

Bharat Heavy Electricals Ltd.,

(A Government of India undertaking)

Electronics Division

PB No.2606, Mysore Road, Bangalore-560026, India

Ref: MDSSCPV056/Advt/04

Date: 01.10.2019

Corrigendum to RFQ: MDSSCPV056 dated 05.09.2019

Following changes are made to the tender.

1. The purchase specification is revised (PS 439 405 Rev 02).
2. The tender due date is extended to 09.10.2019.

RFQ due date & time : 09.10.2019, 13.00 Hrs (IST)

Date & Time of Part-I Bid Opening : 09.10.2019, 13.30 Hrs (IST)

All other terms and conditions of the tender remain unchanged.

AGM (SC&PV/MM)

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TECHNICAL SPECIFICATION FOR SUPPLY OF 330 Wp MULTI CRYSTALLINE SILICON PV MODULES

REVISION DETAILS: (02) PQC revised.	PREPARED		DATE 30.09.2019
	CMH		
	APPROVED SR	ISSUED ENGG	

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1. PRE-QUALIFICATION CRITERIA (PQC) :

Sl. No	Particulars	Bidder's confirmation
1	Bidder shall be original PV module manufacturer. Supplies against this project shall be manufactured and supplied by the bidder only.	Accepted / Not accepted PV module manufacturer name: Manufacturing Plant Address: Manufacturing capacity / annum : Website: Contact details : <i>(Please mention name of PV module manufacturer, capacity, complete address & contact details with email address)</i>
2	Bidder must have supplied PV modules of cumulative quantity of at least 500 MW during preceding three years from the date of publication of this BHEL tender.	<i>Please enclose following document.</i> <i>Self declaration letter in the company letter head signed by functional head stating the quantity of PV modules in MW supplied during preceding three years from the date of publication of this BHEL tender along with list of invoices in a tabular form (excel sheet) containing Customer name, material description, Invoice number, Invoice date, quantity in KW or MW.</i>
3	Bidder shall provide the performance certificate from the clients (owner or developer) of any grid connected single solar power project of minimum capacity of 10 MW, where the PV modules supplied by the bidder are working satisfactorily since last two years.	Client certificate in their letter head with sign and seal to be provided with the following details. 1. Name of the Project 2. Project Location (with Latitude, Longitude details) 3. Module make 4. Capacity of the Project 5. Date of Commissioning 6. Contact details of the project owner or developer.

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4	PV Module manufacturers has to be approved by customer. Module manufacturers approved by BHEL's customer only will be considered. Any other supporting documents or clarifications insisted by the customer during bid evaluation stage shall be submitted by the bidder. Customer decision will be final and binding on all parties.	Accepted / Not accepted Accepted / Not accepted
5	Price Variation Clause : Price variation clause will be applicable for the unit rate in PO to take care of market trend in PV Module price. The unit price in PO will be varied with respect to the variations of reference price. The reference price will be average price of Poly Solar Module as per www.pvinsights.com, displayed under the heading "Solar PV Module Weekly Spot Price". The unit rate in PO will be allowed to vary (increase/decrease) for each lot of supply, in the ratio of 1:1 for variations (increase/ decrease) in reference price between invoice date for the lot and techno-commercial bid opening date of the tender.	Accepted / Not accepted

Note A :

- Pre-qualification will be carried out based on the details furnished by the bidder / Client certificates / inspection of the company / product, if required by BHEL and at its sole discretion.
- The pre-qualification criteria are mandatory requirements and the technical bids will be considered only if all the above Pre-Qualification Criteria are met.

2. TECHNICAL REQUIRMENTS:

Sl. No	Item	Remarks
1	PV Module Configuration	Multi crystalline photovoltaic module with 72 nos. of cells in 12X6 series configuration. The module construction and bill of material shall be as per module manufacturer's approved IEC certification. <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 of power , voltage and current etc.</i>
2	Power Output	330 Watts and above, in 5 Watt band only. No negative tolerance accepted. Each 5 watt band PV modules supplied shall be in multiple of 2.9 MW.
3	System Voltage	Modules shall be suitable for 1500V DC System Voltage application. Confirm for 1500 V System Voltage : Yes / No

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4	Module Efficiency	> 16.5 %
5	Fill Factor	0.7 (min)
6	Temp. coefficients	Please indicate temperature coefficient for Voltage: _____ Current: _____ Power: _____
7	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 gust up to 200 km/h on the surface of the panel.
8.1	IEC Certifications	The PV modules supplied shall be with Latest IEC certifications as below. 1. IEC 61215 or equivalent BIS standards. 2. IEC 61730-1 & 2 (Safety Qualification – Part 1 & 2) 3. IEC 61701 (Salt Mist Corrosion testing) 4. IEC TS 62804 (PID Testing) Module manufacturers shall use Bill of materials for manufacture of PV modules as per approved CDF of IEC Certificates. All IEC Certificates and IEC test reports containing CDF to be submitted along with the tender.
8.2	Application Class as per IEC 61730	Class A
8.3	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
9	BILL OF MATERIALS	
9.1	Solar cells	Multi-crystalline solar cells
9.2	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.
9.3	Glass	The front surface of the module shall consist of impact resistant, low iron and high transmission toughened glass.
9.4	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.
9.5	PV Module Frame	Corrosion resistant, Anodized Aluminum with provision for earthing holes. Anodization thickness shall not be less than 15 microns.
9.6	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 . Minimum three number of bypass diodes and two number of IEC 62852/EN 50521 certified MC4 compatible connectors with 1.2 metre length of IEC 62930/EN 50618 certified 4 sq.mm copper cable shall be provided. Pl. confirm for Junction cable length of 1.2 Metre : Yes / No

