

**Bharat Heavy Electricals Ltd**  
Electronics Division  
Mysore Road, Bangalore – 560026

**Tender Document for SUPPLY, I&C & O&M OF  
BOS- OPCL Site  
RFQ REF: HBSBOS021**

Technical Bid Opening Date: 15<sup>th</sup> October, 2014

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, Wednesday” kept in reception

area of BHEL – EDN, Bangalore.

**Contact Person at BHEL:**

- 1. Mr. H.B. Srinivasa : Sr.Manager (SC&PV-MM)**  
**Ph: 080-26988495, Mob: 09449869655**  
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- 2. Ms. Mrinalini Gupta: Sr.Engineer (SC&PV-MM)**  
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# REQUEST FOR QUOTATION

	<b>BHARAT HEAVY ELECTRICALS LIMITED</b> Electronics Division PB No. 2606, Mysore Road Bangalore - 560026 INDIA	RFQ NUMBER: <b>HBSBOS021</b>  RFQ DATE : 24.SEP.2014	Due Date <b>15.OCT.2014</b> Time: <b>13:00 HRS</b>  VENUE : <b>NEW ENGG. BLDG</b>
MMI:PU:RF:003			

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

1. Offer shall be submitted in two part :

Part 1 : Techno-Commercial Bid

Part 2 : Price Bid

2. This RFQ document comprises of :

- (1) Request For Quotation
- (2) Technical Specifications : PS- 439-924
- (3) Enclosures B,B1&B2 : Commercial Terms & Conditions, Unpriced Bid Format and Price Bid Format
- (4) General Terms and Conditions (Doc Ref : SCPV/BOS/01-Rev 01)

3. The delivery date indicated in RFQ is tentative. The actual delivery date shall be as indicated in Annexure B.

SI No.	Description	Qty	Unit	Delivery qty	Delivery Date
1	PS0679043390 Supply of MC4, Cable tie, HDPE pipe etc Supply of MC4 connectors, cable ties, cable ducts, HDPE conduits, cable lugs, hardware, cable trays etc as per clauses 5.05 to 5.15 of BHEL spec PS-439-924. Test Certificate	1	ST	1	14.DEC.2014
2	PS0679043403 Supply of LT/HT/Data cable, kits etc Supply of LT Power cable, LT control cables, LT Auxiliary power cables, HT power cable, Data communication cables, 33kV termination kits etc as per clauses 5.19 to 5.42 of BHEL spec PS-439-924. Test Certificate	1	ST	1	14.DEC.2014
3	PS0679043411 Supply of FP,CT,PT GOS,LA etc for S/yard Supply of items of four pole structures including auxiliary transformer, GOS switches, earth switches, lightning arrestors (surge suppressors), CTs, PTs, Metering panels, ACSR conductor, CT/PT wiring cables, items for connecting to grid, with all related miscellaneous accessories and hardware as per clauses 5.21 -5.30 of BHEL spec PS-439-924. Test Certificate	1	ST	1	14.DEC.2014
4	PS0679043420 Supply of items of earthing systems Supply of items of earthing system for solar array field, control room panels and switchyard equipment including earthing electrodes, GI flats, copper strips, CPVC pipes, Insulation bushes, heat shrinkable sleeves for control room copper strip earthing, all related miscellaneous hardware etc as per clauses 5.35 to 5.37 of BHEL spec PS-439-924. Test Certificate	1	ST	1	14.DEC.2014
	PS0679043438 Supply of LA (ESE), rod for control room	1	ST	1	14.DEC.2014

For and On behalf of BHEL.

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SI No.	Description	Qty	Unit	Delivery qty	Delivery Date
5	Supply of lightning arrestors for solar array field (ESE type) with earthing items and lightning rod with earthing items for control room as per clauses 5.38 and 5.39 of BHEL spec PS-439-924. Test Certificate				
6	PS0679043446 Supply items for module cleaning system Supply of items of module cleaning system such as booster pumps, CPVC pipes with fittings, ball valves, nipples etc as per clauses 5.45 of BHEL spec PS-439-924. Test Certificate	1	ST	1	14.DEC.2014
7	PS0679043454 Supply of items for yard lighting system Supply of items for yard lighting system such as pole pipes, lamps, lamp fittings, CPVC pipes, junction boxes, cable lugs, related accessories, hardware etc as per clauses 5.40 to 5.44 of BHEL spec PS-439-924. Test Certificate	1	ST	1	14.DEC.2014
8	PS0679043462 Supply of misc items Supply of miscellaneous items such as cable tags, danger boards, cable markers, hoarding board, sign boards, display boards, electrical insulation mat, checkered plates, air conditioners, tool kits, measuring instruments, office furniture etc as per clauses 5.46 to 5.54 of BHEL spec PS-439-924. Test Certificate	1	ST	1	14.DEC.2014
9	PS0679043470 Supply of Fire alarm system, extinguisher Supply of safety related items including fire alarm system, fire extinguishers, safety gadgets etc as per clauses 5.55 and 5.56 of BHEL spec PS-439-924. Test Certificate	1	ST	1	14.DEC.2014
10	PS0679043489 Supply of ACDB/DCDB/FCBC/PCU duct etc Supply of ACDB, DCDB, Battery, FCBC with battery, PCU ducting arrangement etc., as per Annexure 1,2 and 3 of BHEL spec PS-439-924. Test Certificate	1	ST	1	14.DEC.2014
11	PS0679043497 I&C: Temp site office, storage yard etc &C: Temporary site office, storage yard, unloading/movement of consignments, arranging electrical power / water etc as per clauses 5.01 to 5.04 of BHEL Spec PS-439-924.	1	AU	1	20.OCT.2014
12	PS0679043500 I&C: Interconnection Modules, SMBs etc I&C: Interconnection of SPV modules, installation of string monitoring boxes including cable terminations and inspection thereof as per clauses 5.05 to 5.11 of BHEL Spec PS-439-924.	1	AU	1	20.OCT.2014

For and On behalf of BHEL.

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SI No.	Description	Qty	Unit	Delivery qty	Delivery Date
13	PS0679043519 I&C: Trenches, cable laying etc I&C: Formation of cable trenches and laying of 185sq-mm cables, as per clause 5.12 of BHEL spec PS-439-924	1	AU	1	20.OCT.2014
14	PS0679043527 I&C: Elect. Panel instaln, terminatn etc I&C: Erection of control room electrical panels including grouting, erection of cable trays and cable supports, routing and terminations of DC and AC cables up to LV side of transformers in switchyard etc as per clauses 5.13 to 5.15 of BHEL Spec PS-439-924.	1	AU	1	20.OCT.2014
15	PS0679043535 I&C: Switchyard equipment, FP, DP etc &C: Erection of switchyard equipment such as transformers, four pole, lightning arrestors / drop out fuses, CTs, PTs, metering panels including ACSR conductor laying, HV cable terminations, fire walls, foundations, oil pit chambers, leveling, jelly spreading, etc, as per clauses 5.16 - 5.30 of BHEL Spec PS-439-924.	1	AU	1	20.OCT.2014
16	PS0679043543 I&C: Data cable trench, termination etc I&C: Cable trenches, cable laying, cable terminations for control cables related to remote annunciation and SCADA as per clauses 5.32 to 5.34 of BHEL Spec PS-439-924.	1	AU	1	20.OCT.2014
17	PS0679043551 I&C: Earthing sys.: Array, S/yard etc I&C of earthing system for solar array field, control room panels and switchyard equipment including installation of earthing electrode, earth mat, erection & electrical interconnection of earth chambers, laying of copper earth strips in control room etc, installation of lightning arrestors (ESE) and lightning rod for control room as per clauses 5.35 to 5.39 of BHEL Spec PS-439-924.	1	AU	1	20.OCT.2014
18	PS0679043560 I&C: Yard lighting, cable trenches etc I&C of yard lights for solar array field, switchyard and compound wall/chain link fencing including cable trenches, cable laying and cable terminations at the yard lighting poles as well as ACDB panel in control room etc as per clauses 5.40 to 5.44 of BHEL Spec PS-439-924.	1	AU	1	20.OCT.2014
19	PS0679043578 I&C: Module Clening system, pumps etc I&C of module cleaning system including trenches for pipelines, laying of pipelines from bore wells to solar array field through overhead tanks, erection of pumps, ball valves, non-returnable valves etc as per clauses 5.45 of BHEL Spec PS-439-924.	1	AU	1	20.OCT.2014
20	PS0679043586 I&C: Misc Items, fire alarm system etc I&C of miscellaneous and safety items such as cable tags,	1	AU	1	20.OCT.2014

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Sl No.	Description	Qty	Unit	Delivery qty	Delivery Date
	danger boards, cable markers, hoarding board, sign boards, display boards, electrical insulation mat, checkered plates, air conditioners, office furniture, fire extinguishers, fire alarm system, as per clauses 5.46 to 5.56 of BHEL Spec PS-439-924.				
21	PS0679043594 I&C: Commissioning, state dept clearances I&C: Pre-commissioning inspections / checks / tests, MRT tests and coordination with state departments STATE ELECTRICITY SUPPLY & TRANSMISSION BOARDS/CEIG etc., for necessary approvals / clearances for commissioning, synchronization with grid and post-commissioning operation of the plant as per clause 5.57 of BHEL Spec PS-439-924.	1	AU	1	20.OCT.2014
22	PS0679043608 O&M of Plant for per month basis Operations and Maintenance per month	6	AU	6	20.OCT.2014

Total Number of Items - 22


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.

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 firms is available on BHEL web site [www.bhel.com](http://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 .


	<b>PURCHASE SPECIFICATION; GROUP: PHOTOVOLTAICS  SUPPLY OF BOS ITEMS, I&amp;C, O&amp;M FOR 3MW (AC) SPV POWER  PLANT AT RAVULAPALLY VILLAGE,  MOMENPET MANDAL, RANGAREDDY DIST. TELANGANA</b>	PS-439-924
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**Technical Specification for**  
**Supply of Balance of System items, Installation and Commissioning,**  
**Operations & Maintenance Design, of 3 MW**  
**(AC side capacity) Solar PV Power Project at Ravulapally village,**  
**Momenpet Mandal, Rangareddy Dist. Telangana**

Approved by :			
Revision details : R 00	Prepared	Issued	Date

	<b>PURCHASE SPECIFICATION; GROUP: PHOTOVOLTAICS  SUPPLY OF BOS ITEMS, I&amp;C, O&amp;M FOR 3MW (AC) SPV POWER  PLANT AT RAVULAPALLY VILLAGE,  MOMENPET MANDAL, RANGAREDDY DIST. TELANGANA</b>	PS-439-924
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## 1.0 Pre Qualification Criteria

- (i) The bidder shall have executed electrical, civil and mechanical package of a single, minimum of 1.5 MWp SPV power plant in last 2 years from RFQ date. Bidder shall be an executor and not a project developer. Bidder shall furnish the details of project executed such as a) Project-location & details b) Customer details c) Satisfactory performance certificate of the installed plant issued by customer.
- (ii) The bidder should have achieved average annual financial turnover of Rs. 100 lakhs in the last three years ending 31st March of the previous financial year. The bidder shall submit the following details along with the bid: a) Audited balance sheets for last three years

### 1.1 Introduction

Bharat Heavy Electricals Limited (BHEL), Electronics Division, Bangalore is setting up a 3 MWp (AC) Grid Connected SPV Power Plant at Ravulapally village, Momenpet Mandal, Rangareddy Dist. Telangana. Overall area of the plant is about 12 acres.

The plant will have a solar array field with fixed type of structures. BHEL PV modules of 300 Wp of mono-crystalline type will be deployed. Electrically, the array will have 5 nearly equal segments, each generating DC power of ~630 kWp, which is then inverted by a grid-connected power conditioning unit (PCU) of 630 kW rating. At the ac output level, four PCUs are combined using two nos of 1600 KVA three-winding oil-immersion transformer and one 630 kW PCU is connected to a two winding 800 kVA oil-immersion transformer. These transformers are connected to the 33kV HT panel.


The plant employs 5x630 kW PCUs that export the generated power to 33 kV grid through 3 transformers and LV/HV breaker panels.

The solar array will have 39 string monitoring combiner boxes (SMBs) that collect the solar PV generated DC power and provide inputs to the 5 PCUs housed within a centralized control room. The plant will have SCADA integration using PC based monitoring desk to gather DC, AC parameters from SMBs, PCUs, weather monitoring equipment, transformers, HT breakers.

Control room building, which is not in vendor scope, is a double storey building having overall dimension of 35 m x 10 m

- (a) The ground floor of control room houses 5 PCUs (630kW each) 33KV HT Panels, a SCADA room (air conditioned), a store room, ACDB panel, DCDB panel, battery room, toilets and staircase portion. SCADA equipment (data station panel, PC control desk) shall be kept within SCADA room. Battery bank and FCBC battery charger shall be housed in battery room.
- (b) There is a future provision for 1st floor of control room which will consist of conference hall office etc.

Switchyard is located right on the back side of the control room. Switchyard (approx dimension 20 x 30 m) comprises of the following major items.

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- (1) Transformers, 1600kVA, 33kV/350V-350V, two LV windings: 2 nos.  
Transformer, 800 kVA, 33 kV/350V: 1 no.
- (2) Four pole structure – 2 sets (with lightning arrestors, outdoor metering CTs/PTs, one Trivector metering panel, GOS, drop out fuses for auxiliary transformer, insulator supports, etc.)

This technical specification provides requirements of BHEL for supply, installation, commissioning of balance of system items and operations and maintenance of power plant for a period of 6 months from the date of commissioning. BHEL scope of supply is mentioned under section 3.0.

## 2.0 Documents enclosed with this specification


1	Single line diagram of overall power plant	3-679-05-00747
2	Site layout with locations of solar array, control room, switchyard	BHEL:OPCL:AL:011
3	Control Room layout	BHEL:OPCL:CR:AR:01
4	SPV module Drawing	3-679-02-00371
5	Specification for Supply and I&C of Batterybank, FCBC & DCDB	Annexure 1
6	Specification for supply and I&C of ACDB Panel	Annexure 2
7	Specification for Supply and I&C of PCU duct	Annexure-3
8	Single Line diagram for ACDB	

## 3.0 Scope of work

### 3.1 Vendor scope of work (as briefly outlined activities)


The table below indicates the scope of work for the vendor, as briefly outlined. Vendor shall submit the offer (in two part bids) as per this list and quantity.

