



Bharat Heavy Electrical Limited
Electronics Division, Bangalore
GROUP: PHOTOVOLTAICS

Empanelment of new vendors for supply of Solar Wafers

125MM PSQ CZ Silicon wafers are required for manufacture of solar cells at its Electronics Division facility in Bangalore. We are in need of potential and prospective manufacturers and their authorized agents for registration.

The specification of CZ monocrystalline is PS-438-670 RV03 and poly crystalline wafers PS-438-016 RV01 are attached. The present annual requirement of monocrystalline is 1.8 millions and poly crystalline is 0.5 millions. BHEL is interested in short and long-term tie up for supply of these wafers. BHEL is also expanding up its manufacturing facility to level of 30 MW in coming years. The quantity of wafers will proportionately go up to five millions in 2008 and to 15 millions by 2010.

BHEL is very keen to associate with prospective vendors who are willing to work with us on long-term basis.

Prospective vendors and their agents are requested to contact us at below mentioned address for any clarification / assistance / information.

Contact Address:

Sri M.S.Shankar Narayanan
Sr .DGM(MM-SCPV)
Email : shankarnarayanan@bheledn.co.in
Phone : 0091-80-26747487 / 26998566
Fax : 0091-80-26744904

Alternate

Sri S.L.V.Nityanand
Sr.Manager (MM-SCPV)
Email: nitya@bheledn.co.in
Phone: 0091-80-26747487 / 26998483
Fax : 0091-80-26744904



**PURCHASE SPECIFICATION
GROUP: PHOTOVOLTAICS**

PS-438-670 RV03

TECHNICAL SPECIFICATION

1. MATERIAL: **125 mm Pseudo Square CZ single crystal silicon wafer**

2. APPLICATION: It is used as starting material for Solar Photovoltaic cells production.

SL. NO.	CHARACTERISTICS	VALUE UNIT	TESTING METHODS / REF. STANDARDS.
1.0	APPEARANCE	As cut cleaned Unaided Visual inspection.	
1.1	SURFACE CONDITION	Wafers after slicing shall be subjected to detergent solution cleaning process and ultrasonic degreasing process for removal of greases, stains etc. It shall be not be subjected to any kind of chemical etching.	
1.2	SAW MARKS DEPTH	≤ 20 microns	Visual inspection and surface profiling.
2.0	DIMENSIONS		
2.1	Size (Side to Side)	125 ± 0.5 mm	Vernier/Go-No Go gauges
2.2	Size (Corner to Corner)	Option 1: 150 ± 1.0 mm Option 2: 165 ± 1.0 mm	--- do ---
2.3	Shape	Pseudo Square	
2.4	Thickness	300 ± 25 microns	ASTM-F533
2.5	TTV (Total Thickness Variation)	≤ 30 microns	ASTM-F533
2.6	BOW	≤ 70 microns	ASTM-F534
3.0	CHARACTERISTICS		
3.1	TYPE	P(Boron doped)	ASTM-F42
3.2	ORIENTATION	$\langle 100 \rangle \pm 3.0$ Deg.	ASTM-F26
3.3	RESISTIVITY	$0.5 - 2.0$ ohm.cm	Four point probe
3.4	OXYGEN CONCENTRATION	$\leq 1 \times 10^{18}$ Atoms/ CM^3	ASTM-F121
3.5	CARBON CONCENTRATION	$\leq 5 \times 10^{16}$ Atoms/ CM^3	ASTM-F123
3.6	Life Time	= 10 micro seconds	ASTM F28-91
3.7	Dislocation Density	$< 10 / CM^2$	ASTM F47-94

4.0 PACKING

- 4.1 Wafers shall be kept sealed in polythene / polypropylene sachets.
- 4.2 Each sachets shall have not more than 100 wafers with a label giving manufacturer name, Ingot No., quantity, wire saw/ID saw cut and wafer characteristics.
- 4.3 Sachets shall be packed in thermocole boxes with soft spacers on both ends or in polyethylene foam packing to absorb transit handling shocks. Final packing shall be in carton/wooden cases for easy handling. Wooden cases shall be suitable for air freight.
- 4.4 Each lot must be accompanied with a test certificate containing actual values in the format given below.

Characteristics	Value Specified	Actual Observed	Test Procedure / standards followed.
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5.0 BHEL ACCEPTANCE / INSPECTION PLAN

Inspection of wafers shall be carried out either in BHEL or at the supplier's works as per single sampling plan IS 2500 (Part I), Inspection level II and Acceptance Quality Level (AQL) of 0.65% for visual inspections and IS 2500 (Part II), Inspection level IV and AQL of 0.65% for dimensional and resistivity measurements.



**PURCHASE SPECIFICATION
GROUP: PHOTOVOLTAICS**

PS-438-016 RV01

TECHNICAL SPECIFICATION

1. MATERIAL: **125 mm Square Poly crystalline silicon wafer**
2. APPLICATION: It is used as starting material for Solar Photovoltaic cells production.

SL. NO.	CHARACTERISTICS	VALUE	UNIT	TESTING METHODS / REF. STANDARDS.
1.0	APPEARANCE:	As cut cleaned Unaided Visual inspection.		
1.1	SURFACE CONDITION	Wafers after slicing shall be subjected to detergent solution cleaning process and ultrasonic degreasing process for removal of greases, stains etc. It shall be not be subjected to any kind of chemical etching.		
1.2	SAW MARKS DEPTH	<=20 microns		Visual inspection and surface profiling.
2.0	DIMENSIONS			
2.1	Size (Side to Side)	125±0.5 mm		Vernier/Go-No Go gauges
2.2	Shape	Square		
2.3	Thickness	330±40 microns		ASTM-F533
2.4	TTV (Total Thickness Variation)	<=50 microns		ASTM-F533
2.5	BOW	<=60 microns		ASTM-F534
3.0	CHARACTERISTICS			
3.1	TYPE	P(Boron doped)		ASTM-F42
3.2	RESISTIVITY	0.5 – 2.0 ohm.cm		Four point probe
3.3	OXYGEN CONCENTRATION	<=5 * 10 ¹⁷	Atoms/CM ³	ASTM-F121
3.4	CARBON CONCENTRATION	<=1 * 10 ¹⁸	Atoms/CM ³	ASTM-F123
3.5	Diffusion Length	80 microns (min.)		
3.6	Life time	> 2 micro seconds		ASTM F28-91
3.7	Dislocation Density	< 2000 / CM ²		ASTM F47-94

4.0 PACKING

- 4.1 Wafers shall be kept sealed in polythene / polypropylene sachets.
- 4.2 Each sachets shall have not more than 100 wafers with a label giving manufacturer name, Casting No., quantity, wire saw/ID saw cut and wafer characteristics.
- 4.3 Sachets shall be packed in thermocole boxes with soft spacers on both ends or in polyethylene foam packing to absorb transit handling shocks. Final packing shall be in carton/wooden cases for easy handling. Wooden cases shall be suitable for air freight.
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