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9.7	Sealant for edge sealing of PV modules	The sealant used for edge sealing of PV modules shall have excellent moisture ingress protection with good electrical insulation and with good adhesion strength.
9.8	Module Sl. No.	Unique Module Sl. No. with barcode shall be embedded inside the laminate for reading.
9.9	.PAN File	Third party verified .PAN file for each 5 watt band PV module (330 Wp, 335 Wp) shall be provided for carrying out PVSyst calculations
9.10	BOM as per CDF of IEC Certificate	Pl. confirm for using solar cells and module materials as per approved CDF as per IEC Certificate. Module manufacturer confirmation : Yes / No
9.11	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. Module manufacturer confirmation : Yes / No
9.12	Mounting hole Pitch	Pl. provide mounting hole pitch details. Horizontal : Vertical : Mounting hole size :
9.13	RFID	Modules deployed must use a RFID tag. This can be inside or outside the laminate, but must be able to withstand harsh environmental conditions. The following information must be mentioned in the RFID tag used on each module (i) Name of the manufacturer of PV Module (ii) Name of the Manufacturer of Solar cells (iii) Month and year of the manufacture (separately for solar cells and module) (iv) Country of origin (separately for solar cells and module) (v) I-V curve for the module (vi) Peak Wattage, I_m , V_m and FF for the module (vii) Unique Serial No. and Model No. of the module. (viii) Date and year of obtaining IEC PV module qualification certificate (ix) Name of the test lab issuing IEC certificate (x) Other relevant information on traceability of solar cells and modules as per ISO 9001 and ISO 14001. Database of all the PV modules containing the above information shall also be provided in excel file format.
9.14	Nameplate	Each module shall be provided with a name plate label (sticker) containing the following information: a. Name of 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}

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		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. It shall be durable for the entire life of panel.
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10	BILL OF MATERIALS WITH MAKE AND MODEL NO.		
	BOM	Specification	Make and Model No.
10.1	Solar cells		
10.2	EVA		
10.3	Glass		
10.4	Back Sheet		
10.5	PV Module Frame		
10.6	Junction box		
10.7	Sealant for edge sealing of PV modules (Frame Adhesive) and Junction box fixing adhesive		
10.8	Cell Connector		
10.9	String Connector		
10.10	Bypass Diode		
10.11	Connector		
10.12	Cable		
10.13	Potting Material for Junction Box		

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.

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4. WARRANTY

4.1 . Material Warranty:

- 1.The module manufacturer shall warrant the Solar Modules to be free from the defects and/or failures specified below (2 to 4) for a period not less than ten (10) years from the date of installation.
2. Defects and/or failures due to manufacturing defects and/or failures due to materials, including PID defect
- 3.Non- conformity to specifications due to faulty manufacturing and/or inspection processes.
- 4.If the Module(s) fails to conform to this warranty, module manufacturer shall repair or replace the solar modules free of cost at BHEL's sole discretion.

4.2 Performance Warranty:

1. The module manufacturer shall warrant the Solar Modules for at least 90% of its rated power at the end of 10 years and 80% of its rated power at the end of 25 years from the date of installation of modules on Site. The module manufacturer shall warrant for the linear output of Solar Module and degradation of the PV modules will be linear over 25 years from the date of receipt of modules at site.
2. If, modules fail to exhibit such power output in prescribed time span, the module manufacturer will either deliver additional PV Modules to replace the missing power output or replace or repair the failed modules.

5. 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 by the PV module manufacturer. The Bidder shall submit a suitable insurance from Third Party.

The insurance shall be in the name of BHEL end customer. The performance warranty shall be specifically a warrant and indemnity insurance against excessive loss of output of PV module.

6. PACKING & IDENTIFICATION OF PV MODULE

The modules shall be packed in carton boxes. One carton box shall contain one module power rating (330 Wp or 335 Wp). 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 by the module manufacturer.

7. GENERAL CONDITIONS

- a. PV Modules shall be manufactured at the module manufacturer's works only.
- b. Manufacturing date of all the modules shall be after BHEL Purchase Order date.
- c. Manufacturing clearance shall be given only after approval of manufacturing quality plan, approval of drawings and datasheet by BHEL / BHEL's customer.

