test certificates as per the standards mentioned above shall be submitted for approval. The tests should have been conducted at a test laboratory compliant with ISO 17025 for testing and calibration and accredited by an ILAC member signatory. Laboratory accreditation certificate or weblink along with scope of accreditation shall also be submitted. It is the responsibility of the Contractor to substantiate the compliance for CEA Regulations using test reports.

**5. Inverter Transformer**

Standards and Codes

Inverter transformer, wherever applicable, shall comply with the latest edition of the following standards and codes including amendments

Standard	Description
IS:2026, IEC:60076	Specification of Power Transformers
IS:2099, IEC:60137	Bushings for alternate voltage above 1000 V
IS: 335, IEC 60296	Insulating oil

IS: 3639

Fittings and Accessories for Power Transformers

Technical Requirements

<b>Parameters</b>	<b>Inverter Transformer</b>
VA Rating	As per system requirement and SLD
Voltage Ratio	11 kV output voltage or 415V output voltage (as per site requirement)
Duty, Service & Application	Continuous Solar Inverter application and converter Duty (Outdoor)
Winding	As per system design requirement. Appropriate winding (aluminium or copper) may be selected
Frequency	50 HZ
Nos. of Phase	3
Vector Group & Neutral Earthing	As per system/inverter manufacturer requirement and SLD
Cooling	ONAN
Tap Changer	OCTC, No. of steps shall be as per the SLD and system requirement
Impedance at 75°C	As per Inverter Manufacturer requirement and SLD
Permissible Temperature rise over an ambient of 50°C (irrespective of tap)	
Top Oil	50°C
Winding	55°C
SC withstand time (thermal)	2 second
Termination	As per system requirement and SLD
Bushing rating, Insulation class (Winding & bushing)	HV side - 12 kV porcelain bushings LV side – 1.1 kV porcelain bushings
Noise level	As per NEMA TR-1
Loading Capability	Continuous operation at rated MVA on any tap with voltage variation of +/-3%, also transformer shall be capable of being loaded in accordance with IEC 60076-7

Flux density	Not to exceed 1.9 Wb/sq.m. at any tap position with combined frequency and voltage variation from rated V/f ratio by 10% corresponding to the tap. Transformer shall also withstand following over fluxing conditions due to combined voltage and frequency fluctuations: a) 110% for continuous rating b) 125% for at least one minute c) 140% for at least five seconds. Bidder shall furnish over fluxing characteristic up to 150%
Air Clearance	As per CBIP
* Single Line Diagram (SLD) will be finalized during detailed engineering.	
Transformer shall be of appropriate plant DC capacity as per MNRE guidelines or policies and its latest amendments	

### Construction

- The transformer shall be provided with conventional single compartment conservator with prismatic toughened glass oil gauge. The top of the conservator shall be connected to the atmosphere through indicating type cobalt free silica gel breather with transparent enclosure. Silica gel shall be isolated from atmosphere by an oil seal. Inverter transformers shall be provided with Magnetic Oil Gauge (MOG) with low oil level alarm contact.
- It is the responsibility of the Contractor to ensure that the inverter transformer comply with all the requirements of inverter provided by the inverter manufacturer.
- Inverter Transformer shall be designed for at least 5% total harmonic distortion (THD) to withstand distortion generated by the inverter as well as possible outside harmonics from the network.
- The transformer shall be suitable for continuous operation with a frequency variation of  $\pm 2.5\%$  from nominal frequency of 50 Hz without exceeding the specified temperature rise.
- Inverter Transformer shall have shield winding between LV & HV windings. Each LV winding must be capable of handling non-sinusoidal voltage with voltage gradient as specified by the inverter manufacturer. Also, shield winding shall be taken out from tank through shield bushing and the same shall be brought down to the bottom of the tank using copper flat and support insulator for independent grounding.
- Neutral bushing of Inverter duty transformer shall be brought outside the tank for the testing purpose. It shall be covered with MS sheet and a sticker "For testing purpose only. Do not earth". Neutral bushing of auxiliary transformer shall be brought outside the tank for earthing.
- Transformer shall have 150 mm dial type Oil Temperature Indicator (OTI) and Winding Temperature Indicator (WTI) with alarm and trip contacts. All indicators shall have accuracy class of  $\pm 2$  deg. For inverter transformers, WTI shall be provided for all the windings.
- The radiators shall be detachable type, mounted on the tank with shut off valve at each point of connection to the tank, lifts, along with drain plug/ valve at the bottom and air release plug at the top.

- Marhalling Box shall be of sheet steel, dust and vermin proof provided with proper lighting and thermostatically controlled space heaters. The degree of protection shall be IP 55. Marhalling Box of all transformers shall be preferably Tank Mounted. One dummy terminal block in between each trip wire terminal shall be provided. At least 10% spare terminals shall be provided on each panel. The gasket used shall be of neoprene rubber. Wiring scheme (TB details) shall be engraved in a stainless steel plate with viewable font size and the same shall be fixed inside the Marhalling Box door.
- Suitable relay, double float type with alarm and trip contacts, along with suitable gas collecting arrangement shall be provided. RTCC panel, as per design, to be provided.
- Inverter transformer shall be provided with spring operated Pressure Relief Device (with trip contacts) with suitable discharge arrangement for oil.
- Filter valve at top the tank and drain cum sampling valve at bottom of the tank shall be provided.
- All external surface of the transformer shall be painted with two coats of epoxy-based paint of colour shade RAL 7032. Internal surface of cable boxes and marshalling box shall be painted with epoxy enamel white paint. The minimum dry film thickness (DFT) shall be 100 microns.
- LV and HV cable box shall be provided with disconnecting chamber to facilitate the movement of transformer without disturbing cable box and termination.
- Air release plug, bi-directional wheel/skids, cover lifting eyes, transformer lifting lugs, jacking pads, towing holes, core and winding lifting lugs, inspection cover, rating plate, valve schedule plate, accessories and terminal marking plates, two nos. of earthing terminals shall be provided.
- Rain hoods to be provided on MOG & PRD. Entry points of wires shall be suitably sealed. The accessories listed above are indicative only. Accessories which are not mentioned above but required for satisfactory operation of the transformers are deemed to be included in the contract without extra charges.

### General Standards

- i. All equipment shall be designed for operation in coastal climate at the required capacity. The reference parameters for which the transformers are to be designed are as under: -

Particular	Condition
Maximum ambient temperature	50°C
Maximum daily average ambient temp	40°C
Maximum yearly weighted average ambient temp	35°C
Minimum ambient air temperature (Cooling)	-5°C
Max. Relative Humidity	95%
Yearly Avg. number of thunder storms	30-50
Average Number of rainy days	60 days
Fog	In winter
Number of months during which topical monsoon	5 months
Dust storms	May occur
Cyclone	Area is cyclone prone
Average Annual rain fall	100 cms.
Maximum wind speed	180 kmph

**ii. Efficiency:**

The percentage loading for the maximum efficiency shall be clearly stated at unity power factor as well at 0.9 and 0.9 power factor (lead and lag).

**iii. Insulation:**

The dielectric strength of the winding, given insulation and the bushings shall conform to the values given in IS: 2026 (Part III)/1981 (or its latest amendment) for highest system voltage and shall be suitable for the impulse test\power frequency test voltages.

**iv. Factory Assembly and Tests:**

The transformer shall be completely assembled and tested at the Factory. Routine and Acceptance tests as per specification/ standards are to be conducted and no deviation in respect of conducting these tests will be acceptable. No extra charges for these tests will be paid. Test charges shall be part of cost of the equipment. If CEL/Customer/ DISCOM/ End Customer selects to send a representative, all tests shall be carried out in his presence. Type test certificate shall be furnished before start of supply.

**v. Routine Tests:**

Each completed transformer shall be subjected to following routine tests as per IS: 2026

Part. I & III (latest amendment). No extra charges for any of the tests shall be paid. No deviation shall be acceptable. If the supplier desires, he may not fix radiators on transformers (other than the one which is to be type tested) during routine testing. However in that case, radiator manufacturer's test certificate shall be furnished for reference of inspecting officer with undertaking that supplier shall be responsible for proper alignment/fixing of radiator on transformer at site.

- o Measurement of resistance of each winding.
- o Measurement of turn's ratio between HV-LV windings at each tap.
- o Checking of polarity and phase relation-ships for each winding.
- o Measurement of no load loss and no load current.
- o Positive phase sequence impedance/short circuit impedance between HV-LV windings on minimum, maximum and normal taps.
- o Separate source voltage withstand test.
- o BDV test on transformer oil.
- o Induced over voltage withstand test.
- o Measurement of neutral unbalance current.
- o Regulation at rated load at unity, 0.90 and 0.80 lagging power factor.
- o Load losses measured at rated frequency by applying voltage sufficient to produce the rated relevant current in one winding with the other winding short circuited.
- o Measurement of insulation resistance.
- o The total losses shall comprise of the No Load Losses, load losses at rated output duly converted at 75 deg. C average winding temperature and shall also be indicated in the test report. Load losses shall be that corresponding to rated load on HV & LV winding.
- o Routine dielectric tests as per IS: 2026(Part. I & III), 1981 and any amendments thereto.
- o Check complete transformer against approved outline drawing, provision for all fittings, finish oil level etc.

**vi. Tests at Site**

After erection at site all transformer(s) shall be subjected to the following tests:

- i. Insulation resistance test.
- ii. Ratio and polarity test.
- iii. Dielectric test on oil.
- iv. Physical check

In case the equipment is not found as per the requirements of the Technical Specification of Tender Documents, all expenses incurred during site testing will be to the tenderer's account and the material shall be replaced by him at site, free of cost.

**Further Tests:**

The CEL reserves the right of having other reasonable tests carried out at his own expenses either before dispatch or during performance guarantee period from Govt. approved/ Govt. recognized lab to ensure that the transformer complies with the requirements of this specification after due intimation to the supplier. In case the equipment is not found meeting the requirement of Technical Specification of Tender Document, all expenses incurred for such testing will be on supplier's account and the material shall be replaced by the supplier at site free of cost.

**vii. Frequency and System Voltage:**

The transformer shall be suitable for continuous operation with a frequency variation of  $\pm 2.5\%$  from normal of 50Hz without exceeding the specified temperature rise. The system shall be designed for a suitable voltage range as per the Grid code of the state or as per End Customer standard. However, the flux density requirements shall be as per this specification.

**viii. Installation & Commissioning:** Mainly following activities are required to be carried out before commissioning of Power Transformers: -

- Assembling of Power Transformer accessories as per GA drawing.
- Testing activities in presence of CEL such as
  - Ratio Test
  - Megger Value
  - Magnetic balance.
  - Oil BDV
  - Earth Resistance
  - Buchhloz Relay checking.
  - WTI/OTI/MOLG (oil level) checking.
  - Checking of points of leakage of oil from Transformer body/ Radiator/Valve
  - Setting of Relays in Panel

**Circuit Breakers**

- i. The circuit breakers shall be capable of rapid and smooth interruption of currents under all conditions completely suppressing all undesirable phenomena even under the most severe and persistent short circuit conditions or when interrupting small currents or leading or lagging reactive currents. The circuit breakers shall be 'Restrike-Free' under all operating conditions. The details of any device incorporated to limit or control the rate of rise of re-striking voltage across, the circuit breaker contacts shall be stated. The over voltage across, the circuit breaker contacts shall be stated. The over voltage caused by circuit breaker while switching inductive or capacitive loads shall not exceed 2.5 times the highest phase to neutral voltage. The actual make and break times for the circuit breakers throughout the ranges of their operating duties shall be stated in the offer and guaranteed.
- ii. **Applicable Standards:** The materials shall conform in all respects to the relevant Indian Standard Specifications/ IEC Standards, with latest amendments indicated (reference only) below:

IS-13118/1991	General requirements for Circuit breakers for voltage above 1000 V IEC 62271-100-1/2001
IS-2705/1992	Current Transformers
IS-2099/1986	Bushings for alternating voltages above 1000 V
ISS-2633/1964	Methods of testing uniformity of coating of zinc coated articles
IS-3231/1986	Electrical relays for power system protection
IS-1248/1983	Specification for Ammeters & Voltmeters
IS-335/1983	New insulating oils Electrical IEC 71 (For oils in CTs) Clearances
IS-2147/1962	Degree of protection provided by enclosures for low voltage switchgear & control gear

- iii. The arc quenching chambers shall have devices to ensure almost uniform distribution of voltage across the interrupters.
- iv. Appropriate & adequate Capacity 415V AC indoor air Circuit Breaker as per the IEC 60898 / IEC 62271 – 100 or equivalent Indian Standards along with control circuit and protection relay circuit, fuses, annunciations and remote operating and controlling facility from the Main Control Room.
- v. Circuit breaker shall be C2/MI class under all duty conditions and shall be capable of performing their duties without opening resistor. The circuit breaker shall meet the duty requirement of any type of fault or fault location and shall be suitable for line charging and dropping when used on 6kV effectively grounded or ungrounded systems and perform make and break operations as per the stipulated duty cycles satisfactorily.
- vi. The circuit breaker shall be capable for breaking the steady & transient magnetizing current corresponding to transformers. It shall also be capable of breaking line charging currents as per IEC- 62271-100 with a voltage factor of 1.4.
- vii. The rated transient recovery voltage for terminal fault and short line faults shall be as per IEC: 62271-100.
- viii. The Contractor may note that total break time of the breaker shall not be exceeded under any duty conditions specified such as with the combined variation of the trip coil voltage, pneumatic pressure etc. While furnishing the proof of the total break time of complete circuit

breaker, the Contractor may specifically bring out the effect of non-simultaneity between same pole and poles and show how it is covered in the guaranteed total break time.

