

Amendments in technical spec BHEL:EPD:SPV:PH2:001					03-07-2019
	Page. No.	point no.	Tender Description	revised	Bidder's confirmation
1	2	1	the basic configuration of the PV Module manufacturing line shall consist of 2 manufacturing lines each of 75 modules per hour capacity for 72 cells module operating concurrently and together having 150 modules per hour capacity	the basic configuration of the PV Module manufacturing line shall consist of 2 manufacturing lines each of 75 modules per hour capacity for 72 cells module operating concurrently and together having 150 modules per hour capacity. For the purpose of capacity calculation conventional backsheets aluminium framed module is considered.	
2	2	2	The approximate plant foot print shall be designed to accommodate both the lines within the provided shop dimensions of 55 x 45 meter approx. with a clear height of 6 meters in an existing building.	The approximate plant foot print shall be designed to accommodate both the lines within the provided shop dimensions of 55 x 56 meter approx. with a clear height of 6 meters in an existing building. CAD drawing of revised dimensions is provided to vendors for optimal placement of the line and bidder should submit their layout in techno commercial offer. However, bidders may provide their optimum shop dimension to design a layout meeting the technical specification. The actual layout will be finalized by BHEL along with the successful bidder post placement of purchase order.	
3	2	5	The Solar PV Module manufacturing line shall have built in buffers for work in process at each of the critical operations for a minimum un-interrupted operational period of 30 minutes for each of the line	The Solar PV Module manufacturing line shall have built in buffers for work in process at each of the critical operations like after layup, bussing, before EL, after trimming etc for a minimum un-interrupted availability of 30 panels for each of the line.	
4	4	3a (Pre-Qualification criteria)		Addendum to Pre-Qualification Criteria: The autobussing equipment in the Solar PV Module manufacturing line shall have references of more than 3 installations during the period 01.12.2012 to 30.11.2018 and satisfactorily working for minimum 2 years. The laminator equipment in the Solar PV Module manufacturing line shall have references of at least 1 installation during the period 01.12.2012 to 30.11.2018 and working satisfactorily for more than 1 year. References shall be submitted for the model offered against this tender. Documentary evidence for the above shall be provided in the form of purchase order, commissioning certificate and performance certificate from the customers. BHEL reserves the right to independently verify the claims and if found to be non-conforming and or non-satisfactory, such bids are liable to be rejected at techno-commercial evaluation stage.	
5	4	6	All the major equipment as mentioned in serial number 3 above shall bear the 'Conformité Européenne (CE)' Marking. The relevant certificates and technical documentation shall be made available in the techno-commercial bid / or at the time of supply.	All the major equipments as mentioned in serial number 3 above, and additionally at 3a. Auto bussing and Laminator shall also bear the 'Conformité Européenne (CE)' Marking. The relevant certificates and technical documentation shall be made available in the techno-commercial bid / or at the time of supply.	
6	5	2a	PV Module size: 2000 x 1000 mm. Cells Size : 156.75 x 156.75mm, 157 x 157mm, 158 x 158 mm, 160x160 mm, PV	PV Module size: (maximum) 2200 X 1100 mm. PV Cells Size : 156.75 x 156.75mm, 157 x 157mm, 158 x 158 mm, 160x160 mm and 161x161mm.	
7	6	2b	Plant uptime :>=95 %. Line throughput: Minimum 150 SPV Modules per hour for 72 cell module.	Plant uptime : 7260 hours per year. Line throughput: Minimum 150 conventional backsheets aluminium framed Modules per hour for 72 cell module. However for critical equipments viz., Tabber & stringer, Autobussing, EL tester, laminator, framing machine, IV tester and sorting & packing shall have individual uptime of minimum 95%.	
8	6	2c	4. Automatic Layup of EVA & backsheets/glass and EL testing integrated with image analytics	4. Automatic Layup of EVA & backsheets/glass and EL testing with provision for integration of image analytics in future.	
9	6	2c	6. Edge trimming and EL testing integrated with image analytics	6. Edge trimming and EL testing integrated with provision for integration of image analytics in future.	
10	6	2c	8. Hi-Pot testing, IV Testing, EL Testing with image analytics & Auto sorting and Packing	8. Hi-Pot testing, IV Testing, EL Testing with provision for image analytics integration in future & Auto sorting and Packing .	
11	8	6	no of equipment: 01 Auto EVA, auto glass loader, auto backsheets	no of equipment: 01 each for (Auto 2nd EVA layup, 2nd auto glass loader, auto backsheets layup)	
12	8	7	Equipment: Electro-Luminescence (EL) Tester integrated with image analytics	Equipment: Electro-Luminescence (EL) Tester with provision for integration of image analytics in future.	
13	8	8	Minimum Throughput per equipment: 85 modules / hour / Laminator	Minimum Throughput per equipment: 75 modules / hour / Laminator	
14	8	9	Technology/ Process: Automated 180 degree flipping station for visual inspection	Technology/ Process: Automated 90 degree flipping station for visual inspection	
15	9	15	Equipment: Online flipping station for cleaning with scrubbing system.	Equipment: Online flipping station for manual cleaning.	