#	Scope of work (as briefly outlined)	Qty
1	Supply of MC4 connectors, cable ties, cable ducts, HDPE conduits, cable lugs, hardware, cable trays etc as per clauses 5.05 to 5.15	1 set
2	Supply of LT Power cable, LT control cables, LT Auxiliary power cables, HT power cable, Data communication cables, 33kV termination kits etc as per clauses 5.19 to 5.42	1 set
3	Supply of items of four pole structures including auxiliary transformer, GOS switches, earth switches, lightning arrestors (surge suppressors), CTs, PTs, Metering panels, ACSR conductor, CT/PT wiring cables, items for connecting to grid, with all related miscellaneous accessories and hardware as per clauses 5.21–5.30.	1 set
4	Supply of items of earthing system for solar array field, control room panels and	1 set


	<b>PURCHASE SPECIFICATION; GROUP: PHOTOVOLTAICS</b> <b>SUPPLY OF BOS ITEMS, I&amp;C, O&amp;M FOR 3MW (AC) SPV POWER</b> <b>PLANT AT RAVULAPALLY VILLAGE,</b> <b>MOMENPET MANDAL, RANGAREDDY DIST. TELANGANA</b>	PS-439-924
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	switchyard equipment including earthing electrodes, GI flats, copper strips, CPVC pipes, Insulation bushes, heat shrinkable sleeves for control room copper strip earthing, all related miscellaneous hardware etc as per clauses 5.35 to 5.37.	
5	Supply of lightning arrestors for solar array field (ESE type) with earthing items and lightning rod with earthing items for control room as per clauses 5.38 and 5.39.	1 set
6	Supply of items of module cleaning system such as booster pumps, CPVC pipes with fittings, ball valves, nipples etc as per clauses 5.45.	1 set
7	Supply of items for yard lighting system such as pole pipes, lamps, lamp fittings, CPVC pipes, junction boxes, cable lugs, related accessories, hardware etc as per clauses 5.40 to 5.44.	1 set
8	Supply of miscellaneous items such as cable tags, danger boards, cable markers, hoarding board, sign boards, display boards, electrical insulation mat, checkered plates, air conditioners, tool kits, measuring instruments, office furniture etc as per clauses 5.46 to 5.54.	1 set
9	Supply of safety related items including fire alarm system, fire extinguishers, safety gadgets etc as per clauses 5.55 and 5.56.	1 set
10	Supply of ACDB, DCDB, Battery, FCBC with battery, PCU ducting arrangement etc., as per Annexure 1,2 and 3	1 set

11	I&C: Temporary site office, storage yard, unloading/movement of consignments, arranging electrical power / water etc as per clauses 5.01 to 5.04	1 AU
12	I&C: Interconnection of SPV modules, installation of string monitoring boxes including cable terminations and inspection thereof as per clauses 5.05 to 5.11	1 AU
13	I&C: Formation of cable trenches and laying of 185sq-mm cables, , as per clause 5.12	1 AU
14	I&C: Erection of control room electrical panels including grouting, erection of cable trays and cable supports, routing and terminations of DC and AC cables up to LV side of transformers in switchyard etc as per clauses 5.13 to 5.15	1 AU
15	I&C: Erection of switchyard equipment such as transformers, four pole, lightning arrestors / drop out fuses, CTs, PTs, metering panels including ACSR conductor laying, HV cable terminations, fire walls, foundations, oil pit chambers, leveling, jelly spreading, etc, as per clauses 5.16 – 5.30	1 AU
16	I&C: Cable trenches, cable laying, cable terminations for control cables related to remote annunciation and SCADA as per clauses 5.32 to 5.34.	1 AU
17	I&C of earthing system for solar array field, control room panels and switchyard equipment including installation of earthing electrode, earth mat, erection &	1 AU

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	electrical interconnection of earth chambers, laying of copper earth strips in control room etc, installation of lightning arrestors (ESE) and lightning rod for control room as per clauses 5.35 to 5.39.	
18	I&C of yard lights for solar array field, switchyard and compound wall/chain link fencing including cable trenches, cable laying and cable terminations at the yard lighting poles as well as ACDB panel in control room etc as per clauses 5.40 to 5.44	1 AU
19	I&C of module cleaning system including trenches for pipelines, laying of pipelines from bore wells to solar array field through overhead tanks, erection of pumps, ball valves, non-returnable valves etc as per clauses 5.45.	1 AU
20	I&C of miscellaneous and safety items such as cable tags, danger boards, cable markers, hoarding board, sign boards, display boards, electrical insulation mat, checkered plates, air conditioners, office furniture, fire extinguishers, fire alarm system, as per clauses 5.46 to 5.56.	1 AU
21	I&C: Pre-commissioning inspections / checks / tests, MRT tests and coordination with state departments STATE ELECTRICITY SUPPLY & TRANSMISSION BOARDS/CEIG etc., for necessary approvals / clearances for commissioning, synchronization with grid and post-commissioning operation of the plant as per clause 5.57.	1 AU
22	Operations and Maintenance per month	6 Mon

	<b>PURCHASE SPECIFICATION; GROUP: PHOTOVOLTAICS</b> <b>SUPPLY OF BOS ITEMS, I&amp;C, O&amp;M FOR 3MW (AC) SPV POWER</b> <b>PLANT AT RAVULAPALLY VILLAGE,</b> <b>MOMENPET MANDAL, RANGAREDDY DIST. TELANGANA</b>	PS-439-924
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### 3.2 BHEL scope of work:

For the sake of clarity to the vendor, the items that are within the scope of BHEL supply are listed below. The receipt, unloading, storage, handling, erection of these items are within the scope of vendor. However, insurance for these items are within BHEL scope:


1	Solar PV Modules(L24270-3000Wp)(Packed in boxes of each having 16 nos.)	~ 11400 Nos
2	Solar array structures with modules mounted on the structures: Fixed type structure, with each having 20 Nos of 3000Wp modules:	3.42 MWp
3	Cable, 1Cx 6 sq-mm (connection of PV modules to string monitoring boxes)	required length
4	Cable, 1C x 185sq-mm (for connection from SMBs to PCUs in control room)	required length
5	String monitoring boxes with mounting fixtures	39 sets
6	Power conditioning units (PCUs) of 630 kW	5 sets
7	Transformers 1600 kVA, 33kV/350V-350V (1 HV winding, 2 LV windings)	2 Nos.
8	Transformer 800 kVA, 33kV/350V (1 HV winding, 1 LV winding)	1 Nos.
9	HT panels (indor type) including VCBs, CTs, PTs, Relays (3 incomers & 1 outgoer).	1 set
10	Weather monitoring equipment for solar irradiation, wind velocity, ambient temperature, module temperature including supply and termination of data cables for the same. (Cable laying and installation is in vendor scope)	1 set
11	SCADA data station with PC, accessories and software	1 set
12	Data cable terminations at SCADA data station panel and control desk (supply and laying of data cables shall be in vendor scope)	1 set
13	Control room with plumbing lines, overhead tanks, internal electrical wiring.	1 set
14	Sewerage and septic tank works and interconnections with control room.	1 set
15	Chain link fencing for the entire plant, pathways, approach road, drains, landscaping within the solar plant including switchyard fencing with gates.	-

### 4.0 Instructions to vendors on 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.
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4.2	<p>First-part shall be techno-commercial bid. Following details shall be furnished:</p> <ol style="list-style-type: none"> <li>1. Technical offer with covering letter.</li> <li>2. Filled-up enclosures as per BHEL formats (meant for first-part) provided in tender.</li> <li>3. Clause-wise compliance shall be filled-up in the column provided in this specification, with signature and seal on every page.</li> <li>4. Company brochure.</li> <li>5. Project implementation time schedule.</li> <li>6. Stage-wise manpower schedule.</li> </ol>
4.3	<p>Second-part shall be price bid with filled up enclosures as per BHEL formats provided in tender.</p>
4.4	<p>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.</p>

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### 5.0 Technical specification for supply, installation and commissioning

Vendor shall indicate clause-wise compliance (Yes/No) in the column provided as below. In case of non-compliance or deviation, vendors shall record their comment.

#	BHEL specification	Vendor compliance (Yes / No) In case of non-compliance or deviation, vendors shall record their comments:
5.01	<b>Setting up of temporary site office</b> (1) Vendor shall set up a temporary site office using porta cabin of minimum 200 sq-ft within one week to 10 days from the date of purchase order to enable speedy commencement of site activities. (2) Cabin shall be retained at the site until completion of 3 months after commissioning. (3) Cabin shall be furnished with essential amenities such as two work tables, six chairs and necessary number of power points, lamps and fans.	
5.02	<b>Electrical power and water for construction</b> (1) Vendor shall organize necessary electrical power supply such as DG sets etc required for construction activities and also for the porta cabin. (2) Vendor shall also establish, on their own, water source such as bore wells, water tankers etc., for construction activities. (3) Vendor shall arrange drinking water for the site engineers of BHEL and the staff/employees of vendor.	
5.03	<b>Construction of temporary yard for safe storage of all BHEL as well as vendor supplied items</b> (1) Vendor shall, at a suitable location at the site, as decided based on discussions with BHEL site engineer, construct a temporary yard for safe storage of BHEL as well as vendor supplied items. This includes storage of all items such as electrical panels (PCUs, HT panels, Battery banks, Battery chargers, SCADA Panel etc.), transformers, cables, string monitoring boxes, solar PV modules, spares, tools, instruments etc. (2) Area of storage yard shall be approximately 1500 sq-m. Typical size shall be 30m x 50m. However, exact size shall be	



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	<p>decided mutually with BHEL based on site conditions.</p> <p>(3) An appropriate portion of yard area shall be provided with suitable roof (asbestos, FRP, steel sheet etc.) supported by steel poles that shall be grouted using suitable concrete foundations.</p> <p>(4) Necessary raised / covered arrangements shall be provided to the individual panels / equipment to ensure that these items are not affected by water at the ground level during time of rain storm, flood etc.</p> <p>(5) Yard shall be fenced all around with a steel gate of width of 5m minimum. Height of fence and gate shall be 2.5m minimum above the ground level.</p> <p>(6) Suitable fencing shall be provided using steel poles at every 3m intervals and barbed wires between the poles.</p> <p>(7) Gate shall be suitably secured to the fencing poles and shall be provided with lock and key.</p> <p>(8) Watch and ward security personnel shall be provided for the yard on round-the-clock basis.</p>	
<b>5.04</b>	<p><b>Receipt, unloading, safe storage and movement of BHEL and vendor supplied items:</b></p> <p>(1) Vendor shall organize all necessary resources such as labour, machinery and tools (cranes, hydra, forklifts, transportation trucks / trolleys, lifting accessories etc.) for unloading the items received at the site and subsequent movement to the storage yard. Similar arrangements shall also be made by vendor for movements of the items from storage yard to the point of construction.</p> <p>(2) Vendor shall maintain proper documentation / compilation of all the records related to shipping (invoices, delivery challans etc) and shall take verification and approval from BHEL site engineer for every consignment. The documents shall be suitably preserved for further handing over to BHEL.</p> <p>(3) Safeguarding the items from pilferage etc is responsibility of vendor. For this purpose, vendor shall post adequate watch and ward for the yard on round-the-clock basis.</p> <p>(4) Registers shall be maintained for the yard to keep track of incoming / outgoing items.</p> <p>(5) Vendor shall arrange for necessary insurance for the stored items of vendor supply up to the time of commissioning.</p>	



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5.05	<p>(6) BHEL will ensure insurance for all the BHEL supplied items.</p> <p><b>Interconnection of SPV modules to form strings</b> Supply of SPV modules is in BHEL scope. BHEL make, L20270 type, 300 Wp As per drawing 3-679-02-00371 Total quantity = 11400 Nos Erection of mounting structures and mounting of the SPV modules on the structures are in BHEL scope. Vendor shall interconnect the modules as follows:</p> <p>(a) Each module is fitted integrally with a junction box having positive and negative polarity cables (4 sq-mm). (b) Positive cable of one module shall be connected to the negative cable of adjacent module. The cables have MC4 type of connectors. One polarity cable has male type connector, while the other has female type connector. (c) This way, 20 modules shall be connected in series. Each set of connections is called as a series string. Thus, 570 series strings shall be formed with 11400 modules. (d) After placing the purchase order on vendor, BHEL will provide layout drawings that will describe the exact way in which the series strings are formed. Vendor shall implement the interconnection as per these drawings. (e) Interconnected cables shall be neatly routed and dressed using UV resistant nylon cable ties of appropriate dimension. (f) These cable ties shall be in vendor scope of supply. Approved make: 3M, Phoenix contact, Weidmuller, Hellermannntyton, Panduit/equivalent. <b>Specs:</b> Nylon cable ties, polyamide 6.6 UV stabilized black, UL94 flammability rating V2, meant for outdoor use. Operating temperature up to 85 deg C. Width of cable tie shall be minimum 4.5 mm. BHEL approval shall be obtained for the selected brand and length of cable tie. (g) Cables shall not be loosely hanging.</p>	
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<b>5.06</b>	<b>Installation of string monitoring boxes</b> <p>(1) Supply of string monitoring boxes (SMB) is in BHEL scope. These are 16-in and 1-out type.</p> <p>(2) Vendor shall install the SMBs in the solar array field.</p> <p>(3) All fixtures including stand, hardware etc required for installation of SMBs are in BHEL scope of supply.</p> <p>(4) Drawings and details of SMBs and the fixtures will be provided to the vendor after placement of purchase order.</p> <p>(5) Vendor shall fix the SMB stands on to the module mounting structure by drilling/punching the necessary holes on the structure. After drilling vendor has to apply a coat of primer and two coats of aluminium paint at the hole to prevent rusting/corrosion. SMB location will be identified by BHEL and will be provided in the wiring layout.</p> <p>(6) SMBs shall be fixed on the stands using the hardware that are supplied by BHEL as part of SMB assembly kit.</p> <p>(7) All tools necessary for mounting shall be in vendor scope.</p>	
<b>5.07</b>	<b>Interconnection of SPV module cable to 6 sq-mm cable:</b> <p>(1) Each SPV module string shall be connected to SMB using 1Cx 6 sq-mm cable (copper, PVC insulation, PVC outer sheath, IS: 1554 part-1) supplied by BHEL.</p> <p>(2) SPV module is provided with positive and negative cables (4 sq-mm) having male and female parts of MC4 type connectors.</p> <p>(3) Vendor shall supply plug connectors of MC4 type, each set having a pair of male and female parts, to join the 6 sq-mm cable with SPV module cable.</p> <p>(4) MC4 connectors shall have rating of 1000 V<sub>DC</sub> (IEC), rated current of 30 A, Type approved by TUV Rheinland for product safety.</p> <p>(5) Approved make: Multi-contact (MC4)/ Tyco/ Weidmuller/Bizlink equivalent.</p> <p>(6) Total quantity of MC4 connector sets required = 570 sets (each set having a male and a female part)</p> <p>(7) Extra quantity shall also be procured considering possibilities of damages during the installation. Vendor shall ensure that there shall not be any shortage during execution time.</p> <p>(8) In addition to the above safety margin, vendor shall supply 50 sets extra as spares for contingency use during post-</p>	



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	<p>commissioning period.</p> <p>(9) Two sets of tool kits (with plastic box enclosure) shall be supplied and stored at the site as O&amp;M tools. This shall include crimping plier MC4, open end spanner set MC4, stripping plier MC4, socket wrench insert to tighten, socket wrench insert to secure, inserts for both 4 sq-mm and 6-sqmm (of both pliers). Vendor should make available extra MC4 tool kits of at least 4 nos., during execution for simultaneous working on the array.</p> <p>Note: For any other equivalent make of plug connectors and tool sets, BHEL approval shall be taken prior to procurement.</p>	
<b>5.08</b>	<p><b>Routing of 1Cx 6 sq-mm cable</b></p> <p>(1) 6 sq-mm cables connecting the SPV module strings to SMBs shall be neatly routed along the structure.</p> <p>(2) Cable ties, nylon polyamide 6.6 UV stabilized black, UL94 flammability rating V2, operating temperature up to 85 deg C, shall be used to arrest any possibility of movement or sagging. Cable ties shall be of make: 3M, Phoenix contact, Weidmuller, Hellermannntyton, Panduit. Width of the cable ties shall be a minimum of 4.5 mm. BHEL approval shall be obtained for the selected brand and length of cable tie.</p> <p>(3) Cables shall not be loosely hanging.</p>	
<b>5.09</b>	<p><b>Underground laying of 6 sq-mm cables between the rows</b></p> <p>(1) Where 6 sq-mm cables run between two rows of structure, HDPE double walled corrugated (DWC) pipe shall be used to guide the cables underground from one row to the other.</p> <p>(2) HDPE DWC pipe shall be within scope of vendor supply.</p> <p>(3) Specification of HDPE DWC pipe: As per IEC 61386 part 1-4; ID shall be selected to accommodate the number of 6 sq-mm cables to be guided. However, ID shall be minimum 63mm.</p> <p>(4) Make: Jyoti electricals or reputed make as shall be approved by BHEL.</p> <p>(5) Make, part number, sizes / dimensions shall be submitted to BHEL for approval.</p> <p>(6) Details of cable trench:</p> <p>(a) Trench depth = 600 mm minimum</p> <p>(b) Trench width = 200 mm minimum</p> <p>(c) Bottom layer shall be sand of IS: 383 with 100mm thick.</p>	