- ix. Contractor shall indicate the noise level of breaker at distance of 50 to 150 m from base of the breaker.
- x. While furnishing particulars regarding the D.C. component of the circuit breaker, the Contractor shall note that IEC-62271-100 requires that this value should correspond to the guaranteed minimum opening time under any condition of operation.
- xi. The critical current which gives the longest arc duration at lock out pressure of extinguishing medium and arc duration shall be indicated.
- xii. Contractor has to provide the type test reports for the CB before the dispatch.
- xiii. All the duty requirements specified above shall be provided with the support of adequate test reports.

**Operating Mechanism of Circuit Breakers**

- i. Circuit shall be vacuum type with electrically spring charged mechanism.
- ii. The operating mechanism shall be anti-pumping and trip free (as per IEC definition) electrically under every method of closing. The mechanism of the breaker shall be such that the position of the breaker is maintained even after the leakage of operating media and / or gas. The circuit breaker shall be able to perform the duty cycle without any interruption.
- iii. Electrical tripping shall be performed by shunt trip coil. Provision shall also be made for local electrical control. 'Local / remote' selector switch and close & trip push buttons shall be provided in the breaker central control cabinet. Remote located push buttons and indicating lamps shall also be provided. The VCB coil DC supply through appropriately rated battery bank and charger to be supplied by the Contractor.
- iv. Operating mechanism and all accessories shall be in local control cabinet. A central control cabinet for the three poles of the breaker shall be provided along with supply of necessary tubing, cables, etc.
- v. Mounting and supporting structure for Circuit Breaker: The circuit breakers should be self-supporting type. However, if necessary for the purpose of minimum ground clearance the circuit breakers should be mounted on raised steel structures which should be included in the scope of supply of circuit breaker. Bidder/Contractor to obtain the necessary information and data required for design of foundations of the circuit breaker be obtained from the CB supplier.
- vi. Max. Impact loading in terms of equivalent static load both compression and upward due to opening/closing of the breakers. It shall be clearly stated whether these forces shall act simultaneously or at different timing.
- vii. Necessary connecting materials such as clamps, bolts, nuts, washers etc. and fixing bolts for mounting the equipment on the supporting structures wherever required should be obtained from the circuit breaker supplier.
- viii. General parameters: Vacuum type Circuit Breaker:

Particulars	Details
Type of circuit breaker	Vacuum type
Highest System Voltage	As per system design
Rated operating voltage	As per system design



Rated frequency	50 Hz (+3% to -5%)
Number of poles	Three (3)
Rated/ minimum power frequency Withstand voltage	As per system design
Rated lightning impulse Withstand	As per system design
Rated operating duty cycle	0 - 0.3 sec. - CO – 3 min. – CO
Rated line charging breaking	As per IEC
Reclosing	Single and three phase high speed
Maximum fault level	As per system design
Auxiliary contacts	As required plus 6NO and 6NC
Noise level	Maximum 140dB at 50m distance
Seismic acceleration	0.4 g horizontal

- ix. Co-ordination of rated voltages, short circuit breaking current and rated normal current for guidance as per IS 13118 for rated voltage 33 kV and above
- x. Circuit Breaker Protection against
  - o Over Current
  - o Earth fault
  - o Under voltage & over voltage protection
  - o Under frequency & over frequency
  - o SF6 gas pressure low (where applicable)
  - o DC supply failure

□ **Isolators**

- i. The isolators and accessories shall conform in general to IEC 62271-102 (or equivalent Indian standard) except to the extent explicitly modified in specification.
- ii. Each isolating switch should have the following particulars under the site conditions for the system under design (typical values for 36 kV system are given).
- iii. General Parameters: Isolators

Particular	Details
Operating mechanism of Isolator and Earth Switch	Motor operated
Nominal system voltage	As per system design
Highest system voltage	As per system design
Type	Outdoor (IP 65)
Rated short time current of isolator and earth switch	As per system design

Rated dynamic short time with stand current of isolator and earth	As per system design
Impulse withstand voltage with 1.2/50 micro sec. wave	As per system design
One minute power frequency withstand Voltage	As per system design
Temperature rise	As per Table-IV of IS: 9921
Rated mechanical terminal load	As per 62271-102

□ **Indicating and Integrating Meters/Instruments:**

- i. All indicating instruments shall be of switchboard type, back connected, suitable for flush mounting and provided with dust and vermin proof cases for tropical use and finished in suitable color. All instruments shall have practical laboratory means for adjustment of accuracy. The limits of errors for ammeters/voltmeters shall be those permissible for class 1.5 instruments as per IS: 1248.
- ii. A.C. Static HT Tri Vector Meter:  
A.C. Static HT Tri Vector Meter shall be installed as per STATE DISCOM's/STU's norms and shall be intimated while placement of order. The meters shall be located at eye level to facilitate observations of readings correctly.
- iii. The ammeters and voltmeters shall be suitably scaled to indicate the current/voltage for all the rating of current/voltage transformers. A phase selector switch with four/six position shall be used to measure the current/voltage of each phase/line. The Contractor shall provide test certificate and calibration certificate along with the supply of the instrument.
- iv. The meters shall be located at normal eye level to facilitate observation of readings correctly.

□ **Surge Arrestors**

- i. The surge arrestors (SAs) shall conform in general to IEC 60099-4 or IS: 3070 except to the extent modified in the specification. Arrestors shall be of hermetically sealed units, self-supporting construction, suitable for mounting on lattice type support structures. Contractor shall furnish the technical particulars of Surge arrester.
- ii. The SA's shall be of heavy duty station class and gapless Metal Oxide type without any series or shunt gaps. The SAs shall be capable of discharging over-voltages occurring during switching of unloaded transformers, and long lines.
- iii. Arrestors shall be complete with insulating base for mounting on structure. Suitably enclosed for outdoor use and requiring no auxiliary or battery supply for operation shall be provided for each single pole unit with necessary connection.
- iv. The surge arrestors shall conform to type tests and shall be subjected to routine and acceptance tests in accordance with IEC-60099-4.
- v. Each lightning arrestors should have the following particulars under the site conditions for the system under design:

**Codes and Standard**

IS: 2309: Code of Practice for the protection of building and allied structures against lightning.  
NF C 17-102: Lightning Protection with Early Streamer Air Termination rod

Complete Solar Array with associated structure shall be protected from Direct Lightning Stroke. Lightning Protection for solar array shall be achieved with any or both of the following two systems as per specification provided in the following section;

- (1) Single Rod Air Terminal (Faraday Rods),
- (2) Early Streamer Emission (ESE) Air Terminal.

Suitable earthing and equipotential bonding shall be ensured for the air termination rods as per applicable standard/Equipment manufacturer guidelines. Current carrying parts and accessories such as clamps, fasteners, down conductor, Test links and earth termination etc. shall be preferably procured from OEM of Air Terminals if it is supplied by them as part of lightning protection system.

#### **Lightning Protection System for solar array with single rod air terminal**

Solar array of Plant shall be protected from direct lightning strike with straight or angled air termination rods of suitable class as per IS:2309 to be fixed with the module mounting structure (MMS). Air termination rods shall have minimum two clamps to be fixed with MMS and must be capable of carrying full lightning current. Contractor to ensure proper fixing of the clamps with MMS to allow lightning current to pass through the clamp without damage and to sustain the rods during high velocity wind. Contractor shall submit the calculation to determine the no. and location of air termination rods to be fixed on structure to provide the lightning protection to each solar module and structure. Earth riser shall be connected to that part/pole of MMS which is nearest to air termination rod.

#### **Lightning Protection System for solar array with E.S.E air terminal**

Solar array shall be protected from direct lightning stroke with Early Streamer Emission air terminal in accordance to NF C 17-102 (Latest revision). Number and location of ESE air terminal shall be decided during detail engineering. For this purpose, design calculation and AutoCAD drawing of the layout of ESE terminal shall be submitted to CEL for approval. ESE air terminal shall be type tested in any national/international approved lab for advance triggering time ( $\Delta T$ ) and lightning Impulse current test and type test report shall be submitted to CEL for approval.

1. Each ESE air terminal shall be provided with separate earthing termination and test link for equipotential bonding of Lightning Protection System as per OEM guidelines/NFC 17 -102. Each ESE air terminal shall be equipped with lightning stroke counter to be fixed at suitable height in serial on the down conductor.
2. ESE air terminal shall be erected on isolated foundation to be approved by CEL. If required, Suitable guy wire shall be used to support the mast of ESE terminal against the wind

Location and layout of ESE terminal shall be in such a manner that it cast no shadow on the PV Modules during 08:30 AM to 04:30 PM.

Lightning Protection System for Inverter Room (LCR) and MCR Contractor needs to provide the Lightning Protection for each inverter, Switchyard building and Main Control Room building in accordance to IS:2309.

#### **Protective Relays**

- i. The Solar PV system and the associated power evacuation system interconnections should be protected as per IEC 61727 Ed.2, norms. Over current relays, differential protection relays (for grid tie power Transformer only) and earth fault relays have to be essentially provided. All relay should be numerical type & should also be remote operation and control enabled from the control room.
- ii. All the relays must be solid state type and based on open access communication protocol. The numerical relays shall have RS 485 port for communication.

- iii. The operating voltage of the relays shall be 110 V DC/220 V DC as per battery bank rating.
- iv. Necessary battery bank shall also be provided in order to supply uninterrupted power to relays and control & protection circuit of the Plant.
- v. Detailed Design calculations shall be provided on fault power computations and the philosophy of protective relaying with respect to short circuit kA calculations. Design, drawing and model of protection relay shall be approved by CEL.
- vi. The Contractor must submit the relay setting chart as a part of design documents in coordination with the connecting substation.

**Contacts:**

- i. The moving & fixed contacts shall be made of hard drawn electrolytic grade copper strips and shall be heavy duty self-aligning & high pressure type preferably which applies pressure to the contact surfaces after the blades are fully closed and release the pressure before they start to open. High pressure type contacts shall wipe the contact surfaces, while opening and closing. The contacts shall be so designed that wiping, action shall not cause securing or abrasion on the contact surfaces. The wiping action shall be sufficient to remove oxide film, formed during the operation of the switches. The pressure shall be developed by rotation of the entire blade.
- ii. The temperature rise of contacts due to the flow of rated short circuit current for a period of 3 seconds shall not cause any annealing or welding of contacts.
- iii. The moving contacts, if provided, shall close first and open last so that no damage is caused due to arcing whatever to the main contacts. The Contractor shall give full details of such contacts with necessary drawings.
- iv. The arcing contacts, if provided shall close first and open last so that no damage is caused due to arcing whatever to the main contacts. The tender shall give full details of such contacts with necessary drawings.
- v. The female contact and its tensioning by spring shall be such that there will, always, be a positive contact with adequate pressure to give enough contact surface for the passing of current. The springs provided should not go out of alignment or get entangled with the male contact during operation. The details of springs shall be furnished on the G.A. drawing.

**Earthing Blades**

- i. The Isolators controlling the transmission line (underground transmission cables) shall be equipped with earthing blades. The Earthing blades shall be counter balanced to ensure easy operation.
- ii. Line earth switch shall consist of three Earthing links per Isolator which will normally rest against the frames, when the connected Isolator is in closed position. The Earthing links of all three phases shall be suitable for fitting on either side of the Isolator.
- iii. Short time current withstand capacity of earthing blades of Isolator Earthing Switch shall be same as that of the main blades of Isolator. The material of the earthing Isolator, Each earthing blade shall be provide with flexible copper connections of adequate length of not less than 60mm<sup>2</sup> are for connection between the operating shall and the base frame.
- iv. The rated making capacity of earthing switches shall be as specified in the applicable standard of isolators

**Insulators**

- i. Bushings shall be manufactured and tested in accordance with IS: 2099 & IEC:137. Hollow column insulators shall be manufactured and tested in accordance with IEC: 60233/IS: 5261. The support insulators shall be manufactured and tested as per IS: 2544 / IEC: 600168/IEC: 600273. The insulators shall also conform to IEC 815 as applicable. Contractor shall furnish the technical particulars of all type of insulators used.
- ii. Porcelain insulator shall comply IS: 731-1976 or equivalent international standard and shall be homogenous, free from laminations, cavities and other flaws or imperfections that might affect the mechanical or dielectric quality and shall be thoroughly vitrified, tough and impervious to moisture. Hollow porcelain should be in one integral piece in green & fired stage.
- iii. Contractor may offer silicone rubber housed composite type insulator as an alternative to the above porcelain insulator with equivalent creep age distance.
- iv. Data sheets for the insulators with cantilever strength and compression strength, etc. shall be submitted.
- v. Insulators shall be rated for not less than 6kN for bus bar supports and 4kN for isolators.

