

BHEL SAMVAAD 3.0

- सहयोग से सफलता



Indigenization of items & Development of local suppliers

9th Nov 2023

Bharat Mandapam, New Delhi

**Session 5 – (a) Insulated Rivetless & Anti Friction Bearings
(b) Electric Insulation Materials**

Evolution of Public Procurement Policy – Make in India

PPP-MII Order,
2017

2017

Public Procurement (Preference to Make in India), Order 2017 Dtd 15.06.2017 - to promote manufacturing and production of goods & services in India

Works included

2018

PPP-MII Order partially modified on 28.05.2018 to include works (including turnkey works)

Partial
modification

2019

PPP-MII Order partially modified on 29.05.2019 (only local suppliers eligible if sufficient local capacity is available)

Restriction on GTE

2020

PPP-MII Order partially modified on 04.06.2020 (Class I/ Class II local suppliers, no global tender above Rs. 5 Lakh and below Rs. 200 Cr. etc., unless approved by CA)

Notification on
Countries sharing
land border

2020

DoE Order dated 23.07.2020 (Bidders from countries sharing land borders to be registered with DPIIT)

Notification on
Countries sharing
land border

2023

DoE Order dated 23.02.2023 (Includes even TOT from Bidders from countries sharing land borders to be registered with DPIIT)

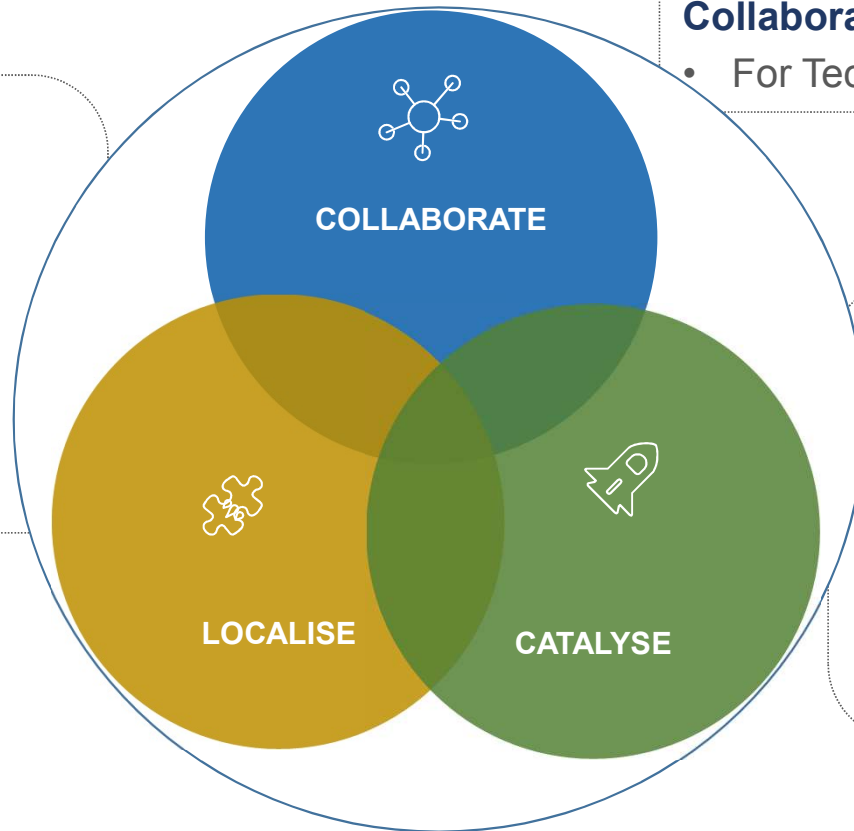
Type	Local content	Price preference
Class I	≥ 50%	✓
Class II	More than 20% but less than 50%	X
Non Local	≤ 20%	X

BHEL's Framework for AtmaNirbharBharat

Localise

Import substitution through

- in house engineering or manufacturing
- supporting domestic manufacturers for indigenization



Collaborate

- For Technology and Manufacturing

Catalyse

- Enable solutions for challenges faced in engineering and manufacturing
- Support domestic ecosystem with R&D and Testing infrastructure

Indigenized offerings with Indigenized supply chain

BHEL's Outreach Initiatives

COLLABORATE

April '20

Expression of Interest (29.04.20)

Manufacturing in India with BHEL

July '20

SANYOJAN (03.07.20)

Domestic Collaborations for Manufacturing

CATALYSE

Aug '20

SANRACHNA (24.08.20)

Technology Innovation Platform

LOCALISE

Nov'20

Expression of Interest (13.11.20)

for import substitution

Interaction (18.11.20)

with IEEMA

Dec '20 – Oct'23

Interaction (03.12.20)

with Local industry (coordinated by DPIIT)

SAMVAAD 1.0 (21.12.20 – 11.02.22)

Workshops with Local industry

SAMVAAD 2.0 (28.10.22 – 29.11.22)

Workshops with Local industry

BHEL SAMVAAD conducted till date

SN	Category of Material	BHEL Unit	Date
1	Raw Materials-Special/ Alloy/ Electrical Steel	Corporate Office	29.12.2020
2	Consumables for Foundry Applications	Hardwar	01.01.2021
3	Welding Consumables of Special Grade	Trichy	05.01.2021
4	Castings & Forgings	Hardwar	08.01.2021
5	Components-Mechanical	Hyderabad	12.01.2021
6	Insulating Materials	Bhopal	15.01.2021
7	Components - Electrical & Electronics	Bangalore	19.01.2021
8	Components – Solar	Bangalore	22.01.2021
9	Systems, Packages & BOPs	Noida	27.01.2021
10	Components - Electrical & Electronics (with IEEMA)	Bhopal	11.02.2022
11	Alloy Steel Pipes for supercritical projects	Trichy	08.06.2022
12	Castings & Forgings	Hardwar	26.08.2022
13	Mechanical & Electrical components/ Non-Ferrous items	Hardwar	05.09.2022
14	Insulating materials	Hardwar	09.09.2022
15	BQ plates of thickness >= 150 mm and SS plates of width 1500-2500mm	Hardwar	12.10.2022
16	Fibre Optic Generator End Winding VMS, Blade VMS, Calibrated Flow nozzle	Hardwar	14.10.2022

