

Bharat Heavy Electricals Ltd
Electronics Division
Mysore Road, Bangalore – 560 026

**Tender Document for SUPPLY & I&C OF
MODULE MOUNTING STRUCTURES
RFQ REF: HBS0000448**

Technical Bid Opening Date: 31st May, 2013

This Tender Document Contains:

General Terms and Conditions, Technical Specification, Unpriced Bid Formats & Price
Bid Formats

Note: Part – I: To be submitted in a separate sealed cover

Part – II: To be submitted in a separate sealed cover.

And Part-I & Part-II sealed covers should be put in outer envelope and super scribing the Name of work and Name & Address of the tenderer. Tender document should be dropped in Tender drop box super scribed “SC&PV-MM, Friday” kept in reception area of

BHEL – EDN, Bangalore.

Contact Person at BHEL:

**1. Mr. H.B. Srinivasa : Manager (SC&PV-MM)
Ph: 080-26988945, Mob: 09449869655**

**2. Ms. Mrinalini Gupta: Engineer (SC&PV-MM)
Ph: 080-26988198, Mob: 07259176677**

REQUEST FOR QUOTATION

	BHARAT HEAVY ELECTRICALS LIMITED Electronics Division PB No. 2606, Mysore Road Bangalore - 560026 INDIA	RFQ NUMBER: HBS0000448 RFQ DATE : 10.MAY.2013	Due Date 31.MAY.2013 Time: 13:00 HRS VENUE : NEW ENGG. BLDG
MMI:PU:RF:003			

	(for all correspondence) Purchase Executive : SRINIVAS H B Phone : 26998452 Fax : 00918026989217 E-mail: srinivasahb@bheledn.co.in
--	--

Please submit your lowest quotation subject to our terms and conditions attached for the material mentioned below. The quotation must be enclosed in a sealed envelope / Fax superscribed with RFQ no. and due date, should reach us on or before the due date by **13.00** hours IST and will be opened on the same day at **13.30** hours at the venue mentioned above. **PLEASE DROP THE OFFER IN THE BOX PROVIDED AT RECEPTION.**

RFQ Terms and Conditions for Module Mounting Structure

1. Bid has to be submitted as TWO PARTS - in two sealed covers-Techno Commercial Bid(Part-I) & Price Bid (Part-II)- clearly written on each cover both put into one cover super scribed with RFQ No. and Due date.

1A. Submit Enclosures- 1& 2 along with technical bid & Enclosure-3 along with Price bid.

1B. Submit Offer on "FREE ON ROAD" basis to BHEL-RANIPET.

1C. Pre-Qualification criteria read and noted.

2. DELIVERY: Delivery date mentioned in RFQ is tentative. Actual requirement is as given below:

Supply: 10 weeks from drawing approval. Drawings to be submitted in 1 week from LOI/ PO release.

For I &

C: 04 weeks from Supply

3A. PAYMENT TERMS:

For Supply: 75% of basic supply value + 100% taxes & duties with 30 days credit on receipt of material at BHEL-RANIPET. 15% on commissioning and certification. Balance 10% against PBG for 10% of basic supply value valid for 18 months from date of Supply or 12 months from the date of I&C whichever is earlier + 6 months claim period from BHEL Consortium bank.

For I&C: 100% against Commissioning and Certification.

For any other deviation in payment term the offer will be liable for rejection.

3B. Overall L1 of Supply (Fixed Type Structures for 280 Wp modules+ Fixed Type Structures for 230 Wp modules + Structures seasonal tilt 280 Wp modules+ Structures automatic single axis track 280Wp module) + I&C of Fixed Type Structures for 280 Wp modules+ Fixed Type Structures for 230 Wp modules + Structures seasonal tilt 280 Wp modules+ Structures automatic single axis track 280Wp module) + Post Warranty Breakdown Maintenance on "FOR" basis to BHEL-RANIPET will only be considered.

3C. The basic unit price quoted shall be inclusive of Supply, P&F & Insurance. Taxes like ED, CST/VAT to be quoted extra separately. However the order will be placed on "FREE ON ROAD" basis to BHEL-RANIPET. If Freight is quoted extra, original money receipt from Transporter has to be submitted for payment of freight. Insurance is in vendor's scope. BHEL is trying to get concession on Excise Duty under Supply of Solar Power Project. At the time of clearance of goods we may issue Exemption Certificate. In such case, ED will be exempted but not reimbursed. At present, please quote with applicable rate without concession of ED for comparison.

3D. C-form will be issued if applicable. Mention taxes clearly and state whether taxes are included or extra. Indicate the state from which supply takes place.

Wherever E1/E2 transactions are made, the CST will not be reimbursed. Preferably, all supplies are to be made from Supplier's address only (Material Dispatch).

4A. Pre Shipment Inspection will be carried out by BHEL for which test report shall be sent one week in advance.

4B. Penalty applicable: Penalty of 0.5% per week at the basic price of the good for undelivered quantity of supply portion, subject to a maximum of 10%. Pre Shipment Inspection Call Letter Date (Receipt of test report) will be treated as delivery for purpose of penalty for supply only. Any Deviation attracts Loading.

5. Warranty for a period of 18 months from date of Supply or 12 months from the date of I&C whichever is earlier as per Tech Spec.PS-439-825.

6. Road permit if applicable will be given by BHEL before Dispatch of ordered Items.

For and On behalf of BHEL.

REQUEST FOR QUOTATION

	BHARAT HEAVY ELECTRICALS LIMITED Electronics Division PB No. 2606, Mysore Road Bangalore - 560026 INDIA	RFQ NUMBER: HBS0000448 RFQ DATE : 10.MAY.2013	Due Date 31.MAY.2013 Time: 13:00 HRS VENUE : NEW ENGG. BLDG
MMI:PU:RF:003			

(for all correspondence)

Purchase Executive : SRINIVAS H B
 Phone : 26998452
 Fax : 00918026989217
 E-mail: srinivasahb@bheledn.co.in

Please submit your lowest quotation subject to our terms and conditions attached for the material mentioned below. The quotation must be enclosed in a sealed envelope / Fax superscribed with RFQ no. and due date, should reach us on or before the due date by **13.00** hours IST and will be opened on the same day at **13.30** hours at the venue mentioned above. **PLEASE DROP THE OFFER IN THE BOX PROVIDED AT RECEPTION.**

SI No.	Description	Qty	Unit	Delivery qty	Delivery Date
--------	-------------	-----	------	--------------	---------------

7. Do not indicate any TERMS & CONDITIONS in Price Bid. Only Financial Values shall be indicated.
8. Enclose the Clause Wise Compliance / Confirmation with respect to BHEL Specification & Purchase Specification.
9. Deviation from RFQ Terms & Conditions may lead to the rejection of the offer.
10. BHEL reserves the right to conduct Reverse Auction. Procedure for the same will be informed by BHEL. Please send your acceptance for reverse auction.
11. The successful bidder will be getting Letter of intent (LOI) from BHEL, EDN, Bangalore. The regular PO/Payment will be issued by BHEL-Ranipet.
12. Kindly indicate the place/state from where the shipment will take place for assessment of taxation.

SI No.	Description	Qty	Unit	Delivery qty	Delivery Date
1	Post warranty breakdown maintenance As per BHEL Specs PS-439-825.	6	AU	6	30.SEP.2016
2	I&C of Structure-Fixed (280 W Module) Design, installation, structure erection, module mounting, commissioning, checking / inspections for fixed type structure (~280Wp modules) as per BHEL specification PS-439-825.	1	AU	1	30.SEP.2013
3	I&C of Structure-Single Axis Tracker Design, installation, structure erection, module mounting, commissioning, checking / inspections for for single-axis tracking system (~280Wp modules) as per BHEL specification PS-439-825.	1	AU	1	30.SEP.2013
4	I&C of Structure-Seasonal (280 W Module) Design, installation, structure erection, module mounting, commissioning, checking / inspections for seasonal manual tilt structures (~280Wp modules) as per BHEL specification PS-439-825.	1	AU	1	30.SEP.2013
5	I&C of Structure-Fixed (230 W Module) Design, installation, structure erection, module mounting, commissioning, checking / inspections for fixed-type structures (~230Wp modules) as per BHEL specification PS-439-825.	1	AU	1	30.SEP.2013
6	PS0679031537 Structures fixed type for 280Wp modules Supply of fixed-type structures for mounting 3600 Nos (equivalent to 1MWp) of BHEL make modules of type L24270 (~280 Wp) with an arrangement facilitating series connection of 20 modules per string as per BHEL spec	1	ST	1	20.SEP.2013

For and On behalf of BHEL.

Page 2 OF 4

REQUEST FOR QUOTATION

	BHARAT HEAVY ELECTRICALS LIMITED Electronics Division PB No. 2606, Mysore Road Bangalore - 560026 INDIA	RFQ NUMBER: HBS0000448 RFQ DATE : 10.MAY.2013	Due Date 31.MAY.2013 Time: 13:00 HRS VENUE : NEW ENGG. BLDG
MMI:PU:RF:003			

	(for all correspondence) Purchase Executive : SRINIVAS H B Phone : 26998452 Fax : 00918026989217 E-mail: srinivasahb@bheledn.co.in
--	--

Please submit your lowest quotation subject to our terms and conditions attached for the material mentioned below. The quotation must be enclosed in a sealed envelope / Fax superscribed with RFQ no. and due date, should reach us on or before the due date by **13.00** hours IST and will be opened on the same day at **13.30** hours at the venue mentioned above. **PLEASE DROP THE OFFER IN THE BOX PROVIDED AT RECEPTION.**


Sl No.	Description	Qty	Unit	Delivery qty	Delivery Date
	PS-439-825. This supply shall also include an additional 0.5% of total hardware items as mandatory spares that will be kept for use during post-warranty period. Certificate as per BHEL Norms				
7	PS0679031545 Structures fixed type for 230Wp modules Supply of fixed-type structures for mounting 8832 Nos (equivalent to 2MWp) of BHEL make modules of type L20220 (~230 Wp) with an arrangement facilitating series connection of 24 modules per string as per BHEL spec PS-439-825. This supply shall also include an additional 0.5% of total hardware items as mandatory spares that will be kept for use during post-warranty period. Certificate as per BHEL Norms	1	ST	1	20.SEP.2013
8	PS0679031553 Structures seasonal tilt 280Wp modules Supply of seasonal tilt type structures (manual, 3 positions) for mounting 3600 Nos (equivalent to 1MW) of BHEL make modules of type L24270 (~280 Wp) with an arrangement facilitating series connection of 20 modules per string as per BHEL spec PS-439-825. This supply shall also include an additional 0.5% of total hardware items as mandatory spares that will be kept for use during post-warranty period. Certificate as per BHEL Norms	1	ST	1	20.SEP.2013
9	PS0679031561 Structures single axis track 280W module Supply of single axis tracking type structures for mounting 3600 Nos (equivalent to 1MWp) of BHEL make modules of type L24270 (~280 Wp) with an arrangement facilitating series connection of 20 modules per string as per BHEL spec PS-439-825. This supply shall also include an additional 0.5% of total hardware items as mandatory spares that will be kept for use during post-warranty period. Certificate as per BHEL Norms	1	ST	1	20.SEP.2013

Total Number of Items - 9

Please note that the tender will be opened in the presence of the bidders or his authorised representatives (maximum two per organisation) who choose to be present with authorisation letters. Refer annexure for the terms and conditions.
 Preference will be given to vendors who accepts our standard payment terms i.e.100% payment - 30 days after receipt of material at our works subject to acceptance. Please specify Terms of delivery, Excise duty, sales tax, Ex-BHEL, Ex-works surcharge, Insurance,P&F, Freight and other taxes very clearly .
 For evaluation,exchange rate(TT selling rate of SBI) as on scheduled date of tender opening (Part-I bid incase of two part bid) shall be considered.
 The offers of the bidders who are on the banned list as also the offer of the bidders, who engage the services of the banned firms, shall be rejected.The list of banned

For and On behalf of BHEL. Page 3 OF 4

REQUEST FOR QUOTATION

 MMI:PU:RF:003	BHARAT HEAVY ELECTRICALS LIMITED Electronics Division PB No. 2606, Mysore Road Bangalore - 560026 INDIA	RFQ NUMBER: HBS0000448 RFQ DATE : 10.MAY.2013	Due Date 31.MAY.2013 Time: 13:00 HRS VENUE : NEW ENGG. BLDG
		(for all correspondence) Purchase Executive : SRINIVAS H B Phone : 26998452 Fax : 00918026989217 E-mail: srinivasahb@bheledn.co.in	
Please submit your lowest quotation subject to our terms and conditions attached for the material mentioned below. The quotation must be enclosed in a sealed envelope / Fax superscribed with RFQ no.and due date, should reach us on or before the due date by 13.00 hours IST and will be opened on the same day at 13.30 hours at the venue mentioned above. PLEASE DROP THE OFFER IN THE BOX PROVIDED AT RECEPTION.			
firms is available on BHEL web site www.bhel.com			
i). This is only RFQ not an order. ii). In all correspondence quote RFQ No. & due date. iii). In Quotation BHEL material code / RFQ Sl. No. should be mentioned clearly. iv). Quotation Envelope / Fax not superscribed with RFQ No.and due date is liable for rejection. v). Quotation should remain valid for a minimum peiod of 90 days from due date. vi). In case of non-receipt of Quotation or regret letter for 3 consecutive RFQs you are liable to be removed from our vendors list. vii). All Prices should be written in words and numbers. viii). Excise Chapter Heading should be mentioned for all items where VAT is applicable .			


For and On behalf of BHEL.

	PURCHASE SPECIFICATION, GROUP : PHOTOVOLTAICS DESIGN, SUPPLY, I&C OF MOUNTING STRUCTURES FOR 5MW SPV POWER PLANT AT BHEL-BAP, RANIPET	PS-439-825
		REV NO: 00
		PAGE : 1 OF 14

COPY RIGHT AND CONFIDENTIAL
The information on this document is the property of Bharat Heavy Electricals Limited.
It must not be used directly or indirectly in anyway detrimental to the interest to the company

Technical specification
for
Design, supply, installation and commissioning of
SPV module mounting structures
for
5MWp Solar Photovoltaic Power Plant at BHEL-BAP, Ranipet, Tamilnadu

Approved by :			
Revision details :R 00	Prepared	Approved	Date
	VRK	NHK	30-Apr-2013

	PURCHASE SPECIFICATION, GROUP : PHOTOVOLTAICS DESIGN, SUPPLY, I&C OF MOUNTING STRUCTURES FOR 5MW SPV POWER PLANT AT BHEL-BAP, RANIPET	PS-439-825
		REV NO: 00
		PAGE : 2 OF 14


1.0 Introduction

- 1.1 Bharat Heavy Electricals Limited (BHEL), Electronics Division, Bangalore is setting up a 5 MWp Grid Connected SPV Power Plant at Boiler Auxiliary Plant, BHEL, Ranipet, Tamilnadu.
- 1.2 This technical specification provides requirements for design, supply, installation and commissioning of four different types of structures: fixed type (with 280Wp modules), fixed type (with 230Wp modules), seasonal tilting (manual) type, automatic single axis tracking type. The scope includes design, civil foundations for grouting the structures, erection of structures, module mounting, commissioning and checking / inspection.
- 1.3 Solar Photovoltaic Modules will be within BHEL scope of supply. Two types of BHEL make modules of mono-crystalline type will be supplied.
- (a) L20220 type: ~230 Wp
 - (b) L24270 type: ~280 Wp
- 1.4 Technical documents included in the tender:
- (a) This technical / purchase specification
 - (b) Drawings of both types of modules: 3-679-02-00351, 3-679-02-00352
 - (c) Technical specification for PV modules CD-4-4001-114, CD-4-4001-115
 - (d) Drawing of site layout: 3-679-05-00620 Rev-02
 - (e) Soil report

2.0 Pre-qualification criteria (PQC) for vendors

Vendor shall read the following criteria carefully and furnish the necessary details. For this, vendor shall fill up the check list under section 2.5 with signature, seal and date.