### **Bus Bar**

- i. The outdoor bus-bars and equipment connections shall be of suitable size as per norms of End Customer.
- ii. The bus-bars and the connection jumpers shall be supported on post insulators wherever required.
- iii. The ACSR bus bars are an over ground system of wires strung between two supporting structures and supported by strain type insulators. The stringing tension may be limited to 500-900 kg depending upon the size of the conductor used. These types of bus bars are suitable for earthquake prone areas. All the bus bars are to be provided with insulating sleeves with appropriate color code.
- iv. Bus bar Material – The materials in common use for bus bars and connections of the strain type are ACSR conductor or as per DISCOMs requirement.
- v. Since aluminium oxides rapidly, great care is necessary in making connections. In the case of long spans expansion joints should be provided to avoid strain on the supporting insulators due to thermal expansion or contraction of pipe.
- vi. The bus bar sizes should meet the electrical and mechanical requirements of the specific application for which they are chosen

Note: Unless otherwise specified, all equipment and materials shall conform to the latest applicable Indian Standards. Equipment complying with any other International Standards will also be considered if it ensures performance of equipment equal to a superior to Indian Standard.

### **Control & Relay Panel**

- i. General Requirement:
  - o The control & relay panel shall be free standing, simplex type, floor mounting type, fabricated from 2 mm thick MS sheet for main enclosure and 1.6 mm thick MS sheet for internals and partitions. The main enclosure shall be mounted on a base frame fabricated out of 100x50 ISMC mild steel section.
  - o The enclosure external finish color shade shall be decided by the CEL, The internal surface shall have a glossy white finish all over.
  - o The control & relay panel shall contain the following metering and protection devices:
    1. Metering, Indications & Controls
    2. Ammeter:

3. Ammeter selector switch
4. Voltmeter:
5. Voltmeter selector switch
6. Load manager to display the following parameters: MW, MVA, MVArh, MVAr Cos, Hz,
7. Indication lamps for R, Y, B phases, Breaker 'ON' (R), Breaker 'OFF' (G), Breaker 'TRIP' (A), Spring charged (W), Trip Circuit Healthy (B)
8. TNC switch, spring return to neutral position shall be provided for circuit breaker operation.
9. Local / Remote selection switch for circuit breaker operation
10. Semaphore indicators (LED type) for CB and Isolator 'Open' & 'Close' positions
11. Mimic diagram for the systems with aluminium strips and 'ON' 'OFF' indications for isolators

Standards and Codes:

Standard/Code	Description
IS 3231	Electrical relays for power systems protection
IEC 60255	Measuring relays and protection equipment
IEC 61850	Communication networks and systems for power utility automation
IEC 61131-3	Programmable controllers - Part 3: Programming languages
IS 9385	High voltage fuses
IS 9431	Indoor post insulators of organic material for systems with nominal voltages greater than 1000 V up to and including 300 kV
IEC 60099-4	Surge arresters - Part 4: Metal-oxide surge arresters without gaps for A.C. systems
IS 3070-3	Lightning Arresters for Alternating Current Systems - Part 3: Metal Oxide Lightning Arresters Without Gaps
IEC 62052-11	Electricity metering equipment (A.C.) - General requirements, tests and test conditions - Part 11: Metering equipment
IEC 62053	Electricity metering equipment (A.C.) - Particular requirements
IS 14697	AC Static Transformer Operated Watt-hour and Var-hour Meters, Class 0.2S and 0.5S

**Control Circuit**

- i. Control supply for breaker closing / tripping - 110V DC
- ii. Air Circuit Breaker spring charge motor – 240 V AC, 1 phase
- iii. Moulded Case Circuit Breakers – 240 V AC, 1 phase
- iv. Indications, annunciation – 110V DC
- v. Space heater, sockets, etc. – 240 V AC, 1 phase

### **Bus Bar & Cable Cavity**

- i. The material for main bus bars and tap off bus bars shall be electrolytic grade aluminum with properly color coded HR PVC sleeved insulation
- ii. Bus bar shall be suitable for short circuit rating and current suitable for all connected load.
- iii. Cable entry for incoming and outgoing cables shall be from Bottom.
- iv. A suitable gland plate shall be supplied for termination of power, control and instrumentation cables.
- v. Whenever feeders are housed in multi-tier configuration, these tiers shall be segregated by sheet metal barriers.
- vi. Earthing: Earthing bus bar shall be terminated at both ends of the switchgear to suit the connections to outside earthing conductor. All components inside the module are required to be earthed individually and are to be looped and connected to the horizontal earth bus. All the non-current carrying parts of the panels, e.g., enclosure, must be connected to earth as per the regulations.

### **Terminals:**

- i. CT circuit - Isolating link type terminals with shorting facility
- ii. PT circuit – clip on type terminals
- iii. Spare contacts shall be wired up to terminal block. 10% spare terminals shall be provided for each module.

### **Specific Requirement**

- i. All ACBs/ VCBs, as applicable, shall be 4 pole, electrically operated, draw-out type, with closing coil, spring charge motor, trip coil, TNC switch for close and trip, manual closing and tripping push buttons, door I/L, test and service position micro switches, emergency P.B., safety shutters, etc. The circuit breaker shall be provided with anti-pumping feature.
- ii. ACBs/ VCBs, as applicable, shall be complete with microprocessor release and shall be provided with over current, short circuit and earth fault protections.
- iii. Minimum 10% spare feeders of each rating shall be provided in the switchgear.
- iv. All current transformers shall have 5/1A secondary and all meters shall be suitable for 5/1A operation.
- v. All indicating lamps shall be of LED cluster type. ACB feeders shall be provided with ON, OFF, AUTOTRIP, SPRING CHARGED, TEST, SERVICE, TRIP CIRCUIT HEALTHY indications
- vi. All indicating instruments, including MFM, shall be flush mounting, Digital type and of standard size.
- vii. Window annunciator with hooter and accept, test, reset button shall be provided. Necessary auxiliary relays for contact multiplication shall be provided in the panel.
- viii. The maximum temperature of the bus bars, droppers and contacts at continuous current rating under site reference ambient temperature of 50° C shall not exceed 105° C.
- ix. Instrumentation: Switchgear instrumentation shall be provided as follows:
  - o Mains Incomer – Voltmeter with selector switch
  - o Ammeter with selector switch
  - o Power Factor meter

- Frequency meter
- TVM + MD meter
- Potential indicating lamps
- Outgoing Feeders
- Ammeter with selector switch on all feeders

## 7. LT/HT Switchgear

Standards and Codes for LT/HT switchgear

- All equipment provided under LT/HT switchgear shall comply with latest editions and amendments of the relevant IEC standards and IS codes. In particular, the switchgear shall comply with the following standards and codes.

Standards and Codes:

Standard/Code	Description
IS/IEC 62271-1	High Voltage Switchgear and Control gear - Part 1: Common Specifications
IS/IEC 62271-100	High Voltage Switchgear and Control gear - Part 100: AC Circuit Breakers
IS/IEC 62271-102	High Voltage Switchgear and Control gear - Part 102: AC Disconnectors and Earthing Switches
IS/IEC 62271-200	High Voltage Switchgear and Control gear - Part 200: AC Metal Enclosed Switchgear and Control gear for Rated Voltages Above 1 kV and Up to and Including 52 kV
IEC 61869	Instrument Transformers
IS 3231	Electrical relays for power systems protection
IEC 60255	Measuring relays and protection equipment
IEC 61850	Communication networks and systems for power utility automation
IEC 61131-3	Programmable controllers - Part 3: Programming languages
IS 9385	High voltage fuses
IS 9431	Indoor post insulators of organic material for systems with nominal voltages greater than 1000 V up to and including 300 kV
IEC 60099-4	Surge arresters - Part 4: Metal-oxide surge arresters without gaps for A.C. systems
IS 3070-3	Lightning Arresters for Alternating Current Systems - Part 3: Metal Oxide Lightning Arresters Without Gaps
IEC 62052-11	Electricity metering equipment (A.C.) - General requirements, tests and test conditions - Part 11: Metering equipment
IEC 62053	Electricity metering equipment (A.C.) - Particular requirements
IS 14697	IS 14697 AC Static Transformer Operated Watthour and Var-hour Meters, Class 0.2S and 0.5S



	For LT Panel relevant standards as per IS/IEC shall be applicable
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### Low/ High Voltage Switchgear Panels

- i. The LT/ HT switchgear panels shall be designed as per the relevant IS codes and as per the approved design for the panel. All the parts of the panel must be rated as per the relevant rated voltage level. All the panels must have multifunction meters (MFM) flushed with the surface of the panels. However, the outgoing feeder can have Tri vector meter (TVM) for the energy accounting.
- ii. The HT switchgear would be connected with a separate ABT meters which shall be of same specification as the commercial meter. The meter shall be connected with modem to communicate with the server for data storage. The meter shall record generation data in 15mins time packet and record all events of grid outage in 15mins time packet. The bidder shall make sure that any such meter installed shall have current class as the LT/HT Panel CT class. This meter be installed in the solar plant switch yard area. The bidder shall make all arrangement in terms of fabrication to connect ABT meter with the LT/HT Panel and ensure the container of the meter should at least be of IP65/66 rating.
- iii. The Power Control Centre (PCC)/ Switchgear shall be rated for the maximum output of the supply transformer feeding the system. The short circuit withstand rating (1 sec) at rated voltage of the switchgear shall be relevant to the existing electrical system short circuit ratings.
- iv. The configuration of the PCCs shall be as per the Single Line Diagram of the system.
- v. Power Control Centers (Construction)
  - o Single front / compartmentalized, modular design, degree of protection IP52 with provision of extension on both sides.
  - o Incomer feeders: mains incomer – Electrically operated draw out type Air Circuit
  - o Breakers (ACBs)/ Vacuum Circuit breakers (VCBs), as applicable.
  - o Outgoing feeders: Moulded Case Circuit Breakers (MCCBs)/ electrically operated draw out type Air Circuit Breakers (ACBs) / Vacuum Circuit Breakers (VCBs), as applicable.
  - o The color finish shade of switchgear enclosure for interior shall be glossy white & for exterior it shall be light grey, semi glossy shade 631 of IS: 5. If a different exterior shade is desired by the CEL, the same shall be intimated to the supplier.
  - o The PCC shall be fabricated out of CRGO sheet steel; 2 mm thick for the outer shall all-round. The internal walls and separators shall be of 1.6 mm thick CRGO sheet steel.
  - o The gland plates shall be 3 mm thick.

The detailed requirements are however discussed in the previous sections.

#### Type Test for HT/LT switchgear:

Test Standard	Relevant	IEC Clause
<b>Switchgear Panel</b>		
Dielectric tests		
Power frequency voltage test	IEC 62271-200	6.2.6.1
Lightning impulse voltage test	IEC 62271-200	6.2.6.2

Dielectric tests on auxiliary and control circuits	IEC 62271-200	6.2.10
Measurement of the resistance of the main circuit	IEC 62271-200	6.4.1
Temperature-rise tests	IEC 62271-200	6.5
Short-time withstand current and peak withstand current tests	IEC 62271-200	6.6
Verification of the IP coding	IEC 62271-200	6.7.1
Verification of making and breaking capacities	IEC 62271-200	6.101
Mechanical operation test	IEC 62271-200	6.102
Internal arc test	IEC 62271-200	6.106
<b>Circuit Breaker</b>		
Mechanical operation test at ambient air temperature (M2 Class)	IEC 62271-100	6.101.2
Basic short-circuit test-duties	IEC 62271-100	6.106
<b>Relays</b>		
Vibration tests	IEC 60255-21-1	
Shock and bump tests	IEC 60255-21-2	
Seismic tests	IEC 60255-21-3	
Electromagnetic compatibility requirements	IEC 60255-26	
Product safety requirements	IEC 60255-27	
Common requirements	IEC 60255-1	
Functional requirements	Relevant parts of IEC 60255-100 Series	
Communication requirements	IEC 61850	
<b>Current Transformers</b>		
Temperature-rise test	IEC 61869-2	7.2.2
Impulse voltage withstand test on primary terminals	IEC 61869-2	7.2.3
Tests for accuracy	IEC 61869-2	7.2.6
Short-time current tests	IEC 61869-2	7.2.201
<b>Voltage Transformer</b>		
Temperature-rise test	IEC 61869-3	7.2.2

