1.0 ITEM : ACID TEXTURISATION STATION FOR SOLAR CELLS

Sl. No.	TECHNICAL SPECIFICATION	VENDOR'S CONFIRMATION
1.	**SCOPE** Saw damage removal and Texturing of multi crystalline silicon wafers in the Solar Cell processing.	
2.	**TECHNICAL SPECIFICATION**	
	• Wafer Sizes : 125mm * 125mm and 156 mm * 156 mm. • Wafer Shape : Square / Pseudo Square • Wafer thickness : 180 to 300 microns • Acids : HF / HNO_3 • Cooling arrangement to control fumes and acid reaction • Neutralisation : NaOH or KOH dip • Cleaning : HF / HCl • Wafer transport : Inline / Batch • Exhaust • Air drying • Chemical dispense modules, Media cabinet and tanks • PLC control for process • Throughput required : 500 wafers / hour minimum	

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Sl. No.	FUNCTIONAL SPECIFICATION	VENDOR'S CONFIRMATION
3.	**FUNCTIONAL SPECIFICATION**	
1	Type of Machine : Inline or Batch type	
2	Wafer size: 125 mm x 125 mm 156 mm x 156 mm	
3	Wafer shape: Square & Pseudo Square	
4	Wafer thickness: 180 to 300 microns	
5	Conveyor speed: 0.3 to 3 m/minute (variable)	
6	Bath1 : Acid (HF/HNO3/H20) Filter: 10 micron filter to be provided Process time: 100 to 120 sec (typical) Bath temperature : 6 to 8 deg C Note Water cooler Huber Type UC 150 Tw-4-H or equivalent to be provided for bath temperature control	
7	Cascade rinsing-1 No. of stages: 2 Water conductivity: Better than 10 micro-siemens Spray pressure: 0.3 to 0.5 bar Water flow: 500 to 600 LPH Filter : 1 micron filter option to be provided Drier: Squeegee drier for removal of water (0.6 ml/wafer typical to be provided for inline type)	
8	Bath2: KOH etching Process time: 40 to 60 sec Process temperature: Room temperature	

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Sl. No.	FUNCTIONAL SPECIFICATION	VENDOR'S CONFIRMATION
9	Cascade rinsing-2 No. of stages: 2 Water conductivity: Better than 10 micro-siemens Spray pressure: 0.3 to 0.5 bar Water flow: 500 to 600 LPH Filter : 1 micron filter option to be provided Drier: Squeegee drier for removal of water (0.6 ml/wafer typical to be provided for inline type)	
10	Bath 3: HCL cleaning Process time: 20 to 30 sec	
11	Cascade rinsing-3 No. of stages: 2 Water conductivity: Better than 10 micro-siemens Spray pressure: 0.3 to 0.5 bar Water flow: 500 to 600 LPH Filter : 1 micron filter option to be provided Drier: Squeegee drier for removal of water (0.6 ml/wafer typical to be provided for inline type)	
12	Bath4: HF cleaning Process time: 20 to 30 sec (typical)	
13	Cascade rinsing-4 No. of stages: 2 Water conductivity: Better than 10 micro-siemens Spray pressure: 0.3 to 0.5 bar Water flow: 500 to 600 LPH Filter : 1 micron filter option to be provided Drier: Squeegee drier for removal of water (0.6 ml/wafer typical to be provided for inline type)	

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Sl. No.	FUNCTIONAL SPECIFICATION	VENDOR'S CONFIRMATION
14	Drier section Typical process time: 30-40 sec Typical process temperature: 40 to 50 deg C Type: Blower for hot air Filter: Class 1000 filter to be used for air filter	
15	Throughput: 500 wafers per hour (typical)	
16	Flow monitoring: For individual stages to be provided	
17	All chemical media and drain piping: Double piping to be used	
18	Drain type: Gravity	
19	Base equipment and frame All wetted parts and equipment support frames shall be of PP. Support frames shall be reinforced with SS profiles. Levelling screws shall be of SS.	

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Sl. No.	FUNCTIONAL SPECIFICATION	VENDOR'S CONFIRMATION
20	Sensors for all fluids (including process chemicals) to be provided and integrated with equipment controls	
21	Transparent windows with necessary safety interlocks shall be provided in the front	
22	DI Water guns shall be provided for process area and maintenance area	
23	Sieve for removal of broken silicon pieces from the top of the tank to be provided	
24	Leakage tray from the fume hood: Provision for tray at the bottom for collection of spills and connection to facilitate drain to be provided	
25	Any alternate sequence of operation for acid texturisation of multi crystalline wafers shall be quoted.	
26	The equipment model quoted shall have been working for a minimum period of ONE YEAR for the purpose of acid texturisation on multi crystalline silicon wafers.	

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OTHER TECHNICAL SPECIFICATION

Sl. No.	OTHER TECHNICAL SPECIFICATION	VENDOR'S CONFIRMATION
4.	**ESSENTIAL ACCESSORIES** List of essential accessories like process cassettes, chemical dispense modules including media cabinet, tanks and all service connections between media cabinet and main equipment , offline analytic kit with individual price breakup to be provided.	
5.	**SPARES** Recommended set of Spare parts & all consumable items for 2-years of trouble-free operation should also be quoted separately. . Spares support for a minimum period of **TEN** years shall be ensured.	
6.	**INSTALLATION,COMMISSIONING,START-UP&TRAINING** Vendor shall include installation, commissioning, start-up and training (at supplier's works for two BHEL engineers for two weeks and also at BHEL works at the time of commissioning) as part of the supply. The training shall include operation and maintenance of the equipment.	
7.	**PROCESS OPTIMISATION** Vendor shall depute their process Specialist for optimizing the Texturisation process parameters for 125/156-mm size multi crystalline silicon solar cells.	