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	<p>(d) HDPE conduit shall be laid over the sand layer. (e) Another layer of sand of 100 mm thick. (f) Trench shall, then, be filled with refill soil and compacted (7) Total length of HDPE DWC pipe required ~1000m.</p>	
<b>5.10</b>	<p><b>Connecting the 6 sq-mm cables on input side of SMBs</b></p> <p>(1) 6 sq-mm cables of positive and negative polarities originating from SPV module strings shall be terminated at the input side of SMBs. (2) Vendor scope includes removal of sleeve at the cable end, crimping with male type MC4 connectors. These MC4 male type connectors have to be terminated on to the female type MC4 connectors that are part of the SMBs supplied by BHEL. (3) MC4 connectors required on the cable side will be in the scope of the vendor. Qty required = 1140 nos (male connector only) All necessary tools such as pliers, strippers, crimping tool etc shall be within vendor scope.</p>	
<b>5.11</b>	<p><b>Connecting the 185 sq-mm cables on output side of SMBs</b></p> <p>(1) Cables of 1Cx185 sq-mm (Aluminium, armoured, XLPE insulation, PVC sheathed) cables of positive and negative polarities shall be terminated at the output side of SMBs. Supply of this cable is in BHEL scope. Positive and negative cables are identified by the colour: red and black, respectively. (2) Overall diameter of cable ~ 30 mm. (3) Vendor scope includes removal of sleeve at the cable end, crimping with suitable cable lug of appropriate type/size and connecting the lugged end to the bus bar within the SMB. Cables shall enter the SMB through the cable glands that are also supplied by BHEL along with SMBs. (4) Cable lug shall be in vendor scope of supply. Lug shall be bimetallic (Cu and Al) of appropriate duty and size. Make: Dowell's / 3M/3D or any other reputed equivalent and shall be approved by BHEL. Quantity required ~ 80 Nos + contingency during installation. (5) Hardware such as bolts, nuts, plain washers and spring washers shall be in vendor scope of supply. The size and type of these shall be in accordance with termination arrangement on the bus bar of SMB. (6) All necessary tools such as pliers, strippers, crimping tool</p>	



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	etc., shall be within vendor scope.	
5.12	<p><b>Cable trenches for laying power cables from SMB to control room:</b></p> <p>(1) 1Cx185 sq-mm (Aluminium, armoured, XLPE insulation, PVC sheath) cables of positive (red) and negative (black) polarities are routed from SMB box to power conditioning units (PCUs) kept at the centralized control room.</p> <p>(2) Overall diameter of cable ~ 30 mm.</p> <p>(3) These cables shall be laid underground from the point near SMB to a point close to the control room.</p> <p>(4) Two cables (+, -) from each of the 39 SMBs have to be routed to the control room.</p> <p>(5) Exact solar array layout with positions of SMBs will be provided by BHEL after placing purchase order. Generally these power cables will be coming in 500/1000 m drums. Vendor has to carefully plan laying of farther cables first to ensure cut lengths can be used for shorter cables. Any shortage of cable occurring because of vendor's works will be in the scope of the vendor. However, estimated length of the cable trench, all the stretches added together, is approximately 2500m.</p> <p>(6) Vendor shall construct the underground trench as follows:</p> <p>(a) Trench depth = 750 mm minimum</p> <p>(b) Trench width shall vary en route to control room, based on the number of cables. As the cables join from SMBs en route, bunching takes place and the width of trench shall increase. Max trench width expected = 2m.</p> <p>(c) Sand as per IS: 383 of 100 mm layer thickness shall be laid at the bottom most level of trench.</p> <p>(d) Over the sand layer, cables shall be laid one adjacent to the other. Cables shall not be laid one over the other. In other words, only one layer of cables shall be allowed.</p> <p>(e) Over the layer of cables, one more layer of sand of 100mm shall be laid.</p> <p>(f) Then, a single layer of class-2 brick of 75 mm thickness shall be laid.</p> <p>(g) Trench shall then be filled up with refill soil.</p> <p>(h) Subsequently, land over the cable trench shall be leveled and compacted suitably.</p>	



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5.13

**Installation (indoor) of PCUs and ducts, battery banks, FCBC battery charger panels, ACDB/DCDB panels, HT Panels, data stations of SCADA within control room together with cable trays in cable trench:**

- (1) Vendor shall organize necessary resources such as labour, cranes, hydra, forklifts, transportation trucks / trolleys and other accessories for movements and positioning of the items as below within the control room:
  - (a) 630kW PCU panels: 5 sets
  - (b) Battery bank (110V, 100AH): 2 sets **(vendor scope of supply)**
  - (c) FCBC battery charger panel: 2 sets**(vendor scope of supply)**
  - (d) DCDB: 1 set **(vendor scope of supply)**
  - (e) ACDB panel: 1 set **(vendor scope of supply)**
  - (f) Data station for SCADA: 1 set
  - (g) Control desk with PCs and accessories: 1 set
  - (h) 33KV HT Panel :4 sets
  - (i) Ducts for PCUs : 5 sets **( vendor scope of supply)**
- (2) Panels shall be placed over the cable trenches in control room, in the exact sequence and locations as shown in BHEL drawings that will be provided to vendor at an appropriate time during the period of execution.
- (3) Panels shall be suitably grouted using welding / bolting methods as appropriate. BHEL approval shall be obtained for the grouting arrangement. All necessary hardware for the same shall be within vendor scope of supply.
- (4) Vendor shall supply and install cable trays within control room for laying DC, AC & signal cables over the trays.  
Vendor shall supply cable trays as follows:
  - (a) Ladder(AC&DC) & Perforated(Signal) GI
  - (b) Hot dip galvanized
  - (c) Thickness = 3 mm
  - (d) Depth = 40 mm
  - (e) Width = 600 mm
  - (f) Normal type trays: 150m maximum (total length)
  - (g) Corner-bend trays of proportionate size to align with the normal type at the corners to be used.
- (5) Vendor shall fix the cable trays on the projecting steel sections in cable trench of control room. Any works related



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	<p>to the appropriate placement of these steel sections will be in the vendor's scope.</p> <p>(6) Suitable cut outs shall be made in the cable trays to provide path for the cable to reach the lower level trays.</p> <p>(7) Adjacent cable trays shall be interconnected using suitable hardware items that shall be in vendor scope of supply.</p> <p>(8) Cables shall be laid over the cable trays and neatly dressed using appropriate cable ties etc.</p> <p>(9) For 185 sq-mm cables, cable support structure within control room (close to the entry holes) shall be provided to avoid sagging strain on the cables. Supports shall be made using suitable ISA MS angles (75x6 minimum) suitably painted with red oxide and BHEL approved black paint. BHEL approval shall be taken for the support arrangement. A maximum of four such support structures shall installed within control room and close to the cable entry holes.</p> <p>(10) Similarly, cable ladders shall be provided for 1Cx 300 sq-mm cables to avoid sagging strain, near the three exit points, through which the cables approach transformers placed at the switchyard. Cable ladders shall be made of MS, painted using red oxide and black paint. Drawing of ladder arrangement shall be submitted to BHEL for approval.</p> <p>(11) 1Cx300 sq-mm cables (3 runs per phase) are routed from control room to transformers in switchyard through an opening in the walls of control room. These openings shall be closed using a suitable sheet made of steel/aluminium/fiber etc. to arrest entry of rodents. These cable support structures at the entry and exit are for ensuring cable will be entering the control room at an elevated level than the ground level. This will be useful to avoid any sort of water ingress into the cable trench in the control room.</p>	
<b>5.14</b>	<b>Power cable terminations on DC side of PCUs in control room</b> <p>(1) On DC side, for each PCU, vendor shall carry out the cable terminations for 8 positive and 8 negative input connections – unsleeving, crimping and connecting.</p> <p>(2) BHEL shall supply the cables (1Cx185 sq-mm Aluminium, armoured, XLPE insulation, PVC sheath)</p> <p>(3) Vendor should supply required cable glands, cable lugs, bolts, nuts and washers for the termination of these cables</p>	



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	<p>at the DC chamber. Qty= 80 sets</p> <p>(4) Any termination required from the DC chamber on to the PCU also will be in the scope of vendor along with the required glands, lugs and hardware.</p> <p>(5) All tools and accessories required to carry out the termination shall be within scope of vendor.</p>	
<p><b>5.15</b></p>	<p><b>Power cable terminations on AC (LT) side for PCUs and transformers</b></p> <p>(1) On AC side, 3-phase 3-wire power cable interconnections shall be made between PCUs, LT panels and transformers using 1Cx300 mm<sup>2</sup> Aluminium, armoured, XLPE 3 runs per phase. <b>Total length req: approx. 900 mtrs. Supply of 1 C X 300 sqmm Al. Armoured XLPE cable is in vendor's scope. Make : Polycab/ KEI/ Advanced Cable / Lapp / Universal / Torrent / CCI / Havells or any other as shall be approved by BHEL.</b></p> <p>(2) For cable terminations at transformer end, Vendor shall supply the cable glands, cable lugs, bolts, nuts, plain washers, spring washers. Bimetallic lugs (Al-Cu) shall be supplied. Bolts, nuts, plain washers shall be of SS304 type. Spring washers shall be zinc plated steel. All these shall be of Dowell's / 3M / Comet or reputed equivalent as shall be approved by BHEL. BHEL will furnish the exact diameter of the cable at an appropriate time during the period of execution. Considering 3 transformers of 2x1600 kVA each having two LV windings and 1x800 kVA having one LV winding, total quantity for 3 runs per phase lugs, hardware required = 90 sets.</p> <p>(3) For cable terminations at PCUs/LT panels, Vendor shall supply the cable glands, cable lugs, bolts, nuts, plain washers and spring washers.</p> <p>(4) Vendor shall make the measurements between the equipment, cut the cables to the required lengths, fix them with glands, unsleeve them at the ends, crimp them with the lugs and terminate them at the respective bus bar provisions within the panels.</p> <p>(5) There are 5 PCUs of 630kW, including LT section with Air Circuit Breakers, 2 nos., of 3-winding Transformers of 1600 kVA and 1 no., of 2-winding transformer of 800 kVA.</p> <p>(6) All tools and accessories required to carry out the</p>	



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	<p>termination shall be within scope of vendor.</p> <p>(7) Cable supporting structure shall be installed between control room and LV side of transformer using ISA angles of minimum 75x6 arranged in vertical and horizontal orientations and joined using welding. The level of structure shall be at a minimum height of 400 mm above the ground level. Adequate number of horizontal angles shall be provided to minimize gap between two angles so that cable sagging is avoided. Vertical angles shall be grouted using concrete foundation with depth of minimum 400mm. PCC layer 1:3:6 of 100mm thick shall be used. Cross section of foundation shall be minimum 200x200mm. All items required for the structure shall be in vendor scope of supply. Structure shall be painted using red oxide and BHEL approved black paint. Suitable arrangement, such as fixing perforated cable trays in inverted position, shall be provided to cover the laid cables. Drawing of cable supporting structure shall be submitted to BHEL for approval. Quantity of cable support structure with cover = 3 sets.</p>	
<p><b>5.16</b></p>	<p><b>Foundation pedestals and outdoor installation of 1600 kVA, 33kV/350-350V &amp; 800 kVA 33kV/350V transformers supplied by BHEL</b></p> <p>(1) Number of 1600 kVA transformers = 2 sets Number of 800 kVA transformers = 1 set</p> <p>(2) Vendor shall construct RCC foundation for each set of transformer. Following are the requirements :</p> <p>(a) Weight of each transformer ~ 4500 Kg</p> <p>(b) Soil report will be shared up on vendor's request after placing P.O</p> <p>(c) Size of foundation ~ 3000 x 3000 mm (L x B)</p> <p>(d) Foundation below ground level shall include PCC 1:3:6 layer (~200 mm) and if required based on site conditions, sand and boulder layers also shall be required to strengthen the foundation, in which case overall foundation depth shall be ~ 600mm.</p> <p>(e) Foundation pedestal height above the ground level ~ 500 mm that includes M25 concrete with steel rods of 8mm minimum diameter for skin reinforcement all around with inside steel chairs etc.</p>	



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	<p>(f) Hardware arrangements (steel bolts, plates, nuts, washers etc.), which will be part of foundation pedestal for anchoring the transformer, shall be provided as per BHEL drawing.</p> <p>(g) Pedestal shall be provided with cement plastering all around to achieve a smooth finish and painted with two coats of approved brand and colour water proofing cement paint. Second coat of painting shall be carried out after installation of transformer.</p> <p>(3) Transformer and its accessory parts such as radiators, cable boxes, hardware etc. as supplied by BHEL shall be moved from storage yard and positioned on foundation pedestal. All parts and hardware shall be assembled as per guidance at site provided by BHEL / transformer vendor.</p> <p>(4) Vendor shall provide all necessary support and assistance to the representative of transformer manufacturer during installation:</p> <p>(a) Oil filling in all transformers.</p> <p>(b) Measurement of parameters: insulation resistance etc.</p> <p>(c) Connections to marshalling box</p> <p>(5) Vendor shall submit drawing of transformer foundation to BHEL for approval.</p>	
<b>5.17</b>	<b>Firewalls between transformers</b> <p>(1) Firewall shall be constructed in between adjacent transformers.</p> <p>(2) Quantity of firewalls = 2 Nos.</p> <p>(3) Soil report will be shared up on vendor's request after placing P.O</p> <p>(4) Length of firewall ~4000 mm; Height ~3500 mm above ground level.</p> <p>(5) Wall shall be 230 mm minimum thick with suitable reinforcing steel and concrete for stability.</p> <p>(6) Foundation for a minimum depth of 900 mm below ground level. This shall include PCC 1:4:8 as the bottom layer.</p> <p>(7) Firewall shall be finished with cement plaster and water proof cement paint of BHEL approved colour all around.</p> <p>(8) Any specific regulations of STATE ELECTRICITY SUPPLY &amp; TRANSMISSION BOARDS/CEIG shall be duly considered.</p> <p>(9) Vendor shall provide the firewall drawing to BHEL for</p>	



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	approval.	
5.18	<p><b>Oil pits for 1600 kVA &amp; 800 kVA transformers in switchyard</b></p> <p>(1) Transformers shall be provided with suitable soak pit around the foundation. Further, such arrangements of individual transformers shall be interconnected using suitable hume / concrete pipes and terminated at a remote oil tank. These arrangements shall be in accordance with STATE ELECTRICITY SUPPLY &amp; TRANSMISSION BOARDS / CEIG requirements / practices.</p> <p>(2) Note: Oil capacity per transformer: ~ 1800 Liters</p> <p>(3) The foundation of transformer shall be accordingly designed to facilitate the provision of soak pits.</p> <p>(4) Drawings of soak pit / pipes / remote tank arrangements shall be submitted to BHEL for approval. Further, based on these inputs, transformer foundation shall be fine-tuned.</p>	
5.19	<p><b>Cable trench and laying of power cables in switchyard (both HT and LT cables)</b></p> <p>(1) Vendor shall construct underground cable trench (rectangular cross section) for laying the 33kV cables. Cable trench shall be (a) between the transformers and incomers of HT panels (1Cx3RX185 sq-mm cables). Total running length of trench = 300m maximum.</p> <p>(b) between the outgoer HT panels and the four pole structure (1Cx3Rx185 sq-mm cable). Total running length of trench: 150 m maximum, and</p> <p>(c) between the 100 kVA auxiliary transformer to the entry point of control room wall bordering the switchyard (3.5Cx 95 sq-mm cable); Total running length of trench: 30m maximum.</p> <p>(2) 1Cx3RX185 sq-mm sq-mm 33 kV cable shall be within vendor scope of supply. Specification of cables is as follows:</p> <p>(a) Cable, 1Cx3Rx185 sq-mm, 33kV, Al conductor, XLPE insulation, armoured, PVC sheath as per IS: 7098-1985 part-2. Quantity required ~ 450 m</p> <p><b>Make : Polycab/ KEI/ Advanced Cable/ Lapp / Universal / Torrent / CCI/ Havells or any other as shall be approved by BHEL.</b></p>	



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	<p>(3) Following shall be considered in trench construction:</p> <p>(a) Trench width shall be based on bunching of cables from transformers towards HT panels. Accordingly, width shall vary en route. Alternately, an average constant width shall be maintained.</p> <p>(b) Trench depth shall be minimum 600mm.</p> <p>(4) Trench layout and trench drawings shall be submitted to BHEL for approval.</p>	
<b>5.20</b>	<p><b>Power cable terminations on AC HT side (33kV)</b></p> <p>(1) Vendor shall carry out HT power cable terminations on HV side (33kV) of transformers (3 sets) and HT panels (3 incomers) using 1Cx 3RX 185 sq-mm, cable lugs, HT termination kits and all necessary hardware, all of which shall be within vendor scope of supply.</p> <p>(2) For terminations at the outgoer HT panels, the 33KV cable shall be 1Cx 3RX185 sq-mm.</p> <p>(3) HT termination kits shall be of 33kV, 1-core, indoor type. Make: Raychem, 3M or reputed equivalent as shall be approved by BHEL.</p> <p>(4) Qty of termination kits = 7 sets for 1Cx3Rx185 sq-mm. Extra spare quantities shall be provided (3 Sets).</p> <p>(5) The other end of the cable from the outgoer shall be terminated at four pole structure that houses the GOS switches. For this, the HT termination kits shall be of 33kV, 3-core, outdoor type. Quantity = 2 set + 1 set spare. Make: Raychem, 3M or reputed equivalent as shall be approved by BHEL.</p> <p>(6) Cable lugs and hardware shall be of dowell's / 3M or reputed equivalent as shall be approved by BHEL.</p> <p>(7) All tools and accessories required to carry out the termination shall be within the scope of vendor.</p> <p>(8) Since no cable glands are provided for these cases, vendor shall apply suitable grade of bitumen, RTV or any other sealant as shall be approved by BHEL, for sealing the gap around the cable at the cable entry of transformers and HT panels.</p>	
<b>5.21</b>	<p><b>RSJ poles</b></p> <p>(1) Vendor shall supply rolled steel joist beams (RSJ I-beams) with length of minimum 9m as per IS: 2062-1992 (hot rolled steel) with dimensions as per IS: 808-1989 and tolerances as</p>	