Impulse voltage withstand test on primary terminals	IEC 61869-3	7.2.3
Electromagnetic Compatibility tests	IEC 61869-3	7.2.5
Test for accuracy	IEC 61869-3	7.2.6
Short-circuit withstand capability test	IEC 61869-3	7.2.301
Communication requirements	IEC 61850	
<b>Current Transformers</b>		
Temperature-rise test	IEC 61869-2	7.2.2
Impulse voltage withstand test on primary terminals	IEC 61869-2	7.2.3
Tests for accuracy	IEC 61869-2	7.2.6
Short-time current tests	IEC 61869-2	7.2.201
<b>Voltage Transformer</b>		
Temperature-rise test	IEC 61869-3	7.2.2
Impulse voltage withstand test on primary terminals	IEC 61869-3	7.2.3
Electromagnetic Compatibility tests	IEC 61869-3	7.2.5
Test for accuracy	IEC 61869-3	7.2.6
Short-circuit withstand capability test	IEC 61869-3	7.2.301
For LT Panels, relevant standards as per IEC/IS shall be applicable		

## 8. DC Cable and Wires

- i. All cables and connectors for use for installation of solar field must be of solar grade which can withstand harsh environment conditions including High temperatures, UV radiation, rain, humidity, dirt, salt, burial and attack by moss and microbes for 25 years and voltages as per latest IEC standards. (Note: DC cables for outdoor installations should comply with the TUV 2PFG 1169/09.07 and EN 50618:2014 for service life expectancy of 25 years.
- ii. **Insulation:** Outer sheath of cables shall be electron beam cross-linked XLPO type and black in colour. In addition, Cable drum no. / Batch no. to be embossed/ printed at every one meter. Cable Jacket should also be electron beam cross- linked XLPO, flame retardant, UV resistant and black in colour. DC positive current carrying cables should have marking of red line on black outer sheath.
- iii. All the DC cables from SMU to Inverter must be Single Core cable.
- iv. DC cables used from solar modules to array junction box shall be solar grade copper (Cu) with XLPO insulation and rated for 1.1kV only. However, the cables used from array junction box to inverter can be XLPE Aluminium with 1.1kV rating as per relevant standards.
- v. In addition to manufacturer's identification on DC cables as per relevant standard, following marking shall also be provided over outer sheath.
  - (i) shall be designed Cable size and voltage grade

- (ii) Word 'FRNC/ FRLS' (as applicable) at every metre
- (iii) Sequential marking of length of the cable in metres at every metre
- vi. Wires with sufficient ampacity and parameters and used so that maximum voltage-drop at full power from the PV modules to inverter should be less than 0.5%. Successful Bidder/Contractor shall provide voltage drop calculations in unlocked excel sheet.
- vii. Only terminal cable joints shall be accepted. No cable joint to join two cable ends shall be accepted. Necessary bimetallic connectors have to be used for connecting Cu bus bar and Al cables or vice-versa. All wires used on the LT side shall conform to IS and should be of appropriate voltage grade. Only copper conductor wires (up to Array Junction Box) compliant with IEC 60228, Class 5 of reputed make shall be used.
- viii. All high voltage cables connecting the main junction box/string inverters to the transformers should be PVC insulated grade conforming to IS 1554 and cables shall also conform to IEC 60189 for test and measuring the methods.
- ix. Cable terminations shall be made with suitable cable lugs & sockets etc., crimped properly and passed through brass compression type cable glands at the entry & exit point of the cubicles.
- x. All cable/wires shall be provided with UV resistant printed ferrules for DC side however, for HT cables, punched/ embossed aluminium tags are required. The marking on tags shall be done with good quality letter and number ferrules of proper sizes so that the cables can be identified easily.
- xi. The wiring for modules interconnection should be weather resistant. However, for crossing with road, drain and trenches etc., the cable must pass through GI / Hume pipe of appropriate size with proper protection at ends to prevent any damage inflicted by the edge of the pipe.
- xii. Type test reports and Data sheets of individual cable sizes (HT & LT) shall be submitted for approval by CEL.

Standards and codes:

<b>Cable</b>	<b>From</b>	<b>To</b>	<b>Conductor/ Insulation</b>	<b>Voltage Rating</b>	<b>Applicable Standard</b>
Solar Cable*	Module	SMU	Copper/ XLPO	1.1 kV DC	TUV 2 PfG 1169/08.2007
DC Cable	SMU	Power Conditioning Unit	Copper or Aluminium/ XLPE	1.1 kV DC	IS 7098 Part I

\* Cable used for module interconnection shall also be referred as solar cable.

**Switchboard box / DC Distribution Box (DCDB) / AC Distribution Box (ACDB) panels**

- i. Successful Bidder/Contractor shall provide sufficient no. of switchboards / DCDB/ ACDB wherever required.
- ii. All boxes/ panels should be equipped with appropriate functionality, safety (including fuses, grounding, etc.) and protection.
- iii. The terminals will be connected to bus-bar arrangement of proper sizes to be provided. The panels/ boxes will have suitable cable entry points fitted with cable glands of appropriate sizes for both incoming and outgoing cables.

- iv. Adequate rating fuses & isolating MCB/ MCCB should be provided.
- v. The panels/ boxes shall have suitable arrangement for the followings:
  - o Provide arrangement for disconnection
  - o Provide a test point for quick fault location
  - o To provide isolation
  - o The current carrying rating of the boxes/ panels shall be suitable with adequate safety factor
  - o The rating of the boxes/ panels shall be suitable with adequate safety factor to inter connect to the local/ internal grid
  - o Thermal/ heat dissipation arrangement/ Vent for safe operation.
  - o Adequate number of spare terminals to receive suitable runs and size of cables required for the Inverter/Transformer rating
- vi. The boxes/ panels must be grounded properly to ensure all safety related measures for safe operation. The parts of panel, wherever applicable, must be insulated properly.
- vii. All the Panels to be manufactured with sufficient space for working and must have temperature suitability up to 85<sup>0</sup> C with separate cable and bus bar alley.
- viii. The boxes/ panels shall be dust, vermin, and waterproof and made of thermoplastic/ metallic in compliance with IEC 62208, which should be sunlight/ UV resistive as well as fire retardant & must have minimum protection to IP 65(Outdoor)/ IP 20(indoor) and Protection Class II.

All panels/ boxes shall be provided with adequately rated bus-bar, incoming control, outgoing control etc. as a separate compartment inside the panel to meet the requirements of the Chief Electrical Inspector General (CEIG)/CEA. All live terminals and bus bars shall be shrouded.

**9. AC Cables:**

Standards and Codes:

IS 7098	Crosslinked polyethylene insulated PVC sheathed cables, Part 1: For working voltage up to and including 1100 V
IS 7098	Crosslinked Polyethylene Insulated Thermoplastics Sheathed Cables Part 2: for Working Voltages from 3.3 kV up to and Including 33 kV

- All AC cables shall be flame retardant, low smoke (FRLS) type designed to withstand all mechanical, electrical and thermal stresses develop under steady state and transient operating conditions.
- Only terminal cable joints shall be accepted. No cable joint to join two cable ends shall be accepted. However, cable joints may be allowed if the route length is more than maximum available drum length subject to Owner's approval.
- In addition to manufacturer's identification on cables as per relevant standard, following marking shall also be provided over outer sheath.
  - o Cable size and voltage grade
  - o Word 'FRLS' at every metre
  - o Sequential marking of length of the cable in metres at every metre
- Cables shall be sized based on the following considerations:
  - o Rated current the equipment
  - o Maximum voltage drop in LT cable (from inverter to inverter transformer) shall be limited to 2% of the rated voltage. For HT cables (from inverter transformer to interconnection point),

maximum voltage drop shall be limited to 2% of the rated voltage. Successful Bidder shall provide voltage drop calculations in excel sheet.

- Short circuit withstand capability as per design for 1s.
- De-rating factors according to laying pattern.

## 10. Earthing

Earthing system shall comply with latest revisions and amendments of the relevant IEC standards and IS codes. In particular, earthing system shall comply with the following standards and codes.

Standard/Code	Description
IS 3043	Code of Practice for Earthing
IEEE 80	IEEE Guide for Safety in AC Substation Grounding
IEEE 142	IEEE Recommended Practice for Grounding of Industrial and commercial Power Systems
Indian Electricity Rules	

- Earthing system shall be designed based on system fault current and soil resistivity value obtained from geo-technical investigation report. Earth grid shall be formed consisting of number of earth electrodes sufficient enough to dissipate the system fault current interconnected by earthing conductors.
- The earth electrode shall be made of high tensile low carbon steel rod, molecularly bonded by high conductivity copper on outer surface with coating thickness not less than 250 micron as per relevant standards. Suitable earth enhancing material shall be filled around the electrode to lower the resistance to earth. Inspection chamber and lid shall be provided as per IS 3043.
- Earth conductors shall be made of copper bonded steel or galvanized steel of sufficient cross section to carry the fault current and withstand corrosion.
- Earth electrodes shall not be situated within 1.5m from any building whose installation system is being earthed. Minimum distance between earth electrodes shall be the driven depth of the electrode.
- Every alternate post of the transformer yard and switchyard fence shall be connected to the earth grid by one GS flat and gates by flexible lead to the earthed post.
- All welded connections shall be made by electric arc welding. For rust protection the welds should be treated with red lead compound and afterwards thickly coated with bitumen compound.

## 11. Lightning Protection System

- Lightning Protection System for entire plant against direct lighting strokes shall be provided with Early Streamer Emission (ESE) Air Terminal as per NFC 17-102:2011.
- Protection Level for the entire plant shall be level – I.
- Each ESE air terminal shall be provided with following accessories.
  - I. Highly insulated poly-plastic adaptor to fix the ESE air terminal with the FRP mast
  - II. Fiberglass Reinforced Plastic (FRP) mast
  - III. Coupler to connect FRP mast with GI mast
  - IV. Galvanized Iron mast with base plate and guy wire kit

- V. Down-conductor: PVC insulated flexible copper cable of suitable size complying with EN 50164-2 or equivalent standard. It shall be routed along the mast with suitable fixings and connectors.
  - VI. Test joint with each down conductor
  - VII. Lightning event counter complying with EN 50164-6 or equivalent standard. It shall be fixed at suitable height in series with the down conductor.
  - VIII. Earth termination system in accordance with NFC 17-102. Earth electrodes shall comply with the EN 50164-2 or equivalent standard. Earth enhancing compounds complying with EN 50164-7 or equivalent standard, may be used where soil resistivity is higher and making it impossible to achieve system resistance within specified limit.
- Accessories listed above are indicative only and any other fittings or accessories, which are usual or necessary for satisfactory operation of the lightning protection shall be provided by the Contractor without extra charges.
  - Necessary foundation/anchoring for holding the lightning mast in position to be made after giving due consideration to shadow on PV array, maximum wind speed and maintenance requirement at site in future.

## **12. SCADA and Remote Monitoring System**

- i. The Plant shall be automatically operated and shall be controlled by microprocessor based control system SCADA and should be Open Platform Communications (OPC) compliant. There shall be simultaneous data logging, recording and display system for continuous monitoring of data for different parameters of different sub systems, power supply of the power Plant at DC side and AC side. Bidder shall have the provision of monitoring of plant (s).
- ii. An integrated SCADA shall be supplied which should be capable of communicating with all inverters and provide information of the entire Solar PV Grid interactive power Plant.
- iii. The SCADA shall be string level monitoring compatible and shall have features of remote access to the real time data. SCADA shall have features for generating the day ahead schedule of generation based on historical data/ suitable logic. Also, system must be capable of sending the telemetry data to the local SLDC via GPRS/ GSM/ suitable mode.
- iv. Computer-aided data acquisition unit shall be a separate & individual system comprising of different transducers to read the different variable parameters, A/D converter, multiplexer, demultiplexer, interfacing hardware and software which will be robust & rugged suitable to operate in the control room Environment.
- v. Reliable sensors for solar insolation, temperature, and other weather and electrical parameters are to be supplied with the data logger unit.
- vi. The Data Acquisition System should be housed in a desk made of steel sheet.
- vii. All data shall be recorded chronologically date wise. The data file should be MS Excel/ CSV compatible. The data, if needed, can be accessible remotely through authorized access. The data logger shall have internal reliable battery backup and data storage capacity to record all sorts of data simultaneously round the clock. All data shall be stored in a common work sheet chronologically and representation of monitored data shall be in graphics mode or in tabulation form. All instantaneous data can be shown in the Computer Screen. Provision should be available for Remote Monitoring.
- viii. SCADA shall measure and continuously record electrical parameters and provide following data (but not limited to) at a 5-15 minute interval.

- ix. SCADA shall have feature to be integrated with the local system as well remotely via the web using either a standard modem or a GSM/WIFI modem. The Contractor shall provide compatible software and hardware so that data can be transmitted via. Standard modem.
- x. In addition, Contractor shall also provide the live data (in required format) from various instrument such as Inverter, SMU, LT/HT Panel, WMS, Temperature sensors etc. via APIs, FTP etc. at 5-15 minute interval, as and when required by CEL/CEL Customer.
- xi. This will be the Contractor's responsibility to apply and get the suitable connection for SCADA, office & control room on behalf of the CEL/CEL Customer/DISCOM/End Customer & all the expenditures including payment of periodic bills of Internet provider shall be met by the Contractor.
- xii. SCADA shall be provided with reliable power supply along with backup supply for at least one hour to cater to outage of grid.
- xiii. The SCADA shall be compatible to the requirements for measuring and reporting the performance-ratio (PR) of the Plant.
- xiv. The Contractor shall provide all administrative rights/ privileges/passwords of the SCADA system to the CEL. The CEL have rights over the data generated in the Plant.

