

 BHEL-EPD	ELECTRIC & PHOTOVOLTAIC DIVISION BENGALURU – 560012, INDIA Purchase Specification Group : Photovoltaic Module		SPEC. NO: SPV-SP1047-SPVM
			REV. 00 JOB NO.- SP1047
	PAGE 1 of 9		

TECHNICAL SPECIFICATION FOR SUPPLY OF CRYSTALLINE SILICON PV MODULES

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			REV. 00 JOB NO.- SP1047
	PAGE 2 of 9		

1. TECHNICAL REQUIRMENTS:

Sl. No	Item	Remarks
1	PV Module Configuration	Multi crystalline photovoltaic module with 72 nos. of cells in 12X6 series configuration. <i>Please enclose:</i> <i>i. Module overall assembly drawing with mounting holes</i> <i>ii. Data sheet with typical electrical characteristics, I-V curves, temperature coefficients etc.</i>
2	Power Output & efficiency	330 Watts and above & and efficiency 17% and above.
3	Fill Factor	0.73 (min)
4	Temp. coefficient of Power	-0.40% / Deg. C or better
5	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 and wind speed as per site condition or as per IS:875 Part-3 whichever is higher.
6.1	IEC Certifications	The PV modules supplied shall be with valid IEC certifications as below. 1. IEC 61215-1:2016 – Edition 1 (Design Qualification and Type Approval-Part 1) 2. IEC 61215-1-1:2016 – Edition 1 (Design Qualification and Type Approval-Part 1-1) 3. IEC 61730-1:2016-Edition 2 (Safety Qualification – Part 1) 4. IEC 61730-2:2016- Edition 2 (Safety Qualification – Part 2) 5. IEC 61701:2011-Edition 2 (Salt Mist Corrosion testing) 6. IEC 62716:2013-Edition 1 (Ammonia Corrosion testing) 7. IEC TS 62804-1:2015-Edition 1 (PID Testing – Part 1, 85°C/85% RH, 192 hours) Vendors shall use same Bill of materials for manufacture of PV modules as per subset of approved CDF of all IEC Certificates. Copies of above IEC Certificates & Test reports shall be submitted along with techno-commercial offer.
6.2	Application Class as per IEC 61730	Class A
6.3	BIS Registration	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. BIS Registration Received : Yes / No. Copies of above BIS registration shall be submitted along with techno-commercial offer.

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				REV. 00	JOB NO.- SP1047
				PAGE 3 of 9	
7	BILL OF MATERIALS				
7.1	Solar cells	Multi-crystalline solar cells, of class “A”. Pl. mention make of cells that will be used for this project :			
7.2	EVA	The encapsulant used for the PV modules should be UV resistant and PID resistant in nature. No yellowing of the encapsulant with prolonged exposure shall occur. Gel content : > 75% Volume resistivity : > $1 \times 10^{15} \Omega \cdot \text{cm}$ Peeling strength with glass : > 60 N / cm			
7.3	Glass	Toughened low iron glass with minimum thickness of 4.0 mm and light transmission of above 90 %. Confirmation for 4 mm thickness of glass : Yes / No			
7.4	Back Sheet	The back sheet used in the PV modules shall be of three layered structure durable for humid – hot conditions with properties of moisture barrier, elongation retention and UV resistance. Material thickness : ≥ 300 micron Water vapour transmission rate : < 2 g/m ² /day Partial discharge test voltage : ≥ 1000 V / 1500 V Elongation at break : > 100% Adhesion strength with encapsulant : > 70 N/cm Interlayer adhesion strength : > 5 N/cm The Customer reserves the right to conduct Pressure Cooker (PC) test/ Highly Accelerated Stress Test (HAST) to confirm the durability of the back sheet in accelerated conditions.			
7.5	PV Module Frame	Corrosion resistant, Anodized Aluminum with provision for earthing holes. Anodization thickness shall not be less than 15 microns.			
7.6	Junction box	The material used for junction box shall be UV resistant to avoid degradation during module life. The degree of protection of the junction box shall be at least IP67 and shall have - Minimum three number of Schottky bypass diodes. - Two number of MC4 compatible connectors certified with IEC 62852 / EN 50521. - Copper cable of 4 sq.mm of length 1.2 metre certified with IEC 62930 / EN 50618. (Cable length should be without MC connector) Pl. confirm for Junction box specification as above : Yes / No			
7.7	Sealant for edge sealing of PV modules	The sealant used for framing of PV modules shall have excellent moisture ingress protection with good electrical insulation (Break down voltage >15 kV/mm) and with good adhesion strength. Framing with tapes is not permitted.			
7.8	Module Sl. No.	Module Sl. No. shall be embedded inside the laminate with barcode for reading.			