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	<p>per IS: 1852-1985. Beams shall be hot-dip galvanized or suitably painted based on STATE ELECTRICITY SUPPLY &amp; TRANSMISSION BOARDS/CEIG etc requirements.</p> <p>(2) The cross section dimensions of RSJ poles shall be as per STATE ELECTRICITY SUPPLY &amp; TRANSMISSION BOARDS/CEIG etc requirements meant for four pole structures.</p> <p>(3) Vendor shall submit the dimension details of RSJ poles. BHEL approval shall be obtained for the brand and supplier of the poles.</p> <p>(4) Vendor shall provide inspection call to BHEL for witnessing acceptance tests at manufacturer works. Quality inspection plan shall be submitted to BHEL prior to inspection call.</p> <p>(5) Test reports shall be submitted to BHEL.</p> <p>(6) Quantity = 8Nos (four pole structures: 2 sets x 4 Nos)</p> <p>(7) RSJ poles shall be grouted with a foundation depth of 1.55 m minimum below ground level. RCC foundation (M25 concrete, with steel rods of minimum 8mm) shall be constructed over PCC layer of 1:3:6 (100 mm thick). Cross section size of foundation shall be in line with STATE ELECTRICITY SUPPLY &amp; TRANSMISSION BOARDS/CEIG etc., requirements. RCC foundation shall be up to a level of ~500mm above ground level.</p> <p>(8) Vendor shall submit drawing of RSJ pole foundation for BHEL approval.</p>	
<p><b>5.22</b></p>	<p><b>Gang operated switch (Air break switch), triple pole, double break, horizontal and centrally rotating type:</b></p> <p>(1) Rated voltage: 36kV</p> <p>(2) Operating voltage: 33kV</p> <p>(3) Impulse withstand voltage: 170kV peak</p> <p>(4) Power frequency withstand voltage (1 min): 70kV rms</p> <p>(5) Continuous current rating: 400A</p> <p>(6) Short-time current rating: 40 kA</p> <p>(7) Construction: Triple pole, one or two insulators per pole, double break, centrally rotating type</p> <p>(8) Insulators: Porcelain type conforming to IS: 2544 / IEC 273, made of homogeneous material with uniform glazing, free from cavities and other flaws, with high quality smooth finish. Fixed electrical contacts are supported by the insulators.</p> <p>(9) Mounting base: The three poles shall be mounted on a rigid</p>	



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	<p>base of MS channel of minimum size of 75x40x6 mm (hot dip galvanized), provided with suitable holes, clamps and bolts to enable firm mounting.</p> <p>(10) Electrical contacts: All current carrying parts shall be made of electrolytic copper (silver plated). The fixed contacts shall be of spring-loaded pressure type so as to ensure firm contact and proper alignment. (The springs shall not carry any current). Arcing contacts shall be provided with spring assisted operation.</p> <p>(11) Earthing terminals: Two terminals with adequate size to carry full short circuit current; shall be provided on the frame of each pole.</p> <p>(12) Coupling rod: 25mm nominal bore GI pipe medium gauge</p> <p>(13) Operating rod: 32 mm nominal bore GI pipe medium gauge single length 6m.</p> <p>(14) Standard: IS: 9921 part 1 to 4 / IEC 265 part 1</p> <p>(15) Quality Assurance Plan and drawings shall be submitted by the vendor for BHEL approval. QAP shall include routine tests / acceptance tests as per relevant IS / IEC standards. BHEL shall witness the tests at the works, for which vendor shall provide inspection call to BHEL in advance.</p> <p>(16) Approved make: Electrolite (Jaipur), Lamco, GR power or reputed equivalent as shall be approved by BHEL.</p> <p>(17) Quantity of GOS switch required as a whole:</p> <p>(a) 3 sets without earth switch</p> <p>(b) 1 set with earth switch (manually operated)</p>	
<p><b>5.23</b></p>	<p><b>Lightning arrestors for switchyard (Surge suppressors)</b></p> <p>(1) Arrestor rating: 33kV, 10kA, Class-3 with IB</p> <p>(2) Type: Metal oxide Gapless lightning arrestor</p> <p>(3) Make: Lamco (Hyderabad), Electrolites (Jaipur) or any other reputed equivalent as shall be approved by BHEL.</p> <p>(4) Standard: IS 3070 (part-3) 1993 &amp; IEC 60099-4 of 2004</p> <p>(5) Minimum acceptance tests that shall be witnessed by BHEL</p> <p>(a) Power frequency reference voltage test at 3mA</p> <p>(b) Partial discharge test at MCOV x 1.05</p> <p>(c) Lightning impulse residual voltage test at 100% NDC</p> <p>(d) Functional tests on surge monitor</p> <p>(e) Galvanization test on exposed metal parts</p> <p>- Uniformity, mass, thickness of Zn coating</p>	



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	<p>(f) Visual examination and dimensional verification</p> <p>(6) Vendor shall provide inspection call to BHEL. Quality assurance plan shall be submitted prior to inspection call.</p> <p>(7) These lightning arrestors / surge suppressors (3 Nos) shall be mounted on the four pole structures as shown in SLD diagram.</p> <p>(8) Total quantity required = 6 Nos+ 1 extra as spare</p>	
<b>5.24</b>	<p><b>Installation of first set of four pole structure with GOS switch</b></p> <p>The switchyard comprises of one sets of four pole structure. The installation requirements for the first set are as follows:</p> <p>(1) Vendor shall install first set of four pole structure that carries the following items:</p> <p>(a) RSJ poles with foundation as per clause above : 4 Nos</p> <p>(b) GOS switches (Air break switch), 3 pole, double break, horizontal, centrally operated, 33kV, 400A as per IS:9921 part 1-4, without earth switch: 3 sets</p> <p>(2) Insulators as per IS: 2544 / IEC 273 shall be used wherever required to maintain HV isolation from RSJ poles.</p> <p>(3) CPVC pipes shall be used to guide the XLPE HT cables (33kV, aluminium conductor) reaching the four pole structure from the outgoer HT panel. This pipe shall be positioned vertically at the central location between adjacent RSJ poles. The pipe shall be fixed using a suitable arrangement of GI clamps, IS angles, hardware etc. The pipe as well as the clamping arrangement shall be approved by BHEL prior to procurement / fabrication. Diameter of CPVC pipe shall be in accordance with diameter of 1Cx3RX185 sq-mm cable. Length shall be a minimum of 4m. Quantity of CPVC pipes = 1 No.</p> <p>(4) The XLPE cable shall be connected to GOS switch.</p> <p>(5) The second GOS switch shall be for connected to the auxiliary transformer that is mounted on cement foundation. Drop out fuse wires with 33kV fuse holders shall be mounted on a suitable mounting arrangement such as base channel of 75x40x6, etc. Rated voltage 36kV, BILL 75kV, copper fuse wire of AWG 30 (~6A melting). Make: Electrolite (Jaipur) / or reputed equivalent as shall be approved by BHEL</p> <p>(6) The third GOS switch is for closing / opening of the plant as a whole. Hence, this shall be looped to the output from the</p>	



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	<p>first switch.</p> <p>(7) All hardware fittings and accessories, which are essential to fulfill the functional requirements of the four pole structure in terms of mechanical stability, electrical insulation / connections etc, shall be provided by the vendor. This shall include items such as cross-arms, stay sets, disk insulators, insulation hardware (suspension string, tension string etc), forging fittings, yoke plates, clamps, connectors, corona control rings, arcing horns, earthing accessories, ACSR conductor and its accessories, vibration dampers, spacers, etc as applicable to meet the electricity board requirement shall be provided by the vendor.</p> <p>(8) Vendor shall submit general arrangement and detailed drawings with bill of materials/ quantities of the four pole structure set with individual item description, quantity, make, specs / ratings etc for BHEL approval.</p> <p>Note: All MS parts of FP structure shall be suitably painted using red oxide and BHEL approved silver colour paint.</p>	
<p><b>5.25</b></p>	<p><b>Installation of second set of four pole structure with GOS switches and Lightning arrestors</b></p> <p>The second set of four pole structure is at the end of the plant where the plant can be connected to 33kV grid line.</p> <p>Vendor shall install the second set of four pole structure that carries the following items:</p> <p>(1) RSJ poles with foundation as per clause above: 4 Nos</p> <p>(2) GOS switches (Air break switch), 3 pole, double break, horizontal, centrally operated, 33kV, 400A as per IS:9921 part 1-4, interlocked with earth switch (manually operated): 1 set</p> <p>(3) Base channels of 75x40x6 mm minimum shall be used for mounting the lightning arrestors.</p> <p>(4) Insulators as per IS: 2544 / IEC 273 shall be used wherever required to maintain HV isolation from RSJ poles.</p> <p>(5) Lightning arrestors (surge suppressors) of 33kV, 10kA - 3 Nos at the overall plant output lines.</p> <p>(6) Outdoor oil-immersed combined CT/PT set for metering purpose. The CTs and PTs shall have two cores on their secondary side both meant for metering. CT: CL 0.2s, 10VA; PT: 0.2s, 30VA.</p>	



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CT and PT shall be manufactured in accordance with IS: 2705 / IEC 185 and IS: 3156 / IEC 186 respectively.

**Note:** In case combined CT/PT is not available, separate CTs and PTs shall be procured (either three phase or three units of single phase). Accordingly, selection of CT/PT units shall be approved by BHEL prior to procurement.

Make: Lamco / Kappa / Intrans / Mehru / AE or reputed equivalent as shall be approved by BHEL.

(7) Suitable arrangement, using base channels min 100x50x6etc, shall be provided for mounting the CT/PT sets on the four pole structure. Mounting arrangement shall be approved by BHEL prior to procurement.

(8) One metering panel, having three numbers ( one main meter, one check meter and one stand by meter) of L&T make ABT electronic trivector meter ER300P (class 0.2s) with RS485 port, MODBUS RTU protocol, with downloading license shall be supplied and installed close to the CT/PT units using appropriate steel fixtures (angles etc) and hardware. The panels shall be either ground-mounted using foundation pedestal or mounted on the four pole structure directly. Either way, the panel shall be at an elevated position (~1 m above ground level) for comfortable viewing of readings. In case of ground-mounting, either foundation pedestal itself shall be elevated (with steps) or suitable mounting fixtures of required height shall be grouted to the foundation. Foundation depth min 600 mm, with PCC 1:3:6 layer of ~100 mm thick, M25 concrete, brick masonry for steps etc. Cable connections, via appropriate flexible corrugated electrical conduits, shall be made between CT/PTs and meters. Both cables and flexible corrugated electrical conduits (UPVC etc) in vendor scope. Common Meter Reading Instrument as per IEC-62056, Sands make (CMRI-1006) or BHEL approved equivalent along with optical probes to be provided (2 sets).

(9) All hardware fittings and accessories, which are essential to fulfill the functional requirements of the four pole structure in terms of mechanical stability, electrical insulation / connections etc, shall be provided by the vendor. This shall include items such as cross-arms, stay sets, disk insulators, insulation hardware (suspension string, tension string etc),



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	<p>forging fittings, yoke plates, clamps, connectors, corona control rings, arcing horns, earthing accessories, ACSR conductor and its accessories, vibration dampers, spacers, etc as applicable to meet the electricity board requirement shall be provided by the vendor.</p> <p>(10) Vendor shall submit general arrangement and detailed drawings with bill of materials / quantities of the second set of four pole structure with individual item description, quantity, make, specs / ratings etc for BHEL approval.</p> <p>Note: All MS parts of FP structure shall be suitably painted using red oxide and BHEL approved silver colour paint.</p>	
<p><b>5.26</b></p>	<p><b>Installation of auxiliary transformer on cement foundation:</b> Vendor shall supply and install :</p> <ol style="list-style-type: none"><li>Outdoor, Oil immersion type, ONAN, 3-phase, Dyn11, 100 kVA, 33kV/415V (+/-10%), 50Hz +/- 3% transformer, Class A insulation, percent impedance 4.5%, cable box with bottom side cable entry on both HV and LV side, as per IS: 2026 for auxiliary power consumption to internal utilities of the power plant. Other parameters:<ul style="list-style-type: none"><li>- Winding material: Electrolytic grade copper</li><li>- HV side delta, LV side star with 4-wire, neutral terminal brought out separately.</li><li>- Highest voltage for equipment: 36 kV rms for HV side, 1.1kV rms for LV side</li><li>- Rated short duration power frequency withstand voltage: 70kV rms for HV side, 3kV rms for LV side</li><li>- Rated lightning impulse withstand voltage: 170kV peak for HV side</li><li>- Off-circuit tap changer on HV side: +/- 5% in steps of 2.5% (-5%, -2.5%, 0, +2.5%, 5%)</li><li>- Temperature rise: For max ambient of 50 degC, the maximum allowable temperature rises in oil and winding by thermometer method shall be 50 deg C and 55 deg C respectively.</li><li>- BHEL shall witness the temperature rise test and routine tests, for which vendor shall provide inspection call to BHEL in advance.</li></ul></li><li>Foundation below ground level shall include PCC 1:3:6 layer (~200 mm) and if required based on site conditions,</li></ol>	



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	<p>sand and boulder layers also shall be required to strengthen the foundation, in which case overall foundation depth shall be ~ 600mm.</p> <ul style="list-style-type: none"><li>- Foundation pedestal height above the ground level ~ 500 mm that includes M25 concrete with steel rods of 8mm minimum diameter for skin reinforcement all around with inside steel chairs etc.</li><li>- Hardware arrangements (steel bolts, plates, nuts, washers etc), which will be part of foundation pedestal for anchoring the transformer, shall be provided by the vendor.</li><li>- Pedestal shall be provided with cement plastering all around to achieve a smooth finish and painted with two coats of approved brand and colour water proofing cement paint. Second coat of painting shall be carried out after installation of transformer</li></ul> <p>3. Electrical interconnections up to the transformer bushings on HV side shall be made using 1CX3RX185 sq.mm XLPE aluminium conductors.</p> <p>On LV side, suitable supporting arrangement shall be provided to route the cable, 3.5Cx 95 sq-mm, Al conductor, armoured, PVC insulation, PVC sheathed cable as per IS:1554. The arrangement shall provide for suitable clips, clamps etc to ensure neat dressing of the cable.</p>	
<b>5.27</b>	<p><b>Overhead lines in switchyard using ACSR conductor</b></p> <ul style="list-style-type: none"><li>(1) Vendor shall supply 7/4.72 DOG type ACSR conductors for use as overhead lines in four pole structures of the switchyard.</li><li>(2) ACSR conductor shall be as per IS:398 part-II 1996</li><li>(3) All electrical interconnection looping in FP structures shall be through stringing / jumpering of ACSR conductors.</li><li>(4) Vendor shall submit test certificates for ACSR conductors for BHEL scrutiny and acceptance.</li><li>(5) Total length of ACSR conductor ~ 100m</li></ul>	
<b>5.28</b>	<p><b>Connecting to the 33kV grid line</b></p> <ul style="list-style-type: none"><li>(1) The 33 kV grid line will be provided at the plant second four pole structure of the SPV plant.</li><li>(2) Vendor shall submit a general arrangement drawing for the interconnection at the four pole structure with detailed bill of materials / quantities with individual item description,</li></ul>	