### **13. Power and Control Cables specifications on AC side**

- i. The size of each type of cable selected shall be based on minimum voltage drop; however the maximum drop shall be limited to 2%. Due consideration shall be made for the de-rating of the cables with respect to the laying pattern in buried trenches / on cable trays, while sizing the cables.
- ii. All cables shall be supplied in the single largest length to restrict the straight- through joints to the minimum number.
- iii. Only terminal cable joints shall be accepted. No cable joint to join two cable ends shall be accepted. All cable/wires shall be marked with good quality letter and number ferrules of proper sizes so that the cables can be identified easily. The ferrules used must be UV resistant. However, for HT cables, embossed ferrules can be used.
- iv. Cable terminations shall be made with suitable cable lugs & sockets etc., crimped properly and passed through brass compression type cable glands at the entry & exit point of the cubicles.
- v. The cables shall be adequately insulated for the voltage required and shall be suitably colour coded for the required service. Bending radii for cables shall be as per manufacturer's recommendations and IS: 1255.
- vi. Cables inside the equipment room, control room and in the switchyard shall be laid in Galvanized Cable Trays mounted on mild steel supports duly painted, in constructed trenches with RCC raft and sidewalls or bricks sidewalls and provided with removable RCC covers. All the communication cables (RS 485, fibre optics etc.) must be supplied with type test reports and shall laid in accordance with the relevant IS codes. It must be laid so that there is no interference with the power cables.
- vii. Type test reports and Data sheets of individual cable sizes (HT & LT) shall be submitted for approval by CEL. Drum numbers and drum length details shall be submitted with each consignment.

### **Codes and Standards**

- i. IS: 1255 Code of practice for installation and maintenance of power cables Up to and including 33kV rating.
- ii. IS: 9537 Conduits for electrical installation.
- iii. IS: 13573 Joints and termination for polymer cables for working voltages from 6.6kV



- up to and including 33kV performance requirements and type tests.
- iv. VDE 0278 Tests on cable terminations and straight through joints.
  - v. BS 6121 Specification for mechanical cable glands for elastomers and Plastic insulated cables.
  - vi. Indian Electricity Act
  - vii. Indian Electricity Rules

### **Design and Constructional Features**

#### **i. Inter Plant Cabling**

Interplant cabling for main routes shall be laid in Cable trenches/cable trays/buried/duct banks. In case of Duct banks, pull-pits shall be filled with sand and provided with a PCC covering. All buried cables shall be armoured.

### **Cable glands**

Cable shall be terminated using double compression type cable glands. Cable glands shall conform to BS: 6121 and be of robust construction capable of clamping cable and cable armour (for armoured cables) firmly without injury to insulation. Cable glands shall be made of heavy duty brass machine finished and nickel chrome plated. Thickness of plating shall not be less than 10 micron. All washers and hardware shall also be made of brass with nickel chrome plating. Rubber components shall be of neoprene or better synthetic material and of tested quality. Cable glands shall be suitable for the sizes of cable supplied/erected.

### **Cable lugs/ferrules**

Cable lugs/ferrules for power cables shall be tinned copper solder less crimping type suitable for aluminum compacted conductor cables. Cable lugs and ferrules for control cables shall be tinned copper type. The cable lugs for control cables shall be provided with insulating sleeve and shall suit the type of terminals provided on the equipments. Cable lugs and ferrule shall conform to relevant standard.

### **Trefoil clamps**

Trefoil clamps for single core cables shall be pressure die cast aluminum or fibre glass or nylon and shall include necessary fixing accessories like G.I. nuts, bolts, washers, etc. Trefoil clamps shall have adequate mechanical strength to withstand the forces generated by the peak value of maximum system short circuit current.

### **Cable Clamps & Straps**

The cable clamps required to clamp multi-core cables on vertical run shall be made up of suitable size. For clamping the multi-core cables, self- locking, de- interlocking type nylon clamps/straps shall be used. The clamps/straps shall have sufficient strength and shall not get affected by direct exposure to sun rays and outdoor environment.

## **Installation**

### **Cable tray and Support System Installation**

- i. Cables shall run in cable trays mounted horizontally or vertically on cable tray support system which in turn shall be supported from floor, ceiling, overhead structures, trestles, pipe racks, trenches or other building structures.

- ii. Horizontally running cable trays shall be clamped by bolting to cantilever arms and vertically running cable trays shall be bolted to main support channel by suitable bracket/clamps on both top and bottom side rails at an interval of 2000 mm in general.
- iii. For vertical cable risers/shafts cable trays shall be supported at an interval of 1000mm in general. Fixing of cable trays to cantilever arms or main support channel by welding shall not be accepted. Cable tray installation shall generally be carried out as per the approved guidelines/ drawings.
- iv. The cantilever arms shall be positioned on the main support channel with a minimum vertical spacing of 300 mm unless otherwise indicated.
- v. All cable way sections shall have identification, designations as per cable way layout drawings and painted/stenciled at each end of cable way and where there is a branch connection to another cable way.

### **Conduits/Pipes/Ducts Installation**

- i. The Contractor shall ensure for properly embedding conduit pipe sleeves wherever necessary for cabling work. All openings in the floor/roof/wall /cable tunnel/cable trenches made for conduit installation shall be sealed and made water proof by the Contractor.
- ii. GI pull wire of adequate size shall be laid in all conduits before installation. Metallic conduit runs at termination shall have two lock nuts wherever required for junction boxes etc.
- iii. Conduit runs/sleeves shall be provided with PVC bushings having round edge at each end. All conduits/pipes shall have their ends closed by caps until cables are pulled. After cables are pulled, the ends of conduits/pipes shall be sealed with Glass wool/Cement Mortar/Putty to prevent entrance of moisture and foreign material.
- iv. Exposed conduit/pipe shall be adequately supported by racks, clamps, straps or by other approved means. Conduits /pipe support shall be installed square and true to line and grade with an average spacing between the supports as given below, unless specified otherwise.

### **Cable Installation**

Cable installation shall be carried out as per IS: 1255 and other applicable standards. For Cable unloading, pulling etc. Following guidelines shall be followed in general:

- i. Cable drums shall be unloaded, handled and stored in an approved manner on hard and well drained surface so that they may not sink. In no case shall be drum be stored flat i.e. with flange horizontal. Rolling of drums shall be avoided as far as possible. For short distances, the drums may be rolled provided they are rolled slowly and in proper direction as marked on the drum. In absence of any indication, the drums may be rolled in the same direction as it was rolled during taking up the cables. For unreeling the cable, the drum shall be mounted on suitable jacks or on cable wheels and shall be rolled slowly so that cable comes out over the drum and not from below. All possible care shall be taken during unreeling and laying to avoid damage due to twist, kink or sharp bends. Cable ends shall be provided with sealed plastic caps to prevent damage and ingress of moisture.
- ii. While laying cable, ground rollers shall be used at every 2 meter interval to avoid cable touching ground. The cables shall be pushed over the rollers by a gang of people positioned in between the rollers. Cables shall not be pulled from the end without having intermediate pushing arrangements. Pulling tension shall not exceed the values recommended by cable manufacturer. Selection of cable drums for each run shall be so planned so as to avoid using straight through joints. Care should be taken while laying the cables so as to avoid damage to cables. If any particular cable is damaged, the same shall be repaired or changed to the satisfaction of Project Manager.

- iii. Bending radii for cables shall be as per manufacturer's recommendations and IS: 1255.
- iv. Where cables cross roads/rail tracks, the cables shall be laid in Hume pipe/HDPE pipe.
- v. No joints shall be allowed in trip circuits, protection circuits and CT/PT circuits. Also joints in critical equipment in main plant area shall not be permitted. Vendor shall identify and accordingly procure the cable drum length.
- vi. In each cable run some extra length shall be kept at suitable point to enable one LT/two HT straight through joints to be made, should the cable develop fault at a later stage. Control cable termination inside equipment enclosure shall have sufficient lengths so that shifting of termination in terminal blocks can be done without requiring any splicing.

### **Separation**

At least 300mm clearance shall be provided between:

- HT power & LT power cables,
- LT power & LT control/instrumentation cables

### **Directly Buried Cables**

- i. Cable trenches shall be constructed for directly buried cables. Construction of cable trench for cables shall include excavation, preparation of sieved sand bedding, riddled soil cover, supply and installation of brick or concrete protective covers, back filling and compacting, supply and installation of route markers and joint markers. Laying of cables and providing protective covering shall be as per IS: 1255.
- ii. RCC cable route and RCC joint markers shall be provided wherever required. The voltage grade of the higher voltage cables in route shall be engraved on the marker. Location of underground cable joints shall be indicated with cable marker with an additional inscription "Cable Joint".

### **Cable Terminations & Connections**

- i. Work shall include all clamps, fittings etc. and clamping, fitting, fixing, plumbing, soldering, drilling, cutting, taping, preparation of cable end, crimping of lug, insulated sleeving over control cable lugs, heat shrinking (where applicable), connecting to cable terminal, shorting and grounding as required to complete the job.
- ii. The equipment will be generally provided with undrilled gland plates for cables/conduit entry. The Contractor shall be responsible for punching of gland plates, painting and touching up. Holes shall not be made by gas cutting. The holes shall be true in shape. All cable entry points shall be sealed and made vermin and dust proof. Unused openings shall be effectively sealed by 2mm thick aluminium sheets.
- iii. Control cable cores entering control panel/switchgear/MCC/miscellaneous panels shall be neatly bunched, clamped and tied with self-locking type nylon cable ties with de interlocking facility to keep them in position.
- iv. All the cores of the control cable to be terminated shall have identification by providing ferrules at either end of the core, each ferrule shall be indelible, printed single tube ferrule and shall include the complete wire number and TB number as per the drawings. The ferrule shall fit tightly on the core. Spare cores shall have similar ferrules with suffix sp1, sp2, --- etc. along with cable numbers and coiled up after end sealing.

- v. All cable terminations shall be appropriately tightened to ensure secure and reliable connections.

Note: Contractor must comply with the relevant grid regulations, DISCOM'S, State Transco's and CEA's guidelines with respect to all the works corresponding to power evacuation, transmission, termination along with metering at designated substation.

### **Danger Plates**

Size of each Danger Notice plates shall be 200 mm x 150 mm made of mild steel sheet and at least 2 mm thick, and vitreous enameled white on both sides and with inscription in signal red colours on front side as required. The inscriptions shall be in Hindi, Local Language and English.

### **Fire alarm System**

- i. Any rooms shall have fire detection and alarm system installed as per relevant standards and regulations. The installation shall meet all applicable statutory requirements, safety regulations in terms of fire protection.
- ii. Liquefied CO<sub>2</sub>/ Foam/ ABC type fire extinguisher shall be upright type of capacity 5/10 kg having IS: 2171. 7 IS: 10658 marked. The fire extinguisher shall be suitable for fighting fire of Oils, Solvents, Gases, Paints, Varnishes, Electrical Wiring, Live Machinery Fires, and all Flammable Liquid & Gas. Contractor shall provide portable fire extinguisher as per the recommendation by relevant fire safety authority.
- iii. The minimum 2 no. of fire extinguishers (CO<sub>2</sub> and Foam type each) shall be provided at every buildings/enclose, however Contractor must comply with existing building code for fire Protection by NFPA, IS & State Fire Protection Department.
- iv. Sand bucket should be wall mounted made from at least 24 SWG sheet with bracket fixing on wall conforming to IS 2546 at strategic locations.
- v. The plan for fire extinguishing must be provided by the Contractor to CEL for the approval.

### **Testing Instruments for Electrical & Electronic**

- a) It is Contractor's responsibility to provide tools, tackles, etc. required for trouble free operation of Plant during AMC.
- b) Contractor shall also provide required set of onsite testing instruments/equipment

### **General Guidelines**

- i. Any civil, electrical, mechanical & plumbing work which is not mentioned or included in this tender document but necessary for the Plant shall be borne by the Contractor.
- ii. Successful Bidder/ Contractor shall prepare all designs / drawings have based on the specifications given in the tender and in light of relevant BIS/IS/ equivalent standard.
- iii. The Contractor shall provide type test reports and datasheet/ GTP for all equipment used for the project.
- iv. The CEL (as instructed by CEL project team) reserves right to modify the design at any stage, to meet local site conditions / project requirements.
- v. All work shall be carried out in accordance with the latest edition of the Indian Electricity Act and rules formed there under and as amended from time to time.

## **14. Weather Monitoring System**

As a part of weather monitoring system, the Contractor shall provide the following measuring instruments with all necessary software and hardware required to integrate with SCADA.