BHEL SAMVAAD conducted till date

SN	Category of Material	BHEL Unit	Date
17	Castings & Forgings	Hardwar	28.10.2022
18	Bearings	Bhopal	04.11.2022
19	Pipes, Tubes, Special steels	Trichy	09.11.2022
20	Items for Flue Gas Desulphurization (FGD)	Ranipet	11.11.2022
21	Electrical insulating materials	Bhopal	15.11.2022
22	Quality first in supplies	Corporate Office	19.11.2022
23	Electronics & Solar Items	Corporate Office	21.11.2022
24	Castings & Forgings	Corporate Office	12.05.2023
25	Seamless Pipes & Tubes (High Alloy steel Tubes/ Pipes, Alloy steel Pipes , Carbon steel Pipes)	Trichy	17.08.2023
26	Seamless Pipes (High Alloy steel, Alloy steel, Carbon steel)	Trichy	26.10.2023

Items imported hitherto where local suppliers have been developed

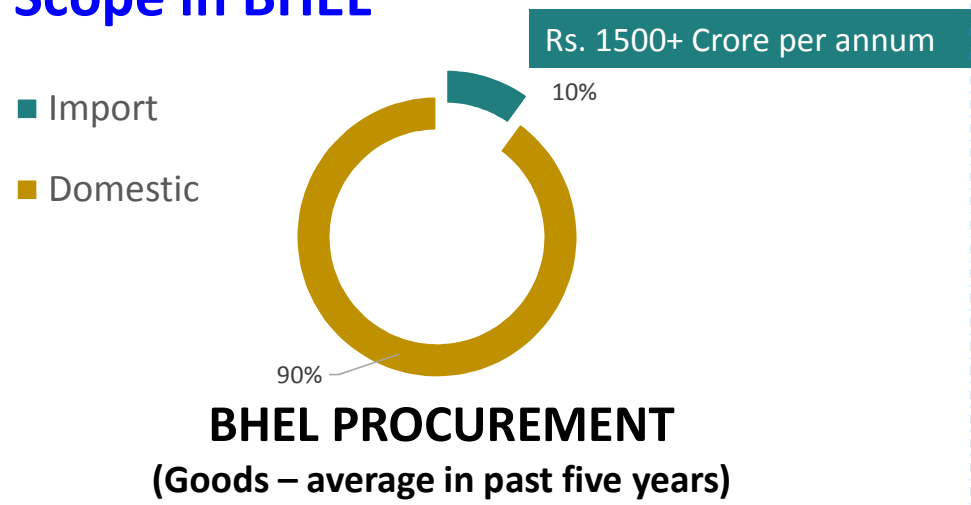
Orders Placed			
Sl.	Item description	Source identification through	Supplier, M/s
1		BHEL-SAMVAAD	
2			
3			
4			
5			
6			
7			
8			
9			
10			
11			
12			
13			

Items imported hitherto where local suppliers have been developed

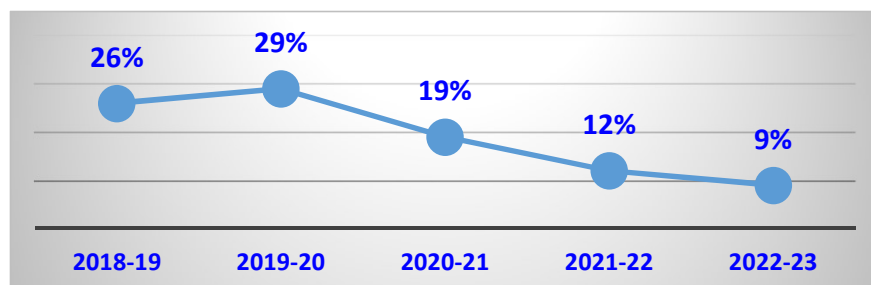
Orders Placed			
Sl.	Item description	Source identification through	Supplier, M/s
14		BHEL-SAMVAAD	
15			
16			
17			
18			
19			
20			
21			
22		Open Tender	
23			
24			
25		GeM	
26			
27			
28			