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				REV. 00	JOB NO.- SP1047
				PAGE 4 of 9	
7.9	RFID & Bar code	RFID Chip (Integrated Circuit) & Antenna : ALN-9640 or equivalent using IC's of Make Alien Higgs-3 / NXP G2iM / IMPINJ Monza 4QT only RFID tag and Bar code should be positioned inside the laminate. RFID shall be durable for the entire life of panel and shall contain the following information: (i) Name of the manufacturer of PV Module (ii) Name of the Manufacturer of Solar cells (iii) Type of cell: Multi (iv) Month and year of the manufacture (separately for solar cells and module) (v) Country of origin (separately for solar cells and module) (vi) I-V curve for the module (vii) Peak Wattage, Im, Vm and FF for the module (viii) Unique Serial No. and Model No. of the module. (ix) Date and year of obtaining IEC PV module qualification certificate (x) Name of the test lab issuing IEC certificate (xi) Other relevant information on traceability of solar cells and modules as per ISO 9000 series. Database of all the PV modules containing the above information shall also be provided in Microsoft excel file format.			
7.10	Nameplate	Each module shall be provided with a name plate label (sticker) containing the following information: a. Name of the module manufacturer b. Module model number c. Overall Dimension d. Weight e. P _{max} , I _{max} & V _{max} f. Short-circuit current I _{sc} & Open-circuit voltage V _{oc} g. System Voltage h. Relevant standards and certifying lab name i. Warnings, if any j. Other relevant information Nameplate shall be clearly visible and shall not be hidden by equipment wiring, and placed behind the panel. It shall be durable for the entire life of panel.			
7.11	.PAN File	.PAN file (Third party verified) for each module wattage band shall be provided for carrying out PVSYS calculations at our end by successful bidder, before supply.			
7.12	BOM as per CDF of IEC Certificate	Pl. confirm for using solar cells and module materials as per approved CDF as per IEC Certificate, indicated at clause 6.1) of this specification. Vendor confirmation : Yes / No			
7.13	RFID Readers	Two numbers (2 nos) of hand-held RFID reader of reputed make (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. Vendor confirmation : Yes / No			

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			REV. 00 JOB NO.- SP1047
	PAGE 5 of 9		

2. QUALITY ASSURANCE

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

1	Quality Plan	Pre-Shipment inspection by customer at Vendor's works will include : i. Dimensional and Visual Check ii. Electrical test (I-V test) iii. IR-HV-IR test and Earth Continuity Test iv. Electro Luminescence (EL) Test v. Wet Leakage test vi. Mechanical Load test vii. Any other test as required by customer Successful bidder has to prepare and submit Quality Assurance Plan to BHEL Customer approval, which shall confirm Pre-dispatch inspection protocol (PDI) of M/s SECL. Vendor confirmation : Yes / No
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			REV. 00 JOB NO.- SP1047
			PAGE 6 of 9

3. WARRANTY

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

PV modules must be warranted with linear degradation rate of power output except for first year (maximum 3% including LID) and shall guarantee 80% of the initial rated power output at the end of 25 years. The modules shall be warranted for minimum of 10 years against all material / manufacturing defects and workmanship.

Modules that do not meet the above criteria shall be replaced free of cost at BHEL's / customer's sole discretion.

4. Third Party Insurance for Product and Power output warranty for 25 years

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 for 25 years in case of vendor not resolving pre-mature failures and / or insolvency and / or bankruptcy of the PV module manufacturer. The successful Bidder shall submit a suitable insurance from reputed international Third Party, insurance company.

5. PACKING & IDENTIFICATION OF PV MODULE

The modules shall be packed in carton boxes. One carton box shall contain modules of same wattage bin power rating (eg. 330 Wp or 335 Wp and Current Rating).

Current binning of modules shall also be employed so that current mismatch of modules in a pallet does not exceed 0.1 A. Different colour codes shall be provided on the modules as well as pallet for identification of different bins. Maximum three nos. of bins will be allowed for each module rating.

Module power rating and current bin rating shall be displayed with a sticker on both the longer sides of the carton box. Eg: "330 Wp-8.8 A" Multi Crystalline PV module to be identified as "**Multi-330 Wp-8.8 A**" in Sticker. The carton box should display the manufacturer's name, number of modules, type, serial numbers, module wattage etc.

Each 5 watt band PV modules supplied shall be in multiple of 2.75 MW.

Modules from outside India shall be with Sea worthy packing and modules made in India shall be with road worthy packing.

Modules found damaged at the time of opening of the cartons in the project site shall be replaced by the vendor, free of cost at site.

