

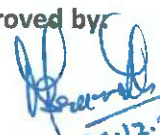

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## TECHNICAL SPECIFICATION FOR SUPPLY OF CRYSTALLINE SILICON PV MODULES – GSECL, RAGHANESDA SOLAR PROJECTS

<b>REVISION DETAILS: (06)</b>  - PQC: Minimum annual manufacturing capacity revised to 250 MWp - Specification revised for 580 Wp or above with TOPCon based PV modules - Both monofacial and bifacial PV modules configurations included - JB cable length as per manufacture's standard	Prepared by: MDS 	Reviewed by : PM 	<b>DATE</b>  <b>29.12.2024</b>
	Approved by: SM  20.12.2024	ISSUED ENGG	


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### 1. PRE-QUALIFICATION CRITERIA

Sl. No	Particulars	Bidder's confirmation
1.	The offer shall be quoted only by the original PV module manufacturer with module manufacturing capacity of 250 MW / annum.	PV module supplier name: Manufacturing Plant Address:  Manufacturing capacity / annum :  Website:  (Supporting document for PV module manufacturing capacity like ALMM list, to be enclosed)
2.	Only those crystalline modules (300 Wp or above) of the same module manufacturer which has supplied for a capacity more than 100MW in other projects in India shall be eligible for the tender.	Yes / No  <i>Enclose customer/client certificate/PO copies. The documents shall include contact details of the issuing authority</i>
3.	Out of the 100MW supplies made as required above, 10 MW or more of PV modules must have been supplied to at least one solar Power plant project of minimum capacity of 10 MW.	Yes / No  <i>Enclose customer/client certificate/PO copies. The documents shall include contact details of the issuing authority</i>

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## 2. TECHNICAL REQUIRMENTS:

Sl. No	Item	Remarks
1	PV Module Configuration	<p>Mono crystalline photovoltaic module with 72 nos of cells in / 144 no of cells in series- parallel configuration. Both Monofacial and Bifacial configurations are acceptable.</p> <p>The module construction and bill of material shall be as per vendor's approved IEC certification.</p> <p><b>Please enclose:</b></p> <p><b>i. Module overall assembly drawing with mounting holes</b></p> <p><b>ii. Data sheet with typical electrical characteristics, I-V curves, temperature coefficients etc.</b></p>
2	Power Output	580 Watts and above, in 5 Watt band only. No negative tolerance accepted.
3	System Voltage	Modules shall be suitable for 1500V DC System Voltage application.
4	Efficiency	20% (min)
5	Fill Factor	0.75 (min)
6	Temp coefficient of Power	-0.40% or better
6	Operating Conditions	Modules shall be able to perform satisfactorily in relative humidity up to 85% with temperature between -40°C to +85°C and shall withstand adverse climatic conditions, such as high speed wind with dust/sand particles, saline climatic/soil conditions etc.
7	IEC Certifications	<p>The PV modules supplied shall be with valid latest IEC certifications as below.</p> <ol style="list-style-type: none"> <li>1. IEC 61215-1:2016 (Design Qualification and Type Approval-Part 1)</li> <li>2. IEC 61215-1-1:2016 (Design Qualification and Type Approval-Part 1-1)</li> <li>3. IEC 61215-2:2016 (Design Qualification and Type Approval-Part 2)</li> <li>4. IEC 61730-1:2016 (Safety Qualification – Part 1)</li> <li>5. IEC 61730-2:2016 (Safety Qualification – Part 2)</li> <li>6. IEC 61701 (Salt Mist Corrosion testing)</li> <li>7. IEC 62804 (PID Testing, 85 % humidity, 85 Deg. C, 1000 V or higher)</li> <li>8. IEC 62716 (Ammonia test)</li> </ol>