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Module Testing :

a. Factory Testing of PV Modules

BHEL shall depute its representative in the module manufacturer's factory for witnessing of QAP (Quality Assurance Plan) and flash tests of complete production of the modules. BHEL customer may also depute its authorized Representative to be present at the time.

Module manufacturer shall provide test report and electrical characteristics (I-V data) of all the solar PV modules that is supplied against the purchase order.

Factory Tests to be performed in presence of the customer include the following.

Factory Tests	Pre-Shipment inspection by BHEL and BHEL 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 BHEL customer The acceptance criteria and Sampling plan are as per our customer requirement. Pl. confirm for adherence to Pre-Shipment Inspection Plan. Module manufacturer confirmation : Yes / No
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b. Random testing of PV Modules

Third party testing of the random sample by the Solar Energy Centre, MNRE, India is also mandatory. The acceptance criteria shall be as per the applicable IEC / IS with mutual understanding. **Cost towards this testing shall be borne by the module manufacturer.**

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c. Laboratory tests

Following inspections and testing shall be carried out by an independent internationally accredited testing laboratory as per the applicable IEC standards. The sampling will be carried out at factory in presence of BHEL / Customer representative. The IEC standards and norms of sample testing and acceptance shall be followed to compare the test results. In case where the tests show non-conformity to tender document and / or has impact on plant performance and guaranteed generation of the plant, the module manufacturer shall compensate by replacing or adding the module capacity at the sole discretion of BHEL / Customer. **Cost towards these tests shall be borne by the module manufacturer.**

1	Determination of module efficiency under standard test conditions - A sample of 100 modules for 25MW block shall be tested. The test shall be repeated on the same modules after the light soaking of modules i.e. to test LID.
2	Determination of module efficiency under standard test conditions - A sample of 5 modules for 25MW block shall be tested.
3	Low insolation tests with 200, 300, 400, 500 and 800 w/sqm. - A sample of 5 modules for 25 MW block shall be tested.
4	Electroluminescence test. - A sample of 100 modules for 50MW shall be tested.
5	Determination of cell cracks, snail trail and connection errors through electroluminescence testing and normative- actual value comparison of characteristic parameters. A sample of 100 modules for 25MW block shall be tested.
6	Determination of EVA cross-linking degree. A sample of 13 modules for 25 MW block shall be tested.
7	Wet leakage test - A sample of 13 modules for 25 MW block shall be tested. Mechanical load test - A sample of 10 modules for 25 MW block shall be tested (half of the modules from previous tests and half new).
8	Dynamic load test - A sample of 13 modules for 25 MW block shall be tested (half of the modules from previous tests and half new).
9	Tear off test. - A sample of 5 modules for 25MW block shall be tested (one of the modules from previous tests and one new).
10	The module manufacturer shall provide the necessary testing reports to BHEL / Customer as and when required.

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8. Confirmation by the Module manufacturer

Sl. No.	Item	Acceptance by the Module manufacturer (Yes / No)
1.	Multi Crystalline PV Modules with power output ≥ 330 Wp in 5 watts bands.	
2.	Multi Crystalline PV Modules suitable for 1500 V System Voltage application	
3.	Availability of IEC 61215, 61730-1 & 2, IEC 61701 & IEC TS-62804-1 test certificates and IEC Test reports with CDF.	
4.	PV Modules registered with BIS (Bureau of Indian Standards)	
5.	Junction box cable length : 1.2 Metres	
6.	RFID Tag be inside or outside the laminate	
7.	Supply of 1 no. of hand held RFID readers	
8.	Adherence to Quality Plan and Pre-Shipment Inspection as per customer	
9.	Bill of materials as per subset of the CDF of the IEC Certificates	
10.	Cost of Random Tests to be borne by the module manufacturer	
11.	Cost of Laboratory Tests to be borne by the module manufacturer	

9. Enclosures

Sl. No.	Document
1.	Self declaration letter in the company letter head signed by functional head stating the quantity of PV modules in MW supplied during preceding three years from the date of publication of this BHEL tender along with list of invoices in a tabular form (excel sheet) containing Customer name, material description, Invoice number, Invoice date, quantity in KW or MW. Soft copy of excel sheet also to be submitted.
2.	Performance certificate from the client (owner or developer) of any grid connected single solar power project of minimum capacity of 10 MW, where the modules supplied by the module manufacturer are working satisfactorily since last two years.
3.	IEC 61215, 61730-1 & 2, IEC 61701 & IEC TS-62804-1 test certificates and IEC Test reports with CDF.
4.	PV Module catalogue having Over all PV module assembly drawing indicating mounting hole pitch & I-V Electrical data sheet for PV modules.
5.	Signed copy of BHEL Specification PS-439-405
6.	Third party verified .PAN files for each wattage of PV modules (330 Wp and 335 Wp)
7.	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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10. DEVIATION SHEET

Sl. No.	Particulars	Bidder's Confirmation
1.	Confirmation to BHEL Specification PS- 439- 405 Rev. 02 in toto	<i>YES / No</i> <i>Please indicate deviations, if any.</i>

Signature of Tenderer with stamp

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