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	<p>quantity, make, specs / ratings etc. for BHEL approval. Note: All MS parts of FP structure shall be suitably painted using red oxide and BHEL approved silver colour paint.</p>	
5.29	<p><b>Power cable terminations at 100 kVA transformer, ACDB panel:</b></p> <p>(1) Vendor shall carry out termination on HT side of 100 kVA auxiliary transformer (33kV/415V) using 1Cx3Rx 185 sq-mm, Al conductor, armoured, 3300V, XLPE insulation, PVC sheath cable as per IS: 7098, 33KV HT termination kit cable lugs, bolts, nuts, plain washers and spring washers. All these items including cable shall be within vendor scope of supply.</p> <p>(2) Vendor shall carry out termination on LT side of 100 kVA auxiliary transformer (33kV/415V) using 3.5Cx 95 sq-mm, Al conductor, armoured, 1100V, PVC insulation, PVC sheath cable as per IS: 1554 (part-1), cable glands, cable lugs, bolts, nuts, plain washers and spring washers. All these items including cable shall be within vendor scope of supply.</p> <p>(3) Similar terminations shall be carried out on the other end of cable that gets terminated at ACDB panel kept within control room. Vendor shall supply the necessary cable glands, cable lugs and hardware for ACDB end as well.</p> <p>(4) Quantity of cable ~ 75m</p> <p>(5) All tools and accessories required to carry out the termination shall be within the scope of vendor.</p>	
5.30	<p><b>Erection of Switch Yard:</b></p> <p>(1) Switchyard size~ : 30 x 20 sq.m</p> <p>(2) Stone jellies of 20 mm or 40 mm shall be spread uniformly with a layer of minimum 100 mm thick throughout the switchyard area except for the stretches of WBM road and other occupied foundation areas. Approximate area for stone jelly spreading ~ 600 sq-m.</p> <p>(3) WBM road of minimum width of 3.5m shall be laid within the switchyard for the purpose of movement of vehicles etc for maintenance. The road shall consist of two layers of WBM grade-2 material with each layer having 75 mm thickness, along with screening and binding materials to achieve desired compaction.</p> <p>(4) Approximate length of WBM road ~ 24 m. BHEL shall provide drawing at an appropriate time during execution.</p> <p>(5) It shall be ensured that levels of WBM road shall be at a higher level than stone jelly level at least by 50 mm.</p>	



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<p><b>5.31</b></p>	<p><b>Support and assistance for SCADA integration for the power plant</b></p> <p>(1) SCADA of power plant comprises of data station panel and PC based control desk with software to collect, store, process and report the data parameters of power plant as follows:</p> <ul style="list-style-type: none"><li>(a) String monitoring boxes in solar array field: string current, voltage, box temperature, module temperature, status of SPD and load break switch in SMBs</li><li>(b) Weather monitoring equipment: solar irradiation, ambient temperature, wind velocity.</li><li>(c) Power conditioning units: DC input /AC output parameters of inverters, grid data, fault status and events logged, etc, ACB ON/OFF status</li><li>(d) HT breaker panels: status of VCB breakers, status of protection relays of transformers, oil / winding temperatures, AC parameters at 1 MW and 3MW levels, energy generation values.</li></ul> <p>(2) Vendor shall provide support and assistance to BHEL in following activities:</p> <ul style="list-style-type: none"><li>(a) Formation of underground cable trenches and cable laying for data communication cables from SMBs to SCADA, from transformers / HT panels/metering panels to SCADA/remote annunciation panel.</li><li>(b) Data cable laying from PCUs, ACDB /DCDB panels to SCADA</li><li>(c) Data cable terminations at PCUs ACDB panels, transformers and HT panels.</li></ul>	
<p><b>5.32</b></p>	<p><b>Cable trenches for laying data communication cables from SMB to control room.</b></p> <p>(1) Data communication cables shall be laid from SMBs to the data station panel in the SCADA room of the centralized control room.</p> <p>(2) Cable specification:</p> <ul style="list-style-type: none"><li>- Cable, 1.1kV grade, 1 pair x 0.5 sq-mm, annealed tinned copper drain wire, stranded, PVC type-A insulation, twisted pair, overall shielded with aluminium backed polyester film / mylar sheet, inner sheath of extruded PVC type ST1, Galvanized steel strip/round wire armoured as per IS, outer sheath of extruded FRLS PVC</li></ul>	



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	<p>type ST1 conforming to IS:1554 / part-1 with latest amendments up to date.</p> <ul style="list-style-type: none"> <li>- Approximate outer diameter = 9 mm</li> <li>- Make: Polycab, Advance cables, Lapp, Torrent, Universal, Havells, CCI or any other reputed equivalent as shall be approved by BHEL.</li> </ul> <p>(3) Cable shall be within vendor scope of supply.</p> <p>(4) Approximate length of cable required ~ 3000 m</p> <p>(5) This cable is meant for RS485 interfacing. The RS485 output of SMBs shall be daisy-chain looped using this cable. Approximately every 8 SMBs shall be daisy-chained to form one cable connection running up to SCADA room. In such a case, since 39 SMBs are there, approximately 5 cables will be running from solar array field to SCADA room.</p> <p>(6) These data cables shall be laid underground using separate cable trench. In other words, these cables shall not be laid along with power cables. A minimum distance of 500mm shall be maintained between the data cable trench and power cable trench to avoid EMI interference.</p> <p>(7) Underground laying shall be ensured even within the daisy-chain looping between adjacent SMBs.</p> <p>(8) Cable trench shall be as per details below:</p> <ul style="list-style-type: none"> <li>(a) Trench depth = 600mm minimum</li> <li>(b) Trench width shall be 200mm minimum</li> <li>(c) Bottom layer shall be sand as per IS: 383 with 100mm layer thickness.</li> <li>(d) Data cable shall be laid over the sand.</li> <li>(e) Another layer of sand, 100 mm thick, shall be laid.</li> <li>(f) A single layer of brick, class-2, 75mm thick, shall be laid over the sand.</li> <li>(g) Trench, then, shall be filled up with refill soil.</li> </ul> <p>(9) Total length of trench ~ 2000 m</p>	
<p><b>5.33</b></p>	<p><b>Cable trench and laying of data communication cables in switchyard</b></p> <ul style="list-style-type: none"> <li>(1) Following are the data cables in switchyard <ul style="list-style-type: none"> <li>(a) Transformers to HT panels</li> <li>(b) Transformers to SCADA station</li> </ul> </li> <li>(2) These data cables (details under following section), which are within the vendor scope of supply, shall be laid underground as follows:</li> </ul>	



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	<ul style="list-style-type: none"> <li>(a) Trench depth = 600mm minimum</li> <li>(b) Trench width shall be 200mm minimum</li> <li>(c) Bottom layer shall be sand as per IS: 383 with 100mm layer thickness.</li> <li>(d) Data cable shall be laid over the sand.</li> <li>(e) Another layer of sand, 100 mm thick, shall be laid.</li> <li>(f) A single layer of brick, class-2, 75mm thick, shall be laid over the sand.</li> <li>(g) Trench, then, shall be filled up with refill soil and suitably compacted.</li> </ul>	
<p><b>5.34</b></p>	<p><b>Data cable terminations in control room and switchyard</b></p> <ul style="list-style-type: none"> <li>(1) Vendor shall carry out data cable terminations at 1600 kVA / 800kVA transformers, HT panels and Remote annunciation panels, Metering panels, ACDB DCDB panels and PCUs.</li> <li>(2) Terminations at marshalling box of all 3 transformers and 3 incomers of HT panels (Buchholz relay, pressure release valve, low oil level, WTI, OTI etc.).</li> <li>(3) Terminations at 4 sets of HT panels (Buchholz relay, pressure release valve, low oil level, WTI, OTI, OC/EF relay, OV/UV relay, multi function meters etc.) for SCADA connections.</li> <li>(4) Terminations at 5 sets of PCU for capturing ON/OFF status of PCUs for SCADA purpose.</li> <li>(5) Terminations at 5 PCUs of 630kW for RS485 MODBUS communication cable connections.</li> <li>(6) Terminations at 1 ACDB and DCDB panel.</li> <li>(7) Terminations at two metering panels in switchyard.</li> <li>(8) All the cables required for the above terminations shall be within vendor scope of supply. Cable specification as follows: Cable, 1.1kV grade, copper conductor, stranded, PVC type-A insulation, twisted pair, overall shielded with aluminium backed mylar sheet in combination with ATC drain wire of 0.5 sq-mm, inner sheath of extruded PVC type ST1, Galvanized steel strip / round wire armoured as per IS, outer sheath of extruded FRLS PVC type ST1, conforming to IS: 8130 / part-1 with latest amendments up to date.</li> <li>(9) Approximate quantity requirements of cables for the above purposes as follows: 1 Pair x 0.5 sq-mm ~ 900m (PCUs, transformers to SCADA) 5 Pair x 0.5 sq-mm ~ 300m (HT panel to SCADA)</li> <li>(10) Make of cables: Polycab, Advance cables, Lapp, Torrent,</li> </ul>	



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	<p>Universal, CCI, Havells or any other reputed equivalent as shall be approved by BHEL.</p> <p>(11) Cable lugs and all hardware required for making the above terminations shall be in vendor scope of supply.</p> <p><b>Note:</b> Along with the above activities, DC/AC power supply cable laying and terminations shall be also be carried out for transformers and HT panels using 2Cx2.5 sq-mm copper, armoured, PVC cables. Cable shall be laid from battery bank and DCDB(for DC) and ACDB panel (for AC).</p>	
5.35	<p><b>Earthing of solar array structures</b></p> <p>(1) Vendor shall supply and interconnect solar array structures using welding of 25x6 mm GI strips.</p> <p>(2) Every row of such interconnected structures shall be terminated in an chemical earthing electrode of 3000 mm long, Zn coated, hot dip galvanized, OD of minimum 50 mm shall be supplied by vendor.</p> <p>(3) Quantity of earthing electrodes for solar array structures = 50 sets approx.</p> <p>(4) Earth pit shall be drilled and chemical earthing electrode shall be placed in the pit, filled with back filling chemical compound all around the electrode as per vendor datasheet instructions. Procedure shall be as follows:</p> <ul style="list-style-type: none"><li>a) Make 250 mm dia bore to a suitable depth in the soil to match the electrode length. From the dug-out soil, remove lumps and stones. If necessary, sieve the soil to remove foreign materials.</li><li>b) Mix the back filling compound (BFC), as recommended by vendor, with soft soil and throw a handful of the mix into the pit.</li><li>c) Place the electrode in the kit.</li><li>d) Throw 2 or 3 Kg of BFC-soil mixture into the pit around the electrode and add a bucket of water.</li><li>e) Poke the pit with a long pole around the electrode for a few minutes to enable the trapped air to escape. In this manner, continue the earth filling process till the entire electrode stands firmly in the pit. Ensure that the consistency of the BFC is pasty and not watery.</li><li>f) After finishing the pit work, pour a few buckets of water around the pit.</li></ul> <p>(5) Earth chambers of brick masonry shall be constructed. All</p>	



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	<p>items of earth chambers, including lid, shall be in vendor scope of supply.</p> <p>(6) Earth chambers shall be interconnected in the solar array field as per the earthing layout proposed, using 50x6 mm GI strip that shall be laid underground.</p> <p>(7) Terminations at the electrode end shall be made using bolting method. Welding shall not be applied at electrode end. For this purpose, a separate link with multiple mounting holes shall be used at the electrode end. This way, GI strips (25x6 mm) running from structure leg and the GI strips (50x6 mm) from adjacent electrodes shall be terminated at this link, which shall, in turn, be connected to the electrode. Joining of 50x6 mm GI strips at intermediate positions, wherever applicable, shall be made using either welding or bolting method. Either way, the overlapping of the two strips shall be for a minimum length of 150mm. Welding shall be for the entire overlapping length. In case of bolting, minimum three bolt joints shall be used per overlap length.</p> <p>(8) All GI strips and all hardware (nuts, bolts and washers) shall be in vendor scope of supply.</p> <p>(9) Vendor shall prepare the drawing for earthing layout showing earth pit locations and submit for BHEL approval showing earth chamber locations.</p>	
<p><b>5.36</b></p>	<p><b>Earthing lines for control room panels – PCUs Battery banks, FCBC charger, ACDB / DCDB panels, SCADA panels, etc.</b></p> <p>(1) 50x4 copper strips shall be laid in the cable trenches of control room. Copper strips shall be in vendor scope of supply. Total length of copper strips required ~ 90 m.</p> <p>(2) Strips shall be covered by heat-shrinkable sleeves that will be supplied by BHEL. Heater gun for heat-shrinking the sleeves over copper strips shall be organized by vendor.</p> <p>(3) Copper strips shall be anchored to the cable trench wall using insulation bush supports that will be in the scope of vendor. Quantity of supports required ~ 30 Nos.</p> <p>(4) Expansion bolts of appropriate size (Minimum M8) shall be used to fix the insulation bush supports.</p> <p>(5) Copper strips shall be interconnected to the earthing terminals of all the control room panels using 25 sq-mm copper, unarmoured, PVC cables that shall be supplied by BHEL. Cable lugs and hardware (bolts, nuts, washers etc)</p>	



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	<p>required for connecting the 25 sq-mm cable to the earth terminals of panels and also to the copper strip end shall be in vendor scope of supply.</p> <p>(6) Seven sets of chemical earthing electrodes MS pipes 3000 mm long, Zn coated, hot dip galvanized, of OD min 50 mm shall be supplied by vendor. Earth chambers of brick masonry shall be constructed. These chambers shall be located around the control room. Exact locations will be intimated by BHEL site engineer.</p> <p>(7) Connection between earth chamber and copper earthing strip in the control room shall be made using cable, 1Cx 25sq-mm, copper, unarmoured, 1100 V, PVC cables as per IS:1554 (part-1) that shall be in vendor scope of supply. Quantity of cable required ~ 150m maximum.</p> <p>(8) Routing of 1Cx25 sq-mm cables to electrode earth chambers shall be using 1-inch CPVC pipes, joints, bends and elbows that shall be in vendor scope of supply. Routing shall be underground outside the control room, at a depth of ~450mm below the ground level. Number of CPVC joints and elbows shall be as applicable.</p> <p>(9) Expansion bolts, cable lugs and all hardware required for this activity shall be within vendor scope of supply.</p>	
<p><b>5.37</b></p>	<p><b>Earthing of switchyard equipment.</b> Vendor shall install chemical earthing electrode Zn coated, Hot dip galvanized, with brick masonry earth chamber for each case.</p> <p>(1) Inverter Transformers body earth – 3 x 2 Nos each = 6 Nos (2) FP structure 1, GOS switch body earth – 2 Nos (3) FP structure 2, GOS switch body earth – 2 Nos (4) FP structure 2, Lightning arrestors– 2 Nos (5) FP structure 2, Metering CTs / PTs body earth – 2 Nos (6) FP structure 2, Metering PTs body earth – 2 Nos (7) Metering panel 1 body earth – 2 Nos (8) Aux transformer, body earth – 2 Nos (9) Aux transformer, neutral earth – 1 Nos (10) Switchyard fencing – 3 Nos</p> <p>Total Earth electrodes required for switchyard = 24 Nos</p> <p>GI strips of 50x5 mm shall be used for this purpose. Length of GI</p>	



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	<p>strip required ~ 300 m. GI strips shall be laid underground at a depth of ~ 500 mm. Earth electrodes with chemicals, GI strips, all hardware required for making the connections shall be within vendor scope of supply.</p> <p>Vendor shall carry out all the necessary GI strip laying and interconnections.</p> <p>In Addition vendor shall design supply and install earth mat for 33KV switchyard as per state electricity rules.</p> <p>Vendor shall carry out measurement of earth resistance in all the cases that shall be witnessed, verified and certified by BHEL site engineer.</p>	
<b>5.38</b>	<p><b>Lightning arrestors (ESE) type</b></p> <ol style="list-style-type: none"><li>(1) Early streamer emission lightning with counters and earthing systems. Make: ABB, Ingesco</li><li>(2) Quantity = 5 sets approx</li><li>(3) Lightning arrestors shall be mounted on top of a mast of height 12m minimum above ground level using MS pipe of 100 mm minimum average diameter with painted finish; Each mast shall be secured by three steel stay wires that are suitably grouted. Masts shall have appropriate steel base plate for mounting on an RCC concrete foundation pedestal of 450x450 mm size, 1m depth below ground level, 300mm minimum above ground level, PCC 1:4:8 as the bottom layer (~100 mm thick), steel rods of diameter 8mm minimum, concrete M25 with four J bolts (M16) of 750 mm long, with nuts and washers.</li><li>(4) Two earthing chambers per lightning arrestor set using chemical earthing electrodes shall be constructed. Total quantity of earth electrodes for this purpose = 10 Nos.</li><li>(5) All mechanical and electrical connections, cables, junction boxes, hardware etc shall be within vendor scope.</li><li>(6) Vendor shall submit general arrangement and detailed drawings with bill of materials / quantities of the overall lightning arrestor arrangement including foundation pedestal details to BHEL for approval.</li></ol>	
<b>5.39</b>	<p><b>Lightning arrestor for control room</b></p>	