- 2.1 Vendor should have supplied, installed and commissioned a minimum of 5MWp solar photovoltaic (SPV) module mounting structures (all different types executed by the vendor put together) for SPV projects in India. Evidence shall be furnished in the form of copies of purchase orders and/or completion certificates.
- 2.2 Vendor shall also provide a list of supply, installation, commissioning of module mounting structures of various types for SPV projects in India during the last three years. The list shall include details such as year of commissioning, client name, kW/MW size of power plant, type of structures / tracking systems, number of units etc. This list is only for reference. However, providing this list is mandatory as part of pre-qualification criteria.
- 2.3 Specifically in the case of tracking systems, vendor should have supplied, installed and commissioned single axis / dual axis tracking systems for a minimum of 1MWp solar photovoltaic (SPV) module mounting structures in India. In case the vendor does not have direct experience in this, the vendor, in order to qualify for this bid, must avail the services of a sub-vendor who has executed the above said work. In such a case, following shall be provided:

	PURCHASE SPECIFICATION, GROUP : PHOTOVOLTAICS DESIGN, SUPPLY, I&C OF MOUNTING STRUCTURES FOR 5MW SPV POWER PLANT AT BHEL-BAP, RANIPET	PS-439-825
		REV NO: 00
		PAGE : 3 OF 14

- (a) Details of sub-vendor (name, address) with whom the vendor will establish a tie-up for execution of tracking systems for this BHEL project.
- (b) Evidence of supply, installation and commissioning of tracking systems by sub-vendor, in the form of purchase orders or completion certificates.
- (c) A joint declaration (between vendor and sub-vendor) for participation of sub-vendor in this BHEL project for supply, installation and commissioning of automatic single-axis tracking systems.


2.4 Vendor and sub-vendor (in case their services for tracking systems are availed as above) shall be registered companies in India. Necessary evidence for this shall be submitted.

2.5 Checklist for Pre-Qualification-Criteria:

a)	PQC clause 2.1	Have the evidence documents – PO copies / client certificates - been enclosed? (For supply, installation and commissioning of SPV module mounting structures for a minimum of 5MWp SPV projects as per PQC clause 2.1)	Yes / No
b)	PQC clause 2.2	Has the list of supply, installation and commissioning of module mounting structures in India for last three years, with particulars, as per PQC clause 2.2, been enclosed?	Yes / No
c)	PQC clause 2.3	Has the vendor supplied, installed and commissioned a minimum of 1MWp tracking systems (single axis / dual axis) in India, as per clause 2.3?	Yes / No
d)		In case vendor does not have past experience in tracking systems as required above, the details of the availed sub-vendor having the said experience, as per clause 2.3 (Name, address shall be provided):	
e)		Have the evidence documents - PO copies / client certificates – been enclosed? (For 1MWp tracking systems, as per clause 2.3)	Yes / No
f)		Has the joint declaration with sub-vendor, as per clause 2.3, been enclosed?	Yes / No
g)	PQC clause 2.4	Have evidences for the vendor and sub-vendor as registered companies in India been enclosed, as per clause 2.4?	Yes / No


Note: Failure to comply with PQC as per clause 2.0 as evidenced in the responses to the checklist above will result in rejection of bid.

Signature with seal and date

	PURCHASE SPECIFICATION, GROUP : PHOTOVOLTAICS DESIGN, SUPPLY, I&C OF MOUNTING STRUCTURES FOR 5MW SPV POWER PLANT AT BHEL-BAP, RANIPET	PS-439-825
		REV NO: 00
		PAGE : 4 OF 14

3.0 Scope of supply


#	Scope description	Qty
3.1	Supply of fixed-type structures for mounting 3600 Nos (equivalent to 1MWp) of BHEL make modules of type L24270 (~280 Wp) with an arrangement facilitating series connection of 20 modules per string. This supply shall also include an additional 0.5% of total hardware items as mandatory spares that will be kept for use during post-warranty period.	1 set
3.2	Supply of fixed-type structures for mounting 8832 Nos (equivalent to 2MWp) of BHEL make modules of type L20220 (~230 Wp) with an arrangement facilitating series connection of 24 modules per string. This supply shall also include an additional 0.5% of total hardware items as mandatory spares that will be kept for use during post-warranty period.	1 set
3.3	Supply of seasonal tilt type structures (manual, 3 positions) for mounting 3600 Nos (equivalent to 1MWp) of BHEL make modules of type L24270 (~280 Wp) with an arrangement facilitating series connection of 20 modules per string. This supply shall also include an additional 0.5% of total hardware items as mandatory spares that will be kept for use during post-warranty period.	1 set
3.4	Supply of automatic single axis tracking type structures for mounting 3600 Nos (equivalent to 1MWp) of BHEL make modules of type L24270 (~280 Wp) with an arrangement facilitating series connection of 20 modules per string. This supply shall also include an additional 0.5% of total hardware items as mandatory spares that will be kept for use during post-warranty period.	1 set
3.5	I&C of structures – fixed type – ~280Wp modules: Scope covers design, installation (including civil foundations), structure erection, module mounting, commissioning, checking / inspections for fixed type structures with 3600 Nos (equivalent to 1MWp) of BHEL make modules of type L24270 (~280Wp) .	1 AU
3.6	I&C of structures – fixed type – ~230Wp modules: Scope covers design, installation (including civil foundations), structure erection, module mounting, commissioning, checking / inspections for fixed type structures with 8832 Nos (equivalent to 2MWp) of BHEL make modules of type L20220 (~230Wp) .	1 AU
3.7	I&C of structures– seasonal tilt manual type – ~280Wp modules: Scope covers design, installation (including civil foundations), structure erection, module mounting, commissioning, checking / inspections for seasonal tilt type (manual, 3 positions) structures with 3600 Nos (equivalent to 1MWp) of BHEL make modules of type L24270 (~280Wp) .	1 AU
3.8	I&C of structures– automatic single axis tracking – ~280Wp modules: Scope covers design, installation (including civil foundations), structure erection, module mounting, commissioning, checking / inspections for automatic single axis tracking structures	1 AU

	PURCHASE SPECIFICATION, GROUP : PHOTOVOLTAICS DESIGN, SUPPLY, I&C OF MOUNTING STRUCTURES FOR 5MW SPV POWER PLANT AT BHEL-BAP, RANIPET	PS-439-825
		REV NO: 00
		PAGE : 5 OF 14

	with 3600 Nos (equivalent to 1MWp) of BHEL make modules of type L24270 (~280Wp) .	
3.9	Warranty Vendor shall provide warranty for 12 months from the date of commissioning or 18 months from the date of supply, whichever is earlier.	-
3.10	Post-warranty breakdown maintenance on the basis of call from BHEL, during the two years after the expiry of warranty period. A total of 6 calls shall be considered during the two years period. A single lump-sum price shall be indicated per breakdown maintenance call from BHEL.	6 AU

4.0 Instructions to vendors for Bid submission

4.1	Offer shall be submitted in two-parts (Two part-bid). Both parts shall be in separate sealed envelopes as per instructions in tender. The individual envelopes shall be enclosed in a common bigger envelope with markings (address, etc) on the envelope as per instructions provided in tender.																																																																								
4.2	First-part shall be techno-commercial bid. Following details shall be furnished: <ol style="list-style-type: none"> Details required for pre-qualification criteria as per clause 2.0 above, including signed checklist. Technical offer with covering letter. Filled-up enclosures as per BHEL formats (meant for first-part) provided in tender. Clause-wise compliance shall be filled-up in the column provided in this specification, with signature and seal on every page. Company brochure especially with reference to structures and installations. Audited balance sheets of the vendor company for the last 3 years. Employee / manpower profile of the vendor company. Details of solar array shall be submitted for each of the four cases viz. (1) fixed type with L24270 modules, (2) fixed type with L20220 modules, (3) seasonal tilt (manual) with L24270 modules and (4) automatic single axis tracking with L24270 modules. Following table shall be filled up: <table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th></th> <th></th> <th>Fixed type 280Wp</th> <th>Fixed type 230Wp</th> <th>Seasonal tilt type</th> <th>Single axis tracking</th> </tr> </thead> <tbody> <tr> <td>1</td> <td>Number of rows</td> <td></td> <td></td> <td></td> <td></td> </tr> <tr> <td>2</td> <td>Number of structures per row</td> <td></td> <td></td> <td></td> <td></td> </tr> <tr> <td>3</td> <td>Number of modules in each structure</td> <td></td> <td></td> <td></td> <td></td> </tr> <tr> <td>4</td> <td>Number of vertical support legs per structure</td> <td></td> <td></td> <td></td> <td></td> </tr> <tr> <td>5</td> <td>Module matrix per structure (for e.g, 4x3)</td> <td></td> <td></td> <td></td> <td></td> </tr> <tr> <td>6</td> <td>Module orientation (portrait or landscape)</td> <td></td> <td></td> <td></td> <td></td> </tr> <tr> <td>7</td> <td>Direction of module facing (e.g south facing)</td> <td></td> <td></td> <td></td> <td></td> </tr> <tr> <td>8</td> <td>Distance of separation between the rows</td> <td></td> <td></td> <td></td> <td></td> </tr> <tr> <td>9</td> <td>Distance between two structures within a row</td> <td></td> <td></td> <td></td> <td></td> </tr> <tr> <td>10</td> <td>Total area (sq-m, acres) occupied</td> <td></td> <td></td> <td></td> <td></td> </tr> <tr> <td>11</td> <td>Type of foundation (pile, ramming etc)</td> <td></td> <td></td> <td></td> <td></td> </tr> </tbody> </table>			Fixed type 280Wp	Fixed type 230Wp	Seasonal tilt type	Single axis tracking	1	Number of rows					2	Number of structures per row					3	Number of modules in each structure					4	Number of vertical support legs per structure					5	Module matrix per structure (for e.g, 4x3)					6	Module orientation (portrait or landscape)					7	Direction of module facing (e.g south facing)					8	Distance of separation between the rows					9	Distance between two structures within a row					10	Total area (sq-m, acres) occupied					11	Type of foundation (pile, ramming etc)				
		Fixed type 280Wp	Fixed type 230Wp	Seasonal tilt type	Single axis tracking																																																																				
1	Number of rows																																																																								
2	Number of structures per row																																																																								
3	Number of modules in each structure																																																																								
4	Number of vertical support legs per structure																																																																								
5	Module matrix per structure (for e.g, 4x3)																																																																								
6	Module orientation (portrait or landscape)																																																																								
7	Direction of module facing (e.g south facing)																																																																								
8	Distance of separation between the rows																																																																								
9	Distance between two structures within a row																																																																								
10	Total area (sq-m, acres) occupied																																																																								
11	Type of foundation (pile, ramming etc)																																																																								

	PURCHASE SPECIFICATION, GROUP : PHOTOVOLTAICS	PS-439-825
	DESIGN, SUPPLY, I&C OF MOUNTING STRUCTURES	REV NO: 00
	FOR 5MW SPV POWER PLANT AT BHEL-BAP, RANIPET	PAGE : 6 OF 14

	<p>9. Footprint of the four cases, put together, in the form of a layout, fitting into the two solar array areas, shown as hatched portions in the BHEL drawing, shall be submitted. The individual cases shall be properly identified / marked on the layout. (Note: BHEL drawing 3-679-05-00620 of plant layout is enclosed with tender document). For this purpose, a separate drawing, as prepared by the vendor, showing only the two solar array areas with all the four cases fit within the boundary shall be submitted. The smallest structural unit shall be clearly brought out in each case.</p> <p>10. Drawing of foundation shall be furnished. Soil report for the site is enclosed as part of tender.</p> <p>11. Detailed drawings with bill of materials for all the four types.</p> <p>12. Confirmation on supply of hardware spares.</p> <p>13. List of machinery, tools & tackles, instruments etc that will be deployed at site shall be mentioned.</p> <p>14. Stage-wise manpower plan shall be enclosed.</p> <p>15. Time schedule shall be submitted.</p>
4.3	Second-part shall be price bid with filled up enclosures as per BHEL format provided in tender.
4.4	In addition to the above instructions, tender document provides detailed instructions for bid submission. Vendor shall submit the bid based on instructions in tender document.


5.0 Power plant configuration

A brief summary of the power plant as well as type of SPV modules used is provided here below so as to enable the vendors to select and offer appropriate type of structures.

5.1 Overall summary of plant

The 5MWp solar photovoltaic power plant at BHEL, Ranipet, Tamilnadu will have a solar array with four different types of structures. Two different sizes of modules (230Wp, 280Wp) of mono-crystalline type will be deployed. Electrically, the array will have 10 nearly equal segments, each generating DC power of ~500kWp, which is then inverted by a grid-connected power conditioning unit (PCU) of 500kW rating. At the ac output level, every two PCUs are combined using a three-winding oil-immersion transformer to form a 1 MWp group. Thus, at each 1MWp level, two PCUs are connected independently to the two LV windings of the transformer that is connected to 11kV grid on the HV side. The plant employs 10x 500kW PCUs that export the generated power to 11kV grid through 5 transformers and LV/HV breaker panels.

The solar array will also have 60 string monitoring combiner boxes (SMBs) that collect the solar PV generated DC power and provide inputs to the 10 PCUs housed within a centralized control room. Modules will be interconnected in series using the built-in cables. For parallel grouping, 6 sq-mm copper PVC unarmoured cables will be used. The combined outputs from the SMBs will be taken to the PCUs using 120 sq-mm copper PVC armoured cables that will be laid underground.

	PURCHASE SPECIFICATION, GROUP : PHOTOVOLTAICS DESIGN, SUPPLY, I&C OF MOUNTING STRUCTURES FOR 5MW SPV POWER PLANT AT BHEL-BAP, RANIPET	PS-439-825
		REV NO: 00
		PAGE : 7 OF 14

5.2 Parameters of solar photovoltaic modules

BHEL-make SPV modules with mono-crystalline cells are employed. Details of modules as follows:

#	Module type	Pmax	Voc	Isc	Vmp	Imp	Remarks
1	L20220	~ 230 Wp	36V	8.5A	29V	7.94A	This will be for 4 x 500 kWp = 2 MWp 24 numbers of modules of this type will be connected in series per string.
2	L24270	~ 280 Wp	43V	8.5A	35V	8.0A	This will be for 6 x 500 kWp = 3 MWp 20 numbers of modules of this type will be connected in series per string.