16	10	18	Minimum Throughput per equipment : Min 300 modules / hour / station	Minimum Throughput per equipment: Min 150 modules / hour / station and shall be operational in line.	
17	10	19	Minimum Throughput per equipment: To match above and minimum of 30 minute buffer at all critical stations	Minimum Throughput per equipment: To match above and minimum of 30 panels buffer at all critical stations i.e., (a) After robotic layup (b) After bussing (c) Before Laminator loading and (d) Before framing for each line.	
18	11	19 (Offline Equipment)		D. Bidder shall provide offline laser cutting machine for half cut cells. (optional and price shall be indicated separately in price bid)	

19	11	19 (Offline Equipment)		E. Bidder shall provide offline cell tester. (optional and price shall be indicated seperately in price bid) PV Cells Size : 156.75 x 156.75mm, 157 x 157mm, 158 x 158 mm, 160x160 mm and 161x161mm.	
20	12	4.1.1	BHEL will provide 3 phase, 4 wire, $415 \pm 10\%$ V _{AC} , $50 \pm 5\%$ Hz, electrical supply to each of the equipment. The Supplier shall provide the specification of the cable and termination type required.	BHEL will provide 3 phase, 4 wire plus grounding, $415 \pm 10\%$ V _{AC} , $50 \pm 3\%$ Hz, electrical supply to each of the equipment. The Supplier shall provide the specification of the cable and termination type required.	
21	12	4.1.2	All 3 phase machines shall have $415 \pm 10\%$ V _{AC} , $50 \pm 5\%$ Hz, 4 wire arrangement. Single phase machines shall have $230 \pm 10\%$ V _{AC} , $50 \pm 5\%$ Hz, 2 wire arrangement.	All 3 phase machines shall have $415 \pm 10\%$ V _{AC} , $50 \pm 3\%$ Hz, 4 wire arrangement. Single phase machines shall have $230 \pm 10\%$ V _{AC} , $50 \pm 3\%$ Hz, 2 wire arrangement.	
22	15	7.1.i	Tabber & Stringer machine to Tab and Solder all type of square & pseudo square solar cells of size 156x156mm, 157x157mm and 158x158, 160X160mm	Tabber & Stringer machine to Tab and Solder all types of square & pseudo square solar cells of size 156x156mm, 157x157mm, 158x158, 160X160mm and 161X161mm.	
23	17	7.2.x	Glass Size: 2000 x 1100 (max) and 800 x 500 (min). Glass Thickness : 2.0 to 4.0mm	Glass Size: 2200 x 1100 mm, maximum. Glass Thickness : 2.0 to 4.0mm	
24	19	7.3.x	The bussing station to have buffering facility for holding 30 minutes in process.	The bussing station to have buffering facility for holding 30 panels in process.	
25	20	7.5.xiii	Suitable for Module of size : Upto 2000 x 1000 mm	Suitable for Module of size : 2200 x 1100 mm	
26	20	7.5.xv	Automated Image analytics and data management with variable image resolution controller and also compatible with glass to glass & bifacial module.	EL should have variable image resolution controller and also compatible with glass to glass & bifacial module. EL should also have provision for future integration of automated image analytics and data management.	
27	21	7.6.iii	Indicative Lamination area 2000 mm x 2200 mm per stage (should be having minimum 5 levels which should be able to laminate 10 panels at a time of size measuring 1000mm x 2000 mm) Max. laminate thickness 15 mm (25 mm beneath of diaphragm)	Bidder shall offer Laminator with platen area suitable for providing throughput of 75 modules/hour/laminator and total 150 laminates per hour for both line. Maximum thickness of laminates is 10mm.	
28	21	7.6.iv	Throughput: 85 Modules / hour for 72 cell module.	Throughput: Minimum 75 Modules / hour for 72 cell module.	
29	21	7.6.ix	Operating temperature range 30 - 180 °C	Operating temperature range 50 - 180 °C	
30	21	7.6.viii	Temperature zones : 6 zones/8 zones in the chamber	Temperature measurement zones: 6 zones (minimum) in the chamber with system control to ensure uniformity of temeprature within the tolerance of $\pm 2^\circ\text{C}$ across all zones.	
31	21	7.6.xi	Heating rate less than 30 min. (from 30°C to 150°C)	Heating rate less than 60 min. (from 30°C to 150°C)	
32	21	7.6.xiv	Heating Methodology will be through Thermic Fluid.	Heating Methodology will be through Thermic Fluid / Electric heating	
33	21	7.7.5	Maximum length of the frame : 2000 mm	Maximum length of the frame : 2200 mm	
34	22	7.8	Maximum cut measure 2000 length x 1100 width mm.	Maximum cut measure 2200 length x 1100 width mm.	
35	22	7.10	72 Cells Module of maximum size 2000x1000 mm.	72 Cells Module of maximum size 2200x1100 mm.	
36	23	7.12	An Automatic 180 degree flipping station for online visual inspection before trimming.	An Automatic 90 degree flipping station for online visual inspection before trimming.	