#### Pyranometer

The Contractor shall provide secondary standard pyranometers (ISO 9060 classification) along with necessary accessories for measuring the incidental solar radiation at horizontal and inclined plane of array at each site.

#### Temperature Sensor

The Contractor shall provide required nos. of temperature sensors (for ambient temperature measurement with shielding case and for module temperature measurement). The temperature sensor shall be Resistance Temperature Detector (RTD)/ Semiconductor type with measurement range of 0°C to 80°C. The instrument shall have valid calibration certificate.

#### Anemometer

Contractor shall provide minimum one no. ultrasonic wind sensor (no moving parts) for wind speed and direction monitoring.

### **15. Civil, Mechanical & Plumbing Works**

This section of Technical Specifications describes detailed technical and functional requirements of all civil, Mechanical & Plumbing works included in the scope. All the Civil, Mechanical & Plumbing works must be done considering coastal environmental/climatic condition existing at site.

All design and construction of civil works shall conform to relevant Indian standards such as BIS, IRC, MORST, NBC etc. Design of steel structures shall conform to IS: 800, 802 or 802 as applicable with working stress method (WSD) of design. Design of concrete structure shall conform to IS: 456. For design of liquid retaining structure IS: 3374 shall be followed. Only in case of non-availability of Indian standard, equivalent American or British standard may be used for design with prior approval of the CEL and the contractor shall submit proper justification along with his request to the CEL for his review. All the design/ drawings shall be prepared/ approved by the chartered structural engineer. The design calculations for MMS, RCC structure, steel structure, foundation system, road work, drainage work, etc. shall be submitted for prior approval of CEL before commencement of construction.

The design calculations shall be supplemented with a neat sketch showing the structure geometry, node and member nos., Lengths of various typical members, support points and type of supports, types of materials with design properties considered, type of sections used in analysis & design. The report shall also include back-up calculations for various loads adopted in design, brief write-up on primary load cases and load combinations considered and conclusions on design results with supporting sketches for easy reference and clarity. Where a computer program (other than STAAD Pro) is used for analysis and design, the contractor shall also include a write-up on the computer program used along with validation check. Input and output file shall also be given in the design report to facilitate its review and approval by the CEL.

The construction methodology for MMS and its foundations, road works, drains and pile load test procedure shall also be submitted for prior approval of CEL before start of works. The construction shall be done only as per approved drawings.

### **16. Other Investigations**

- The contractor shall also obtain and study other input data at proposed project site for design of the project. This shall include data related to earthquake and wind, rainfall, maximum & minimum ambient temperature, humidity, high flood level (HFL) etc.
- Topographical survey, area grading, as applicable.

- The contractor shall carry out Shadow Analysis at proposed site and accordingly design strings and array layout with optimum use of space, material and man power. In case of large and steep variations in topography the study shall also include the effect of topographical variations on array layout. The contractor shall submit all the details/design to the CEL for approval.
- The contractor shall also identify potential quarry areas for coarse and fine aggregates to be used for concrete and shall carry out the concrete mix design for different grades of concrete to be used in the work. The concrete mix shall be designed for each source of cement and quarry as per provisions of relevant Indian Standard.

#### **17. Foundations**

- Contractor shall design all foundations for buildings, equipment, Switch yard structures, Transformer, MMS & other structures as per relevant BIS standards and recommendations of Geotechnical investigation report.
- In case the contractor proposes to provide pile foundation for support of module mounting structure (MMS); the type, dia. and length of pile shall be as per recommendations of Geotechnical Investigation Report corresponding to prevalent soil characteristics at site.
- In case collapse of foundation strata during drilling of the pile bore, removal steel liner shall be used to maintain design depth and diameter of the pile for proper concreting.
- The design pile capacity under direct compression, lateral load and pull out shall be verified through field trials by conducting initial load tests on test piles to be specially cast for this purpose. The tests shall conform to IS 2911 – Part 4. The no. and location of such tests shall be as discussed and finalized with Engineer-in-charge. However, min. 3 no. of Tests shall be conducted under each category.
- Contractor shall also carry out routine tests on 0.5 % of the total no. of working piles as per provisions of IS: 2911 – Part 4.
- Contractor must take into account that the site is prepared by filling of sand from coastal area.

#### **18. Module Mounting Structure (MMS)**

- The ground mounting structure design must follow the existing land profile.
- The structure shall be designed to allow easy replacement of any module and shall be in line with the site requirements.
- The MMS stub/ column, rafter, purlin, ties and bracing members shall conform to Indian standards as mentioned in the list of codes and standards: IS: 2062 – Hot rolled Medium and High tensile structural steel IS: 811 – Cold formed light gauge structural steel sections IS: 1161 – Steel tubes for structural purposes IS: 4923– Hollow steel sections for structural use.
- The minimum thickness (BMT) of various elements of MMS structure shall be as following: Stub/ column & Bracing/Purlin & other members. Final thickness of the members shall be arrived by structural analysis considering combination of all possible loads.
- The contractor can also propose new light gauge structural steel or structural aluminium sections other than specified above subject to approval of the CEL. In this case the contractor shall submit his proposal stating the technical advantages of the proposed sections for CEL's review along with supporting literature.
- MMS column post shall be supported with base plate secured to foundation using anchor bolts for easy maintenance/ repair/ replacement.

- The primary loads and load combinations for design of MMS structure shall be as specified under “Design Load”.
- The support structure design shall be as per relevant Indian standard(s) and shall be with working stress method considering appropriate factor of safety. No increase in permissible stress under wind/ Seismic load combination shall be permitted.
- The maximum permissible deflection/side sway limits for various elements of MMS under serviceability conditions shall be as following: Lateral deflection for Column/ stub– Span/ 240 & Vertical deflection for Rafter and Purlin – Span.
- In case of fundamental time period of MSS table structure more than 1 Sec, the structure design shall be checked against dynamic effects of wind as per provisions of IS – 875 (Part-3).
- MMS shall support SPV modules at a given orientation & tilt, absorb and transfer the mechanical loads to the ground properly.
- Welding of structure at site shall not be allowed and only bolted connections shall be used.
- The MMS structure shall be hot dip galvanized with minimum thickness of coating not less than 80 microns on each side. Galvanization shall conform to IS-2629, 4759 & 4736 as applicable, considering coastal environmental condition. It is to ensure that before application of this coating, the steel surface shall be thoroughly cleaned of any paint, grease, rust, scale, acid or alkali or such foreign material as are likely to interfere with the coating process. The Contractor should ensure that inner side should also be coated. The galvanization shall be done after fabrication of members to ensure galvanization of all cut surfaces. In case the proposed section is made up of Aluminium, anodized coating shall be Gr AC25 and shall conform to IS: 1868. 10.13 The array structure shall be so designed that it will occupy minimum space without sacrificing the output from SPV panels at the same time.
- Two numbers of anti-theft fasteners of stainless steel on two diagonally opposite corners for each module shall be provided. All the fasteners and washers (packing & spring) for Module Mounting Structure and Module shall be adequately protected from atmosphere and weather prevailing in the area. Fasteners and washers to be used for erection of mounting structures and those for fixing Module over MMS shall be of stainless steel grade SS 316 equivalent and must sustain the adverse climatic conditions to ensure the life of the structure for atleast 25 years.
- Modules shall be clamped & bolted with the structure properly. The material of clamps shall be Anodized Al / Stainless Steel. Clamp/bolt shall use EPDM rubber and must be designed in such a way so as not to cast any shadow on the active part of a module. In case bolts are used, Spring Washers shall be used bolt head end and EPDM rubber shall be used in between Module & purlin.
- The MMS foundation shall be designed as per the loads specified under clause “Design Loads”. The anti-theft bolts, nuts etc shall be provided by the Contractor.
- The array structure shall be grounded properly using maintenance free earthing kit.
- The Contractor shall specify installation details of the PV modules and the support structures with appropriate diagram and drawings.
- The Contractor should design the structure height considering highest flood level at the site and the finished grade level.
- For multiple module mounting structures located in a single row, the alignment of all modules shall be within an error limit of maximum 10mm.

- The Successful Bidder/ Contractor shall submit the detailed foundation & structural design basis and the list of reference standards, in this Bid, duly certified by a Chartered Structural Engineer having adequate successful experience in similar works.
- The contractor shall submit the detailed design calculations and drawings for MMS structure, bill of materials and their specifications/ standards to the CEL for approval within 7 days from issue of LOA/ NTP before start for fabrication work.
- Contractor must submit the complete quality documents i.e. test certificates for all tests conducted starting from raw material stage, in process, final testing w.r.t structure.

#### **19. Concrete Works**

- All RCC works shall be with design mix as per IS 456 and the materials used viz. Cement, coarse & fine aggregate, Reinforcement steel etc. shall conform to relevant BIS standards.
- The minimum grade of RCC shall be M25 except for underground (UG) water tank where the grade of concrete shall be min. M30. PCC shall be of min. grade M10 (equivalent nominal Mix – 1:3:6) unless otherwise specified.
- Reinforcement steel shall be of high strength TMT bars of grade Fe 500 D conforming to IS: 1786. Ductile detailing in accordance with IS: 13920 shall be adopted for superstructure and sub-structure of all RCC buildings and structures.
- For grouting works anti shrink ready mix grout of approved make or cement mortar (CM) grout with non-shrink additive shall be used. The grout shall be high strength grout having min. characteristic strength of 30 N/mm<sup>2</sup> at 28 days.

#### **20. Miscellaneous Steel Works**

- Unless otherwise specified all structural steel work shall be designed as per provisions of IS: 800 with working stress method of design (WSD).
- Structural steel hot rolled sections, flats and plates shall conform IS: 2062.
- Structural Pipes shall be medium (M)/high (H) grade conforming to IS: 1161.
- Chequered plate shall conform to IS: 3502 and Hollow steel sections for structural purposes shall conform to IS: 4923.

#### **21. Pipe and Cable Trenches**

- All cable trenches shall be of RCC. The min. wall and base slab thickness shall be 100mm for depth  $\leq$  750mm and 150mm for depths  $>$  750mm. The trench shall be designed for lateral load due to external soil fill, ground water table at FGL and 50 KN/ Sq. m surcharge. External trenches shall be kept min. 100mm above FGL to avoid entry of rain water.
- Internal cable trench shall be provided with chequered plate (min. 8mm thick) covers, the trench cover shall be provided with suitable lifting hooks. Both top edges of the cable trench shall be provided with min. 50x50x6 mm edge protection angle.

#### **22. Transformer Yard Civil Works**

- Transformer and equipment foundations shall be founded on piles/isolated spread footings depending on the final geotechnical investigation report.
- Transformer foundations shall have its own pit which would cover the area of the transformer and cooler banks, so as to collect any spillage of oil or oil drainage in case of emergency.



- The oil pit shall be filled with granite stone gravel of 40 mm size uniformly graded. The retention capacity of the transformer pit shall be min. 1/3 volume of the transformer oil which is filled with gravel with 300mm free space above gravel fill.
- The individual transformer oil pit shall be connected to an oil collection pit which shall be sized to accommodate full oil volume of the transformer connected to it, without backflow. The oil collection pit shall be connected to oilywater drainage system. Dimensions of the discharge pipe shall consider rainfall intensity also. The water shall be discharged into the nearest drain by gravity flow or pumping.
- Both, the transformer pit and the oil collection pit shall be of RCC. The oil collection pit shall be provided with RCC cover.
- The area around the transformer and equipment shall be covered with gravel. The transformer yard fencing work shall conform to CEIG requirements.
- Transformer track rails shall conform to IS: 3443. The requirement of fire barrier wall between transformers shall be as per Electricity Rules and IS: 1646 recommendations. Minimum wall thickness shall be 230mm for RCC wall and 300mm for masonry wall.

### **23. Water Supply & Cleaning of Modules**

- Contractor has to plan and install the effective module cleaning system as per the prevailing conditions at Site. The system may include the storage water tanks, pumps, laying of GI/HDPE/UPVC pipes, flexible pipes, taps/ valves, pressure gauges etc. as per the planning by the Contractor. Contractor has to submit the drawing/ plan for the proposed module cleaning system.
- All the pipes thus laid must be buried in ground at least 150mm below FGL. Road crossings and drain crossings, the pipes must be passed through GI/ Hume pipes as applicable.