Opportunity for Indigenization

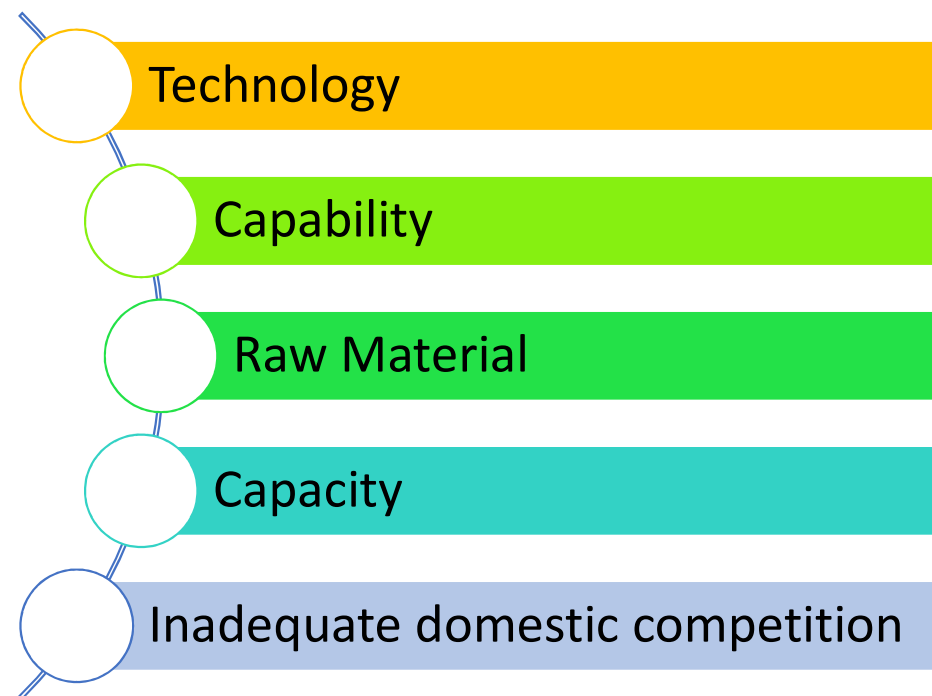
Scope in BHEL



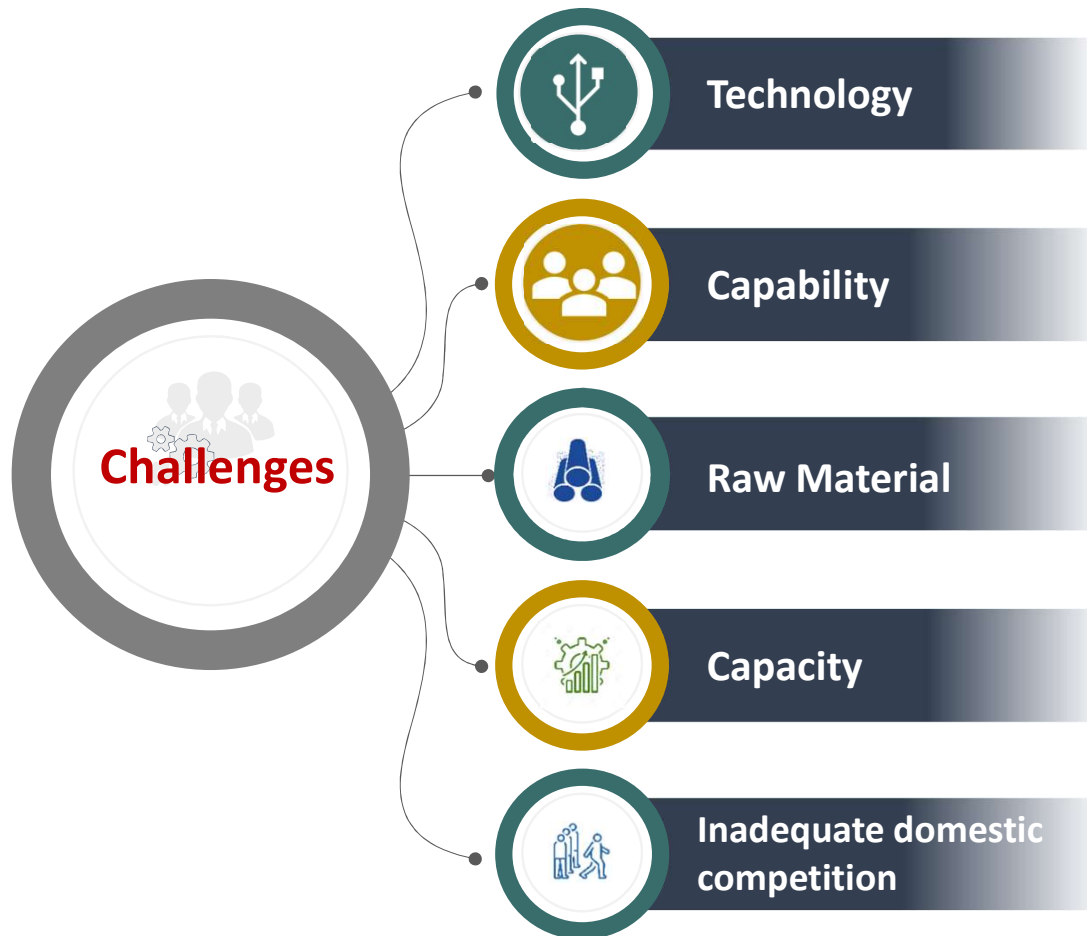
Trend of Imports in BHEL during the last few years



Overcoming the challenges...



Demand-supply gap – Few examples



Examples

Generator Circuit Breakers, Boiler Water Circulating Pumps, **Integrated Electronic devices**, Current Insulated Bearings, **Solar Ingots and Wafers**

LP & TG Forgings > 50 MT, HP & IP Forgings <50 MT, C276 sheets, Titanium Sheets

Nickel, Chromite Sand

Cladded sheets, Alloy Steel pipes & tubes (P91/ 92, T91/ 92)

Pressurization system for Motors, Armature Reversing Contactor, Mono PERC solar cells, Slurry Pumps, Gypsum Dewatering System, FGD Agitators, Mist Eliminators

BHEL SAMVAAD

an opportunity for local vendors to meet the Demand – Supply gap

9

Categories

300+

Items

16

Manufacturing Units

2000+

Crores per annum

- Raw materials – Special / Alloy / Electrical Steel
- Consumables for Foundry Applications
- Welding Consumables of Special Grade
- Castings & Forgings
- Mechanical components
- Insulating Materials
- Electrical & Electronic components
- Components – Solar
- Systems/ Packages

What's new in SAMVAAD 2.0



1.

Focus

on the core few
where gaps in
technology /
facilities are
prominent



2.

Collaborate

Invite ideas from the
domestic industry on
how, as part of a joint
effort with BHEL, one can
minimize the imports in
the Country



3.

Deliberate

on inputs w.r.t.
technical
alternatives

CONSTRAINTS FACED

Non availability of the following in India:

- Semiconductor wafer / solar wafer/ chip fab facility
- Semiconductor IC manufacturing facility
- Surface Mount Device manufacturing facility

BHEL EDN semiconductor components requirement

SNO	Item desc	Types	Value in Rs. Cr.
1	High power IGBTs	10+ types	75
2	Integrated circuits SMD/through hole	1500+ Types	40
3	Passive SMD components	2200+ types	10
4	Fibre Optic components	15+ types	10
5	Discrete semiconductors	550+ types	4
6	Misc components semiconductors, connectors etc	500+ types	20
Total		4775+ types	159

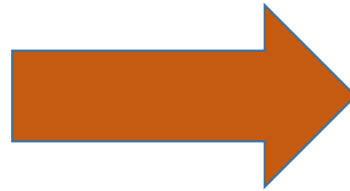


**Let's get down
to business!**

Solar Components

Solar Components

BHEL SBD - Solar Components



List Materials required for Solar Cell Manufacturing

Sl. No.	Item Description	HSN Code	Requirement per Annum Rs. Crs
1.	Solar Wafers	3818	81
2.	Aluminium Paste (Back)	2842	2
3.	Silver Paste (Front / Back)	7106	19 + 3
4.	Phosphorous Oxychloride (POCl_3)	2812	0.3
5.	Texturization Additive	2805	3
	TOTAL		108

Solar Wafer

BHEL					HSN Code	Details of other clients in India who require the job
Classification	Application	Specification	Unit	Requirement p.a. (Rs Cr)		
Solar Wafers	Raw Material for Solar Cell Manufacturing	PS-439-423 R00 PS-439-422 R00 PS-439-411 R01 PS-439-407 R01	SBD Bangalore	81	3818	Mundra Solar, Premier Energy, Jupiter, Tata Power etc.
Special Features of the Job		As per BHEL Specification				

Sl.	Facility/Technology	Whether available in India (Yes / No)
1.	Turnkey manufacturing line for Solar Wafer (Czochralski Furnace, Slicing Machine etc)	No