6.0 Technical specification

#	BHEL specification	Vendor compliance (Yes / No) In case of non-compliance or deviation, vendors shall record their comments:
6.1	Angle of module mounting For fixed type: constant angle at Latitude For seasonal tilt type: Lat-15 deg, Lat, Lat+15 deg (three positions)	
6.2	Module facing direction For fixed type: south facing For seasonal tilt type: south facing at Latitude position For single axis tracking: Facing east, rotating east to west.	
6.3	Solar array layout parameters (1) Number of modules per structure (2) Module matrix per structure (for example: 4 x 3) (3) Module orientation (portrait or landscape) (4) Number of vertical support legs for each structure (5) Number of structures per row (6) Type of foundation for each of the four cases	




PURCHASE SPECIFICATION, GROUP : PHOTOVOLTAICS
DESIGN, SUPPLY, I&C OF MOUNTING STRUCTURES
FOR 5MW SPV POWER PLANT AT BHEL-BAP, RANIPET

PS-439-825

REV NO: 00

PAGE : 8 OF 14

	<p>These parameters shall be selected based, for the four cases, based on following considerations:</p> <ul style="list-style-type: none">(a) 24 modules of L20220 type (~230Wp) shall be interconnected in series to form a single string.(b) 20 modules of L24270 type (~280Wp) shall be interconnected in series to form a single string.(c) Rows shall be, as much as possible, formulated to maintain multiplicity of 24 or 20 for the respective module types.(d) Layout shall fit into the solar array areas shown as hatched portions in the site layout drawing 3-679-05-00620, leaving ~10m space from compound wall shown in the drawing.(e) Distance between adjacent rows shall be so chosen to avoid shadow of the structure on the modules of back side row during the period 8:00 AM to 5:00 PM in any part of the year.	
6.4	<p>Load bearing structure material</p> <ul style="list-style-type: none">(a) Load bearing material shall essentially be made of steel with appropriate anti-corrosive finish such as GI etc. In case of GI, it shall be hot dip galvanized with minimum coating thickness of 100 microns. Galvanizing methods shall be in line with relevant IS standards.(b) These shall be made of standard IS sections, angles, tubes etc. Alternately, steel sheets are also acceptable provided they are of adequate thickness to ensure the needed strength and durability.	
6.5	<p>Height of the structure shall be selected in such a way that the lowest level of the module plane shall have adequate minimum clearance (~800mm) above the ground level to safeguard against floods, bushes etc.</p>	
6.6	<p>Hardware (required for foundations as well as mounting structures)</p> <ul style="list-style-type: none">(a) Bolts, nuts, screws, washers etc shall be of stainless steel SS304.(b) Foundation bolts (J-bolts), if applicable, shall be of GI with minimum 100 microns of galvanization thickness and process as per relevant standards.(c) Spring washers shall be with appropriate anti-corrosive finish (zinc coating etc) with adequate coating thickness as per relevant IS standards.(d) Hardware sizes shall be of adequate duty to withstand wind	

	PURCHASE SPECIFICATION, GROUP : PHOTOVOLTAICS DESIGN, SUPPLY, I&C OF MOUNTING STRUCTURES FOR 5MW SPV POWER PLANT AT BHEL-BAP, RANIPET	PS-439-825
		REV NO: 00
		PAGE : 9 OF 14

	speed loads (minimum of 150km per hour). Sizes of bolts, screws, nuts and washers shall be proportionate to one another based on relevant IS standards.	
6.7	<p>Fastening torque</p> <p>(a) All fastenings, wherever applicable, shall be to a pre-determined torque value. Tools such as torque wrench etc shall be selected accordingly.</p> <p>(b) Wherever possible, electrically operated tools shall be employed to speed up the operations and to ensure accuracy.</p>	
6.8	Suitable jigs, fixtures and templates shall be designed, fabricated and deployed at site for foundation, erection of structures, mounting of modules etc. Quantity of these shall be appropriate to ensure the required throughput per day.	
6.9	Earthing will be in BHEL scope of supply. Provisions such as suitable holes etc shall be given in structure legs (in all the four types of structures) so as to facilitate earthing connections. BHEL will be forming earth grids by interconnecting the structures using suitable GI strips and earth electrodes.	
6.10	Design calculations for foundations and module mounting structures shall be carried out using STAAD.pro software for wind velocity of minimum 150 km per hour. Results shall be submitted to BHEL for approval.	

7.0 Installation and commissioning – vendor scope

7.1	<p>Marking of foundation positions</p> <p>Total stations of suitable accuracy of coordinates / directions, together with necessary accessories, instruments etc shall be deployed. Quantity of stations shall be appropriate to ensure the required throughput per day.</p>	
7.2	<p>Foundations for all the four types.</p> <p>(a) This includes all related activities such as excavation, drilling, assembly of steel rods with stirrups, mixing of concrete of appropriate grade, casting, curing, pedestal construction, finishing with paint etc - as shall be applicable depending upon the selected foundation type such as ramming, pile foundation, pedestals etc.</p> <p>(b) All materials related to foundations such as sand, cement, steel rods / stirrup wires, steel plates, stone jellies, bricks, concrete, J</p>	




PURCHASE SPECIFICATION, GROUP : PHOTOVOLTAICS
DESIGN, SUPPLY, I&C OF MOUNTING STRUCTURES
FOR 5MW SPV POWER PLANT AT BHEL-BAP, RANIPET

PS-439-825

REV NO: 00


PAGE : 10 OF 14

	<p>bolts, nuts, bolts, washers etc shall be within the scope of vendor supply and hence, <u>shall be included in the offer as integral part of clause 3.0.</u></p> <p>(c) Appropriate machinery, tools & tackles and measuring instruments for foundation works such as JCBs, drilling machines, ramming machines, concrete mixers, transport trucks, transport trolleys, jigs / fixtures / templates (for positioning, alignment, shuttering etc), measuring tapes / scales, weighing machines, water level indicators, precision aligners (such as laser), spanners, pliers, torque wrenches, electrically / pneumatically operated screw drivers etc shall be deployed with adequate quantity to ensure the required throughput per day.</p>	
7.3	<p>Grouting of module structure legs ensuring suitable positioning accuracies.</p>	
7.4	<p>Erection of steel structures including material movements, placing, assembly, fixing, tightening etc.</p> <p>Cranes, hydra, forklifts, transport trucks, transport trolleys, jigs / fixtures / templates (for positioning, alignment etc), measuring tapes / scales, water level indicators, precision aligners (laser etc), spanners, torque wrenches, electrically / pneumatically operated screw driver sets etc shall be deployed with adequate quantity to ensure the required throughput per day.</p>	
7.5	<p>Mounting of modules including module movements, placing, aligning, fixing, tightening etc.</p> <p>Hydra, forklifts, transport trucks, transport trolleys, jigs / fixtures / templates (for positioning, alignment etc), measuring tapes / scales, precision aligners (laser etc), spanners, pliers, torque wrenches, electrically / pneumatically operated screw driver sets etc shall be deployed with adequate quantity to ensure required throughput per day.</p>	
7.6	<p>Foundations shall be provided with suitable painting finish.</p>	

	PURCHASE SPECIFICATION, GROUP : PHOTOVOLTAICS DESIGN, SUPPLY, I&C OF MOUNTING STRUCTURES FOR 5MW SPV POWER PLANT AT BHEL-BAP, RANIPET	PS-439-825
		REV NO: 00
		PAGE : 11 OF 14

8.0 Documents to be submitted after receipt of purchase order for BHEL approval


8.1	BHEL approval shall be obtained for the following technical documents, which shall be submitted within seven days from the date of purchase order:	
8.2	Detailed solar array layout with all four cases fitting within the boundaries of the two solar array areas shown as hatched portions in the site layout drawing 3-679-05-00620.	
8.3	Detailed drawings of foundations.	
8.4	Results of stability calculations for foundations.	
8.5	Detailed drawings of module mounting structures with bill of materials, for all the four cases. BoM shall include item description, type, quantity, make, part / model number, specification etc.	
8.6	Bill of materials of tracking system for automatic single axis tracking (Items such as bearings, shafts, motor, actuator, control panel, power supply etc.). BoM shall include item description, type, quantity, make, part / model number, specification etc.	
8.7	Results of design computations for solar module structures: Stress analysis, strength calculations, wind velocity withstand computations etc.	
8.8	Drawings of jigs, fixtures and templates for positioning / leveling alignment etc in foundation works .	
8.9	Drawings of jigs, fixtures and templates for positioning / leveling alignment etc in erection of mounting structures .	
8.10	Drawings of jigs, fixtures and templates for positioning / leveling alignment etc in module mounting works .	
8.11	List of sub-vendors for all the BoM items related to (a) foundations, (b) module mounting structures and (c) automatic single axis tracking system.	
8.12	List and quantity of total station and associated instruments and accessories for marking for foundation : Details of make, model number, features, accuracy of coordinates / directions, planned throughput per day, etc shall be submitted. Details of marking pins shall be mentioned.	

	PURCHASE SPECIFICATION, GROUP : PHOTOVOLTAICS	PS-439-825
	DESIGN, SUPPLY, I&C OF MOUNTING STRUCTURES	REV NO: 00
	FOR 5MW SPV POWER PLANT AT BHEL-BAP, RANIPET	PAGE : 12 OF 14

8.13	List and quantity of machinery, tools & tackles, measuring instruments for foundation works – JCBs, drilling machines, ramming machines, concrete mixers, transport trucks, transport trolleys, jigs / fixtures / templates, water level indicators, weighing machines, measuring tapes / scales, precision aligners (laser etc), spanners, pliers, torque wrenches, electrically / pneumatically operated screw drivers etc. Details of make, model number, planned throughput per day etc shall be submitted.	
8.14	List and quantity of machinery, tools & tackles, measuring instruments for erection of mounting structures – cranes, hydra, forklifts, transport trucks, transport trolleys, jigs / fixtures / templates, measuring tapes / scales, water level indicators, precision aligners (laser etc), spanners, pliers, torque wrenches, electrically / pneumatically operated screw driver sets etc. Details of make, model number, planned throughput per day etc shall be submitted.	
8.15	List and quantity of machinery, tools & tackles, measuring instruments for module mounting works – hydra, forklifts, transport trucks, transport trolleys, jigs / fixtures / templates, measuring tapes / scales, precision aligners (laser etc), spanners, pliers, torque wrenches, electrically / pneumatically operated screw drivers etc. Details of make, model number, planned throughput per day etc shall be submitted.	
8.16	Working procedures and instructions for marking, foundation, erection of mounting structures and mounting of SPV modules.	
8.17	Detailed activity-time chart for project implementation.	
8.18	Detailed manpower deployment schedule.	

9.0 Pre-dispatch inspection of vendor supplied items

9.1	<p>Vendor shall provide pre-dispatch inspection call to BHEL for inspection at manufacturer works, as per BHEL approved drawings, for all fabricated items such as steel structure members, galvanization process etc.</p> <p>Prior to inviting BHEL for pre-dispatch inspection, vendor shall submit detailed quality assurance plan (QAP) for BHEL approval.</p> <p>QAP shall include type tests, routine tests, factory acceptance tests, sampling plan, applicable standards etc.</p> <p>After the inspection, complete set of test reports shall be submitted.</p>	
-----	---	--

	PURCHASE SPECIFICATION, GROUP : PHOTOVOLTAICS DESIGN, SUPPLY, I&C OF MOUNTING STRUCTURES FOR 5MW SPV POWER PLANT AT BHEL-BAP, RANIPET	PS-439-825
		REV NO: 00
		PAGE : 13 OF 14


9.2	For all bought out items such as motors, actuators, bearings, control mechanisms etc, test certificates as per relevant standards shall be submitted.	
-----	---	--

10.0 Quality inspections at site

10.1	<p>Prior to start of foundation and erection works at site, following shall be submitted to BHEL for approval:</p> <p>(1) QAP for marking / foundation / erection of structures / module mounting works at site.</p> <p>(2) Recording formats for the parameter values measured at site.</p>	
10.2	Vendor shall submit filled-up recording formats and quality inspection reports periodically for BHEL approval.	
10.3	For any deviations, formal approval shall be obtained from BHEL before implementation.	

11.0 General conditions

11.1	Vendor shall construct their own site office for the purpose of overseeing and execution of the contract.	
11.2	<p>Vendor shall, on their own, organize following infrastructure needed for the construction at their own expenses:</p> <p>(a) Power supply required. In case DG sets etc are required, the same shall be organized by the vendor.</p> <p>(b) Water required for activities such as foundations, concrete mixtures etc. Bore wells, sump tanks, tankers etc, if required, shall be constructed by the vendor.</p> <p>(c) All the machinery such as cranes, hydra, JCBs, forklifts, tools & tackles, measuring instruments etc for various activities such as unloading of materials at site, movement of materials, foundation, erection of structures, module mounting, etc shall be organized by the vendor.</p> <p>(d) Labour required for unloading of vendor materials at site, movement of materials, construction activities etc shall be organized by the vendor.</p>	