### **24. Inspection & Testing Inspection:**

- CEL shall have free access to Contractor's manufacturer's works to inspect, expedite and witness shop floor tests. Any materials or work found to be defective or which does not meet the requirements of the specification will be rejected and shall be replaced at Contractor's cost. CEL reserves the right to carry out stage wise inspection of fabrication and components. The Contractor shall furnish a detailed quality assurance plan (QAP) for review by the CEL.
- The test & inspection shall be carried out at manufacturer's work and at the site with the Contractor's obligation. The test and Inspection shall be done in accordance with the relevant standards and the Manufacturer's standard before the delivery to site as well as after the erection and commission at site. The Contractor shall give the list of tests that they will carry out at site to show the performance of Plant.
- A detailed 'QAP' for Manufacturing and Inspection shall be submitted by the Contractor for CEL's approval. The data of each test and inspection shall be recorded and submitted as soon as the test/ trials are conducted and will also be a part of final documentation.
- The shop test shall be carried out to prove the performance parameters of the offered model. The testing shall be done in the presence of the representatives of the department.
- The CEL will nominate its representatives for inspection of stage manufacturing and testing at works & training PCU manufacturer.
- Manufacturer has to submit procedure for Test carried out at their Factory:
  - i. Start Up Trials
  - ii. Load Test
  - iii. Records & Measurements
  - iv. Safety Device List
  - v. Setting values for all sensors for Pressure and Temperature

- vi. Dimensional Check-up, Overall Inspection, Completeness of Scope of Supply
- vii. Shop Test/Load Test for Solar Power Plant

## **25. Load Trials & Reliability test at Site**

- Performance Test at Site for Grid Connect Solar Power Plant, HT Panel etc.
- These tests will be conducted at site as per site conditions at available load and after performing all pre-commissioning check and trials and after readiness of the entire Solar Power Plant system which are required to carry out the load trials. All the tests which are mentioned in the load test of Solar Power Plant will be carried out in presence of CEL's Representative at Site under site conditions and the parameters checked in accordance with the data sheet and guaranteed parameters given by the Contractor.
- All the equipment supplied by the vendor will be tested as per relevant standard/ Quality assurance plan at site conditions and the performance monitored.

## **26. Quality Considerations**

- Contractor will submit and get finalized detailed comprehensive Standard Field Quality Plan (SFQP) within 7 days from date of issue of the PO for bought out items and items manufactured by them. The Standard Field Quality Plan shall equipment till final inspection and testing to be followed for bought out items and items manufactured by Contractor. Accordingly, the Manufacturing Quality Plan shall be submitted broadly under following sub-heads: -
  - i. Raw material/Bought Out items and Components.
  - ii. In process inspection and test/checks to establish successful completion/ accomplishment of the process.
  - iii. Final tests/checks in accordance with relevant national/ international standards/specification.
- The quantum of check for each and every inspection/test items shall be based on an established sampling method and the quantum of check indicated in the SFQP should be designed adequate quality protection.
- In case reference documents/acceptance norms are indicated as per Plant standards then the same shall be duly substantiated/properly explained by well-established and proven engineering practices. All submissions will be in English language only.
- Contractor will to allow CEL to carry out Quality/Audit/Quality surveillance on Contractor's and our sub-vendor's work with reference to contractual obligations to ensure that the quality management practices/norms as detailed out in the Quality Manual are adhered to. To facilitate this activity, you shall keep CEL informed all progress of work in this contract on monthly basis.
- Contractor will associate/fully witness in each inspection being carried out at their/their sub-vendor's works by our authorized inspection engineer(s).
- CEL shall also carry out quality audit and quality surveillance of your systems, procedures and quality control activities. However, this shall not relieve you of any of your contractual responsibilities under the contract.

**PRICE BID FOR PALLI SITE**

<b>Item</b>	<b>Description</b>	<b>Quantity</b>	<b>Price per Wp</b>	<b>Total Price</b>
<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>	<b>5 = 3 x 4</b>
1	Supply of BOS, erection, installation & commissioning of Solar Power Plant including transportation, loading, unloading and transfer to site, insurance and other costs incidental to delivery and AMC of the power plant for 5 years from the date of handing over of the power plant.	500,000 Wp		
	Total Amount			

**Note: GST – Extra at actual**

Plant has to be installed at any one site i.e. Nagrota or Palli. PO shall be placed for both the sites. NTP of the site shall be issued after placement of PO.

**PRICE BID FOR NAGROTA SITE**

<b>Item</b>	<b>Description</b>	<b>Quantity</b>	<b>Price per Wp</b>	<b>Total Price</b>
<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>	<b>5 = 3 x 4</b>
1	Supply of BOS, erection, installation & commissioning of 500 KWp Solar Power Plant including transportation, loading, unloading and transfer to site, insurance and other costs incidental to delivery and AMC of the power plant for 5 years from the date of handing over of the power plant.	500,000 Wp		
	Total Amount			

**Note: GST – Extra at actual**

Plant has to be installed at any one site i.e. Nagrota or Palli. PO shall be placed for both the sites. NTP of the site shall be issued after placement of PO.

**Annexure - B****Commercial Terms and Conditions:**

1.	This is a Proprietary tender for M/s BNK Energy Alternatives Pvt. Ltd. Bid is to be submitted offline only. Bid having deviation from our specifications, terms & conditions would be rejected.
2.	<b>Basis of price:</b> Prices should be submitted as per the scope of work described in Annexure - A.
3.	In a tender either the Indian agent on behalf of the Principal/OEM or Principal/OEM itself can bid but both cannot bid simultaneously in the same tender. If an agent submit bid on behalf of the Principal/OEM, the same agent shall not submit a bid on behalf of another Principal/OEM in the same tender. Agent quoting on behalf of OEM /Principal shall submit valid authorization certificate along with their offer.  The Principal OEM should not be from any country restricted by Public Procurement Division, Department of Expenditure, Ministry of Finance, Government of India vide OM No.6/18/2019-PPD dated 23 July 2020 inserting Rule 144 (xi) in GFR 2017. Further, OM No.6/18/2019-PPD dated 23 July 2020 and Annexures thereto shall be fully applicable to this tender.
4.	<b>GST:</b> GST shall be paid extra on actual as applicable.
5.	<b>Project Timelines:</b> As given in Annexure - A.
6.	<b>Payment terms:</b> As given in Annexure - A.
7.	<b>Guarantee/Warranty:</b> As given in Annexure - A.
8.	<b>Performance bank guarantee:</b> As given under 'Performance Bank Guarantee' clause in Annexure - A. (To be submitted in CEL's prescribed format given in the tender)
9.	<b>Price reduction for delayed delivery:</b> As given in Annexure - A.
10.	<b>Inspection:</b> As given in Annexure - A.
11.	<b>Price variation Clause:</b> Price variation would not be permitted and quotations having Price variation clause would be rejected.
12.	<b>Validity of offer:</b> The quotation/tender/bid submitted by the bidder/supplier shall be valid for a minimum period of 15 days from date of receipt of quotation.
13.	<b>Penalty/LD Clause:</b> As given in Annexure - A.
14.	Any corrections/alterations in the tender/quotation/bid are to be duly signed by the bidder. CEL does not take any responsibility for delay in receipt or non-receipt or loss of tender(s) in transit.
15.	<b>Earnest Money Deposit: NIL</b> (Declaration as per Annexure - E to be submitted)  <b>Security Deposit:</b> Bidder has to submit 2% of the total Purchase Order value as security deposit within three (03) days of receipt of Purchase Order. If security deposit is not received from bidder within three (03) days from the date of purchase order, CEL reserves the right to cancel the PO, blacklist the bidder and take necessary action as per the terms of this tender. No justification for delay will be entertained.  Security deposit can also be submitted through NEFT/RTGS, bank details given below: Beneficiary Name: Central Electronics Limited Beneficiary Account Number/IBAN: 87761250000014 Beneficiary Bank MICR Code: 113502010 Beneficiary Bank Name: Canara Bank (IFSC: CNRB0018776) Bank Address: Sahibabad Branch, CEL Complex, Plot No. 1, Site 4, Sahibabad 201010  Security deposit will be released after handover of the project and submission of 10% Performance Bank Guarantee as per Annexure - A.
16.	CEL reserves the right to reject any or all tenders/quotations/bids received or accept any or all tenders/quotation/bids wholly or in part. Further, CEL reserves the right to order a lesser

	quantity without assigning any reason(s) thereof. CEL also reserves the right to cancel any order placed on the basis of this tender in case of strike, accident or any other unforeseen contingencies causing stoppage of work or to modify the order without liability for any compensation and or claim of any description.
17.	<p><b>Submission of Tender:</b> OFFLINE Bid in <b>SINGLE BID System</b> to be submitted before <b>11:00 hours on 26.03.2022</b>. Bid should be submitted OFFLINE only. Following are to be submitted in the bid:</p> <ol style="list-style-type: none"> <li>i. Filled up Format for Submission of Vendor Data as per format at <b>Annexure - C</b>.</li> <li>ii. Tender acceptance letter as per format at <b>Annexure - D</b>.</li> <li>iii. Undertaking for Earnest Money Deposit/ Bid Security as per <b>Annexure - E</b>.</li> <li>iv. Prices to be filled on a letter head as per price bid format given in <b>Annexure - A</b>.</li> </ol>
18.	<b>Opening of Tenders:</b> Bid will be opened on <b>26.02.2022 at 11:00 hrs (IST)</b> .
19.	<b>Technical Clarifications:</b> Bidders desiring any technical clarification may contact Asstt. General Manager (SPV-PE), Central Electronics Limited, 4, Industrial Area, Sahibabad – 201010 Phone No. 0120-2895165 Fax: 0120-2895148 email: <a href="mailto:aksingh@celindia.co.in">aksingh@celindia.co.in</a> , <a href="mailto:indu@celindia.co.in">indu@celindia.co.in</a> . However, the tender submission and opening dates would remain unchanged.
20.	In case an order placed by the CEL based on the quotation/bid/tender submitted by the bidder/supplier is not executed by the supplier/bidder, CEL may buy the ordered goods/services from elsewhere and recover the additional amount that CEL may have to spend in procuring the stores plus 10% to cover the overhead & incidental expenses.
21.	<p><b>Termination for Default:</b> CEL may, without prejudice to any other remedy for breach of contract, by written notice of default sent to the Supplier, terminate the Contract in whole or in part:</p> <ol style="list-style-type: none"> <li>a) If the Supplier fails to deliver any or all of the Goods within the period(s) specified in the Contract, or within any extension thereof granted by the Purchaser; or</li> <li>b) If the Supplier fails to perform any other obligation(s) under the Contract.</li> <li>c) If the supplier, in the judgment of the purchaser, has engaged in corrupt or fraudulent practices in competing for or in executing the contract.</li> </ol> <p>For the purpose of this clause:  “Corrupt practice” means the offering, giving, receiving, or soliciting of anything of value to influence the action of a public official in the procurement process or in contract execution.  “fraudulent practice” means a misrepresentation of facts in order to influence a procurement process or the execution or a contract to the detriment of the borrower, and includes collusive practice among bidders (prior to or after bid submission) designed to establish bid prices at artificial non-competitive levels and to deprive the borrower of the benefits of free and open competition. In the event the Purchaser terminates the Contract in whole or in part, the Purchaser may procure, upon such terms and in such manner as it deems appropriate, Goods or services similar to those undelivered, and the Supplier shall be liable to the Purchaser for any excess costs for such similar Goods or services. However, the Supplier shall continue the performance of the Contract to the extent not terminated.</p> <p>The contractor/bidder shall not display the photographs &amp; content of the work and also will not take advantage through publicity of the work without written permission of CEL. Noncompliance to this may result in the blacklisting of the supplier.</p>
22.	<b>Banning of Business Dealings:</b> CEL reserves the right to ban the business dealings of the supplier/bidder as per CEL’s “Policy on banning of business dealings” available on CEL website ( <a href="http://www.celindia.co.in">www.celindia.co.in</a> ).
23.	<b>Dispute Resolution:</b> Inter se Ministries and its Departments/ Subordinate Offices/ Attached Offices and Autonomous and Statutory Bodies: In case the bidder is a Ministry or its Departments/ Subordinate Offices/ Attached Offices and Autonomous and Statutory Body, then