Solar Wafer

EFFORTS & STATUS OF INDIGENIZATION

Number of indigenous vendors under approved category	Number of indigenous vendor under trial/ development category	Status of indigenization

ACTION POINTS DISCUSSED IN BHEL SAMVAAD 3.0

Solar Wafer

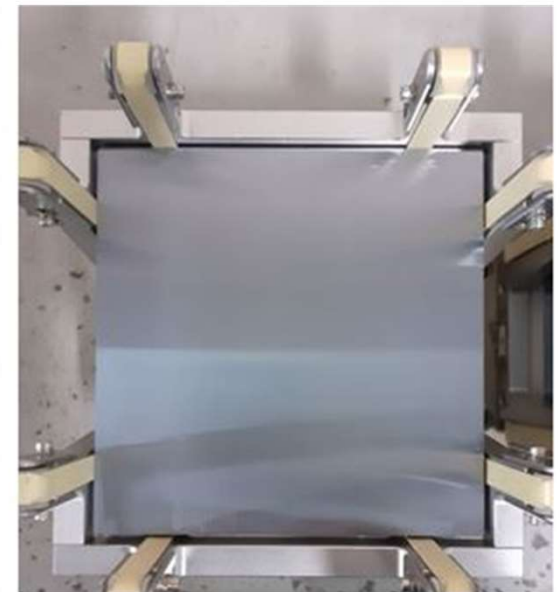
SI	Suggestion	Recommended by	Responsibility	PDC	Remarks

Solar Wafer – 158.75 mm Square Diamond Wire Saw Multi Crystalline Back (MCCE) Silicon Wafer Spec. No. PS-439-423 R00

TECHNICAL SPECIFICATION

1. MATERIAL : 158.75 mm Square Diamond Wire Saw
Multi Crystalline Black (MCCE) 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	Base Wafer	Diamond Wire Saw		Unaided Visual
1.1	Surface Treatment	Metal Catalysed Chemical etching (MCCE) on one side for making it as Black Silicon Wafer		
1.2	Textured Surface Reflectivity	17.5 % \pm 2.5 %		



SOLAR WAFER

Solar Wafer – 158.75 mm Square Diamond Wire Saw Multi Crystalline Solar Wafer Spec. No. PS-439-422 R00

TECHNICAL SPECIFICATION

1. MATERIAL : 158.75 mm Square Diamond Wire Saw Multi Crystalline Solar 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	Diamond Wire Saw		

Wafers shall be free from surface stains, water marks, chips, breakages and pin holes.



SOLAR WAFER

Solar Wafer – 157 mm Square Diamond Wire Saw Multi Crystalline Black (MCCE) Silicon Wafer Spec. No. PS-439-411 R01

TECHNICAL SPECIFICATION

1. MATERIAL : 157 mm Square Diamond Wire Saw
Multi Crystalline Black (MCCE) 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	Base Wafer	Diamond Wire Saw		Unaided Visual
1.1	Surface Treatment	Metal Catalysed Chemical etching (MCCE) on one side for making it as Black Silicon Wafer		
1.2	Textured Surface Reflectivity	17.5 % \pm 2.5 %		
1.3	SURFACE CONDITION			

Wafers shall be free from surface stains, water marks, chips, breakages and pin holes. MCCE etching done on one side.



SOLAR WAFER

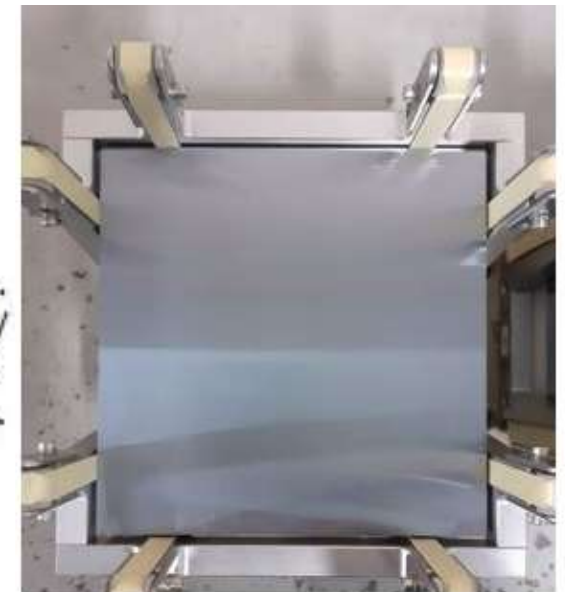
Solar Wafer – 157 mm Square Diamond Wire Saw Multi Crystalline Solar Silicon Wafer Spec. No. PS-439-407 R01

TECHNICAL SPECIFICATION

1. MATERIAL : 157 mm Square Diamond Wire Saw Multi Crystalline Solar 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	Diamond Wire Saw inspection.
1.1	SURFACE CONDITION			

Wafers shall be free from surface stains, water marks, chips, breakages and pin holes.



SOLAR WAFER

Aluminium Paste (Back)

BHEL					HSN Code	Details of other clients in India who require the job
Classification	Application	Specification	Unit	Requirement p.a. (Rs Cr)		
Aluminium Paste (Back)	Raw Material for Solar Cell Manufacturing	PS-439-356 R02	SBD Bangalore	2	2842	Mundra Solar, Premier Energy, Jupiter, Tata Power etc.
Special Features of the Job		As per BHEL Specification				

Sl.	Whether available in India (Yes / No)
1.	No

Aluminium Paste (Back)

EFFORTS & STATUS OF INDIGENIZATION

Number of indigenous vendors under approved category	Number of indigenous vendor under trial/ development category	Status of indigenization

ACTION POINTS DISCUSSED IN BHEL SAMVAAD 3.0

Aluminium Paste (Back)

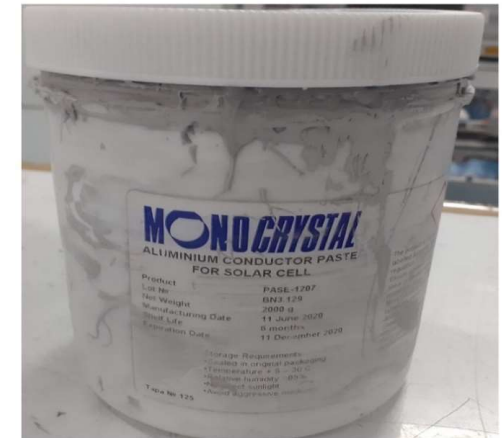
Sl	Suggestion	Recommended by	Responsibility	PDC	Remarks