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	<p>Vendor shall supply and install 1 set of lightning rod with earthing set at the terrace of the control room. BHEL approval shall be obtained for type of lightning rod.</p>	
<p><b>5.40</b></p>	<p><b>Yard lights for switchyard</b></p> <ol style="list-style-type: none"> <li>(1) 10 yard lights</li> <li>(2) 25 NB bend pipes (1m running length) shall be supplied and fixed on angles/ poles of switchyard fencing. Among the 10 lights, 4 shall be fixed on control room wall that is within yard. Balance 6 shall be fixed on the switchyard fencing poles. Suitable fixing arrangements shall be provided.</li> <li>(3) Light fitting, Bajaj/Havells/ CGL/Phillips/OSRAM Equivalent make (36 W) shall be supplied and fitted on the GI bend pipes using necessary hardware.</li> <li>(4) CPVC pipe of 1", carrying 3Cx2.5 sq-mm copper, armoured, PVC cable, from ground level up to Junction box.</li> <li>(5) 2 cores used for phase, neutral of yard light.</li> <li>(6) 1 core used for body earth purpose.</li> <li>(7) Junction box shall be at a height of 1m above ground level.</li> <li>(8) Junction box (IP65, polycarbonate), with 12 elmex-type, DIN rail of suitable length, MCB (1A, single pole) of Schneider or reputed make, 2 glands (nickel plated brass single compression) for 3Cx2.5 sq-mm cable, 1 gland (polyamide) for 2Cx1.5 sq-mm copper, unarmoured, PVC cable.</li> <li>(9) The junction box, cable lugs, steel bracket for mounting the box on the lighting pole and all hardware items shall be in vendor scope.</li> <li>(10) Glands shall be located at the bottom side of Junction box.</li> <li>(11) CPVC pipe of 1" shall be provided between junction box and bend pipe to guide the 2Cx1.5 sq-mm cable.</li> <li>(12) It shall be ensured that CFL lamp is well above the fencing height, which is 3m above the ground level.</li> <li>(13) Vendor shall submit general arrangement and detailed drawings with bill of materials / quantities of the overall yard lighting arrangement to BHEL for approval.</li> </ol>	
<p><b>5.41</b></p>	<p><b>Yard lights for solar array field</b></p> <ol style="list-style-type: none"> <li>(1) 30 yard lights – dome type</li> <li>(2) Lighting poles shall be located at distributed locations in the solar array field as per layout that will be provided by BHEL</li> </ol>	



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	<p>at an appropriate time during period of execution.</p> <ul style="list-style-type: none"><li>(3) 80NB pipes (length 2.8m) to be grouted with concrete foundation of depth 600 mm, with PCC 1:3:6 of 100mm layer (450x450mm), M25 concrete, foundation height 300mm above ground level.</li><li>(4) Dome type light fitting with 20W CFL TOROIDAL bulb Make: Supreme, Model: CFL Board Cast Aluminium (or) reputed equivalent as shall be approved by BHEL.</li><li>(5) CPVC pipe of 1-inch, carrying 3Cx2.5 sq-mm copper, armoured, PVC cable from ground level up to Junction box.</li><li>(6) 2 cores used for phase and neutral for yard light and additional core for body earthing of the pole.</li><li>(7) Junction box (IP65, polycarbonate), with 12 elmex-type, DIN rail of suitable length, MCB (1A, single pole) of Schneider or reputed make, 2 glands (nickel plated brass single compression) for 3Cx2.5 sq-mm cable, 1 gland (polyamide) for 2Cx1.5 sq-mm copper, unarmoured, PVC cable.</li><li>(8) Glands, socket shall be located at the bottom side of Junction box.</li><li>(9) The junction box, cable lugs, steel mounting bracket and all hardware items shall be in vendor scope.</li><li>(10) Vendor shall submit general arrangement and detailed drawings with bill of materials / quantities of the overall yard lighting arrangement including foundation pedestal details to BHEL for approval.</li></ul>	
<b>5.42</b>	<b>Yard lights for compound wall / chain-link fencing</b> <ul style="list-style-type: none"><li>(1) 45 yard lights</li><li>(2) 25NB bend pipes (1m running length) shall be supplied and fixed on angles/ poles of compound wall / chain link fencing. Suitable fixing arrangements shall be provided.</li><li>(3) Light fitting, Bajaj/Havells/equivalent (36 W) shall be supplied and fitted on the GI bend pipes using necessary hardware.</li><li>(4) CPVC pipe of 1", carrying 3Cx2.5 sq-mm copper, armoured, PVC cable, from ground level up to Junction box.</li><li>(5) 2 cores used for phase and neutral of yard light and 1 core used for body earth purpose.</li><li>(6) Junction box (IP65, polycarbonate), with 12 elmex-type, DIN rail of suitable length, MCB (1A, single pole) of Schneider or</li></ul>	



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	<p>reputed make, 2 glands (nickel plated brass single compression) for 3Cx2.5 sq-mm cable, 1 gland (polyamide) for 2Cx1.5 sq-mm copper, unarmoured, PVC cable.</p> <p>(7) Glands, socket shall be at the bottom side of Junction box.</p> <p>(8) The junction box, cable lugs, mounting bracket for fixing junction box and all hardware items shall be in vendor scope.</p> <p>(9) Junction box shall be at a height of 1m above ground level.</p> <p>(10) CPVC pipe of 1" shall be provided between junction box and bend pipe to guide the 2Cx1.5 sq-mm cable.</p> <p>(11) It shall be ensured that CFL lamp is well above the fencing, which is 3m above the ground level.</p> <p>(12) Vendor shall submit general arrangement and detailed drawings with bill of materials / quantities of the overall yard lighting arrangement to BHEL for approval.</p>	
<p><b>5.43</b></p>	<p><b>Cable trench formation and laying of cables for yard lights</b></p> <p>Vendor shall construct the underground trench from control room to various parts of the solar array field, switchyard and compound wall for laying the cables for yard lights</p> <p>(1) Trench depth = 600 mm minimum</p> <p>(2) Trench width = 200 mm minimum</p> <p>(3) Sand as per IS: 383 of 100 mm layer thickness shall be laid at the bottom most level of trench.</p> <p>(4) Over the sand layer, cables shall be laid one adjacent to the other. Cables shall not be laid one over the other. In other words, only one layer of cables shall be allowed.</p> <p>(5) Over the layer of cables, one more layer of sand of 100mm shall be laid.</p> <p>(6) Then, a single layer of class-2 brick of 75 mm thickness shall be laid.</p> <p>(7) Trench shall then be filled up with refill soil.</p>	
<p><b>5.44</b></p>	<p><b>Cable terminations and quantities of cables and CPVC pipes for yard lights</b></p> <p>(1) Cable termination:</p> <p>(a) Termination of cables, including unsleeving, crimping, connecting to the junction box and lamp shall be within scope of vendor.</p> <p>(b) Similarly, cables shall be terminated at the ACDB panel within the control room.</p>	



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	<p>(c) BHEL will provide the wiring scheme of ACDB panel.</p> <p>(2) Vendor shall supply following lengths of cable:</p> <p>(a) 3Cx 2.5 sq-mm Cu, armoured, PVC cable ~5000m approx</p> <p>(b) 2Cx 1.5 sq-mm Cu, unarmoured, PVC cable ~ 500m approx</p> <p>(3) Vendor shall supply following lengths of CPVC pipes:</p> <p>(a) CPVC, 1-inch pipe ~ 200m approx</p>	
<b>5.45</b>	<p><b>SPV module cleaning system</b></p> <p>(1) Vendor shall lay 2-inch CPVC pipelines from overhead tanks to the solar array field with all necessary CPVC nipples, T-joints, reducers, bends, couplers etc. This forms the main header pipeline. Suitable valves such as brass valves of 2-inch etc shall be provided for this main header line. For the branching out lines that spread into various rows of the solar array to provide water delivery points for module cleaning, 1-inch CPVC pipelines shall be used.</p> <p>(2) A suitable 3-phase booster pump of 2HP capacity shall be supplied and installed at a suitable location to draw the water from OH tank to solar array field for solar PV module cleaning. One spare pump shall also be supplied.</p> <p>(3) Starter and DP switch (1 set) shall be supplied and installed near ACDB panel for operating the 2HP pump.</p> <p>(4) Supply of electrical cables (with lugs, hardware) and wiring the pump up to the ACDB panel / starter in the control room shall be in vendor scope. Cable 5Cx 2.5 sq-mm, Cu, armoured, PVC cable shall be used. Length required ~50 m.</p> <p>(5) CPVC pipelines shall be laid underground (at a depth of ~500 mm below ground level).</p> <p>(6) There shall be 50 Nos of minimum delivery points for module cleaning. At these delivery points, 1-inch riser lines shall be provided to tap the water from underground line to the delivery point ~300 mm above ground level. Ball valve forged steel type, 1-inch, with suitable nipple for connecting the hose pipe, shall be provided at each delivery point.</p> <p>(7) After installation and testing of water lines, excavated trenches shall be closed with refill soil. Further, the soil, all along the water lines, shall be suitably leveled and compacted.</p> <p>(8) Hosepipes (ribbed, flexible, high pressure) of 50 m long – 3 sets shall be provided for connecting the hose to the nearest</p>	



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	<p>ball valve / nipple delivery point. High pressure pipe shall be provided with nozzles or appropriate guns to direct the pressurized water on the surface of the module under cleaning.</p> <p>(9) Approximate length for 2-inch header line ~ 1200m</p> <p>(10) Approximate length for 1-inch header line ~ 3600m</p> <p>(11) Vendor shall submit detailed scheme with BoM etc for module cleaning system from OH tank to solar array field along with the pressure drop calculation until the final array for BHEL approval.</p>	
<p><b>5.46</b></p>	<p><b>Identification markings using paint and cable tags, as applicable to the individual cases and as approved by BHEL, shall be provided:</b></p> <p>(1) String monitoring junction boxes: Identification marking by way of painting on nearby module structure.</p> <p>(2) All switchyard equipment such as transformers, HT panels, and metering panels shall be provided with suitable identification markings using painting, with inscriptions as approved by BHEL.</p> <p>(3) Cable sizes with arrow marks in switchyard (for HT cables) using painting.</p> <p>(4) Identification markings for all the earth chambers (using painting) with inscriptions as approved by BHEL.</p> <p>(5) Cable tags using aluminium plate of 1-2 mm thickness with suitable inscriptions as approved by BHEL for all the power cables of the electrical panels such as PCUs, Batteries, FCBC chargers, ACDB panel etc.</p>	
<p><b>5.47</b></p>	<p><b>Cable markers</b></p> <p>(1) Steel cable markers with suitable labels (DC cable, LT cable, HT cable, Data cable, CPVC water pipeline etc) and arrow marks (pointing to the cable destination) shall be supplied and installed along the cable trenches for following cases:</p> <p>a) For 185 sq-mm cable from string monitoring boxes to control room: Quantity of markers = 75 Nos</p> <p>b) For data communication cables from string monitoring boxes to control room: Quantity of markers = 75 Nos</p> <p>c) For cables of yard lights of solar array field, compound wall/chain-link fencing and switchyard fencing: Qty of markers = 60 Nos</p> <p>d) For HT (33kV) cables within switchyard:</p>	



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	<p align="center">Quantity of markers = 10Nos</p> <p>e) For aux transformer to ACDB panel Quantity of markers = 2 Nos</p> <p>f) For CPVC water pipelines, Quantity = 50 Nos</p> <p>(2) Cable markers shall be suitably grouted with concrete foundation depth of minimum 300 mm below the ground level. Cross section of foundation shall be minimum 200mm diameter.</p> <p>(3) Cable markers shall have a minimum height of 300 mm above the ground level.</p> <p>(4) Cable markers shall be suitably painted.</p>																
<p><b>5.48</b></p>	<p><b>Hoarding for the solar power plant.</b></p> <p>(1) Hoarding for the plant shall be made of 1500x1800x 3mm thick MS plate. Approximate dimension of board 1500x1800 mm.</p> <p>(2) Board shall be given a red oxide coat and painted with black colour for background. Letters shall be written with white colour.</p> <p>(3) Board shall be fixed on a frame constructed using ISA 50x50x8 angles. Diagonal supports shall also be provided. The frame shall be supported by two vertical legs of ISA 75x75x8 that is grouted with concrete foundation.</p> <p>(4) Depth of foundation shall be 600 mm below ground level, with 100mm thick PCC layer 1:4:8 of 400x400mm, M25 concrete of 300x300mm, foundation pedestal of 200mm height above ground level.</p> <p>(5) Bottom level of board shall be at a height of 1.5m above the ground level.</p> <p>(6) Vendor shall submit the drawing of hoarding arrangement to BHEL for approval.</p>																
<p><b>5.49</b></p>	<p><b>Display boards and sign boards</b></p> <table border="1" data-bbox="289 1570 1122 1881"> <tr> <td data-bbox="289 1570 349 1648">1</td> <td data-bbox="349 1570 982 1648">Board displaying instruction chart for restoration of person from Electric Shock</td> <td data-bbox="982 1570 1122 1648">1 Nos</td> </tr> <tr> <td data-bbox="289 1648 349 1726">2</td> <td data-bbox="349 1648 982 1726">Board displaying instruction chart for artificial respiration</td> <td data-bbox="982 1648 1122 1726">1Nos</td> </tr> <tr> <td data-bbox="289 1726 349 1766">3</td> <td data-bbox="349 1726 982 1766">Board displaying dos and don'ts.</td> <td data-bbox="982 1726 1122 1766">1 No</td> </tr> <tr> <td data-bbox="289 1766 349 1843">4</td> <td data-bbox="349 1766 982 1843">Board displaying fire extinguishers details and operations</td> <td data-bbox="982 1766 1122 1843">1 Nos</td> </tr> <tr> <td data-bbox="289 1843 349 1881">5</td> <td data-bbox="349 1843 982 1881">"No smoking" board</td> <td data-bbox="982 1843 1122 1881">3 Nos</td> </tr> </table>	1	Board displaying instruction chart for restoration of person from Electric Shock	1 Nos	2	Board displaying instruction chart for artificial respiration	1Nos	3	Board displaying dos and don'ts.	1 No	4	Board displaying fire extinguishers details and operations	1 Nos	5	"No smoking" board	3 Nos	
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	<table border="1"> <tr> <td data-bbox="285 323 350 401">6</td> <td data-bbox="350 323 980 401">Board showing list of O&amp;M staff with name, qualification and work responsibility</td> <td data-bbox="980 323 1122 401">1 No</td> </tr> <tr> <td data-bbox="285 401 350 562">7</td> <td data-bbox="350 401 980 562">Board showing list of contact details of BHEL, O&amp;M team, O&amp;M security, police station, fire service, hospital, medical store etc with names, address, mobile numbers etc</td> <td data-bbox="980 401 1122 562">1 Nos</td> </tr> <tr> <td data-bbox="285 562 350 724">8</td> <td data-bbox="350 562 980 724">Danger boards with details such as value of voltage etc for string monitoring boxes, PCUs, Transformers, HT panels, Four pole / two pole structures in switchyard etc.</td> <td data-bbox="980 562 1122 724">Qty as required</td> </tr> <tr> <td data-bbox="285 724 350 919">9</td> <td data-bbox="350 724 980 919">Identification boards, of suitable sizes, within and outside control room such as control room 3MW, SCADA room, store room, security room, gents / ladies toilets etc. BHEL will provide the list.</td> <td data-bbox="980 724 1122 919">10 Nos</td> </tr> </table>	6	Board showing list of O&M staff with name, qualification and work responsibility	1 No	7	Board showing list of contact details of BHEL, O&M team, O&M security, police station, fire service, hospital, medical store etc with names, address, mobile numbers etc	1 Nos	8	Danger boards with details such as value of voltage etc for string monitoring boxes, PCUs, Transformers, HT panels, Four pole / two pole structures in switchyard etc.	Qty as required	9	Identification boards, of suitable sizes, within and outside control room such as control room 3MW, SCADA room, store room, security room, gents / ladies toilets etc. BHEL will provide the list.	10 Nos	
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<p><b>5.50</b></p>	<p><b>Electrical insulation mat</b></p> <p>(1) Vendor shall supply 20 Nos of electrical insulating mat as follows:</p> <p>(a) Make: Vardhman House Private Ltd or reputed equivalent as shall be approved by BHEL.</p> <p>(b) As per IS: 15652:2006</p> <p>(c) Class B</p> <p>(d) Thickness 2.5 mm minimum</p> <p>(e) Size = 2m x 1m minimum</p> <p>(f) Colour: to be confirmed by BHEL</p> <p>(g) Max use voltage = 33kV</p> <p>(h) Marking of IS standard on the mat</p> <p>(2) Test certificate shall be provided by vendor</p> <p>(3) Vendor shall lay the mats in front of electrical panels (PCUs, SCADA, ACDB, FCBC, HT panels) in control room</p>													
<p><b>5.51</b></p>	<p><b>Checkered plate for closing the cable trenches (a) behind the panels such as PCUs, HT Panels, ACDB panels etc in control room and also (b) other open areas of cable trench</b></p> <p>(1) Plate shall have a suitable handle (welded to the plate) to facilitate ease of lifting and movements.</p>													