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		Vendors shall use raw materials for manufacture of PV modules as per approved IEC Bill of Materials (CDF).
8	Module Safety Class	Safety Class - II
9	<b>BIS Registration</b>	As per the Solar Photovoltaics, Systems, Devices and Components Goods (Requirements for Compulsory Registration) Order, 2017, Government of India, PV Modules used in the grid connected solar power projects in India shall be registered with BIS and bear the Standard Mark as notified by the Bureau of Indian Standards.
10	<b>BILL OF MATERIALS</b>	
10.1	Solar cells	Monocrystalline solar cells using <b>TOPCon technology</b> .
10.2	EVA	Fast cure type, UV resistant
10.3	Glass	Toughened low iron glass with minimum thickness of 3.2 mm for glass to back sheet modules, OR heat strengthened low iron glass with minimum thickness of 2.0mm for glass-to-glass framed modules. Grid printed back glass shall be preferred for glass-to-glass framed modules.
10.4	Back Sheet (if applicable)	The back sheet used in the crystalline silicon-based modules shall be of 3 layered structure. For bifacial modules, if back sheet is offered the same shall be transparent. The thickness of back sheet should be of minimum 300 microns with water vapour transmission rate less than 2.0g/m2/day (38°C at 90% RH). The Back sheet shall be fluoropolymer film-based back sheet. No coating on outside of back sheet is permissible. Back-sheet shall meet globally benchmarked durability properties such as moisture barrier, tensile strength, UV stability etc.
10.5	PV Module Frame	Corrosion resistant, anodized Aluminum.
10.6	Junction box	Junction box(es) of the module should be of high quality IP 68 or better rated fitted at the back side which should be weather proof and designed to be used with standard wiring or conduit connection. Each Junction Box shall contain Bypass Diode. <b>Cables shall be of solar grade and shall conform to specification EN 50618.</b>
10.7	Adhesive for framing, junction-box fixing and potting	As per manufacturer's IEC test report

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10.8	RFID	<p><b>RFID tag positioned inside the laminate.</b> RFID shall be durable for the entire life of panel and shall contain the following information:</p> <ol style="list-style-type: none"> <li>Name of module manufacturer with country of origin</li> <li>Month &amp; year of manufacture of modules</li> <li>Name of cell manufacturer with country of origin</li> <li>Month &amp; year of manufacture of cells</li> <li>IV curve</li> <li>Wattage, <math>I_{max}</math>, <math>V_{max}</math>, <math>V_{oc}</math>, <math>I_{sc}</math>, temperature coefficient of power &amp; fill-factor</li> <li>Module model number</li> <li>Unique serial number</li> <li>Date of obtaining IEC qualification certificates</li> <li>Name of test lab issuing IEC certificates</li> </ol> <p>Other relevant information etc</p>
10.9	Nameplate	<p>Each module shall be provided with a name plate label (sticker) containing the following information:</p> <ol style="list-style-type: none"> <li>Name of module manufacturer</li> <li>Module model number</li> <li>Overall Dimension</li> <li>Weight</li> <li><math>P_{max}</math>, <math>V_{oc}</math>, <math>I_{sc}</math>, <math>I_{max}</math> &amp; <math>V_{max}</math></li> <li>System Voltage</li> <li>Relevant standards and certifying lab name</li> <li>Warnings, if any</li> <li>Other relevant information, etc</li> <li>Nameplate shall be clearly visible and shall not be hidden by equipment wiring. It shall be durable for the entire life of panel.</li> </ol>
10.10	BOM as per CDF of IEC Certificate	Solar cells and module materials shall be used as per approved CDF as per IEC Certificate.
10.11	RFID Reader	1 number of hand-held RFID reader (gun type) compatible to read module IV data (at the site) stored in RFID tags to be supplied at free of cost. All associated software, cables and accessories shall also be provided at free of cost for displaying and downloading RFID data from the RFID reader.

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10.12	.PAN File	.PAN file for each module wattage offered shall be provided for carrying out PVSYS calculations at our end.
10.13	Mounting hole Pitch	Pl. provide mounting hole pitch details. Horizontal : Vertical : Mounting hole size :

### 3. QUALITY ASSURANCE

Module Quality Plan, Data Sheet and GTP shall be subject to customer's approval. Each lot of modules shall be subject to pre-dispatch inspection by BHEL and BHEL customer or any third party.

Quality plan will include the following:

- I. Incoming Quality Checks on bought out item
- II. In-process Quality Checks
- III. Sample tests on final product by the customer

### 4. WARRANTY

**Product warranty shall be for 10 years and performance warranty shall be for 25 years.**

PV modules supplied must be warranted for their output peak watt capacity, which should not be less than 90% at the end of 10 years and not less than 80% at the end of 25 years from the date of supply. Degradation of PV module for first year shall be limited to 2.5%. Modules that do not meet the above criteria shall be replaced free of cost at BHEL's/customer's sole discretion.

### 5. INSURANCE or BANK GUARANTEE FOR POWER OUTPUT WARRANTY

The PV module power output warranty as per the technical specification shall be insured and backed up through an insurance policy by a reputed insurance company which will cover against the PV module power output warranty in case of insolvency or bankruptcy of the PV module manufacturer. The Bidder shall submit a suitable insurance from Third Party.