Back Aluminium Paste for Solar Cells

Spec. No. PS-439-356 R02

1. Description: Back side aluminum paste for mono and polycrystalline silicon solar cell wafers. Should be designed to form excellent back surface field, good adhesion properties, lower bowing, no bubbles on sintering and wider process window.
2. Application: For Screen printing (metalisation) of back aluminium paste on Silicon Solar Cells.
3. Technical Specifications:

Parameter	Range
1. Viscosity (Haake, RV-1, Cone 35/°1, D=12 s ⁻¹ , T = 25 °C)	20 – 50 Pa.s
2. Fineness of Grind	< 25 µm
3. Solid content	73 -80 % mass
4. Rheology	Thixotropic, screen printable paste
5. Appearance	Grey
6. Resistivity	< 50 m.ohm/Sq.
7. Bowing on 156.75 mm wafers	< = 1.5 mm



Silver Paste (Front/Back)

BHEL					HSN Code	Details of other clients in India who require the job
Classification	Application	Specification	Unit	Requirement p.a. (Rs Cr)		
Silver Paste (Front/Back)	Raw Material for Solar Cell Manufacturing	PS-439-431 R00 PS-439-355 R03	SBD Bangalore	22	7106	Mundra Solar, Premier Energy, Jupiter, Tata Power etc.
Special Features of the Job		As per BHEL Specification				

Sl.	Facility/Technology	Whether available in India (Yes / No)
1.		No

Silver Paste (Front/Back)

EFFORTS & STATUS OF INDIGENIZATION

Number of indigenous vendors under approved category	Number of indigenous vendor under trial/ development category	Status of indigenization

ACTION POINTS DISCUSSED IN BHEL SAMVAAD 3.0

Silver Paste (Front/Back)

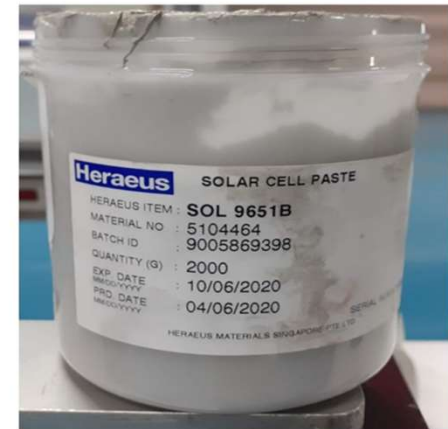
SI	Suggestion	Recommended by	Responsibility	PDC	Remarks

Front Silver Paste for Solar Cells

Spec. No. PS-439-431 R00

1. Description: Front side silver paste for Diamond Wire Saw Multi Crystalline silicon solar cell wafers. Should be designed for excellent electrical features, good aspect ratio, fine grid line printing, high adhesion strength, better ink transfer and wider process window.
2. Application: DWS Multi Crystalline Solar cell screen printing process.
3. Technical Specifications:

Parameter	Range
1. Viscosity (Haake, RV-1, Cone 35/°1, D=12 s ⁻¹ , T = 21 °C)	35 – 110 Pa.s
2. Fineness of Grind	50%: ≤ 8 µm, Average : ≤ 10 µm
3. Solid content	90 to 92 % mass
4. Rheology	Thixotropic, screen printable paste
5. Appearance	Silver Gray
6. Resistivity	< 5 m.ohm/Sq.
7. Finger grid line printing	Suitable for 30 to 35 µm



Back Silver Paste for Solar Cells

Spec. No. PS-439-355 R03

1. Description: Back side silver paste for Diamond Wire Saw Multi Crystalline silicon solar cell wafers. Should be designed for excellent electrical features, good aspect ratio, high adhesion strength, better ink transfer and wider process window.
2. Application: DWS Multi Crystalline Solar cell screen printing process.
3. Technical Specifications:

Parameter	Range
1. Viscosity	50 – 100 Pa.s
2. Fineness of Grind	< 15 μm
3. Solid content	50 % mass



Phosphorous Oxychloride (POCL₃)

BHEL					HSN Code	Details of other clients in India who require the job
Classification	Application	Specification	Unit	Requirement p.a. (Rs Cr)		
Phosphorous Oxychloride (POCL ₃)	Raw Material for Solar Cell Manufacturing	PS-438-617 R04	SBD Bangalore	0.3	2812	Mundra Solar, Premier Energy, Jupiter, Tata Power etc.
Special Features of the Job		As per BHEL Specification				

Sl.	Whether available in India (Yes / No)
1.	No

Phosphorous Oxychloride (POCL3)

EFFORTS & STATUS OF INDIGENIZATION

Number of indigenous vendors under approved category	Number of indigenous vendor under trial/ development category	Status of indigenization

ACTION POINTS DISCUSSED IN BHEL SAMVAAD 3.0

Phosphorous Oxychloride (POCL₃)

Sl	Suggestion	Recommended by	Responsibility	PDC	Remarks

Phosphorous Oxychloride

Spec. No. PS-438-617 R04

1.0 ITEM	: PHOSPHOSROUS OXYCHLORIDE (POCl_3)
2.0 APPLICATION	: This is used as a liquid dopant in the Diffusion Furnace for Solar Silicon Wafers.
3.0 PURITY	: IC GRADE (99.9999 %)
4.0 FILLED VOLUME	: 1000 CC

NOTE: The above POCl_3 shall be filled in the Quartz Bubbler by the supplier.

Quartz Bubbler shall include transparent protective coating, Teflon valves (Inlet : 1/4 inch, outlet : 3/8 inch) , can and shipping container.