37	23	7.13	A total of 3 stations to be provided in each line and shall have suitable gripping and rotating device for holding the module with the provision of automated spray of cleaning reagents	A total of 3 stations is to be provided in each line and shall have suitable gripping and rotating device for holding the module with the provision for manual cleaning.	
38	23	7.14	A+A+A+ Class Sun Simulator (as per IEC Classification) suitable for testing under simulated Air Mass 1.5 global terrestrial conditions for High Efficiency PV Modules (200 nm-1400 nm)	A+A+A+ Class Sun Simulator (as per IEC Classification) suitable for testing under simulated Air Mass 1.5 global terrestrial conditions for High Efficiency PV Modules (300 nm-1400 nm)	
39	23	7.14.i	Tester shall be capable of measuring 72 cell crystalline silicon modules measuring up to 2200 mm x 1100 mm dimension.	Tester shall be capable of measuring 72 cell crystalline silicon modules measuring up to 2200 mm x 1100 mm dimension.	
40	25	7.15	The throughput of the sorting & packing station: Min 300 modules / hour.	The throughput of the sorting & packing station: Min 150 modules / hour.	
41	25	7.15	The reference dimensions / parameters are as follows : Solar PV Module : 2200x1100x35 mm Number of Modules packed per case : 28 (variable depending on module height & glass to glass module) Type of Stacking : Horizontal or Vertical Packing case inner dimensions: 1985x1065x1010 Packing case type : 180 to 469 GSM fluted type (AAA or ACB) carton box seven(7) ply Wooden pallet dimensions: 2020x1105x113 Retainer Strip : Upto 100mm 3 ply	Solar PV Module reference size: 2200x1100x40 mm. Vendors to indicate the type of packing box required for different type of modules. (indicative packing box specification to be provided by bidder)	
42	26	9.e	Vendor has to provide requisite consumables / input materials for the purpose of demonstration and proving at their site.	Vendor has to provide requisite consumables for the purpose of demonstration and proving at their site.	
43	29	17.b	The warranty shall cover all the spares and wear parts for the entire warranty period.	The warranty shall cover all the consumables, spares and wear parts for the entire warranty period. There should not be any exclusion(s) for any equipment. Vendor shall provide warranty for all the equipments which will be used in the line.	
44	29	17.c	The spare and wear parts needed for the smooth operation shall be stocked locally/at BHEL sufficient for a period of 6 (six) months and shall be replenished. There shall not be any interruption of production due to want of spare and wear parts.	The consumables, spares and wear parts needed for the smooth operation shall be stocked locally/at BHEL sufficient for a period of 6 (six) months and shall be replenished. There shall not be any interruption of production due to want of consumables,spares and wear parts.	

45	30	18.f	The general terms and conditions of the TS & M contract governing the deployment of the vendor's personnel at BHEL is provided in Annexure – II.	The general terms and conditions of the TS & M contract governing the deployment of the vendor's personnel at BHEL is as described in SI No. 18 page no. 29 of 31	
46	30	18		g. BHEL reserves the right for extending TS&M contract after warranty period.	
47	30	19	b. AMC shall cover labour, spare and wear parts for the entire period of AMC.	b. AMC shall cover labour and spares (all the parts other than consumables) for the entire period of the AMC.	
48	30	19		e. BHEL reserves the right for opting AMC after warranty period.	
49	30	19	g. The service engineer(s) shall be deputed as and when required by BHEL within 24 hours of notification during the remaining AMC period.	f. The service engineer(s) shall be deputed as and when required by BHEL within 24 hours of notification during the remaining AMC period.	
50	31	20.vii		vii. Supplier will provide the following after the successful Installation and commissioning of the line: (a) Electrical circuit diagram of the entire line including control wiring with proper nomenclature & ferruled reference in English. (b) Mechanical drawings of the entire line in English. (c) Program backup of all the PLCs, drives and all other programmable devices. (d) All PLCs program printout with symbols & comments in English.	
51	31	20.viii		viii. PREFERRED MAKES OF CRITICAL BOUGHT OUT COMPONENTS FOR ALL MACHINERIES OF TURNKEY LINE: a. Servo Drives and Actuators : Rexroth, Siemens, Delta, Festo, Allen Bradley, Schneider, Yaskawa, Mitsubishi b. Linear Guide ways : THK, Hiwin, Scheeneberger, Parker, Bosch Rexroth c. Sensors : Siemens, Telemecanique, Honeywell, Sick, Omron, Schneider, Keyence, Banner, SMC d. Pneumatics : Festo, SMC e. PLC : Siemens, Beckhoff, Allen Bradley, Mitsubishi, Schneider, ABB, Omron, Delta f. Ball Screws : THK, Parker g. Motors : Oriental, Siemens, ABB, Toshiba h. VFD : Siemens, Danfoss, Mitsubishi, Yaskawa, Delta i. Limit Switches : Schneider, Parker, Delta, Omron j. HMI : Siemens, Mitsubishi, Delta, Schneider, ABB, Allen Bradley k. 6 Axis Robot : ABB, Kuka, Fanuc, REIS, Jonas & Redman l. Vision system: Cognex (for camera) m. Hydraulic components: Rexroth, Vickers, Yuken, Nachi. Any other make acceptance would be at sole discretion of BHEL.	