6. GENERAL CONDITIONS

- PV Modules shall be manufactured at the vendor's works only, on whom PO is placed.

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			REV. 00 JOB NO.- SP1047
	PAGE 7 of 9		

- b. Manufacturing clearance shall be given only after approval of manufacturing quality plan, approval of drawings and datasheet by BHEL's customer and after sample PV Module approval (if deemed necessary).
- c. Any additional tests / type tests / Certification required by BHEL / BHEL's customer shall be complied.

7. Manufacturing Clearance Approval Procedure

- i. The successful vendor shall submit Guaranteed Technical Particular (GTP), Datasheet, Bill of Materials (BOM), GA drawing & Quality assurance plan of the module for approval along with the datasheets of each component. The component datasheet shall contain all the information to substantiate the compliance for component specifications mentioned above.
- ii. The Vendor shall also provide test certificates corresponding to the standards mentioned above along with complete test reports for the proposed module. The tests should have been conducted at a test laboratory compliant with ISO 17025 for testing and calibration and accredited by an ILAC / IECCE member signatory. Laboratory accreditation certificate or weblink along with scope of accreditation shall also be submitted.
- iii. The BOM proposed shall be the subset of Constructional Data Form (CDF)'s of all the test reports, indicated at clause 6.1) of this specification.
- iv. The Vendor shall submit a detailed Manufacturing Quality Plan (MQP) for the PV Module with list of checks / tests performed during incoming material inspection, production, pre-dispatch and package.
- v. The above documents will be submitted to SECI / Customer for approval.

8. Manufacturing and Inspection

- i. The Manufacturing shall start only after the clearance by the BHEL / SECI / Customer after the approval as above & inspection of the material as per CDF verified by SECI / Customer / BHEL at vendor works.
- ii. The Vendor shall inform the module manufacturing schedule to the Customer at least 15 (fifteen) working days before the start of proposed schedule.
- iii. The customer shall perform material inspection at the Manufacturer's factory before the start of proposed manufacturing schedule. Proof of procurement of components as per the approved BOM mentioning manufacturer name, manufacturing date and relevant test certificate shall be submitted during material inspection for verification.
- iv. The cells used for module making shall be free from all defects like edge chipping, breakages, printing defects, discoloration of top surface etc.
- v. The modules shall be uniformly laminated without any lamination defects.
- vi. Pre-dispatch inspection of modules shall be performed as per the inspection protocol of the customer, provided at annexure-A.

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			REV. 00 JOB NO.- SP1047
	PAGE 8 of 9		

9. Confirmation by the Vendor

Sl. No.	Item	Acceptance by the Vendor (Yes / No)
1.	Multi Crystalline PV Modules with module wattage 330 Watts and above and efficiency 17% and above	
2.	Temp. coefficient of Power : -0.40% / Deg. C or better	
3.	PV Modules registered with BIS (Bureau of Indian Standards)	
4.	Glass : 4 mm thickness	
5.	Back Sheet : 3 Layer, 300 microns thick, Water vapour transmission rate : < 2 g / m ² / day	
6.	IP67 Junction box	
7.	Junction box cable length : 1.2 Metres	
8.	Edge Sealing of modules with Silicone Sealant (RTV)	
9.	Al. Frame anodisation thickness : >= 15 microns.	
10.	RFID Tag and Bar code inside the laminate	
11.	Supply of 2 nos. of hand held RFID readers	
12.	Adherence to Quality Plan as per customer	
13.	Third Party Insurance for Product and Power performance warranty	
14.	Bill of materials as per subset of the CDF of the IEC Certificates	

10. Enclosures

Sl. No.	Document
1.	Proof for ≥ 500 MW PV module manufacturing capacity
2.	IEC 61215-1& IEC 61215-1-1, IEC 61730-1 & 2, IEC 61701, IEC 62716 & IEC TS-62804-1 test certificates & Type test reports.
3.	PV Module catalogue having Over all PV module assembly drawing with I-V Electrical data sheet for PV modules.
4.	Signed copy of BHEL Specification SPV-SP1047-SPVM Rev 00, As a token of acceptance.
5.	Hard copy of above documents shall be enclosed along with the technical bid. Soft copy of all above documents and IEC test reports to be sent by e-mail to the email id as mentioned in tender documents.

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			REV. 00 JOB NO.- SP1047
	PAGE 9 of 9		

11. DEVIATION SHEET

Sl. No.	Particulars	Bidder's Confirmation
1.	Confirmation to BHEL Specification SPV-SP1047-SPVM Rev 00 in toto	<i>YES / No</i> <i>Please indicate deviations, if any.</i>

Signature of Tenderer with stamp

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