Texturization Additive

BHEL					HSN Code	Details of other clients in India who require the job
Classification	Application	Specification	Unit	Requirement p.a. (Rs Cr)		
Texturization Additive	Raw Material for Solar Cell Manufacturing	PS-439-393 R00	SBD Bangalore	3	2805	Mundra Solar, Premier Energy, Jupiter, Tata Power etc.
Special Features of the Job		As per BHEL Specification				

Sl.	Whether available in India (Yes / No)
1.	No

Texturization Additive

EFFORTS & STATUS OF INDIGENIZATION

Number of indigenous vendors under approved category	Number of indigenous vendor under trial/ development category	Status of indigenization

ACTION POINTS DISCUSSED IN BHEL SAMVAAD 3.0

Texturization Additive

SI	Suggestion	Recommended by	Responsibility	PDC	Remarks

List Materials required for PV Module Manufacturing

Sl. No.	Item Description	HSN Code	Requirement per Annum Rs. Crs
1.	PV Solar Cell	8541	146
2.	Anodized Aluminium Frames	7604	43
3.	Anti-Reflection Coating (ARC) Glass	7007	35
4.	Polymer Back Sheet	3920	12
5.	Ethylene Vinyl Acetate (EVA)	3920	24
6.	Junction Box	8535	8
7.	Cell Interconnect	7409	12
	TOTAL		280

PV Solar Cell

BHEL					HSN Code	Details of other clients in India who require the job
Classification	Application	Specification	Unit	Requirement p.a. (Rs Cr)		
PV Solar Cell	Raw Material for Solar PV Module Manufacturing	PS-901-05-0020 R03	SBD Bangalore	146	8541	Mundra Solar, Premier Energy, Jupiter, Tata Power, Saatvik Energy, Sova Solar, Goldi Solar, Vikram Solar etc.
Special Features of the Job		As per BHEL Specification				

Sl.	Facility/Technology	Whether available in India (Yes / No)
1.	Turnkey manufacturing line for Solar Cells	Yes

PV Solar Cell

EFFORTS & STATUS OF INDIGENIZATION

Number of indigenous vendors under approved category	Number of indigenous vendor under trial/ development category	Status of indigenization

samvaad@bhel.in

ACTION POINTS DISCUSSED IN BHEL SAMVAAD 3.0

PV Solar Cell

SI	Suggestion	Recommended by	Responsibility	PDC	Remarks

PV Solar Cells

Solar Cells are used for manufacture of Solar Photovoltaic Modules.

Solar Cells convert Solar Energy into Electrical Energy.

Solar Cells are manufactured from Silicon Wafer which further processed viz., texturization, p-n Junction formation by diffusion process, junction removal, screen printing of grid pattern and contacts.

The Silicon Solar Cells are generally standard size of 157 mm, 158.75 mm, 161 mm & 210 mm, and thickness of 180 - 220 microns.

The Solar Cells comes with different Bus-Bar arrangement viz., Five & Multi Bus-Bar & Contacts.

Cell shall be 100% PID Resistant

Cell Wattage: 4.67 Wp for Multi / Poly and 5.22 Wp for MonoPERC with 5BB.



Multi / Poly



MonoPERC

PV Solar Cells (MonoPERC)

Spec. No. PS-901-05-0020-R03

Sl No.	Description	Parameter
1.01	Cell Model Number	_____ (vendor to indicate model no. of Solar cell being offered)
1.02	Cell Material & Cell Type	Mono Crystalline Silicon & Mono PERC
1.03	Busbar	Five (5) Bus bar
1.04	Dimensions (mm)	$158.75 \pm 0.5 \times 158.75 \pm 0.5$ mm
1.05	Thickness (microns)	200 ± 20
1.06	Diagonal	Diagonal variation shall not be more than 0.5 mm
1.07	Cell Power Wattage (Wp)	\geq BHEL required wattage (Negative tolerance not allowed)
1.08	Soldering peel strength (N/mm)	≥ 1.0 Front (Across each Busbar) ≥ 1.5 Back (Across each Busbar)
1.09	Cell bow (mm)	< 1
1.10	Shape	Square
1.11	Metallization	<ul style="list-style-type: none"> ▪ Front - Silver oxide ▪ Back – Passivated emitter
1.12	PID Resistant	Cell shall be 100% PID Resistant.
1.13	Anti-Reflection coating	PECVD - Silicon Nitride (Blue Colour)

Cell Wattage: 5.54 Wp with 5BB



Anodized Aluminium Frames

BHEL					HSN Code	Details of other clients in India who require the job
Classification	Application	Specification	Unit	Requirement p.a. (Rs Cr)		
Anodized Aluminium Frames	Raw Material for Solar PV Module Manufacturing	PS-901-01-0020 R00	SBD Bangalore	43	7604	Mundra Solar, Premier Energy, Jupiter, Tata Power, Saatvik Energy, Sova Solar, Goldi Solar, Vikram Solar etc.
Special Features of the Job		As per BHEL Specification				

Sl.	Facility/Technology	Whether available in India (Yes / No)
1.	Die, extruder, precession cutting machine, anodization facility	Yes

Anodized Aluminium Frames

EFFORTS & STATUS OF INDIGENIZATION

Number of indigenous vendors under approved category	Number of indigenous vendor under trial/ development category	Status of indigenization

ACTION POINTS DISCUSSED IN BHEL SAMVAAD 3.0

Anodized Aluminium Frames

SI	Suggestion	Recommended by	Responsibility	PDC	Remarks

Anodized Aluminium Frames

Spec. No. PS-901-01-0020-R00

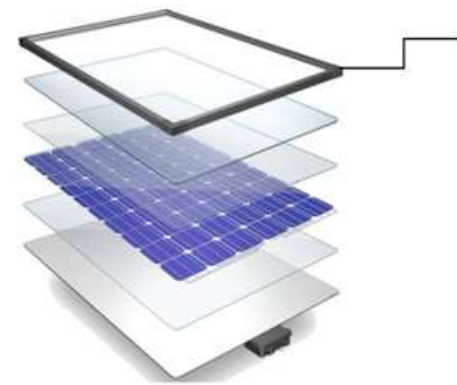
Purpose: Aluminium Frame with Corner Block are used for framing of Solar Module Laminates for Mechanical support.

The basic material used is Aluminium alloy and is extruded to desired section as per the drawing.

These are further fabricated as per the drawing and anodized to 15 to 20 microns thick to protect from corrosion and provides aesthetic look.

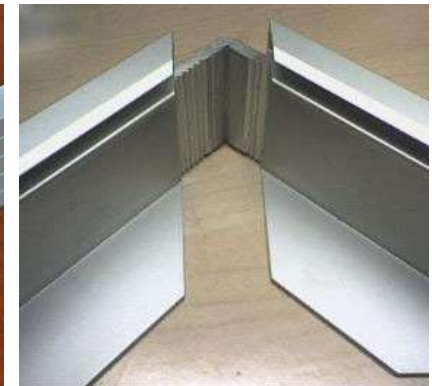
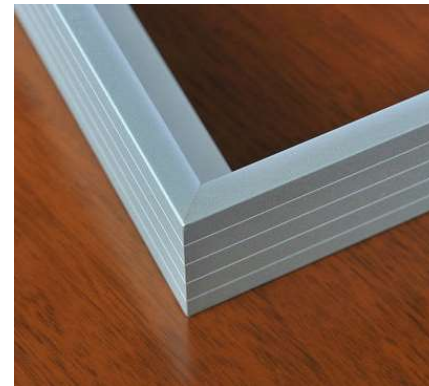
The Aluminum frame with Corner block are supplied in multiples in sets. The standard size with Longer member ~2000mm, Shorter member – 1000mm and overall height of 35 – 50 mm.