	any dispute arising out of this tender, between such bidder and CEL, shall be resolved as per Administrative Mechanism for Resolution of Disputes (AMRD) in accordance with OM No. 334774/DoLA/AMRD/2019 dated 30-03-2020 issued by Ministry of Law & Justice.
24.	<b>Make in India:</b> Public Procurement (Preference to Make in India), Order 2017 dt. 28-05- 2018 and DPE order No. DPE-7(4)2017-Fin-(Part-I) dt. 30-09-2020 and their subsequent amendments/ corrigendum/ memorandums, etc. shall be applicable.
25.	<b>Replacement of Rejected Material:</b> Any material supplied against order placed on the basis of this tender and found to be defective on inspection or differing from approved samples or make or specifications will be replaced by the supplier free of cost or full refund made for the amount paid by Central Electronics Limited including freight and insurance and other incidental charges at CEL's discretion.
26.	<p><b>Arbitration:</b> All the disputes, difference controversies/ difference of opinions, breach and violation arising from or related to this tender between the parties, then the same shall be resolved by mutual discussion /reconciliations in good faith. If disputes, difference controversies /difference of opinions, breach and violation arising from or related to this tender cannot be resolved within 30 days of commencement of reconciliations / discussions then the matter shall be referred to the sole arbitrator. The party invoking arbitration shall suggest five names out of list of panel arbitrators of DIAC/SCOPE, Delhi and the other party will chose one name out of the same to act as an arbitrator Decision of the arbitrator shall be final binding on both the parties. The cost of arbitration, if any shall be shared equally between the parties. The arbitration proceedings shall be conducted by the Arbitral Tribunal in accordance with the provisions of the Arbitration &amp; Conciliation Act, 1996 as amended from time to time. The place of arbitration shall be Delhi and language of such arbitration proceedings shall be in English. All disputes relating to this agreement shall be subject to jurisdiction of the courts at Delhi only.</p> <p><b>Interse Ministries and its Departments/ Subordinate Offices/ Attached Offices and Autonomous and Statutory Bodies:</b> In case the bidder is a Ministry or its Departments/ Subordinate Offices/ Attached Offices and Autonomous and Statutory Body, then any dispute arising out of this tender, between such bidder and CEL, shall be resolved as per Administrative Mechanism for Resolution of Disputes (AMRD) in accordance with OM No. 334774/DoLA/AMRD/2019 dated 30-03-2021 issued by Ministry of Law &amp; Justice</p>
27.	<b>Force Majeure:</b> In no event shall either Party have any liability for failure to comply with this Agreement, if such failure results directly from the occurrence of any contingency beyond the reasonable control of the Party, including, without limitation, strike or other labor disturbance, riot, major power failure, war, natural calamities including but not limited to floods, earthquakes, fire, volcanic eruptions, epidemics, National Emergency, interference by any government or governmental agency, embargo, seizure, or enactment or abolition of any law, statute, ordinance, rule, or regulation (each a " Force Majeure Event"). In the event that either Party is unable to perform any of its obligations under this Agreement because of a Force Majeure Event, the Party who has been so affected shall as soon as may be, after coming to know of the Force Majeure Event, inform the other Party and shall take reasonable steps to resume performance as soon as may be after the cessation of the Force Majeure Event. If the period of nonperformance due to a Force Majeure Event exceeds thirty (30) days, the Party whose ability to perform has been so affected may, by giving written notice, terminate this Agreement.
28.	<b>Ambiguity:</b> All the terms & conditions mentioned in Annexure - A shall also apply. In case of any ambiguity in the terms & conditions mentioned here-above and Annexure - A of the tender, clause defined Annexure - A shall supersede.

**Annexure - C****Format for submission of Vendor Data**

1.	<b>Name of vendor</b>			
2.	Registered Address			
	Postal Code		Company's Year of Establishment	
	Company's nature of business		Company's Legal Status	
	Registration No.		Phone:	
	Fax No.		Website:	
	Name of Proprietor/ CEO/Chairman			
	Phone/Mobile No.			
	Email id			
3.	Factory Address			
	Phone No.			
	Fax No.			
	Email id			
4.	Delhi/NCR Address (if any)			
	Phone No.			
	Fax No.			
	Email id			
5.	Correspondence Address			
6.	Name of Contact Person for this tender			
	Designation			
	Date of Birth			
	Phone/Mobile no.			
	Fax No.			
	Email id			
7.0	<b>GST related information</b>			
7.1	GST No.			



8.0	<b>Income Tax related information</b>	
8.1	PAN No.	
8.2	PAN reference no. (in case PAN applied for)	
8.3	PAN Status (in case PAN applied for)	
9.	Registration No. with Directorate of Industries	
10.	SSI/MSE Reg. No. (if Small Scale Industrial Unit)	(Please enclose certificate from DIC/NSIC along with Certificate from registered CA with value of plant and machinery)
10.1	*Is MSE/SSI is owned by ST/SC?	Yes / No ( If Yes please enclose relevant certificate as proof)
10.2	*Is MSE/SSI is owned by woman?	Yes / No ( If Yes please enclose relevant certificate as proof)
11.0	<b>Bank related information</b>	
11.1	Bank name	
11.2	Branch name	
11.3	Bank address	
11.4	Bank phone no.	
11.5	Bank fax no.	
11.6	Bank MICR Code	
11.7	RTGS-IFSC Code	
11.8	Account type	
11.9	Account no.	
11.10	Swift Code	

*\*Must be answered invariably*

Correspondence with respect to this tender may be addressed to Mr/Ms ..... at email id ..... and mobile no.....

I/We accept that CEL may send SMS and/or email regarding this tender/any other tender, award of contract, purchase order(s) and/or any other information on any/all mobile nos. mentioned in this vendor data sheet.

I/We certify that the information given herein is correct to the best of my knowledge and belief.

Signature of Proprietor/CEO/Chairman  
Seal of the company/concern

**Annexure - D**

**TENDER ACCEPTANCE LETTER**

**(To be given on Company's Original Letter Head)**

Date:

To,

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**Sub: Acceptance of Terms & Conditions of Tender**

**Tender Reference No: C-2(b)/RC/0700/4673/2022**

**Name of Tender / Work: - Design, Engineering, Supply, Construction, Erection, Testing, Commissioning and Warranty/AMC (5 years) for Solar Power Generating System (SPGS) in the Union Territory of Jammu & Kashmir**

**Dear Sir,**

**1. We have downloaded / obtained the tender document(s) for the above mentioned 'Tender/Work' from the web site(s) namely:**

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**as per your advertisement, given in the above mentioned website(s).**

**2. We hereby certify that we have read the entire tender document along with technical specifications and terms & conditions of the tender documents from Page No. 01 to 69 (including all documents like annexure(s), schedule(s), etc.), which form part of the contract agreement and we shall abide hereby by all the terms / conditions / clauses contained therein.**

**3. The corrigendum(s) issued from time to time by your department/ organization too have also been taken into consideration, while submitting this acceptance letter.**

**4. We hereby unconditionally accept all the technical specifications and terms and conditions of the above mentioned tender document(s) /corrigendum(s) in its totality / entirety.**

**5. In case any provisions of this tender are found violated, then your department/ organization shall without prejudice to any other right or remedy be at liberty to reject this tender/bid including the forfeiture of the full said security deposit absolutely.**

**Yours Faithfully,**

**(Signature of the Bidder, with Official Seal)**

Annexure - E

**FORMAT OF DECLARATION IN LIEU OF EMD/BID SECURITY**  
**(To be submitted on the Bidder's Letter Head)**

I/We .....(Insert Name and Address of Applicant) am/are submitting this declaration in lieu of Bid Security/Earnest Money Deposit for **tender No. C-2(b)/RC/0700/4673/2022** for **Design, Engineering, Supply, Construction, Erection, Testing, Commissioning and Warranty/AMC (5 years) for Solar Power Generating System (SPGS) in the Union Territory of Jammu & Kashmir**, thereby fully accepting that I/We will be suspended and shall not be eligible to participate in the EOIs/Tenders invited by Central Electronics Limited, for a period of Two years from the date of such Suspension Orders, under the following circumstances:-

- a) If after the opening of tender, I/We withdraw or modify my/our tender during the period of validity specified in the tender (including extended validity, if any)
- b) If after the award of work, I/We fail to furnish the required Security Deposit/Performance bank guarantee (as applicable as per tender) or sign the Contract, within the time limit specified in this tender.

**Signature of the Applicant with seal**

**PERFORMANCE BANK GUARANTEE**

*(BG to be issued from a bank in the list of Scheduled Commercial Banks of RBI)*

*(Issuing Bank to send SFMS message to: Canara Bank, CEL Campus, Sahibabad, Ghaziabad, U.P. IFSC: CNRB0018776)*

To ,  
Central Electronics Limited,  
A Public Sector Enterprise,  
4, Industrial Area, Sahibabad – 201 010 (U.P.)

1. By a Purchase Order No. \_\_\_\_\_ dated \_\_\_\_\_ (the “Contract”) placed by **Central Electronics Limited, 4, Industrial Area, Sahibabad-201010** (the “buyer”) for \_\_\_\_\_ (as per description given in the P.O./Contract) and unreservedly accepted by M/s \_\_\_\_\_ and having its **Regd. Office at \_\_\_\_\_ and office/works at \_\_\_\_\_** (the “Contractor/Seller”), the Contractor/Seller has agreed to sell, supply and deliver the product of such specifications, qualitatively and quantitatively and for such consideration and subject to such covenants, condition and stipulation as provided in the contract/purchase order including but not limited to a stipulation that the Contractor/Seller shall furnish to the Buyer an irrevocable and unconditional Bank Guarantee for \_\_\_\_\_ percent of Purchase Order value towards Performance Security for the value of **(Currency) ..... (Amount) .....** in favour and to the satisfaction of the Buyer to ensure the due performance of all its obligations and liabilities by the Contractor/Seller under and in terms of such contract.
2. Accordingly, in consideration of the premises, and other good and valuable consideration ..... (the “Bank”) having its head office at ..... undertakes assures and agrees with the Buyer as follows:-
  - a) The Bank, as primary obligor and not merely as surety, hereby irrevocably, unconditionally and absolutely guarantees, as a continuing guarantees, during its currency to the Buyer (its successors and assigns) full complete and prompt performance of the obligations and liabilities by the Contractor/Seller, including but not limited to the financial liabilities of the Contractor/Seller to the Buyer for any payment, repayment, refund or otherwise of any money, or any other dues claim or demand of the Buyer against the Contractor/Seller (Collectively called the “Guaranteed Obligation”)
  - b) The bank hereby further irrevocably and unconditionally guarantees and undertakes to the Buyer that if the Contractor/Seller, in any manner, defaults in the performance of the product or in making any payment, repayment or refund of any Guaranteed Obligations, then the Bank shall without demur upon the first demand by the Buyer, pay to the Buyer forthwith in full the amount due to or claimed or demanded by the Buyer from the Bank without any deduction and withholding and free from any claim by the Bank or any other person. The obligations of the bank hereunder shall be absolute in all respects and the demand so made by the Buyer shall be conclusive and binding on the Bank, regardless of any dispute, difference of proceeding pending or threatened between the Buyer and Contractor/Seller or any other person in Court of Law, arbitration or otherwise.
  - c) It is a strict condition of this Guarantee that the Bank shall not be discharged or released from the Guaranteed Obligations undertaken by it, nor shall the Bank’s liabilities and obligation hereunder diminish, by virtue of any new arrangements between the Buyer and the Contractor/Seller or any variations in the contract mutually made, or any indulgence or forbearance by the Buyer to the Contractor/Seller at any time as regards any of the Guaranteed Obligations with or without knowledge or consent of the Bank, provided that in no case the financial liabilities of the Bank shall be increased without its prior concurrence.
  - d) This Guarantee shall not be released by the Contractor/Seller furnishing to the Buyer any other security under and in terms of the contract nor shall the Buyer be obliged to purse such security as a condition precedent to exercising any of its rights hereunder.

- e) This Guarantee shall come into force from the date of issuance i.e. \_\_\_/\_\_\_/\_\_\_ . The Guarantee shall remain valid and effective up to ---/---/--- i.e \_\_\_\_\_ months/years warranty period or until the Contractor/Seller duly and fully performs and completes all performance its financial and other obligations under and in terms of the contract, or the Guaranteed Obligations are discharged by the Bank hereunder, whichever is earlier.
- f) This Guarantee shall not be discharged or be rendered ineffective by change in the constitution of the Bank or Buyer or the Contractor/Seller and shall nevertheless continue to be binding on its respective successor-in-interest or assigns. Nor shall this Guarantee be discharged by the Buyer recovering its dues, claims or demands partially from the Bank in respect of any of the remaining Guaranteed Obligations hereunder. This Guarantee is and shall always be deemed to be a continuing Guarantee during its currency.
- g) This Guarantee shall be governed by and construed and interpreted in accordance with the laws and courts in **New Delhi** shall have exclusive jurisdiction in this regard.
- h) Notwithstanding anything to the contrary we agree that decision of the Buyer as to whether the Contractor/Seller has committed a breach of any terms and conditions of the contract shall be final and binding on us and we shall not be entitled to ask Buyer to establish claim or claims under this Guarantee but shall pay the same forthwith without any objection or excuse.
- i) The Guarantor hereby declares and represents that this Guarantee has been given without any undue influence or coercion, and that the Guarantor has fully understood the implications of the same. The Guarantor represents and confirms that the signatory of the Guarantee has the legal capacity, power and authority under the delegations of powers and notification made under general regulation and resolutions in this regard to issue this Guarantee and that giving of this Guarantee.

3. Notwithstanding anything herein contained the maximum financial liability of the Bank shall not in any circumstances exceed Rs.....

Notwithstanding anything contained herein above:

- i. Our Liability under this Guarantee shall not exceed Rs..... (Rupees ..... only).
- ii. This Bank Guarantee shall be valid up to and including --/--/--.
- iii. We shall be liable to pay any amount under this bank guarantee or part thereof only if we receive a written claim or demand under this guarantee on or before --/--/--.

Place:

Date:

Signature of the Bank with seal

Full address of Bank:

.....  
.....  
.....

Witness:

1) Name: \_\_\_\_\_ Signature \_\_\_\_\_

2) Name: \_\_\_\_\_ Signature \_\_\_\_\_