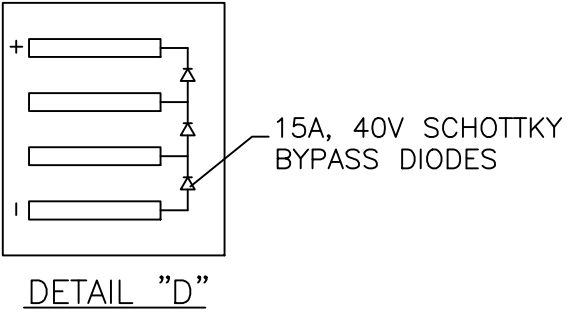
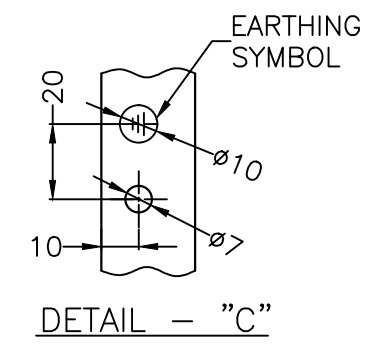
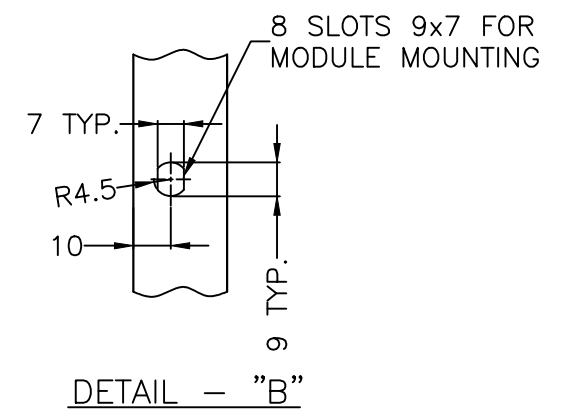
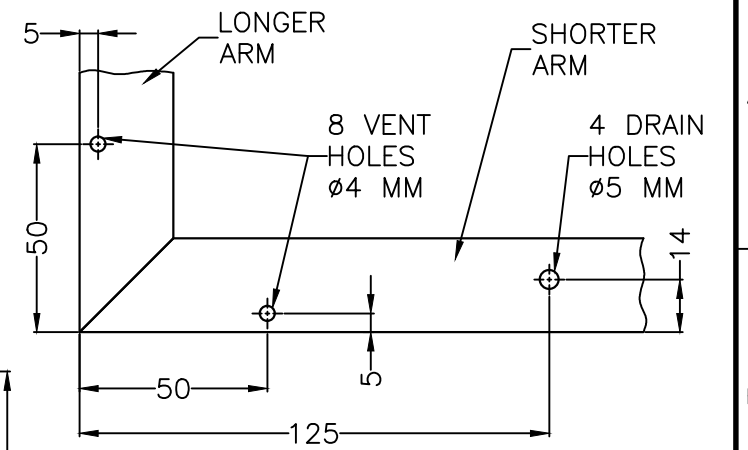
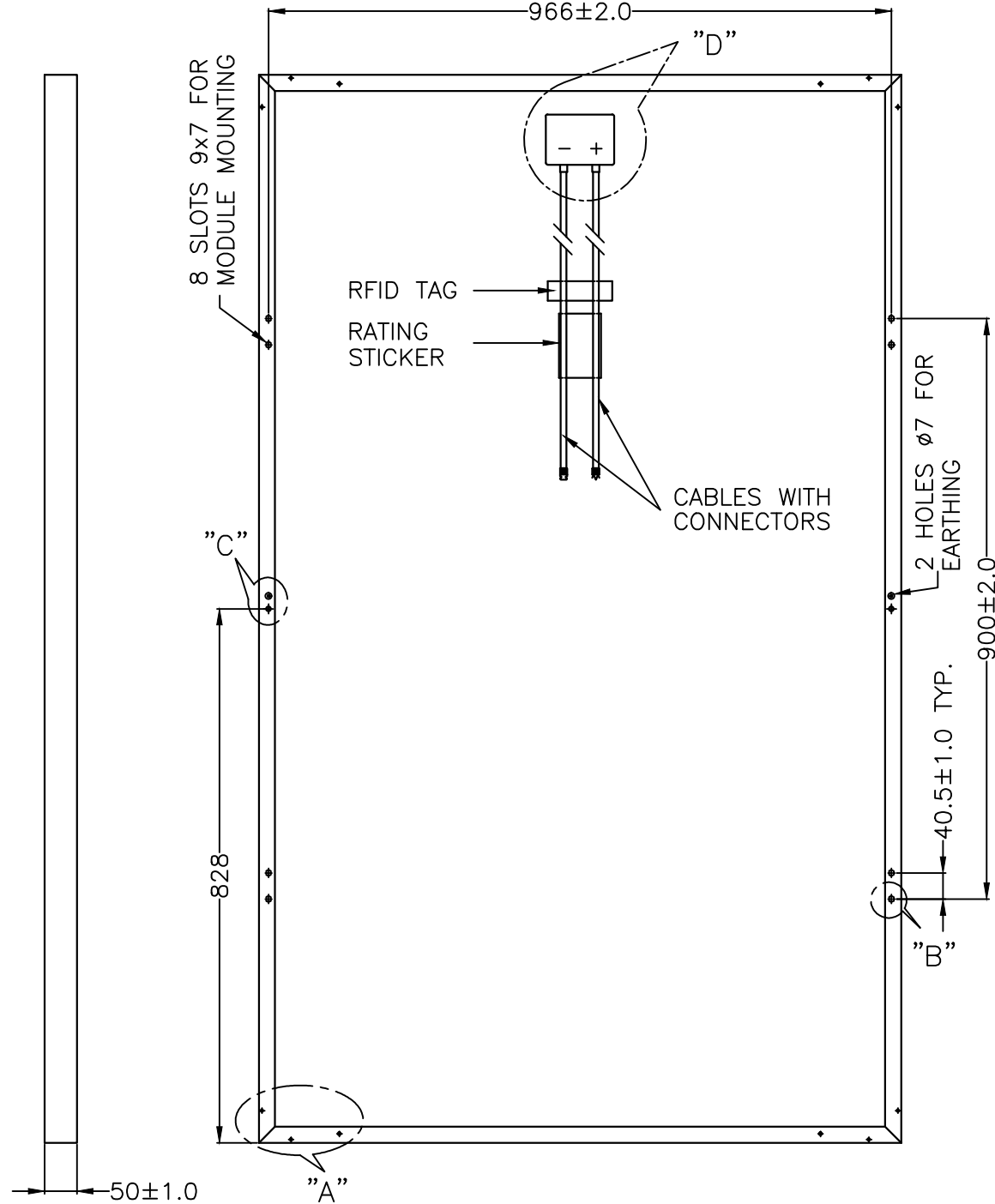
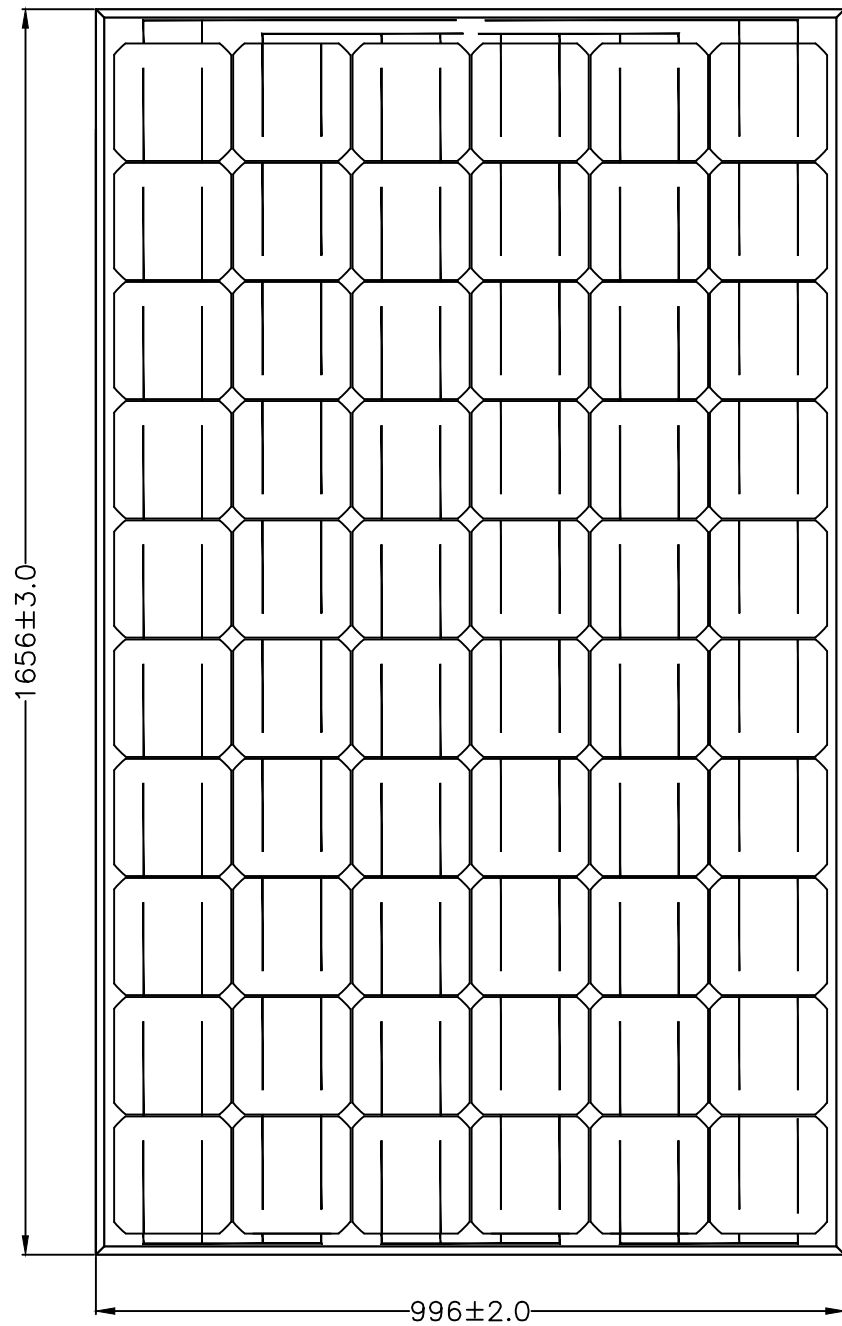
	PURCHASE SPECIFICATION, GROUP : PHOTOVOLTAICS DESIGN, SUPPLY, I&C OF MOUNTING STRUCTURES FOR 5MW SPV POWER PLANT AT BHEL-BAP, RANIPET	PS-439-825
		REV NO: 00
		PAGE : 14 OF 14

11.3	Vendor shall construct their own storage area at the site with appropriate fencing, roofing, gate, lock and key arrangements to store and safeguard their items against rain, flood, fire etc.	
11.4	Safeguarding the vendor supplied materials from theft and pilferage is the responsibility of vendor. For this purpose, necessary security watch and ward, on round the clock basis, shall be arranged by vendor.	
11.5	Insurance for all vendor supplied items shall be within scope of vendor, as applicable until the point of time when the commissioning is completed in all respect and handed over to BHEL.	
11.6	Vendor shall make their own arrangements for necessary food, drinking water and accommodation for their labour and employees posted at the site. Similarly, food and drinking water required at the site, during the construction operations, shall also be in scope of vendor.	
11.7	Vendor shall organize their own labour and transport arrangements to move the BHEL make SPV modules from the storage locations to the construction point at the site. Modules will be stored in BHEL yard opposite to the site at a distance of ~ 200m from the site. Vendor shall carry out such movements only with prior permission from BHEL authorities at the site.	
11.8	Vendor shall organize all necessary labour-related statutory requirements such as labour license, PF, ESI, insurance etc.	
11.9	Vendor shall maintain updated labour register, with name, age, qualification, salary, attendance details etc at the site.	
11.10	Vendor shall use danger boards, wherever required, to ensure safety of the persons during the work at site.	
11.11	Vendor shall adhere to all necessary safety norms such as use of helmet, goggles, hand gloves, footwear, aprons etc. It is the ultimate responsibility of the vendor in all respect to prevent accidents at the site and safeguard their labour from accidents.	
11.12	Vendor shall submit periodic status report, on daily basis as well as weekly consolidated basis, to BHEL on the progress of the contract.	

DRAWING NO. 3 679 02 00351

COPYRIGHT AND CONFIDENTIAL

The information on this document is the property of Bharat Heavy Electricals Limited. It must not be used directly or indirectly in anyway detrimental to the interest of the Company

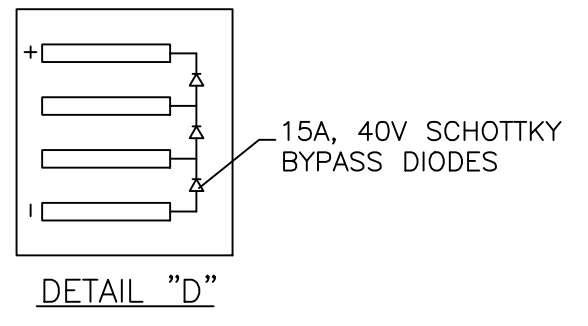
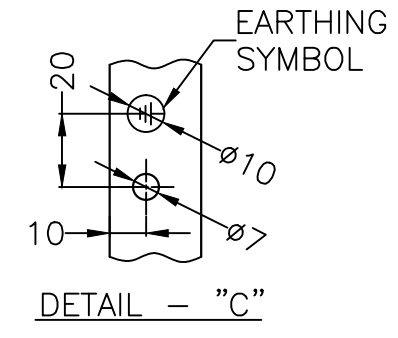
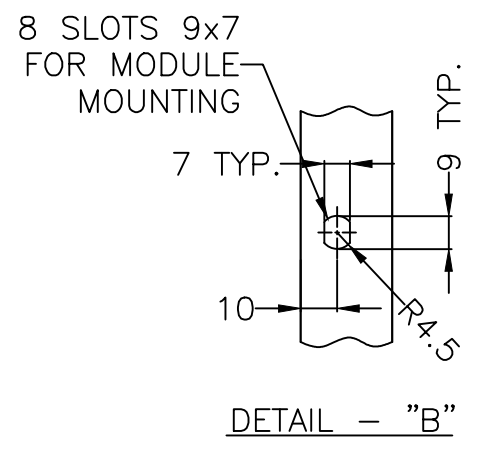
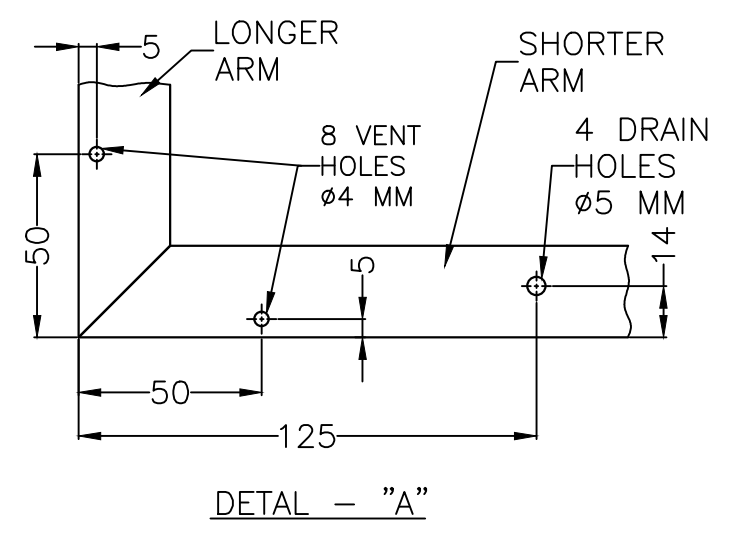
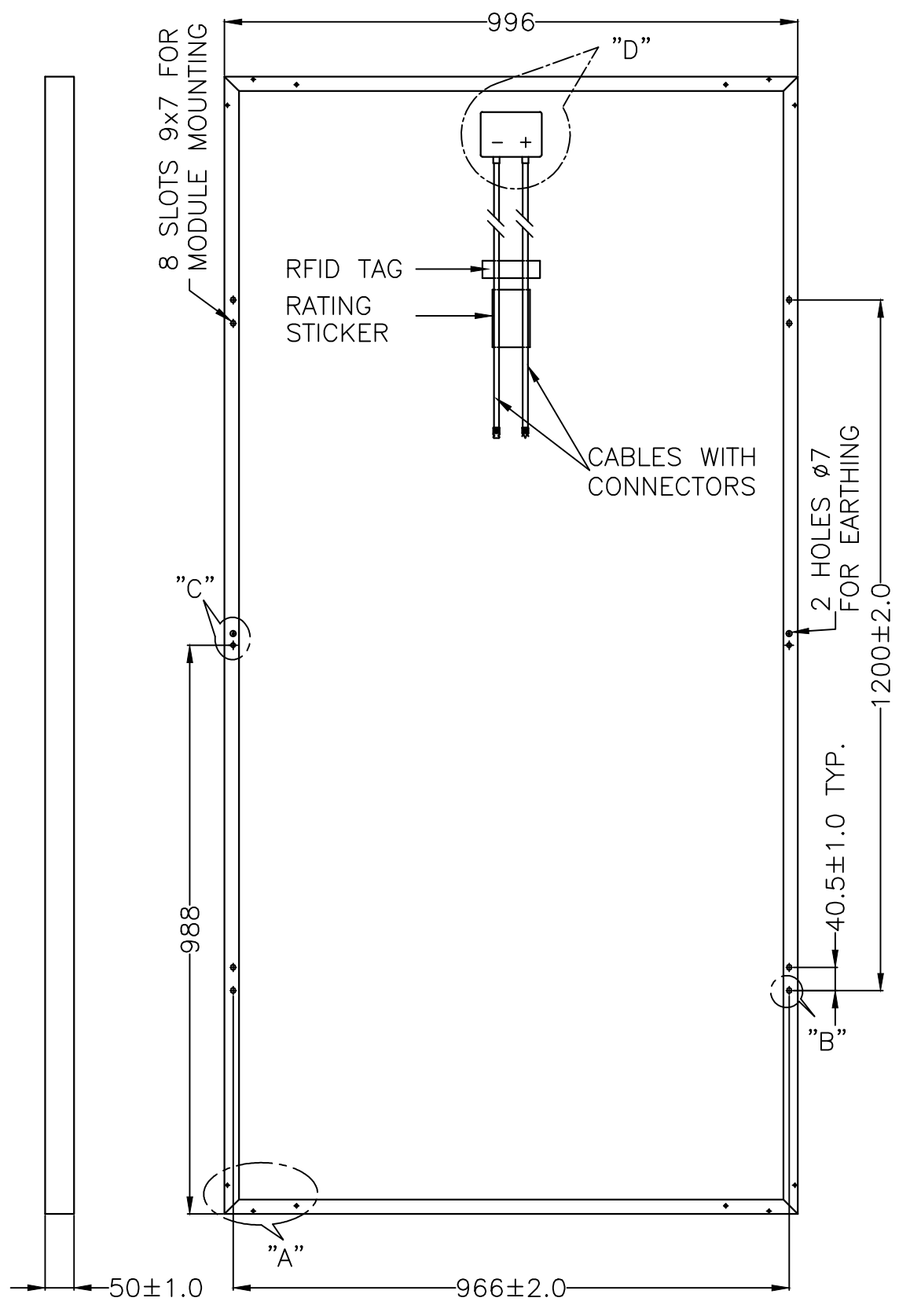
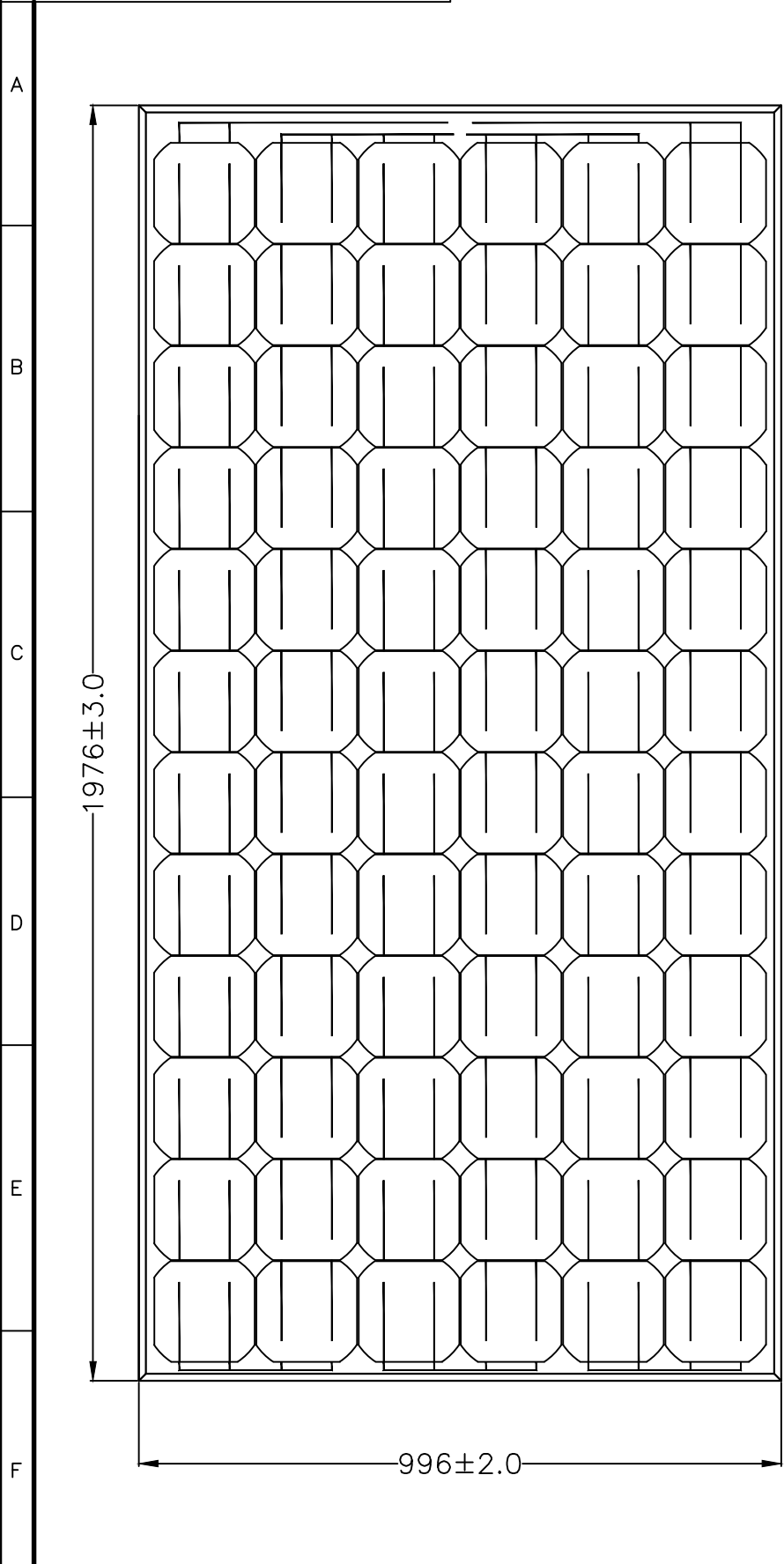