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Sl. No.	OTHER TECHNICAL SPECIFICATION	VENDOR'S CONFIRMATION
8.	**SERVICES** All services required like electrical, air-conditioning, compressed air, chilled water, gases, exhaust and the ambient environmental conditions for the operation of the equipment shall be indicated as per the format enclosed.	
9.	**ONSITE WARRANTY/SERVICE SUPPORT** Onsite warranty for a period of one year from the date of commissioning shall be included. Trouble shooting support by telephone, on-site to be provided.	
10	**REMOTE ACCESS** Provision for remote access by telephone by the supplier to carryout trouble shooting from supplier's end to be provided.	
11.	**AMC FOR THE POST-WARRANTY PERIOD** Annual Maintenance Contract for a period of 4 years after expiry of warranty period shall be quoted as an option. On site availability of service engineer during this period shall be ensured.	
12.	**PACKING** The items shall be packed for air-freight worthiness. Packing slips / labels shall be fixed indicating the items packed inside. Fragile items shall be packed separately with adequate packing indicating "Fragile" slip outside.	
13.	**Floor Space Requirement** Vendor shall provide foot print diagram of the equipment along with approximate weight of the equipment.	

Note :

(1) Supplier shall confirm adequacy of the items offered for above processing. Any other items required for the purpose shall be brought out clearly.

(2) Any deviation from the above spec. shall be clearly brought out by the supplier in their offer.

(3) Vendor's confirmation shall filled up in the space provided for all the items.

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GENERAL CONDITIONS:

Sl. No.	GENERAL CONDITIONS	VENDOR'S CONFIRMATION
01	Three sets of operation and maintenance manual in English shall be supplied along with the equipment.. The manual shall include circuit diagram, component layout, PCB art work, trouble shooting chart indicating symptoms, checks and preventive maintenance schedule to be carried out, suggested remedy for all items including the bought out items. This shall also include all mechanical /pneumatic /hydraulic diagrams for the components /systems used in the equipment.	
02	The equipment shall be designed taking into account all safety and OHSAS requirements. Hazards connected with operation & maintenance of the equipment shall be brought out explicitly and instructions for minimizing the hazards (environmental / safety) to be indicated.	
03	The equipment shall be aesthetically fabricated.	
04	Spares for trouble free operation of the equipment for a period of two years shall form part of the offer.	
05	List of spares, part numbers, and address of original suppliers of spares/subsystems shall be provided.	
06	Service facilities required, Environmental requirements and their tolerance limits may be furnished as per the format enclosed.	
07	The offer shall include adequate training on operation & maintenance of the equipment to BHEL personnel and Inspection of the Equipment at supplier's works. Offer shall also include satisfactory installation, commissioning and performance trials of the equipment at BHEL works by the supplier.	
08	RFI filter /surge suppresser shall be provided at mains (incoming) stage as well as at the input stage of critical electronic instruments / systems used in the equipment.	

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GENERAL CONDITIONS (Continued…)

Sl. No.	GENERAL CONDITIONS	VENDOR'S CONFIRMATION
09	Final clearance will be given after satisfactory trial runs at BHEL for a period of two weeks on two-shift basis for the rated output parameters.	
10	The supplier shall submit test and guarantee certificates. Calibration certificates for all the instruments / gauges / indicators shall be provided. Calibration procedures are also to be indicated in detail. The equipment shall be guaranteed for trouble-free operation and against manufacturing defects for a minimum period of 1- year from date of commissioning.	
11	Equipment shall be rated for 415 V / 3 phase / 50 Hz / 5 wire or 230 V / 1 phase / 50 Hz/ 3 wire system only.	
12	Service Engineers deputed by the supplier for installation of the equipment at BHEL works shall comply with safety regulations and precautions, and have had adequate training in Environmental / Health / Safety hazards associated with the installation and operation of the equipment.	

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FORMAT FOR SERVICE FACILITIES

Sl. No.	SERVICE	DETAILS (To be furnished by vendor)
01	**ELECTRICAL** THREE PHASE KVA RATING NO. OF SERVICE POINTS SINGLE PHASE KVA RATING NO. OF SERVICE POINTS	
02	**CHILLED WATER** FLOW (LPM) PRESSURE (PSI) PORT SIZE(INCHES) NO. OF SERVICE POINTS TEMPERATURE (Deg C)	
03	**RAW WATER** FLOW (LPM) PRESSURE (PSI) PORT SIZE (INCHES) NO. OF SERVICE POINTS	
04	**COMPRESSED AIR** FLOW (LPM) PRESSURE (PSI) PORT SIZE (INCHES) NO. OF SERVICE POINTS	
05	**DRAIN** PORT SIZE (INCHES) NO. OF SERVICE POINTS	
06	**DM WATER** FLOW (LPM) PRESSURE (PSI) PORT SIZE (INCHES) NO. OF SERVICE POINTS RESISTIVITY (M. Ohms)	
07	**EXHAUST** FLOW (CFM) PORT SIZE (INCHES) NO. OF SERVICE POINTS	
08	**CLASS OF CLEAN ROOM FOR PROCESS AREA**	
09	**OTHER SERVICES** **(Inclusive of Process Gases)**	
10	**ENVIRONMENT** TEMPERATURE (DEG C) HUMIDITY (%)	

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