Total Requirement per Annum : 531250 Nos



• **Aluminium Frames & Corner Block:**

- 1) Dimension: 1992 mm / 1004 mm x 35mm x 25 mm
1966 mm/ 986mm x 35 mm x 25 mm
- 2) Composition: Aluminium Extrusion



Anti-Reflection Coating (ARC) Glass

BHEL					HSN Code	Details of other clients in India who require the job
Classification	Application	Specification	Unit	Requirement p.a. (Rs Cr)		
Anti-Reflection Coating (ARC) Glass	Raw Material for Solar PV Module Manufacturing	PS-901-02-0001-R06	SBD Bangalore	35	7007	Mundra Solar, Premier Energy, Jupiter, Tata Power, Saatvik Energy, Sova Solar, Goldi Solar, Vikram Solar etc.
Special Features of the Job		As per BHEL Specification				

Sl.	Facility/Technology	Whether available in India (Yes / No)
1.	Furnace, Rolling Machine, Cutting Machine, Tempering Line & ARC Coating Machine	Yes

Anti-Reflection Coating (ARC) Glass

EFFORTS & STATUS OF INDIGENIZATION

Number of indigenous vendors under approved category	Number of indigenous vendor under trial/ development category	Status of indigenization

ACTION POINTS DISCUSSED IN BHEL SAMVAAD 3.0

Anti-Reflection Coating (ARC) Glass

SI	Suggestion	Recommended by	Responsibility	PDC	Remarks

Anti-Reflection Coating (ARC) Glass

Spec. No. PS-901-02-0001-R06

Purpose: For lamination of Solar Cells in the PV Module manufacturing process

Size: of 1960x980x3.2 / 1986x 998x3.2 mm is used for lamination of Solar Cells in the Photovoltaic Module.

It acts as a superstrate and allows higher light transmission into the Solar Cells for maximizing power output from the Solar Cells.

Protect the Solar Cells from outside environment like UV and moisture when the Photovoltaic Modules are exposed to the sun radiation and provide structural strength.

Total Requirement per Annum : 531250 Nos



• **ARC Glass:**

- 1) Dimension: 1960 mm x 980mm x 3.2mm or 1986mm x 998mm x 3.2mm
- 2) Weight: 14.5 Kg
- 3) ARC (TiO_x) Coated

Polymer Back Sheet

BHEL					HSN Code	Details of other clients in India who require the job
Classification	Application	Specification	Unit	Requirement p.a. (Rs Cr)		
Polymer Back Sheet	Raw Material for Solar PV Module Manufacturing	PS-901-02-0012 R04	SBD Bangalore	12	7409	Mundra Solar, Premier Energy, Jupiter, Tata Power, Saatvik Energy, Sova Solar, Goldi Solar, Vikram Solar etc.
Special Features of the Job		As per BHEL Specification				

Sl.	Facility/Technology	Whether available in India (Yes / No)
1.	Coating / Binding Technology	Yes

Polymer Back Sheet

EFFORTS & STATUS OF INDIGENIZATION

Number of indigenous vendors under approved category	Number of indigenous vendor under trial/ development category	Status of indigenization

ACTION POINTS DISCUSSED IN BHEL SAMVAAD 3.0

Polymer Back Sheet

SI	Suggestion	Recommended by	Responsibility	PDC	Remarks

Polymer Back Sheet

Spec. No. PS-901-02-0024 Rev 01

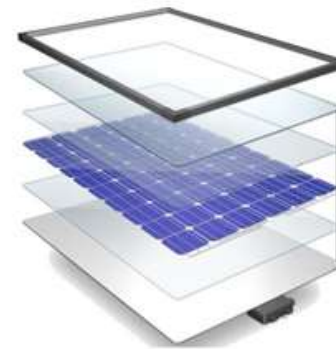
Purpose: Back Sheets are used, for lamination of Solar Cells (Solar Photovoltaic modules) with glass as superstrate and PV Module Back Sheet as substrate.

The Back Sheets melt at a lamination cum curing temperature of over 140 deg. C and forms a bonding of solar cells with Glass and Back Sheets.

This lamination with Back Sheet protect the Solar Cells from outside environment like UV and moisture when the Photovoltaic Modules are exposed to the sun radiation.

The Back sheet are available in required widths in roll form with thickness of 300 microns. Total Requirement per Annum

Total Requirement per Annum : 2125000 Sq.M



- **Back Sheet:**

- 1) Dimension: 985 mm x 0.34 mm / 1003 mm x 0.34 mm
- 2) Composition: PET

Ethylene Vinyl Acetate (EVA)

BHEL					HSN Code	Details of other clients in India who require the job
Classification	Application	Specification	Unit	Requirement p.a. (Rs Cr)		
Ethylene Vinyl Acetate (EVA)	Raw Material for Solar PV Module Manufacturing	PS-901-02-0022 R01 PS-901-02-0023 R01	SBD Bangalore	24	3920	Mundra Solar, Premier Energy, Jupiter, Tata Power, Saatvik Energy, Sova Solar, Goldi Solar, Vikram Solar etc.
Special Features of the Job		As per BHEL Specification				

Sl.	Facility/Technology	Whether available in India (Yes / No)
1.	Chemical Process	Yes

Ethylene Vinyl Acetate (EVA)

EFFORTS & STATUS OF INDIGENIZATION

Number of indigenous vendors under approved category	Number of indigenous vendor under trial/ development category	Status of indigenization

ACTION POINTS DISCUSSED IN BHEL SAMVAAD 3.0

Ethylene Vinyl Acetate (EVA)