The Successful Bidder who is not able to provide insurance of PV modules as above, shall submit a Bank Guarantee of INR Rs. 10 Lakh per each megawatt of PV modules or an equivalent amount in international currency (i.e. DC capacity), through BHEL consortium bank and shall be valid for a period of twenty five (25) years and 90 days. The minimum validity of the Bank guarantee shall be five (5) years and shall be renewed by the bidder of their own subsequently every five (5) years prior to thirty (30) days of its expiry. In case the PV module fails to provide power output as per its performance warranty, and if the bidder fails to rectify, replace or repair the PV module, then BHEL shall carry out the necessary rectification, repair

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or replacement at its own discretion at the risk and cost of the supplier. The cost of such rectification, repair or replacement shall be encashed from the Bank Guarantee against PV Module Warranty. The same shall be replenished by the supplier within thirty (30) days, failing which the entire Bank Guarantee amount shall be encashed and all pending payment shall be withheld by BHEL till such amount is replenished by the supplier. In another instance, if the supplier becomes bankrupt or insolvent, then BHEL shall immediately encash the entire amount of the Bank Guarantee against PV Module Warranty.

#### 6. PACKING & IDENTIFICATION OF PV MODULE

The modules shall be packed in seaworthy carton boxes made from triple-strength corrugated cardboard and resting on a wooden or plywood base. The PV modules packed in a carton box shall be of same power rating band. Carton box and Pallets shall be adequately designed to prevent damage or deterioration during transportation to site in remote road conditions, handling and storage in site till the time of its installation. The carton box should display the manufacturer's name, number of modules, type, serial numbers, module wattage etc. Modules found damaged at the time of opening of the cartons in the project site shall be replaced free of cost by the module manufacturer.

#### 7. GENERAL CONDITIONS

PV Modules shall be manufactured at the vendor's works only.

Manufacturing clearance shall be given only after approval of manufacturing quality plan, Pre-Shipment inspection plan and approval of drawings and datasheet by BHEL's customer.

#### 8. MODULE RATINGS OFFERED

Pl. fill the table as below for the module wattage ratings offered.

Module Type (model No):


Module rating	Wattage	Quantity in MWp

Note :

1) One vendor can offer a maximum of 3 Power ratings.

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**9. ENCLOSURES :**

Sl. No.	Document
1.	Supporting document for PV module manufacturing capacity
2.	Signed copy of BHEL Specification PS-439-421 Rev. 06 for confirming to supply as per BHEL Specification.
3.	Customer/client certificate for cumulative supply of 100 MW or more of 300 Wp and above wattage PV modules to India. Out of the above, 10 MW or more of PV modules must have been supplied to atleast one solar Power plant project of minimum capacity of 10 MW.
4.	IEC 61215-1, IEC 61215-1-1, IEC 61215-2 , IEC 61730-1 & 2, IEC 61701, IEC 62804 test certificates.
5.	Approved CDF (Bill of Materials) of PV modules as per IEC certificates.
6.	Over all PV module assembly drawing indicating mounting hole pitch & data sheet for PV modules.
7.	Third party verified .PAN files for each wattage of PV modules offered.


**10. Confirmation by the vendor :**

Sl. No.	Item	Acceptance by the Module manufacturer (Yes / No)
1.	PV Module model number:	
2.	Mono Crystalline PV Modules with power output $\geq$ 580 Wp in 5 watts bands.	
3.	The offered PV Modules suitable for 1500 V System Voltage application	
4.	Availability of IEC 61215, 61730-1 & 2, IEC 61701, IEC 62804 and IEC 62716 test certificates and IEC Test reports with CDF.	
5.	PV Modules registered with BIS (Bureau of Indian Standards)	
6.	RFID Tag be inside the laminate	
7.	Supply of 1 no. of hand held RFID reader	

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8.	Adherence to Manufacturing Quality Plan and Pre-Shipment Inspection as per customer	
9.	Bill of materials as per subset of the CDF of the IEC Certificates	
10.	Third Party Insurance or Bank Guarantee for Power Performance warranty of PV modules	

#### 11. Compliance

Sl. No.	Particulars	Bidder's Confirmation
1.	<b>Compliance to BHEL Specification</b>  <b>PS- 439- 421 Rev. 06</b>	<p style="text-align: center;"><i>Yes / No</i></p> <p style="text-align: center;"><i>Please indicate deviations, if any.</i></p>

\_\_\_\_\_  
Signature of Tenderer with stamp

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