TYPE OF PRODUCT OR NAME OF CUSTOMER/PROJECT						
BHARAT HEAVY ELECTRICALS LIMITED. ELECTRONICS DIVISION, BANGALORE	DRN	SAN	Sd/-	290811	No. OF VAR	
	CKD	NAR	Sd/-	290811		
	APPD	SR	Sd/-	290811		
DEPT. SC&PV	FOR UNSPECIFIED-TOLERANCES REFER ED 0230499	SCALE 1 : 10	WEIGHT(Kg)	REF. TO ASSY. DRG.	ITEM NO.	No. OF ITEM
CODE 439						
TITLE PHOTOVOLTAIC MODULE-L20220 156mm Mono Solar Cell (Corner Block Type)			DRAWING NO. 3 679 02 00351		REV. 01	
			SHEET NO. 01		NO. OF SHEETS 01	

REV.	DATE	ALTERED CHECKED APPROVED	REV.	DATE	ALTERED CHECKED APPROVED	REV.	DATE	ALTERED CHECKED APPROVED
			01	071012	SAN CHECKED SR APPROVED SR	00		
			DIM 50±1.0 WAS 50±0.1			FIRST ISSUE		

COPYRIGHT AND CONFIDENTIAL

THE INFORMATION ON THIS DOCUMENT IS THE PROPERTY OF BHARAT HEAVY ELECTRICALS LTD. IT MUST NOT BE USED DIRECTLY OR INDIRECTLY IN ANY WAY DETRIMENTAL TO THE INTEREST OF THE COMPANY.



REV.	DATE	ALTERED	SAN	REV.	DATE	ALTERED	NAME	SIGN	DATE		
01	071012	CHECKED	SR	00		CHECKED					
		APPROVED	SR			APPROVED					
DIM 50±1.0 WAS 50±0.1		FIRST ISSUE		DRAWN	SAN	Sd/-	020911				
				CHECKED	NAR	Sd/-	020911			DEPT.	CODE
				APPROVED	SR	Sd/-	020911			SCPV	439

BHARAT HEAVY ELECTRICALS LIMITED. ELECTRONICS DIVISION, BANGALORE		CARD CODE
TITLE: PHOTOVOLTAIC MODULE - L24270 156 mm MONO SOLAR CELLS (Corner Block Type)		No. OF SHTS 01
M.O. No.		SHT No. 01
DRG. No. 3 679 02 00352		REV 01



**PRODUCT STANDARD
ELECTRONICS DIVISION**

CD-4-4001- 114

REV. 00

A4-10

PAGE 01 OF 01

TECHNICAL SPECIFICATION FOR PV MODULE L24270 (24 V, 280 WATTS)

- 1. PV MODULE TYPE NO. : L24270
- 2. CONFIGURATION : SINGLE GLASS LAMINATED TYPE WITH
72 NOS OF 156-mm MONO
CRYSTALLINE SILICON SOLAR CELLS (12*6)
IN SERIES CONFIGURATION
- 3. OVERALL SIZE : 1976 (±3) * 996 (±2) * 50 (±1) mm
- 4. WEIGHT : 25 Kg. (Typ.)
- 5. PV MODULE FRAME MATERIAL : ANODISED ALUMINIUM
- 6. JUNCTION BOX : IP65 GRADE JUNCTION BOX WITH CABLES
AND CONNECTORS
- 7. RFID Tag : As per JNNSM Guidelines
- 8. TYPICAL ELECTRICAL CHARACTERISTICS:
 - 8.1 OPEN CIRCUIT VOLTAGE (Voc) : 43.0 V
 - 8.2 SHORT CIRCUIT CURRENT (Isc) : 8.5 A
 - 8.3 VOLTAGE AT PEAK POWER POINT (Vmp) : 35 V
 - 8.4 CURRENT AT PEAK POWER POINT (Imp) : 8.0 A
 - 8.5 PEAK POWER OUTPUT (Pmax.) : 280 W ± 20 W
 - 8.6 CELL EFFICIENCY AT MODULE LEVEL : 16.3 %
 - 8.7 OVERALL MODULE EFFICIENCY : 14.3 %
 - 8.8 FILL FACTOR : 0.75

NOTE:

- 1. Electrical specifications mentioned above are at Standard Test Conditions of 100 mW/sq. cm solar insolation (AM 1.5) and at 25 deg C temperature.
- 2. Measurement repeatability of peak power output: ± 3 %

REFER MODULE DRAWING NO. : 3-679-02-00352

REVISION: (00)

APPROVED BY:

SR

PREPARED

ISSUED

DATE

SM

Engg.

26.03.2013

COPY RIGHT AND CONFIDENTIAL

The information on this document is the property of Bharat Heavy Electrical Limited. It must not be used directly or indirectly in anyway detrimental to the interest of the company.



**PRODUCT STANDARD
ELECTRONICS DIVISION**

CD-4-4001-115

REV. 00

A4-10

PAGE 01 OF 01

TECHNICAL SPECIFICATION FOR PV MODULE L20220 (20 V, 230 WATTS)

- 1. PV MODULE TYPE NO. : L20220
- 2. CONFIGURATION : SINGLE GLASS LAMINATED TYPE WITH 60 NOS. OF 156-mm MONO CRYSTALLINE SILICON SOLAR CELLS (10*6) IN SERIES CONFIGURATION
- 3. OVERALL SIZE : 1656 (±3) * 996 (±2) * 50 (±1) mm
- 4. WEIGHT : 20 Kg. (Typ.)
- 5. PV MODULE FRAME MATERIAL : ANODISED ALUMINIUM
- 6. JUNCTION BOX : IP65 GRADE JUNCTION BOX WITH CABLES AND CONNECTORS
- 7. RFID Tag : As per JNNSM Guidelines
- 8. TYPICAL ELECTRICAL CHARACTERISTICS:
 - 8.1 OPEN CIRCUIT VOLTAGE (Voc) : 36.0 V
 - 8.2 SHORT CIRCUIT CURRENT (Isc) : 8.5 A
 - 8.3 VOLTAGE AT PEAK POWER POINT (Vmp) : 29 V
 - 8.4 CURRENT AT PEAK POWER POINT (Imp) : 7.94 A
 - 8.5 PEAK POWER OUTPUT (Pmax.) : 230 W ± 20 W
 - 8.6 CELL EFFICIENCY AT MODULE LEVEL : 16.1 %
 - 8.7 OVERALL MODULE EFFICIENCY : 14.0 %
 - 8.8 FILL FACTOR : 0.75

NOTE:

- 1. Electrical specifications mentioned above are at Standard Test Conditions of 100 mW/sq. cm solar insolation (AM 1.5) and at 25 deg C temperature.
- 2. Measurement repeatability of peak power output: ± 3 %

REFER MODULE DRAWING NO. : 3-679-02-00351

COPY RIGHT AND CONFIDENTIAL

The information on this document is the property of Bharat Heavy Electrical Limited. It must not be used directly or indirectly in anyway detrimental to the interest of the company.

Rev (00)

APPROVED BY :

SR

PREPARED

ISSUED

DATE

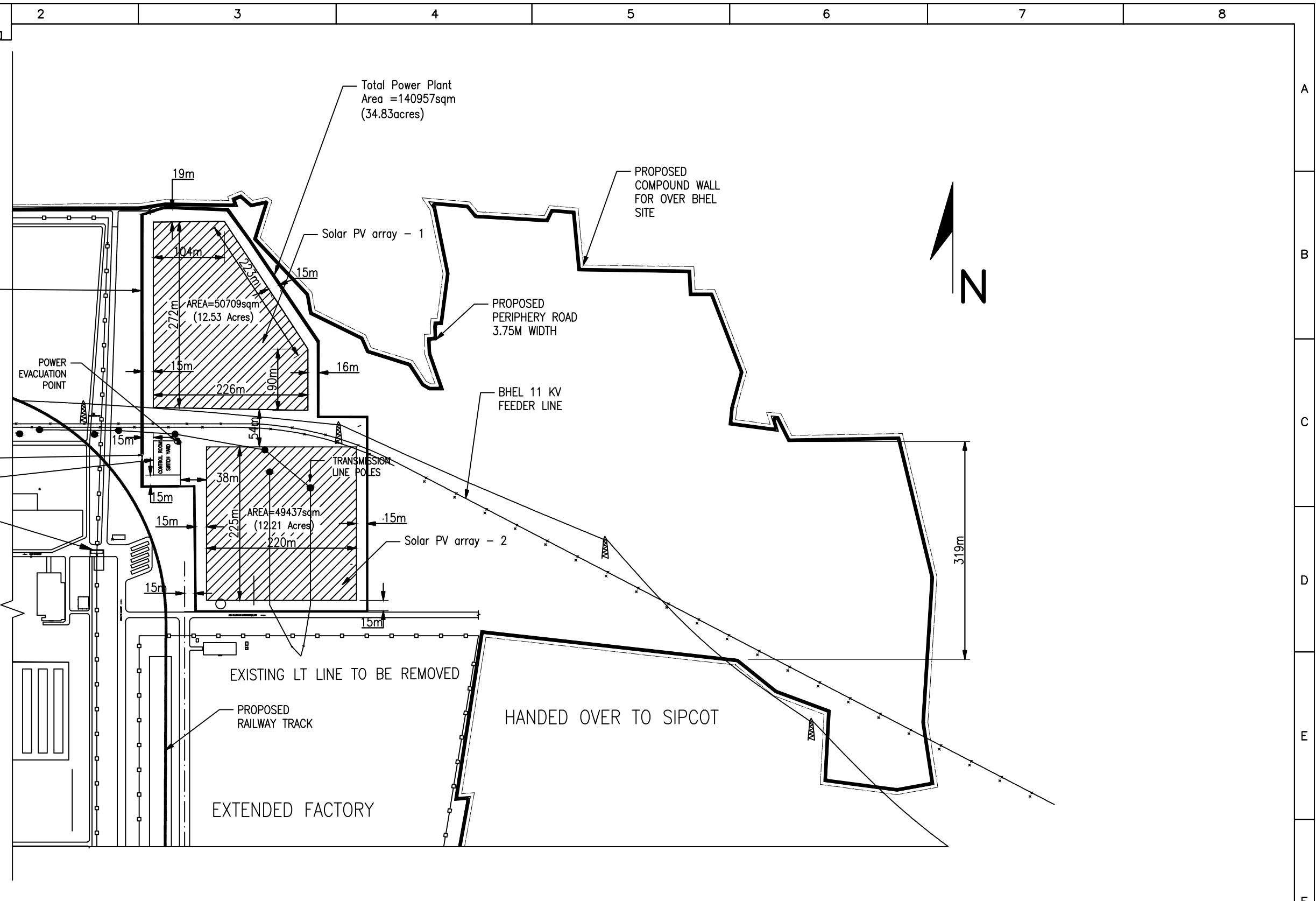
SM

Engg.

26.03.2013


COPYRIGHT AND CONFIDENTIAL
THE INFORMATION ON THIS DOCUMENT IS THE PROPERTY OF BHARAT HEAVY ELECTRICALS LTD. IT MUST NOT BE USED DIRECTLY OR INDIRECTLY IN ANY WAY DETRIMENTAL TO THE INTEREST OF THE COMPANY.