SI	Suggestion	Recommended by	Responsibility	PDC	Remarks

Ethylene Vinyl Acetate (EVA) Sheet

Spec. No. PS-901-02-0026 R-01

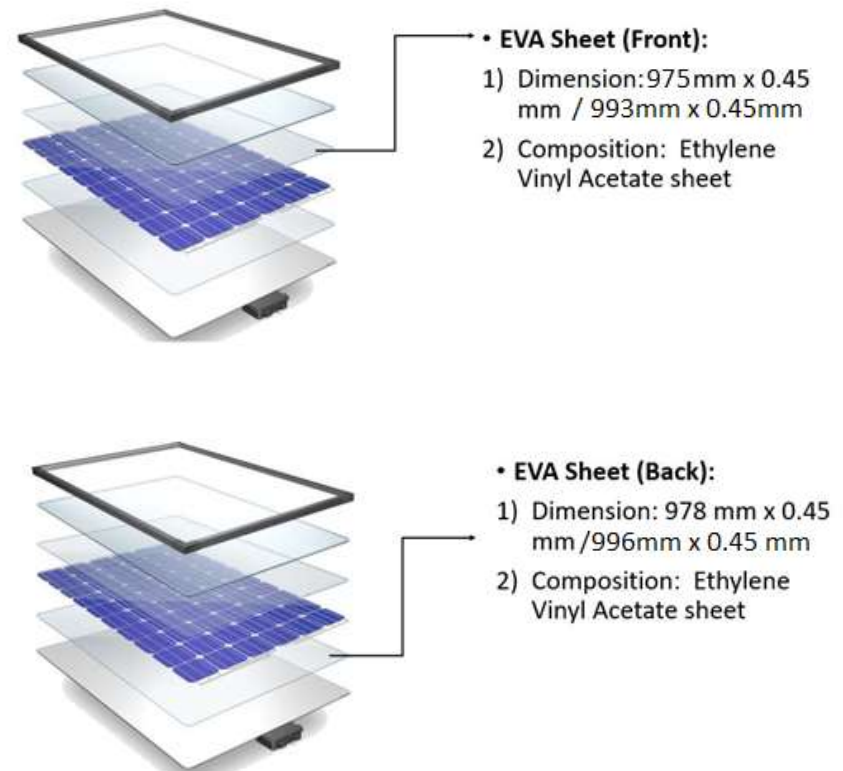
Purpose: EVA sheets are used for lamination of Solar Cells (Photovoltaic Modules) with glass as superstrate and PV module back sheet as substrate.

The EVA sheets melt at a lamination cum curing temperature of over 140 Deg. C and forms a bonding of Solar Cells with Glass and Back Sheets.

This lamination with EVA Sheets protect the Solar Cells from outside environment like UV and moisture when the Photovoltaic Modules are exposed to the sun radiation.

The EVA Sheets are available in required widths in roll form, the visual thickness of 0.4 – 0.5 mm.

Total Requirement per Annum : 2125000 Sq.M



Junction Box

BHEL					HSN Code	Details of other clients in India who require the job
Classification	Application	Specification	Unit	Requirement p.a. (Rs Cr)		
Junction Box	Raw Material for Solar PV Module Manufacturing	PS-901-02-0031 R00	SBD Bangalore	8	8535	Mundra Solar, Premier Energy, Jupiter, Tata Power, Saatvik Energy, Sova Solar, Goldi Solar, Vikram Solar etc.
Special Features of the Job		As per BHEL Specification				

Sl.	Facility/Technology	Whether available in India (Yes / No)
1.	Moulding & Crimping	Yes

Junction Box

EFFORTS & STATUS OF INDIGENIZATION

Number of indigenous vendors under approved category	Number of indigenous vendor under trial/ development category	Status of indigenization

ACTION POINTS DISCUSSED IN BHEL SAMVAAD 3.0

Junction Box

Sl	Suggestion	Recommended by	Responsibility	PDC	Remarks

Junction Box

Spec. No. PS-901-02-0031 R00

Purpose: For electric connection of Bus Bar on Solar Photovoltaic Module (SPV) with by-pass diodes.

The box is mounted to the SPV Module with Silicone Adhesive having optimized structure and effective anti-aging performance.

The box is high degree protection for dustproof and severe weather resistance.

The box will withstand long-term UV, ozone resistance and moisture when the Solar Photovoltaic Modules are exposed to the Sun radiation.

The Junction box are available in assembled kit form having pre-potted Junction Box, Cable duly mounted with Connector.

Total Requirement per Annum : 531250 Nos



• Junction Box:

1) IP-67, 1.5 kV, 15 A



Cell Interconnect

BHEL					HSN Code	Details of other clients in India who require the job
Classification	Application	Specification	Unit	Requirement p.a. (Rs Cr)		
Cell Interconnect	Raw Material for Solar PV Module Manufacturing	PS-901-01-0019 R00	SBD Bangalore	12	8535	Mundra Solar, Premier Energy, Jupiter, Tata Power, Saatvik Energy, Sova Solar, Goldi Solar, Vikram Solar etc.
Special Features of the Job		As per BHEL Specification				

Sl.	Facility/Technology	Whether available in India (Yes / No)
1.	Copper Wire Drawing and Flatting. Coating Facility – controlled process to avoid oxidation	Yes

Cell Interconnect

EFFORTS & STATUS OF INDIGENIZATION

Number of indigenous vendors under approved category	Number of indigenous vendor under trial/ development category	Status of indigenization

ACTION POINTS DISCUSSED IN BHEL SAMVAAD 3.0

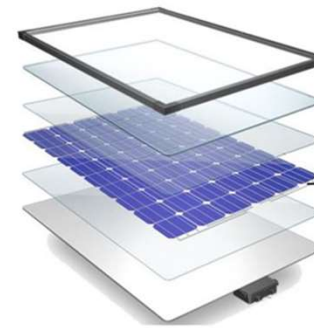
Cell Interconnect

SI	Suggestion	Recommended by	Responsibility	PDC	Remarks

Cell Interconnect

Spec. No. PS-901-01-0019 R-00

- Three types of SPV Interconnects are used for during soldering of Silicon Solar cells to form interconnection strings in the Solar Photovoltaic Module manufacturing process.
- SPV Interconnects is manufactured with “Electrolytic Tough Pitched Copper” as basic material and coated with 16 to 25 microns of Tin : Lead : Silver (62:36:2) for easy solderability during interconnection Silicon Solar cells.
- **Total Requirement per Annum : 129 MT**



- **Cell Interconnect:**
 - 1) Dimension: 1 mm x 0.23 mm
 - 2) Composition: ETP Copper (Coated with Lead and Tin)





THANKS