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	<p>(2) Plate thickness = 6mm  (3) Width = 1000 mm, total length required: ~50m max  (4) These width and length dimensions are indicative. Actual dimensions shall be based on site conditions.  (5) Plate shall be red oxide coated followed by black painting.  (6) BHEL approval shall be obtained for overall arrangement of checkered plate.</p>																																																																										
<b>5.52</b>	<p><b>Air conditioner</b>  Split air conditioner of 1.0T capacity with stabilizer (1 set) shall be supplied and installed in SCADA room. Make: LG, Videocon, Bluestar or reputed equivalent that shall be approved by BHEL.</p>																																																																										
<b>5.53</b>	<p><b>Tool kits and instruments</b>  Vendor shall supply the following tool kits and instruments:  <b>A. Measuring instruments</b></p> <table border="1"> <tr> <td>1</td> <td>Digital Earth Resistance Tester</td> <td>Cambridge Instruments/equivalent</td> <td>DET-2000</td> <td>1 Nos</td> </tr> <tr> <td>2</td> <td>Digital multimeter</td> <td>Reputed make</td> <td></td> <td>2 Nos</td> </tr> <tr> <td>3</td> <td>AC-DC Clamp Meter</td> <td>Lutron/equivalent</td> <td>DM-6506</td> <td>2 Nos</td> </tr> <tr> <td>4</td> <td>Digital thermometer (wall hanging)</td> <td>Reputed Make</td> <td></td> <td>1 Nos</td> </tr> <tr> <td>5</td> <td>Megger – 5KV</td> <td>Shanti Electric Instruments, Nippen/equivalent</td> <td></td> <td>1 Nos</td> </tr> <tr> <td>6</td> <td>Electrical Tester</td> <td>Reputed Make</td> <td></td> <td>2 Nos</td> </tr> </table> <p>Note: Make / model number etc shall be approved by BHEL prior to procurement.</p> <p><b>B. Tool kits</b></p> <table border="1"> <tr> <td>1</td> <td>Double ended spanner Set of sizes 10-11, 12-13, 14-15, 16-17, 17-18</td> <td></td> <td></td> <td>2 Nos each</td> </tr> <tr> <td>2</td> <td>Screwdriver Set</td> <td></td> <td></td> <td>1 Set</td> </tr> <tr> <td>3</td> <td>Crimping tool with Dye range 50-300sq-mm cable, mechanical gear power, hand operated</td> <td></td> <td></td> <td>1 Set</td> </tr> <tr> <td>4</td> <td>Crimping tool up to 6 sq-mm cable</td> <td></td> <td></td> <td>1 set</td> </tr> <tr> <td>5</td> <td>Drilling machine AC, hand operated, with bit size up to 20 mm</td> <td></td> <td></td> <td>1 set</td> </tr> <tr> <td>6</td> <td>Measuring Tape, 5m</td> <td></td> <td></td> <td>1 Nos</td> </tr> <tr> <td>7</td> <td>Measuring Tape, 50 m</td> <td></td> <td></td> <td>1 Nos</td> </tr> <tr> <td>8</td> <td>Allen Key set</td> <td></td> <td></td> <td>1 Set</td> </tr> </table>				1	Digital Earth Resistance Tester	Cambridge Instruments/equivalent	DET-2000	1 Nos	2	Digital multimeter	Reputed make		2 Nos	3	AC-DC Clamp Meter	Lutron/equivalent	DM-6506	2 Nos	4	Digital thermometer (wall hanging)	Reputed Make		1 Nos	5	Megger – 5KV	Shanti Electric Instruments, Nippen/equivalent		1 Nos	6	Electrical Tester	Reputed Make		2 Nos	1	Double ended spanner Set of sizes 10-11, 12-13, 14-15, 16-17, 17-18			2 Nos each	2	Screwdriver Set			1 Set	3	Crimping tool with Dye range 50-300sq-mm cable, mechanical gear power, hand operated			1 Set	4	Crimping tool up to 6 sq-mm cable			1 set	5	Drilling machine AC, hand operated, with bit size up to 20 mm			1 set	6	Measuring Tape, 5m			1 Nos	7	Measuring Tape, 50 m			1 Nos	8	Allen Key set			1 Set	
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<b>5.54</b>	<p><b>Office furniture</b></p> <table border="1"> <tr> <td>1</td> <td>Executive table, wooden type, complete with draws and side racks</td> <td>1 sets</td> </tr> <tr> <td>2</td> <td>Chairs, swivel type, with arm rest</td> <td>4 Nos</td> </tr> <tr> <td>4</td> <td>PC table with chairs</td> <td>1 set</td> </tr> <tr> <td>5</td> <td>Storage almirahs</td> <td>1 Nos</td> </tr> <tr> <td>6</td> <td>Filing cabinets</td> <td>1 Nos</td> </tr> </table> <p>Make: Godrej or reputed equivalent as shall be approved by BHEL. BHEL approval shall be obtained, prior to procurement, for the type of office furniture, for which catalog with model numbers, sizes / dimensions etc shall be submitted to BHEL.</p>	1	Executive table, wooden type, complete with draws and side racks	1 sets	2	Chairs, swivel type, with arm rest	4 Nos	4	PC table with chairs	1 set	5	Storage almirahs	1 Nos	6	Filing cabinets	1 Nos							
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<b>5.55</b>	<p><b>Fire alarm system for control room</b></p> <p>(1) Fire alarm system with smoke detectors, hooters, manual call points, an electronic control panel and interconnection wiring shall be supplied and installed. Make: Zicom or any other reputed equivalent as shall be approved by BHEL.</p> <p>(2) Control panel (1 set), in sheet steel enclosure, power coated finish, shall be a microprocessor based system with central processing unit, input / output modules, power supply with battery and battery charger, control electronics and display mechanisms. The panel shall be a 4 zone system with audio-visual provisions (LED indications and beeps) for zone-wise annunciation. Individual detector-wise traceability / addressability is not required. It shall have provisions for acknowledgement of alarm and manual resetting. Batteries used shall be lead acid maintenance free type provided with connecting leads.</p> <p>(3) Smoke detectors shall be of conventional / optical / photoelectric type. It shall not be of ionization type that</p>																						



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	<p>employs radioactive materials.</p> <p>(4) Electrical hooters shall sound the alarm upon detection of smoke by the detectors.</p> <p>(5) Manual call point shall be with high-gloss finish, alarm LED provision, breakable glass unit, hammer and chain.</p> <p>(6) All the system components shall be installed and commissioned using suitable wiring using copper cable, 2C x 1.5 sq-mm, armoured, fire retardant low smoke PVC with casing / tubing of type and size, of required length, as approved by BHEL.</p> <p>(7) Spares: Smoke detectors – 2 Nos, Manual call point – 2 Nos, Hooter – 1 No.,</p> <p>(8) Locations of sensors shall include cable trenches of control room as well.</p> <p>(9) Vendor should ensure the design of fire protection system in line with the regulations of the Fire Safety department of the state. Vendor shall submit fire alarm layout/scheme along with the detailed BOM to BHEL for approval.</p>																							
<p><b>5.56</b></p>	<p><b>Other safety related items</b></p> <p>(1) Safety gadgets</p> <table border="1" data-bbox="289 1102 1112 1381"> <tr> <td>1</td> <td>Gas Mask</td> <td>2 Nos</td> </tr> <tr> <td>2</td> <td>First Aid Box with essential medicines and bandage cotton, antibiotic cream, Dettol, etc.</td> <td>1 set</td> </tr> <tr> <td>3</td> <td>Hand Gloves 11 KV for GOS operation</td> <td>2 sets</td> </tr> <tr> <td>4</td> <td>Hand Gloves 1KV for Maintenance of SMB</td> <td>2 sets</td> </tr> <tr> <td>5</td> <td>Discharge rod</td> <td>2 Nos</td> </tr> <tr> <td>6</td> <td>Safety Helmet</td> <td>5 Nos</td> </tr> </table> <p>(2) Fire extinguishers and sand buckets, as per the regulations of the Fire safety department of the state, shall be supplied and commissioned at the power plant. BHEL approval shall be obtained for locations at which they shall be kept.</p> <table border="1" data-bbox="289 1617 1112 1890"> <tr> <td>1</td> <td>Dry powder fire extinguisher (stored pressure type)</td> <td>Capacity: 10 Kg IS: 13849, CM/L-7759096 Suitability for Class A, B &amp; C fire, related to solid combustibles, flammable liquid and gases.</td> <td>4 Nos</td> </tr> </table>	1	Gas Mask	2 Nos	2	First Aid Box with essential medicines and bandage cotton, antibiotic cream, Dettol, etc.	1 set	3	Hand Gloves 11 KV for GOS operation	2 sets	4	Hand Gloves 1KV for Maintenance of SMB	2 sets	5	Discharge rod	2 Nos	6	Safety Helmet	5 Nos	1	Dry powder fire extinguisher (stored pressure type)	Capacity: 10 Kg IS: 13849, CM/L-7759096 Suitability for Class A, B & C fire, related to solid combustibles, flammable liquid and gases.	4 Nos	
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	2	Carbon di-oxide (CO2) type fire extinguisher with trolley	Capacity: 9 Kg IS: 2878 Suitability for Class B&C fires Involving flammable liquids & gases, electronic equipment.	4 Nos	
	3	Sand buckets	GI fire buckets (as per IS: 2546) with suitable steel stand and cover arrangement. All items shall be painted with red oxide and BHEL approved red paint. BHEL approval shall be obtained for the overall arrangement. Each set of stand shall carry four sand buckets. A suitable cover shall be designed and provided to protect the buckets from rain.	3 sets	
5.57	<p><b>Pre-commissioning inspections/checks/tests and coordination with state departments for necessary approvals and clearances for commissioning, synchronization with grid and post-commissioning operation of the plant:</b></p> <p>(A) Vendor shall carry out following minimum pre-commissioning checks:</p> <ol style="list-style-type: none"> <li>(1) Verification of firmness of terminations in all electrical equipment: SMBs, PCUs, LT/HT panels, transformers, FP structure items (GOS, LAs etc.), SCADA stations, weather monitoring equipment.</li> <li>(2) Verification of earthing for all these electrical equipment.</li> <li>(3) Measurement and verification of parameters at string monitoring boxes at solar array field: string current, voltage, combined SMB output current, module temperature, SMB temperature.</li> <li>(4) Measurement and verification of parameters on DC input side of PCUs: DC current and voltage; Vendor shall support the PCU engineer on these tests.</li> <li>(5) Insulation resistance measurements (megger tests) for all the electrical equipment of control room and switchyard.</li> <li>(6) Functional checks for LT panels (Air circuit breakers): ACB on/off operations, spring charging, LED indications, etc.</li> </ol>				



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	<p>(7) Functional checks for PCUs: Vendor shall support the PCU engineer during the pre-commissioning tests.</p> <p>(8) Functional checks for transformer marshalling box: Availability of AC/DC power supply, (b) Responses of the relays at HT panels and corresponding indications at annunciation panel by simulating the alarm / trip of Buchholz, PRV, WTI, OTI, LOLA at marshalling box.</p> <p>(9) Functional checks for HT panels and annunciation panel: (a) Availability of AC/DC power supplies, (b) VCB on/ off, (c) spring charging, (d) LED indications, (e) functioning of electromagnetic and numerical relays, (f) responses at HT panels to operations from remote annunciation panels, (g) indications on windows, alarm accept/reset operations at annunciation panel. (b) Verification of interlock operations related to incomer and outgoer VCBs.</p> <p>(10) Verification of parameters at SCADA station: (a) DC/AC parameters from SMBs, HT panels, ACDB panels, Metering panels, (b) status of ACB/VCB breakers and transformer protection relays, (c) weather monitoring parameters.</p> <p>(11) Functional checks on SCADA software: mimic diagrams, trend graphs, remote accessibility etc.</p> <p>(12) Earth resistance measurements at the electrode chambers for solar array, control room panels and switchyard equipment.</p> <p>(B) Pre-commissioning tests on transformers, CTs, PTs, Lightning arrestors, GOS switches, vacuum circuit breaker, relays, etc: (1) Usually performed tests are indicated as below. However, exact type of tests required to be conducted at site prior to commissioning shall be in line with STATE ELECTRICITY SUPPLY &amp; TRANSMISSION BOARDS/CEIG etc., requirements. (a) Transformers: IR tests, ratio tests, excitation current measurement, magnetic balance test on HV, short circuit test, excitation test LV side, vector group test. (b) 11kV vacuum circuit breaker panels: IR tests and continuity tests for panels, IR values for CTs/PTs, excitation test on CTs, primary injection tests for CTs, ratio test for PTs</p>	
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	<p>(c) Auxiliary transformers: IR tests, ratio tests. (d) Relays in HT panels: open/close, tripping, primary injection tests. (e) Outdoor CTs/PTs: IR tests, Polarity tests, Ratio tests, Burden tests, Winding resistance tests, Primary injection tests, excitation tests. (f) Lightning arrestors: IR tests (g) GOS switches: IR and contact resistance tests.</p> <p>(2) Appropriate testing agency shall be arranged for the tests.</p> <p>(3) Vendor shall coordinate / liaison with concerned STATE ELECTRICITY SUPPLY &amp; TRANSMISSION BOARDS/MRT departments to fix up test schedules and witness by their representatives.</p> <p>(4) Vendor shall prepare and submit the reports to MRT departments and obtain their approval through necessary liaison activities.</p> <p>(C) Vendor shall coordinate and liaison with STATE ELECTRICITY SUPPLY &amp; TRANSMISSION BOARDS/CEIG etc., prepare and submit the applications with necessary enclosures on behalf of BHEL and obtain their approval:</p> <p>(a) Approval for BHEL drawings (b) Approval for synchronization of plant with grid. (c) CEIG inspection of power plant (d) Provisional CEIG clearance to proceed with commissioning</p> <p>(D) Vendor shall implement corrective steps on the observations of CEIG, follow-up with them and obtain final clearance for licensed operation of the plant on a continuous basis.</p> <p><b>Note:</b> Scope of coordinating with state departments such as STATE ELECTRICITY SUPPLY &amp; TRANSMISSION BOARDS, CEIG to get the clearances / approvals for licensed / statutory operation of the power plant on a continuous basis includes all transactions required for successful liaison and clearances. Application fees and renewal fees (say, in the form of DD) to be enclosed with application / renewal documents and all other expenses in the above process shall be in the scope of vendor.</p>	
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**6.0 Tests at manufacturer / sub-vendor works and witnessing by BHEL**

<b>6.1</b>	BHEL shall witness routine / acceptance tests performed at	
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manufacturer works for following items. Vendor shall accordingly provide inspection call to BHEL, with submission of quality assurance plan and factory test reports to BHEL in advance.