DRG. No. 3-679-05-00620

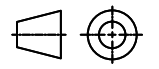


PROJECT NAME : SPV POWER PLANT
CUSTOMER NAME : BAP BHEL RANIPET

REV.	DATE	ALTERED	MANI	REV.	DATE	ALTERED	MANI	REV	NAME	SIGN	DATE
02	200413	CHECKED	HCS	01	160413	CHECKED	HCS	02			
		APPROVED	NHK			APPROVED	NHK				
Compound wall shifted by 15Mtr from centerline of extended factory road based on BAP feedback				Revised based on BAP feedback				DRAWN	MANI		160413
								CHECKED	HCS		160413
								APPROVED	NHK		160413



DEPT. SC&PV
CODE 439



BHARAT HEAVY ELECTRICALS LIMITED.
ELECTRONICS DIVISION, BANGALORE

TITLE: LAYOUT OF 5 MWp SPV POWER PLANT AT BAP BHEL RANIPET

No. OF SHEETS: 01
SHEET No.: 01

WBS. No. _____ DRG. No. 3-679-05-00620 REV 02

REF. DRG. No. _____
SIGN. & DATE _____
INVENTORY No. _____

8. ABSTRACT OF SBC CALCULATIONS:

The summary of safe bearing capacity calculated is presented as follows:

Sl. No.	Depth	SBC in T/sqm									
		BH 1	BH 2	BH 3	BH 4	BH 5	BH 6	BH 7	BH 8	BH 9	BH 10
1	1.00 m	18.22	17.06	15.42	18.78	16.84	19.82	13.34	15.52	14.05	15.85
2	2.00 m	31.86	29.89	28.50	30.57	27.26	33.61	27.91	32.69	29.56	30.95

Station : Madurai

Date : 13.05.13

for COS CONSULTANCY SERVICES

SUMMARY OF LAB TEST RESULTS

TABLE: 1B

Name of Project: Sub Soil Investigation for Proposed Construction of **5MWp Solar Power Plant site BAP BHEL Ranipet, Vellore dist, Tamil Nadu**

BH No : 2

Depth of soil (m)		Soil Description (Visual Identification)	Grain Size Analysis (%)					Index Properties (%)				Bulk Density (KN/m ³)	In Situ Dry Density (KN/m ³)	Void ratio	Specific Gravity	UCC Strength (KN/m ²) (Cohesion "C")	Direct shear			
From	To		Gravel	Coarse Sand	Medium Sand	Fine Sand	Silt & Clay	NMC	Liquid Limit (W _L)	Plastic Limit (W _P)	Plasticity Index (I _P)						Cohesion "C" in (KN/m ²)	Angle of friction (ϕ)	Yd	Yw
0.00	1.00	Yellow colored Silty sand	20.10	14.20	21.80	18.50	25.40	14	-	-	-	18.60	16.32	0.50	2.44	-	0.00	28.5	1.63	1
1.00	2.00	Yellow colored Silty sand(Residual soil)	11.10	18.80	27.50	22.40	20.20	10	-	-	-	18.71	17.01	0.46	2.49	-	0.00	31.5	1.70	
2.00	3.00	Yellow colored Sand mixed gravel (Residual soil)	20.30	17.80	26.60	19.60	15.70	5	-	-	-	18.58	17.70	0.38	2.44	-	0.00	31.5	1.77	
3.00	4.00	Completely weathered rock	Crushing Strength of Completely weathered rock is 112.50 T/m ²									19.00	19.00	-	-	-	0.00	31.0		

SUMMARY OF LAB TEST RESULTS

TABLE: 1C

Name of Project: Sub Soil Investigation for Proposed Construction of **5MWp Solar Power Plant site BAP BHEL Ranipet, Vellore dist, Tamil Nadu**

BH No : 3

Depth of soil (m)		Soil Description (Visual Identification)	Grain Size Analysis (%)					Index Properties (%)				Bulk Density (KN/m ³)	In Situ Dry Density (KN/m ³)	Void ratio	Specific Gravity	UCC Strength (KN/m ²) (Cohesion "C")	Direct shear		Yd	Yw
From	To		Gravel	Coarse Sand	Medium Sand	Fine Sand	Silt & Clay	NMC	Liquid Limit (WL)	Plastic Limit (WP)	Plasticity Index (IP)						Cohesion "C" in (KN/m ²)	Angle of friction (φ)		
0.00	1.00	Brown colored Sand mixed siltyclay	2.30	3.30	17.90	30.40	46.10	13	18.60	14.98	3.62	19.00	16.81	0.49	2.50	28	-	27.0	1.68	1
1.00	2.00	White colored Siltysand (Residual soil)	7.40	4.10	31.50	25.10	31.90	9	-	-	-	18.15	16.65	0.45	2.41	-	0.00	31.0	1.67	
2.00	3.00		10.20	10.60	33.40	20.20	25.60	13	-	-	-	19.23	17.02	0.40	2.39	-	0.00	30.5	1.70	
3.00	5.00	Completely weathered rock	Crushing Strength of Completely weathered rock is 117.50 T/m ²									19.50	19.50	-	-	-	0.00	31.0		

SUMMARY OF LAB TEST RESULTS

TABLE: 1D

Name of Project: Sub Soil Investigation for Proposed Construction of **5MWp Solar Power Plant site BAP BHEL Ranipet, Vellore dist, Tamil Nadu**

BH No : 4

Depth of soil (m)		Soil Description (Visual Identification)	Grain Size Analysis (%)					Index Properties (%)				Bulk Density (KN/m ³)	In Situ Dry Density (KN/m ³)	Void ratio	Specific Gravity	UCC Strength (KN/m ²) (Cohesion "C")	Direct shear			
From	To		Gravel	Coarse Sand	Medium Sand	Fine Sand	Silt & Clay	NMC	Liquid Limit (W _L)	Plastic Limit (W _P)	Plasticity Index (I _P)						Cohesion "C" in (KN/m ²)	Angle of friction (ϕ)	Yd	Yw
0.00	1.00	Brown colored Siltysand (Residual soil)	10.40	10.70	31.30	21.90	25.70	13	-	-	-	18.70	16.55	0.54	2.55	-	0.00	32.0	1.65	1
1.00	2.00	Brown colored Sand mixed gravel (Residual soil)	38.30	15.90	23.30	14.20	8.30	5	-	-	-	18.65	17.76	0.43	2.54	-	0.00	32.5	1.78	
2.00	3.00	Brown colored Gravel mixed sand (Residual soil)	55.40	8.60	15.60	13.20	7.20	6	-	-	-	19.40	18.30	0.32	2.41	-	0.00	31.0	1.83	
3.00	4.00	Completely weathered rock	Crushing Strength of Completely weathered rock is 110 T/m ²									18.87	18.87	-	-	-	0.00	31.0		

SUMMARY OF LAB TEST RESULTS

TABLE: 1E

Name of Project: Sub Soil Investigation for Proposed Construction of **5MWp Solar Power Plant site BAP BHEL Ranipet, Vellore dist, Tamil Nadu**

BH No : 5

Depth of soil (m)		Soil Description (Visual Identification)	Grain Size Analysis (%)					Index Properties (%)				Bulk Density (KN/m ³)	In Situ Dry Density (KN/m ³)	Void ratio	Specific Gravity	UCC Strength (KN/m ²) (Cohesion "C")	Direct shear		Yd	Yw
From	To		Gravel	Coarse Sand	Medium Sand	Fine Sand	Silt & Clay	NMC	Liquid Limit (W _L)	Plastic Limit (W _P)	Plasticity Index (I _P)						Cohesion "C" in (KN/m ²)	Angle of friction (φ)		
0.00	1.00	Gray colored Sand mixed gravel (Residual soil)	41.30	19.20	27.80	7.40	4.30	15	-	-	-	18.60	16.17	0.60	2.59	-	0.00	31.0	1.62	1
1.00	2.00	Gray colored Gravel mixed sand (Residual soil)	54.30	10.10	17.80	10.00	7.80	7	-	-	-	18.56	17.35	0.50	2.60	-	0.00	31.5	1.73	
2.00	3.00	Gray colored Sand mixed gravel (Residual soil)	35.00	14.60	24.00	14.60	11.80	9	-	-	-	18.75	17.20	0.52	2.61	-	0.00	30.5	1.72	
3.00	5.50	Completely weathered rock	Crushing Strength of Completely weathered rock is 112.50 T/m ²									19.10	19.10	-	-	-	0.00	31.0		

SUMMARY OF LAB TEST RESULTS

TABLE: 1F

Name of Project: Sub Soil Investigation for Proposed Construction of **5MWp Solar Power Plant site BAP BHEL Ranipet, Vellore dist, Tamil Nadu**

BH No : 6

Depth of soil (m)		Soil Description (Visual Identification)	Grain Size Analysis (%)					Index Properties (%)				Bulk Density (KN/m ³)	In Situ Dry Density (KN/m ³)	Void ratio	Specific Gravity	UCC Strength (KN/m ²) (Cohesion "C")	Direct shear			
From	To		Gravel	Coarse Sand	Medium Sand	Fine Sand	Silt & Clay	NMC	Liquid Limit (W _L)	Plastic Limit (W _P)	Plasticity Index (I _P)						Cohesion "C" in (KN/m ²)	Angle of friction (φ)	Yd	Yw
0.00	1.00	Brown colored Sand mixed gravel (Residual soil)	25.70	12.20	31.80	23.40	6.90	14	-	-	-	19.00	16.67	0.45	2.42	-	0	32.0	1.67	1
1.00	2.00	Brown colored Sand (Residual soil)	7.40	9.70	40.10	34.20	8.60	19	-	-	-	20.60	17.31	0.40	2.43	-	0	31.5	1.73	
2.00	3.00		10.30	7.50	37.00	37.30	7.90	15	-	-	-	19.87	17.28	0.44	2.48	-	0	31.5	1.73	
3.00	5.00	Completely weathered rock	Crushing Strength of Completely weathered rock is 125 T/m ²									19.62	19.62	-	-	-	0.00	31.5		

SUMMARY OF LAB TEST RESULTS

TABLE: 1G

Name of Project: Sub Soil Investigation for Proposed Construction of **5MWp Solar Power Plant site BAP BHEL Ranipet, Vellore dist, Tamil Nadu**

BH No : 7

Depth of soil (m)		Soil Description (Visual Identification)	Grain Size Analysis (%)					Index Properties (%)				Bulk Density (KN/m ³)	In Situ Dry Density (KN/m ³)	Void ratio	Specific Gravity	UCC Strength (KN/m ²) (Cohesion "C")	Direct shear		Yd	Yw
From	To		Gravel	Coarse Sand	Medium Sand	Fine Sand	Silt & Clay	NMC	Liquid Limit (WL)	Plastic Limit (WP)	Plasticity Index (Ip)						Cohesion "C" in (KN/m ²)	Angle of friction (φ)		
0.00	1.00	Brown colored Siltyclay mixed sand	0.40	0.80	9.90	37.20	51.70	15	19.10	15.10	4.00	16.20	14.09	0.81	2.64	39	-	25.0	1.41	1
1.00	2.00	Brown colored Sand mixed gravel	41.20	11.00	20.80	14.20	12.80	8	-	-	-	20.10	18.61	0.37	2.55	-	0	30.5	1.86	
2.00	3.00	Brown colored Sand (Residual soil)	0.40	15.40	57.00	17.70	9.50	10	-	-	-	19.00	17.27	0.48	2.56	-	0	30.5	1.73	
3.00	5.00	Completely weathered rock	Crushing Strength of Completely weathered rock is 120 T/m ²									19.75	19.75	-	-	-	0.00	31.0		

SUMMARY OF LAB TEST RESULTS

TABLE: 1H

Name of Project: Sub Soil Investigation for Proposed Construction of **5MWp Solar Power Plant site BAP BHEL Ranipet, Vellore dist, Tamil Nadu**

BH No : 8

Depth of soil (m)		Soil Description (Visual Identification)	Grain Size Analysis (%)					Index Properties (%)				Bulk Density (KN/m ³)	In Situ Dry Density (KN/m ³)	Void ratio	Specific Gravity	UCC Strength (KN/m ²) (Cohesion "C")	Direct shear		Yd	Yw
From	To		Gravel	Coarse Sand	Medium Sand	Fine Sand	Silt & Clay	NMC	Liquid Limit (WL)	Plastic Limit (WP)	Plasticity Index (Ip)						Cohesion "C" in (KN/m ²)	Angle of friction (φ)		
0.00	1.00	Red colored Silty sand	25.40	11.80	18.50	15.70	28.60	13	-	-	-	18.90	16.73	0.46	2.44	-	0	31.0	1.67	1
1.00	2.00	Gray colored Gravel (Residual soil)	65.30	2.60	8.20	12.60	11.30	7	-	-	-	20.14	18.82	0.39	2.62	-	0	32.0	1.88	
2.00	3.00	Red colored Sand mixed gravel (Residual soil)	20.50	24.00	34.00	11.60	9.90	14	-	-	-	19.55	17.15	0.50	2.58	-	0	31.5	1.71	
3.00	5.00	Completely weathered rock	Crushing Strength of Completely weathered rock is 122.50 T/m ²									19.30	19.30	-	-	-	0.00	31.5		

SUMMARY OF LAB TEST RESULTS

TABLE: 11

Name of Project: Sub Soil Investigation for Proposed Construction of **5MWp Solar Power Plant site BAP BHEL Ranipet, Vellore dist, Tamil Nadu**

BH No : 9

Depth of soil (m)		Soil Description (Visual Identification)	Grain Size Analysis (%)					Index Properties (%)				Bulk Density (KN/m ³)	In Situ Dry Density (KN/m ³)	Void ratio	Specific Gravity	UCC Strength (KN/m ²) (Cohesion "C")	Direct shear		Yd	Yw
From	To		Gravel	Coarse Sand	Medium Sand	Fine Sand	Silt & Clay	NMC	Liquid Limit (W _L)	Plastic Limit (W _P)	Plasticity Index (I _P)						Cohesion "C" in (KN/m ²)	Angle of friction (φ)		
0.00	1.00	Light yellow colored Sand mixed gravel	38.90	13.90	19.70	13.90	13.60	15	-	-	-	18.90	16.43	0.64	2.69	-	0	31.0	1.64	1
1.00	2.00	Light yellow colored Gravel mixed sand (Residual soil)	47.10	13.10	17.30	10.80	11.70	12	-	-	-	19.55	17.46	0.55	2.70	-	0	31.5	1.75	
2.00	3.00	Light yellow colored Sand mixed gravel (Residual soil)	36.50	24.10	24.70	6.60	8.10	15	-	-	-	19.64	17.08	0.53	2.61	-	0	30.5	1.71	
3.00	6.50	Completely weathered rock	Crushing Strength of Completely weathered rock is 110 T/m ²									18.87	18.87	-	-	-	0.00	31.0		



Name of Project : Sub Soil Investigation for Proposed Construction of **5MWp Solar Power Plant site BAP BHEL Ranipet, Vellore dist, Tamil Nadu**

Bore Hole No.	1
Type of Boring	Rotary
Started on	21.04.13
Ended on	21.04.13

Depth of Water Table	2.00 m
Dia of Boring	150 mm
Total depth	10.00 m
RL of Ground level	198.85 m

Reduced level (m)	Soil Profiles	Description of Soil (Visual Identification)	Depth (m)	Type	15	30	45	N	Graphical Representation of SPT	Type of Samples
198.55		Yellowish Red colored Gravel mixed sand	0.30							UDS
197.85		Yellowish white colored Sand (Residual soil)	1.00	SPT	5cm Penet for 50 blows			>100		DS
196.85		Completely weathered rock	2.00	SPT	2cm Penet for 50 blows			>100		DS
193.35			5.50	SPT	SPT Hammer Rebound			>100		DS
191.85		Dolostone	7.00	SPT	SPT Hammer Rebound			>100		DS
190.35			8.50	SPT	SPT Hammer Rebound			>100		DS
188.85			10.00	SPT	SPT Hammer Rebound			>100		DS

Bore Hole is Terminated at a depth of 10.00 m Below G.L

DS - Disturbed soil sample

UDS - Undisturbed soil sample

Fig 2. Soil Profile at Bore Hole - 1 Location



Name of Project : Sub Soil Investigation for Proposed Construction of **5MWp Solar Power Plant site BAP BHEL Ranipet, Vellore dist, Tamil Nadu**

Bore Hole No.	2
Type of Boring	Rotary
Started on	22.04.13
Ended on	22.04.13

Depth of Water Table	0.50 m
Dia of Boring	150 mm
Total depth	4.00 m
RL of Ground level	198.94 m

Reduced level (m)	Soil Profiles	Description of Soil (Visual Identification)	Depth (m)	Type	15	30	45	N	Graphical Representation of SPT N Values	Type of Samples
198.64		Yellowish red colored Sand mixed gravel	0.30							UDS
197.94		Yellow colored Silty sand	1.00	SPT	14	23	28	51		DS
196.94		Yellow colored Silty sand(Residual soil)	2.00	SPT	9cm Penet for 50 blows			>100		DS
195.94		Yellow colored Sand mixed gravel (Residual soil)	3.00	SPT	8cm Penet for 50 blows			>100		DS
194.44		Completely weathered rock	4.50	SPT	SPT Hammer Rebound			>100		DS
192.94			6.00	SPT	SPT Hammer Rebound			>100		DS

Bore Hole is Terminated at a depth of 6.00 m Below G.L

DS - Disturbed soil sample

UDS - Undisturbed soil sample

Fig 2. Soil Profile at Bore Hole - 2 Location



Name of Project : Sub Soil Investigation for Proposed Construction of **5MWp Solar Power Plant site BAP BHEL Ranipet, Vellore dist, Tamil Nadu**

Bore Hole No.	3
Type of Boring	Rotary
Started on	22.04.13
Ended on	22.04.13

Depth of Water Table	1.80 m
Dia of Boring	150 mm
Total depth	5.00 m
RL of Ground level	196.34 m

Reduced level (m)	Soil Profiles	Description of Soil (Visual Identification)	Depth (m)	Type	SPT			N	Type of Samples
					15	30	45		
196.04	[Pattern]	Brown colored Siltyclay mixed sand	0.30					UDS	
195.34		Brown colored Sand mixed siltyclay	1.00	SPT	9	9	18	27	DS
194.34	[Pattern]	White colored Siltysand (Residual soil)	2.00	SPT	9cm Penet for 50 blows			>100	DS
193.34			3.00	SPT	4cm Penet for 50 blows			>100	DS
191.84	[Pattern]	Completely weathered rock	4.50	SPT	SPT Hammer Rebound			>100	DS
190.34			6.00	SPT	SPT Hammer Rebound			>100	DS

Bore Hole is Terminated at a depth of 6.00 m Below G.L

DS - Disturbed soil sample

UDS - Undisturbed soil sample

Fig 2. Soil Profile at Bore Hole – 3 Location



Name of Project : Sub Soil Investigation for Proposed Construction of **5MWp Solar Power Plant site BAP BHEL Ranipet, Vellore dist, Tamil Nadu**

Bore Hole No.	4
Type of Boring	Rotary
Started on	23.04.13
Ended on	23.04.13

Depth of Water Table	1.50 m
Dia of Boring	150 mm
Total depth	4.00 m
RL of Ground level	195.89 m

Reduced level (m)	Soil Profiles	Description of Soil (Visual Identification)	Depth (m)	Type	SPT				Type of Samples
					15	30	45	N	
195.59		Brown colored Sand mixed siltyclay	0.30						UDS
194.89		Brown colored Silty sand (Residual soil)	1.00	SPT	10cm Penet for 50 blows			>100	DS
193.89		Brown colored Sand mixed gravel (Residual soil)	2.00	SPT	8cm Penet for 50 blows			>100	DS
192.89		Brown colored Gravel mixed sand (Residual soil)	3.00	SPT	8cm Penet for 50 blows			>100	DS
191.39		Completely weathered rock	4.50	SPT	SPT Hammer Rebound			>100	DS
189.89			6.00	SPT	SPT Hammer Rebound			>100	DS

Bore Hole is Terminated at a depth of 6.00 m Below G.L

DS - Disturbed soil sample

UDS - Undisturbed soil sample

Fig 2. Soil Profile at Bore Hole – 4 Location



Name of Project : Sub Soil Investigation for Proposed Construction of **5MWp Solar Power Plant site BAP BHEL Ranipet, Vellore dist, Tamil Nadu**

Bore Hole No.	5
Type of Boring	Rotary
Started on	23.04.13
Ended on	23.04.13

Depth of Water Table	1.80 m
Dia of Boring	150 mm
Total depth	5.50 m
RL of Ground level	196.88 m

Reduced level (m)	Soil Profiles	Description of Soil (Visual Identification)	Depth (m)	Type	15	30	45	N	Graphical Representation of SPT N Values	Type of Samples
196.58		Brown colored Sand mixed siltyclay	0.30							UDS
195.88		Gray colored Sand mixed gravel (Residual soil)	1.00	SPT	35	11cm Penet for 50 blows		>100		DS
194.88		Gray colored Gravel mixed sand (Residual soil)	2.00	SPT	27	45	50/8cm	>100		DS
193.88		Gray colored Sand mixed gravel (Residual soil)	3.00	SPT	11cm Penet for 50 blows			>100		DS
192.38		Completely weathered rock	4.50	SPT	SPT Hammer Rebound			>100		DS
190.88			6.00	SPT	SPT Hammer Rebound			>100		DS

Bore Hole is Terminated at a depth of 6.00 m Below G.L

DS - Disturbed soil sample

UDS - Undisturbed soil sample

Fig 2. Soil Profile at Bore Hole – 5 Location



Name of Project : Sub Soil Investigation for Proposed Construction of **5MWp Solar Power Plant site BAP BHEL Ranipet, Vellore dist, Tamil Nadu**

Bore Hole No.	6
Type of Boring	Rotary
Started on	24.04.13
Ended on	24.04.13

Depth of Water Table	1.20 m
Dia of Boring	150 mm
Total depth	5.00 m
RL of Ground level	199.86 m

Reduced level (m)	Soil Profiles	Description of Soil (Visual Identification)	Depth (m)	Type	15	30	45	N	Graphical Representation of SPT N Values	Type of Samples	
199.56		Yellowish white colored Sand	0.30								UDS
198.86		Brown colored Sand mixed gravel (Residual soil)	1.00	SPT	6cm Penet for 50 blows			>100			DS
197.86		Completely weathered rock	2.00	SPT	6cm Penet for 50 blows			>100			DS
196.86			3.00	SPT	5cm Penet for 50 blows			>100			DS
195.36		Dolostone	4.50	SPT	SPT Hammer Rebound			>100			DS
193.86			6.00	SPT	SPT Hammer Rebound			>100			DS

Bore Hole is Terminated at a depth of 6.00 m Below G.L

DS - Disturbed soil sample

UDS - Undisturbed soil sample

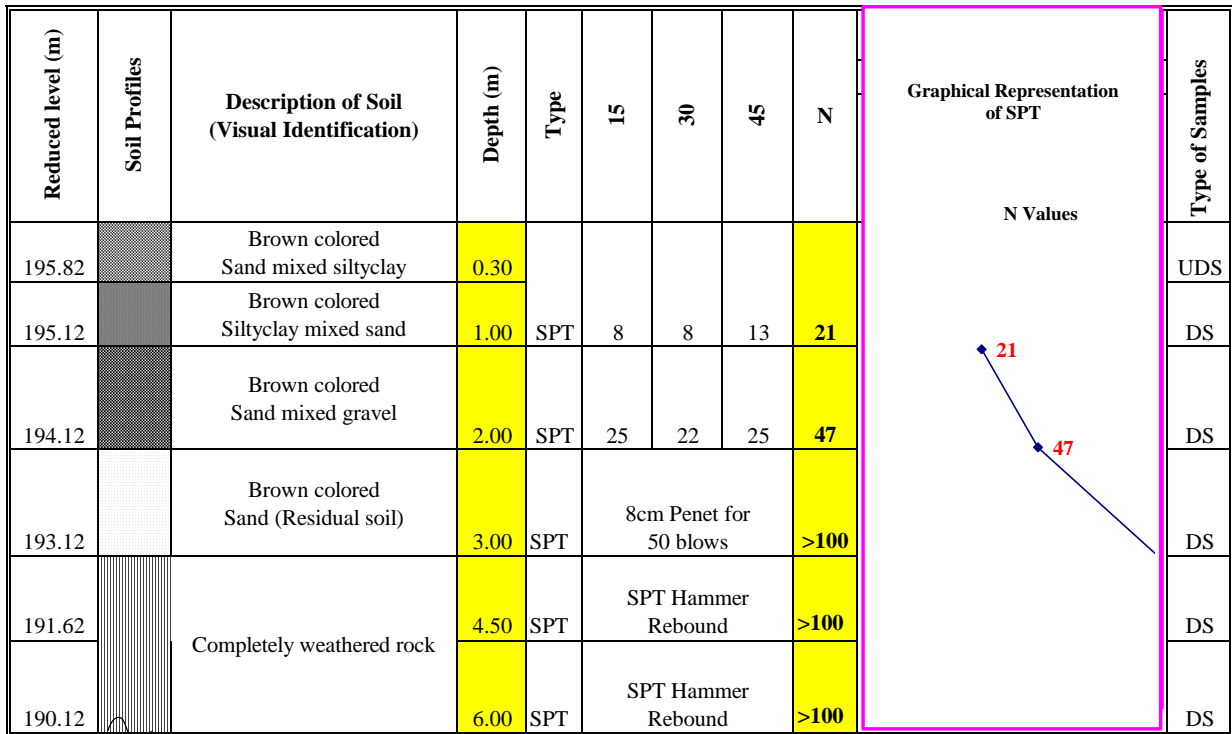
Fig 2. Soil Profile at Bore Hole – 6 Location



Name of Project : Sub Soil Investigation for Proposed Construction of **5MWp Solar Power Plant site BAP BHEL Ranipet, Vellore dist, Tamil Nadu**

Bore Hole No.	7
Type of Boring	Rotary
Started on	24.04.13
Ended on	24.04.13

Depth of Water Table	0.70 m
Dia of Boring	150 mm
Total depth	5.00 m
RL of Ground level	196.12 m



Bore Hole is Terminated at a depth of 6.00 m Below G.L

DS - Disturbed soil sample

UDS - Undisturbed soil sample

Fig 2. Soil Profile at Bore Hole – 7 Location



Name of Project : Sub Soil Investigation for Proposed Construction of **5MWp Solar Power Plant site BAP BHEL Ranipet, Vellore dist, Tamil Nadu**

Bore Hole No.	8
Type of Boring	Rotary
Started on	25.04.13
Ended on	25.04.13

Depth of Water Table	2.00 m
Dia of Boring	150 mm
Total depth	5.00 m
RL of Ground level	198.55 m

Reduced level (m)	Soil Profiles	Description of Soil (Visual Identification)	Depth (m)	Type	SPT				Graphical Representation of SPT	Type of Samples
					15	30	45	N		
198.25		Red colored Sand mixed siltyclay	0.30							UDS
197.55		Red colored Silty sand	1.00	SPT	11	24	28	52		DS
196.55		Gray colored Gravel (Residual soil)	2.00	SPT	6cm Penet for 50 blows			>100		DS
195.55		Red colored Sand mixed gravel (Residual soil)	3.00	SPT	5cm Penet for 50 blows			>100		DS
194.05		Completely weathered rock	4.50	SPT	SPT Hammer Rebound			>100		DS
192.55			6.00	SPT	SPT Hammer Rebound			>100		DS

Bore Hole is Terminated at a depth of 6.00 m Below G.L

DS - Disturbed soil sample

UDS - Undisturbed soil sample

Fig 2. Soil Profile at Bore Hole – 8 Location



Name of Project : Sub Soil Investigation for Proposed Construction of **5MWp Solar Power Plant site BAP BHEL Ranipet, Vellore dist, Tamil Nadu**

Bore Hole No.	9
Type of Boring	Rotary
Started on	25.04.13
Ended on	25.04.13

Depth of Water Table	0.70 m
Dia of Boring	150 mm
Total depth	6.50 m
RL of Ground level	199.15 m

Reduced level (m)	Soil Profiles	Description of Soil (Visual Identification)	Depth (m)	Type	SPT				Graphical Representation of SPT N Values	Type of Samples
					15	30	45	N		
198.85		Brown colored Gravel	0.30						UDS	
198.15		Light yellow colored Sand mixed gravel	1.00	SPT	6	15	30	45	DS	
197.15		Light yellow colored Gravel mixed sand (Residual soil)	2.00	SPT	26	10cm Penet for 50 blows		>100	DS	
196.15		Light yellow colored Sand mixed gravel (Residual soil)	3.00	SPT	8cm Penet for 50 blows			>100	DS	
194.65		Completely weathered rock	4.50	SPT	SPT Hammer Rebound			>100	DS	
192.65			6.50	SPT	SPT Hammer Rebound			>100	DS	

Bore Hole is Terminated at a depth of 6.50 m Below G.L

DS - Disturbed soil sample

UDS - Undisturbed soil sample

Fig 2. Soil Profile at Bore Hole – 9 Location



Name of Project : Sub Soil Investigation for Proposed Construction of **5MWp Solar Power Plant site BAP BHEL Ranipet, Vellore dist, Tamil Nadu**

Bore Hole No.	10
Type of Boring	Rotary
Started on	26.04.13
Ended on	26.04.13

Depth of Water Table	0.50 m
Dia of Boring	150 mm
Total depth	6.50 m
RL of Ground level	196.73 m

Reduced level (m)	Soil Profiles	Description of Soil (Visual Identification)	Depth (m)	Type	15	30	45	N	Graphical Representation of SPT N Values	Type of Samples
196.43		Brown colored Sand mixed siltyclay	0.30							UDS
195.73		Yellow colored Sand mixed gravel (Residual soil)	1.00	SPT	6cm Penet for 50 blows			>100		DS
194.73		Dolostone	2.00	SPT	SPT Hammer Rebound			>100		DS
193.73		Completely weathered rock	3.00	SPT	SPT Hammer Rebound			>100		DS
192.23			4.50	SPT	SPT Hammer Rebound			>100		DS
190.23			6.50	SPT	SPT Hammer Rebound			>100		DS

Bore Hole is Terminated at a depth of 6.50 m Below G.L

DS - Disturbed soil sample

UDS - Undisturbed soil sample

Fig 2. Soil Profile at Bore Hole – 10 Location

TECHNICAL BID ENCLOSURE FOR COMPLIANCE OF QUOTE									
RFQ REF:HBS0000448 Dt.10.05.2013 DUE DATE(TECH BID) : 31.05.2013									
Sl No.	DESCRIPTION	QTY	UNIT	QUOTED	TAXES (TO BE QUOTED EXTRA)				REMARKS (TAX)
					ED %	CST %	VAT %	SERVICE TAX %	
1	PS0679031537: Supply of fixed type structures for 280Wp modules as per Clause No.3.1 of Tech Specification PS-439-825	1	Set	YES/NO				NA	EXTRA
2	PS0679031545: Supply of fixed type structures for 230Wp modules as per Clause No.3.2 of Tech Specification PS-439-825	1	Set	YES/NO				NA	EXTRA
3	PS0679031553: Supply of seasonal tilt type structures for 280Wp modules as per Clause No.3.3 of Tech Specification PS-439-825	1	Set	YES/NO				NA	EXTRA
4	PS0679031561: Supply of automatic single axis track structures for 280Wp modules as per Clause No.3.4 of Tech Specification PS-439-825	1	Set	YES/NO				NA	EXTRA
5	I&C of fixed type structures for 280Wp modules as per Clause No.3.5 of Tech Specification PS-439-825	1	AU	YES/NO	NA	NA	NA		EXTRA
6	I&C of fixed type structures for 230Wp modules as per Clause No.3.6 of Tech Specification PS-439-825	1	AU	YES/NO	NA	NA	NA		EXTRA
7	I&C of seasonal tilt type structures for 280Wp modules as per Clause No.3.7 of Tech Specification PS-439-825	1	AU	YES/NO	NA	NA	NA		EXTRA
8	I&C of automatic single axis track structures for 280Wp modules as per Clause No.3.8 of Tech Specification PS-439-825	1	AU	YES/NO	NA	NA	NA		EXTRA
9	Post Warranty Breakdown Maintenance	6	AU	YES/NO	NA	NA	NA		EXTRA

GENERAL NOTE :

1)PL INDICATE TAXES AS **EXTRA**: ED,VAT/CST,SERVICE TAX CLEARLY APPLICABLE AS ON DATE.

2)USE THIS FORMAT FOR COMPLIANCE(REPRODUCING ON YOUR LETTER HEAD IS ACCEPTABLE).

3)**OVERALL L1 OF SUPPLY (Fixed Type Structures for 280 Wp modules+ Fixed Type Structures for 230 Wp modules + Structures seasonal tilt 280 Wp modules+ Structures automatic single axis track 280Wp module) + I&C of Fixed Type Structures for 280 Wp modules+ Fixed Type Structures for 230 Wp modules + Structures seasonal tilt 280 Wp modules+ Structures automatic single axis track 280Wp module) + Post Warranty Breakdown Maintenance on "FOR" basis to BHEL-RANIPET will only be considered.**

4) **BHEL IS TRYING TO GET CONCESSION ON EXCISE DUTY UNDER SUPPLY OF SOLAR POWER PROJECT.AT THE TIME OF CLEARANCE OF GOODS WE MAY ISSUE EXEMPTION CERTIFICATE.IN SUCH CASE, ED WILL BE EXEMPTED BUT NOT REIMBURSED. At present, please quote with applicable rate without concession of ED for comparison.**

5)**The successful bidder will be getting Letter of intent (LOI) from BHEL, EDN, Bangalore. The regular PO/Payment will be issued by BHEL-Ranipet.**

6) Kindly indicate the place/state from where the shipment will take place for assessment of taxation.

AUTHORISED SIGNATORY WITH SEAL

RFQ TERMS & CONDITIONS COMPLIANCE			
RFQ REF:HBS0000448 Dt.10.05.2013 DUE DATE(TECH BID) : 31.05.2013			
SN IN RFQ	CONDITION AS PER RFQ	ACCEPTANCE/ COMPLIANCE	DEVIATION
1	Two Part Bid	YES/NO	
1A	Enclosure 1 & 2 along with Techno-commercial Bid & Enclosure 3 along with Price bid.	YES/NO	
1B	"FREE ON ROAD" basis to BHEL-RANIPET	YES/NO	
1C	Pre Qualification criteria read and noted	YES/NO	
2	DELIVERY DATE : Supply : 10 weeks from Drawing approval. Drawings to be submitted in 1 week from LOI/PO release. For I&C: 04 weeks from Supply	YES/NO	
3A	PAYMENT TERMS : For Supply: 75% of basic supply value + 100% taxes & duties with 30 days credit on receipt of material at BHEL-RANIPET. 15% on Commissioning and Certification. Balance 10% against PBG for 10% of basic supply value valid for 18 months from date of Supply or 12 months from the date of I&C + 6 months claim period from BHEL Consortium bank. For I&C : 100% against commissioning and certification. For any other deviation in payment term the offer will be liable for rejection.	YES/NO	
3B	Overall L1 of Supply (Fixed Type Structures for 280 Wp modules+ Fixed Type Structures for 230 Wp modules + Structures seasonal tilt 280 Wp modules+ Structures automatic single axis track 280Wp module) + I&C of Fixed Type Structures for 280 Wp modules+ Fixed Type Structures for 230 Wp modules + Structures seasonal tilt 280 Wp modules+ Structures automatic single axis track 280Wp module) + Post Warranty Breakdown Maintenance on "FOR" basis to BHEL-RANIPET will only be considered.	YES/NO	
3C	The basic unit price quoted shall be inclusive of Supply, P&F & Insurance. Taxes like ED, CST/VAT to be quoted extra separately .However the order will be placed on "FREE ON ROAD" basis to BHEL-RANIPET. If Freight is quoted extra, original money receipt from Transporter has to be submitted for payment of freight. Insurance is in vendor's scope. BHEL is trying to get concession on Excise Duty under Supply of Solar Power Project. At the time of clearance of goods we may issue Exemption Certificate. In such case, ED will be exempted but not reimbursed.At present, please quote with applicable rate without concession of ED for comparison.	YES/NO	
3D	C-form will be issued if applicable. Mention taxes clearly and state whether taxes are included or extra. Indicate the state from which supply takes place.	YES/NO	
4A	Pre Shipment Inspection will be carried out by BHEL for which test report shall be sent one week in advance.	YES/NO	
4B	PENALTY APPLICABLE: Penalty of 0.5% per week at the basic price of the good for undelivered quantity of supply portion, subject to a maximum of 10%. Pre Shipment Inspection Call Letter Date (Receipt of test report) will be treated as delivery for purpose of penalty for supply only. Any Deviation attracts Loading.	YES/NO	
5	WARRANTY:for a period of 18 months from date of Supply or 12 months from the date of I&C whichever is earlier as per Tech Spec. PS-439-825.	YES/NO	
6	Road permit if applicable will be given by BHEL before dispatch of ordered items.	NA	BHELSCOPE
7	Do not indicate any TERMS & CONDITIONS in price bid. Only financial values shall be indicated.	YES/NO	
8	Clause Wise Compliance / Confirmation with respect to BHEL Purchase Specification enclosed.	YES/NO	
9	Deviation from RFQ Terms & Conditions may lead to the rejection of the offer	YES/NO	
10	BHEL reserves the right to conduct Reverse Auction. Procedure for the same will be informed by BHEL. Please send your acceptance for reverse auction.	YES/NO	
11	The successful bidder will be getting Letter of intent (LOI) from BHEL, EDN, Bangalore. The regular PO/Payment will be issued by BHEL-Ranipet.	YES/NO	
12	Kindly indicate the place/state from where the shipment will take place for assessment of taxation.		

AUTHORISED SIGNATORY WITH SEAL

NOTE : INDICATE YES/NO CLEARLY IN THE FORMAT. OTHERWISE IT WILL BE TREATED AS DEVIATION FROM RFQ TERMS AND CONDITIONS.

USE THIS FORMAT FOR COMPLIANCE(REPRODUCING ON YOUR LETTER HEAD IS ACCEPTABLE).

PRICE BID ENCLOSURE									
RFQ REF:HBS0000448 Dt.10.05.2013 DUE DATE(TECH BID) : 31.05.2013									
Sl No.	DESCRIPTION	QTY	UNIT	BASIC UNIT RATE (Rs.)	TAXES (TO BE QUOTED EXTRA)				REMARKS
					ED %	CST %	VAT %	SERVICE TAX %	
1	PS0679031537: Supply of fixed type structures for 280Wp modules as per Clause No.3.1 of Tech Specification PS-439-825	1	Set					NA	EXTRA
Unit Rate in Words									
2	PS0679031545: Supply of fixed type structures for 230Wp modules as per Clause No.3.2 of Tech Specification PS-439-825	1	Set					NA	EXTRA
Unit Rate in Words									
3	PS0679031553: Supply of seasonal tilt type structures for 280Wp modules as per Clause No.3.3 of Tech Specification PS-439-825	1	Set		NA	NA	NA		EXTRA
Unit Rate in Words									
4	PS0679031561: Supply of automatic single axis track structures for 280Wp modules as per Clause No.3.4 of Tech Specification PS-439-825	1	Set		NA	NA	NA		EXTRA
Unit Rate in Words									
5	I&C of fixed type structures for 280Wp modules as per Clause No.3.5 of Tech Specification PS-439-825	1	AU		NA	NA	NA		EXTRA
Unit Rate in Words									
6	I&C of fixed type structures for 230Wp modules as per Clause No.3.6 of Tech Specification PS-439-825	1	AU		NA	NA	NA		EXTRA
Unit Rate in Words									
7	I&C of seasonal tilt type structures for 280Wp modules as per Clause No.3.7 of Tech Specification PS-439-825	1	AU		NA	NA	NA		EXTRA
Unit Rate in Words									
8	I&C of automatic single axis track structures for 280Wp modules as per Clause No.3.8 of Tech Specification PS-439-825	1	AU		NA	NA	NA		EXTRA
Unit Rate in Words									
9	Post Warranty Breakdown Maintenance	6	AU		NA	NA	NA		EXTRA
Unit Rate in Words									
10	Freight Charge including Service Tax on Freight	LUMPSUM		Rs.					
Lumpsum Charge in Words									
11	Insurance	LUMPSUM		Rs.					
Insurance Charge in Words									

GENERAL NOTE :

- 1)PL INDICATE TAXES AS EXTRA: ED,VAT/CST,SERVICE TAX CLEARLY APPLICABLE AS ON DATE.
- 2)USE THIS FORMAT FOR COMPLIANCE(REPRODUCING ON YOUR LETTER HEAD IS ACCEPTABLE).
- 3)INDICATE WHETHER FREIGHT CHARGE & INSURANCE IS INCLUDED IN QUOTED RATE OR WILL BE CHARGED EXTRA. IN ABSENCE OF CLARITY, QUOTED RATE WILL BE CONSIDERED AS INCLUSIVE OF FREIGHT CHARGES.
- 4)SERVICE TAX ON FREIGHT APPLICABLE IS 3.09% OF TOTAL FREIGHT.
- 5)OVERALL L1 OF SUPPLY (Fixed Type Structures for 280 Wp modules+ Fixed Type Structures for 230 Wp modules+ Structures seasonal tilt 280 Wp modules+ Structures automatic single axis track 280Wp module) + I&C of Fixed Type Structures for 280 Wp modules+ Fixed Type Structures for 230 Wp modules + Structures seasonal tilt 280 Wp modules+ Structures automatic single axis track 280Wp module) + Post Warranty Breakdown Maintenance on "FOR" basis to BHEL-RANIPET will only be considered.
- 6)INSURANCE IS IN VENDOR'S SCOPE.
- 7) BHEL IS TRYING TO GET CONCESSION ON EXCISE DUTY UNDER SUPPLY OF SOLAR POWER PROJECT.AT THE TIME OF CLEARANCE OF GOODS WE MAY ISSUE EXEMPTION CERTIFICATE.IN SUCH CASE, ED WILL BE EXEMPTED BUT NOT REIMBURSED. At present, please quote with applicable rate without concession of ED for comparison.
- 8)The successful bidder will be getting Letter of intent (LOI) from BHEL, EDN, Bangalore. The regular PO/Payment will be issued by BHEL-Ranipet.
- 9) Kindly indicate the place/state from where the shipment will take place for assessment of taxation.

AUTHORISED SIGNATORY WITH SEAL

PERFORMANCE BANK GUARANTEE
(FOR INDIGENOUS PURCHASE ORDERS)

THIS DEED OF GUARANTEE made and executed on the _____ day of _____ (year), by the _____ (Bank), registered under the Companies Act 1956/Nationalised Bank constituted under the Banking Companies (acquisition and transfer of undertakings) Act constituted under the State Bank of India Act / Subsidiary Banks Act, having its registered / head office at

_____ represented herein by its Branch Manager / authorised representative Sri. _____ & Sri. _____ (Hereinafter called 'guarantor ' which term shall mean and include its successors and assigns)

IN FAVOUR OF BHARAT HEAVY ELECTRICALS LIMITED

_____ (Buyer's Name), a company registered under the companies Act, 1956 having its registered office at BHEL House at Siri Fort , New Delhi-100 049 and its Electronics Division at Mysore road, Bangalore-26 (hereinafter referred to as the 'Company' Which term shall include its successors and assigns):

Whereas the company has placed an order on _____ (State the name of the company / firm and its address) (hereinafter referred to as the 'Supplier' which term shall mean and include its liquidators, successors and assign) for the supply of system under order / Contract No _____ Dt _____.

AND WHEREAS the supplier has agreed to supply the materials and carryout the works as detailed and in accordance with the terms set out in the said order/contract.

AND WHEREAS the company is not required to pay to the supplier a sum of Rupees _____ being the 10% of the value of the goods supplied / Works performed / Services rendered under the said order / contract between the supplier and the company, till the company is satisfied with the mechanical Warranties and the performance standards stipulated in the said order / contract between the company and the supplier has been duly fulfilled, except against a Bank Guarantee for the said sum of Rs _____ in favour of the company by reputed Bank, in which case the company has agreed to make payment to the supplier of the said sum of Rupees _____ being (...%) of the value of the goods supplied / Works performed / Services rendered under the agreement between the supplier and the company and the Guarantor has at the request of the supplier, agreed to furnish this Guarantee subject to the terms and conditions stated below:

NOW THIS DEED WITNESSES THAT IN pursuance of the above said agreement, the guarantor hereby agrees and covenants With company is as follows :-

- 1) That during the period this contract of Guarantee remains effectual, the guarantor shall be liable in respect of the amount due and owing to the company in respect of the payments to the extent of Rs _____ (in words)

_____ against any loss or damage caused to or suffered by the company by reasons of any breach of the terms of the said order / contract / Agreement by the supplier.

- 2) The Guarantor hereby undertakes to pay the amounts due and payable under this guarantee without any demur, merely on demand from the company intimating that the amount claimed is due by way of loss or damage caused to or suffered or would be caused or suffered by the supplier of any terms contained in the said order / contract. Any such demand made on the guarantor shall be conclusive as regards the amount due and payable by the Guarantor irrespective of the fact whether the Contractor / supplier admits or denies.
- 3) The Guarantor further agrees that the agreement herein contained shall remain in force and effect till all the supplies to be made / Works to be performed / Services to be rendered under the said order / contract / agreement are completed to the entire satisfaction of the company or till company certifies that the terms and conditions of the said order / contract / agreement have been fully and properly carried out by the said supplier and accordingly discharges the Guarantee. Unless a demand or claim under this guarantee is made on the guarantor in writing on or before the expiry of claim period indicated in clause 6 below , the guarantor shall be discharged from all the liability under this guarantee thereafter.
- 4) The guarantor further agrees with the company that the company shall have the fullest liberty without the consent of the guarantor and without effecting in any manner the obligations of the guarantor hereunder to vary any of the terms of the said order / contract / agreement or extend the time of performance by the said supplier from time to time or refrain from exercising the power exercisable by the company against the said supplier or to forebear or omit to enforce any of the terms and conditions relating to the said order / contract / agreement, and the guarantor shall not be relieved of its liability in whole or in part , by reason of any act, commission or forbearance on the part of the company or by reason of any such variation, or extension being granted to the said supplier or by reason of any such matter or thing whatsoever which under the law relating to sureties would but for this provision have effect of so relieving the guarantor.
- 5) The guarantor undertakes not to revoke this guarantee during its currency except with the previous consent of the company in writing.
- 6) Notwithstanding anything herein above contained, the liability of the guarantor under these presents is restricted to Rs_____. The guarantee shall be in force till its expiry on _____ unless a demand is made on the guarantor within SIX months from the date of expiry, all the liability of the guarantor under this guarantee shall stand fully discharged. The decision of the claimant in regard to breach of contract is final and binding on the Bank.

IN WITNESS whereof, the guarantor, acting through it authorised representative has executed this deed of Guarantee on the day, month and year first above written.

(Seal of the Bank to be affixed)

WITNESS

- 1.
- 2.

Note:

- (1) To be executed in INR 100 Non-Judicial stamp paper by any authorized Indian Bank.
- (2) To be submitted directly by banker to concerned executive in purchase dept., Please give BHEL address to banker.
- (3) Do not enclose with Bank document.
- (4) Any Modification & omissions to this are not permitted

BHEL MEMBER BANKS (CONSORTIUM BANKS)

PBG SHALL BE ISSUED FROM THE FOLLOWING BANKS OR THEIR BRANCH OFFICES ONLY

1	STATE BANK OF INDIA
2	PUNJAB NATIONAL BANK
3	HDFC BANK
4	SYNDICATE BANK
5	CANARA BANK
6	INDIAN BANK
7	ST. BANK OF HYDERABAD
8	ICICI BANK
9	STANDARD CHARTERED BANK
10	UCO BANK
11	KOTAK MAHINDRA
12	ORIENTAL BANK OF COMMERCE
13	STATE BANK OF TRAVANCORE
14	CENTRAL BANK
15	IDBI BANK
16	FEDERAL BANK
17	HSBC LTD
18	DEUTSCHE BANK
19	CORPORATION BANK
20	CITI BANK
21	BANK OF BARODA
22	ABN AMRO BANK
23	UNITED BANK OF INDIA
24	VIJAYA BANK
25	UNION BANK OF INDIA
26	PUNJAB & SIND BANK
27	ANDHRA BANK
28	BANK OF INDIA
29	AXIS BANK