- 1) HDPE DWC pipe
- 2) RSJ poles
- 3) Gang operated switch 400A, 33kV without earth switch
- 4) Gang operated switch 400A, 33kV with earth switch
- 5) Lightning arrestors 33kV, 10kA
- 6) Outdoor CTs / PTs – combined unit / individual units
- 7) Tri vector meter ER300P
- 8) Auxilliary transformer 100 kVA, 33kV/415V, ONAN
- 9) Drop out fuse units
- 10) Disc insulators and other overhead line accessories
- 11) ACSR conductor
- 12) Cable 3.5Cx95sq-mm, 1100V, Al, PVC, armoured, PVC, FRLS
- 13) Cable 1Cx 25 sq-mm, 1100V, Cu, PVC, armoured, PVC, FRLS
- 14) Cable 5Cx 2.5 sq-mm, 1100V, Cu, PVC, armoured, PVC, FRLS
- 15) Cable 2Cx 1.5 sq-mm, 1100V, Cu, PVC, armoured, PVC, FRLS
- 16) Cable 1Cx 1.5 sq-mm, 1100V, Cu, PVC, armoured, PVC, FRLS
- 17) Cable 1Cx3Rx 185 sq-mm, 33kV, Al, XLPE, armoured, PVC, FRLS
- 18) Cable 1Cx3Rx300sqmm, 1100V, Al, XLPE, armoured PV FRLS
- 19) Data cables 0.5 sq-mm (1 pair, 5 pair, 10 pair), Twisted pair, PVC, shielded, armoured, PVC, FRLS
- 20) Chemical earthing electrodes
- 21) Lightning arrestor (ESE)
- 22) Booster pump 2HP
- 23) Ball valves
- 24) CPVC pipes 1-inch, 2-inch
- 25) Air conditioner
- 26) Fire alarm system
- 27) Fire extinguishers
- 28) Electrical insulation mat
- 29) 33kV termination kits (indoor, outdoor)

**Note:** In case the item is bought out from dealers, test certificates, as per relevant IS / IEC standards, as issued by manufacturer shall be submitted to BHEL. However, prior approval shall be obtained from BHEL for procurement of the item from dealers.


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### 7.0 General conditions applicable during installation and commissioning phase

7.1	As already mentioned in previous clauses, vendor shall organize power supply on their own. Accordingly, DG sets of suitable capacity shall be deployed by the vendor for construction works.	
7.2	Similarly, water required for construction works shall be organized by vendor. Bore wells, which are deliverables of vendor as part of this contract, shall be dug in the beginning stages so that bore well water itself can be used for the construction purposes. In case bore well is not successful, vendor shall make their own alternate arrangements (tankers etc).	
7.3	All machinery such as cranes, hydra, JCBs, forklifts, transport trucks, trolleys etc necessary for movement of materials shall be organized by the vendor.	
7.4	All necessary tools and tackles such as crimping tool (including heavy duty tools for crimping copper cables up to 300 sq-mm), screw driver set, power screwdrivers, cutting pliers, nose pliers, spanner sets, adjustable spanners, hole saw cutter set, bending tools, torque wrenches, hack saw blades, pipe wrenches, flat / round files, HV termination tools, drilling machines, welding machines, concrete mixers, steel bar bending tools / templates for RCC works, spade, shovel, hammer etc shall be organized by the vendor.	
7.5	All necessary measuring instruments such as digital multimeters, electrical testers, meggers (1kV, 2.5kV, 5kV), lamp load testers for solar array string measurements, earth resistance meters, weighing machines, water level indicators etc shall be organized by the vendor.	
7.6	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.	
7.7	Vendor shall organize all necessary steps to meet statutory requirements such as labour license, PF, ESI etc and also ensure compliance with relevant acts such as minimum wages act, income tax act, employee insurance act etc for their labour deployed at site.	
7.8	Vendor shall maintain updated labour register, with name, age, qualification, salary, attendance details etc at the site. Vendor has	

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	to satisfy all the statutory requirements as per the labour law regulations in the state	
7.9	Vendor shall use danger boards, wherever required, to ensure safety of the persons during the work at site.	
7.10	Vendor shall adhere to all necessary safety norms such as use of helmet, goggles, hand gloves, gumboots, 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.	
7.11	Vendor shall, at the completion of every work, clear off the debris, which resulted out of the work. In case of excavation work such as cable trench etc, vendor shall finish the land neatly with necessary leveling, rolling etc.	
7.12	Vendor shall carry out the work without causing inconvenience to other contract groups at the site. In case of conflicts with other groups, vendor shall ensure that the matter is resolved at once amicably so that the progress of work is not affected.	
7.13	Any damages on the building, structures etc attributable to the acts of labour / employees of vendor shall be rectified and made good by the vendor at their own cost.	
7.14	No child labour shall be employed for execution of the present contract.	
7.15	Any miscellaneous materials, which are found essential for technical completion of the contract as per regulations/standards but not mentioned explicitly in this specification, shall be deemed to be included in the specification. Accordingly, such materials shall be included by the vendor as part of the offer.	
7.16	Special instruction for earthing: In compliance with Rule 33 and 61 of Indian Electricity Rules, 1956 (as amended up to date), all non-current carrying metal parts shall be earthed with two separate and distinct earth continuity conductors to an efficient earth electrode. Accordingly, all cases such as cable support structures, cable ladders, cable trays (control room) etc shall be earthed.	
7.17	Any deviations shall be discussed with BHEL site engineers and implementation shall be taken up only after approval from BHEL.	
7.18	Vendor shall submit periodic status report, on daily as well as weekly consolidated basis, to BHEL on the progress of the contract.	

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## 8.0 Operations and Maintenance

8.1	<p>Date of commencement of operations and maintenance Zero date for O&amp;M shall be the actual date on which the complete 3 MWp is commissioned with synchronization / export of power to 33V grid.</p>	
8.2	<p>Period for O&amp;M</p> <p>Vendor shall operate and maintain the power plant for a period of six month from the zero date as above.</p>	
8.3	<p>O&amp;M personnel</p> <p>1. Vendor shall deploy following minimum personnel:</p> <p>(a) Technical / administrative / office personnel</p> <p>(a) One technical-cum-administrative in-charge having graduation in electrical / electronics engineering and experience with overall responsibility for complete plant operations. The in-charge shall have competence to deftly handle technical and operational / crisis problems.</p> <p>(b) Two working level staff with ITI / diploma level qualifications in engineering with competence for operating electrical / electronics / mechanical equipment, taking measurements, data logging / maintaining registers, preparation of reports in computer.</p> <p>(c) One unskilled persons for regular house-keeping (cleaning / mopping etc) and water cleaning of SPV modules.</p> <p><b>Note:</b> At least one among the technical personnel shall essentially be a certified / licensed person for HT operations (11kV minimum).</p> <p>(b) Security personnel</p> <p>(a) Minimum five security guards with competence to handle 24x7 tough situations and safeguard the plant from miscreants.</p> <p>2. Vendor shall provide separately identifiable uniforms for the respective office staff and security guards.</p> <p>3. Similarly, O&amp;M personnel shall be provided with raincoats, toolsets, earthing rods, safety gloves, safety goggles,</p>	



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	<p>gumboots, helmets and all other personal protective equipment (PPE) that will be relevant to ensure human safety.</p> <ol style="list-style-type: none"><li>4. Names, qualification, work responsibility of personnel shall be listed on a display board within control room.</li><li>5. Attendance register shall be maintained for both the teams.</li><li>6. Vendor shall ensure statutory requirements such as ESI, PF and labour license for their O&amp;M personnel posted at site.</li><li>7. BHEL shall have right to disallow any O&amp;M employee, if found unfit to perform. BHEL instructions issued in writing shall be binding on vendor who shall replace the person.</li><li>8. O&amp;M personnel at site shall conform to general regulations in force at site and to any special instructions from BHEL's customer.</li><li>9. O&amp;M personnel at site shall be deemed to be aware of damages and risks incidental to conditions of OPCL land and works from time to time and BHEL shall not be responsible for any injury to personnel arising there from.</li><li>10. Training to O&amp;M personnel It is the absolute responsibility of vendor to ensure imparting of necessary training to their O&amp;M personnel to get them acquainted with the operations of various electrical and mechanical equipment of the power plant. For this purpose, vendor shall identify the O&amp;M personnel well in advance and involve them during installation and commissioning stages so that they become well versed with various functional aspects of the power plant.</li><li>11. Availability of O&amp;M personnel at power plant<ol style="list-style-type: none"><li>(a) Vendor shall ensure that operating staff are present in the power plant during 7:30 AM – 6:30 PM every day.</li><li>(b) Vendor shall ensure that certain minimum operating staffs are present at the power plant even on festivals, public holidays and any other unique occasions so that the plant is</li></ol></li></ol>	
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	<p>run under competent supervision on all days.</p> <p>(c) Security guards shall be available at the power plant on round the clock basis and on all the days. In case of any break in duty of security guard(s), replacement with alternate guard(s) shall be ensured during the break time.</p> <p>12. O&amp;M personnel shall, strictly, not use any part of the power plant for their personal / residential purposes. Their presence at the plant shall, strictly, be meant only for the purpose of operation and maintenance of plant.</p>	
8.4	<p>O&amp;M operations – daily basis</p> <p>(1) Water cleaning of SPV modules</p> <p>(2) Control room cleaning – dry sweeping, wet mopping</p> <p>(3) Cleaning of toilets, urinals</p> <p>(4) Gardening of landscaping areas: watering of plants, trimming of plants as applicable and necessary.</p> <p>(5) Logging of DC, AC, grid parameters (current, voltage, power, energy) at PCUs &amp; HT panels, transformer temperatures, equipment tripping/ breakdown, grid outage etc as per BHEL formats.</p> <p>(6) SCADA data station / PC operations for daily monitoring of weather parameters, trend graphs and urgent reporting to BHEL in case of any problems / anomalies observed with any of the parameters.</p> <p>(7) Reporting the energy generation data to BHEL.</p> <p>(8) Drinking water to be arranged for O&amp;M personnel at site.</p>	
8.5	<p>O&amp;M activities – weekly basis</p> <p>(1) Removal of garbage from solar array field, switchyard, roads, drains, pathways, sand buckets; logging in registers with signatures of operating persons and in-charge.</p> <p>(2) Monitoring and logging of fire extinguisher levels / pressures as per BHEL formats</p>	
8.6	<p>O&amp;M activities – monthly basis</p> <p>(1) Inspection of fire extinguishers (weight, pressure indication, physical status etc) followed by refilling actions, if necessary, based on indications. Report to be submitted as per BHEL approved recording formats.</p> <p>(2) Earthing resistance measurements for solar array structures, control room equipment, switchyard equipment, lightning</p>	



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	<p>arrestors (ESE): measured values shall be recorded in registers and reported to BHEL as per BHEL approved recording formats.</p> <p>(3) Submission of values / status of plant parameters and events for the corresponding month, as below, as per BHEL approved formats:</p> <ol style="list-style-type: none"> <li>a. Daily values of solar array strings (SMB parameters)</li> <li>b. Daily values of weather parameters (solar energy, wind speed, ambient temperature)</li> <li>c. Daily energy generation</li> <li>d. Events (with date, time) of faults / tripping / breakdown of equipment</li> <li>e. Events (with date, time) of grid outage</li> <li>f. Events (with date, time) of equipment damages, accidents and thefts</li> <li>g. Activities of module cleaning</li> </ol> <p>(4) Monthly reports shall be submitted to BHEL for all the above data.</p> <p>(5) Energy generation / meter reading report to be prepared and submitted to the concerned department (STATE ELECTRICITY SUPPLY &amp; TRANSMISSION BOARDS etc). Signatures from BHEL's customer and substation representatives shall be obtained wherever required.</p>	
<p>8.7</p>	<p>O&amp;M activities - quarterly basis</p> <ol style="list-style-type: none"> <li>(1) Cleaning of PCUs, HT panels, battery chargers etc. to remove accumulated dust.</li> <li>(2) Monitoring and status review, followed by rectification / calibration / replenishment / replacement actions as necessary and applicable for following:             <ol style="list-style-type: none"> <li>(a) Spare items of all electrical equipment</li> <li>(b) First aid box items - medicines and accessories</li> <li>(c) Safety gadgets</li> <li>(d) Tool kits and measuring instruments</li> <li>(e) Yard lights</li> <li>(f) Pumps, starters</li> <li>(g) Control room appliances: air conditioners, lights, fans, exhaust fans, switch boards etc</li> </ol> </li> <li>(3) Pest control for control room (rats, snakes etc) – sprays, chemicals, medicines etc to be applied wherever required.</li> </ol>	




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	(4) Submission of quarterly report on above activities to BHEL.	
8.8	<p>O&amp;M activities - as and when required (contextual basis)</p> <p>(1) Monitoring and operation of plant electrical equipment as and when required:</p> <p>(a) GOS Air break switches (with / without earth switch)</p> <p>(b) VCB on/off: local operations from outdoor HT panel and remote operations from indoor remote annunciation(SCADA) panel</p> <p>(c) Settings of numerical relays in HT panels: review and revision in consultation with BHEL.</p> <p>(d) ACB and MCCB on/off operations on LT side</p> <p>(e) PCU operations: emergency close, LCD displays (selection of settings, monitoring the DC/AC/event/fault status parameters), operation of duct fans</p> <p>(f) Battery and battery charger operations</p> <p>(g) Bore well pump operations to fill the overhead tanks</p> <p>(2) Coordinating, on behalf of BHEL, and obtaining renewal of statutory licenses, clearances and approvals from state departments such as State Electricity Supply &amp; Transmission Boards/CEIG/etc.</p> <p>(3) Repair and replacement of vendor supplied items, by vendor, with urgent action plans and implementation, when the items are found non-working / damaged. The same shall be reported to BHEL within 12 hours from time of observation.</p> <p>(4) Reporting, on an immediate basis (within max 2 hours) of functional problems / damages in BHEL supplied items to facilitate repair / replacement by BHEL. Further, vendor shall correspond / coordinate with respective equipment vendors / service centers, on behalf of BHEL, for getting the service engineers to the site. Later, coordinating with the service engineers during their visit to site, and assisting them in the trouble shooting process until the problem is resolved. Vendor shall report to BHEL (within max 2 hours) immediately after the problem is resolved.</p> <p>(5) Vendor shall keep updating the spares inventory at the site every time there is consumption of spare items towards replacement. In case of shortage of spares, the same shall be reported on an urgent basis (with max 2 hours) to BHEL.</p> <p>(6) Coordinating with sub-station upon grid failures, line problems etc and implementing the needful steps to restore the plant to</p>	

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	<p>normal operation.</p> <p>(7) The electrical charges for the auxiliary consumption and broadband telephone charges, if any, of the SPV plant during the entire period will be in scope of the vendor</p> <p>(8) Theft incidents: immediate reporting to BHEL, filing FIRs with police stations on behalf of BHEL, coordination for site inspection by insurance companies and clearance of insurance claims, logging of events (date, time) and maintaining records.</p> <p>(9) Accidents: immediate reporting to BHEL, coordinating with hospitals, logging of events (data, time) and maintaining records.</p> <p>(10) Procurement of all O&amp;M consumables for fulfilling the activities detailed above will be in the scope of vendor.</p>	
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#### 9.0 Documents to be submitted for BHEL approval after receipt of purchase order

9.1	BHEL approval shall be obtained for the following technical documents, which shall be submitted to BHEL in phased manner based on priority sequence of activities. However, it shall be ensured that all documents are submitted within 5 days from date of intimation by BHEL.	
9.2	Vendor make, model number / part number, specification / sizes / dimensions / drawings / datasheets of all the vendor supplied items as listed in clause 6.0.	
9.3	<p>General arrangement drawings / schemes / layouts etc with bill of materials / quantities and design calculations shall be submitted for the following:</p> <ol style="list-style-type: none"> <li>(1) Transformer foundation pedestal</li> <li>(2) Oil pit arrangements for transformers</li> <li>(3) Firewalls</li> <li>(4) 33KV switchyard layout</li> <li>(5) Earth Mat for 33KV switchyard</li> <li>(6) Overall plant earthing layout</li> <li>(7) Trench details for HT cables &amp; data cables of switchyard</li> <li>(8) Cable support structure for 1Cx300 sq-mm cables between control room and transformers</li> <li>(9) RSJ pole foundations</li> <li>(10) Four pole structure sets (1 and 2)</li> <li>(11) Lightning arrestor arrangement with foundation details</li> <li>(12) Yard lights – solar array field, switchyard, compound</li> </ol>	

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	wall/chain link fencing (13) Water pipeline layout from OH tank to solar array field for module cleaning system (14) Fire alarm system scheme / layout (15) Cable support structures and cable ladders within control room	
9.4	Quality assurance plans for items listed under clause 7.0	
9.5	Detailed activity-time chart for project implementation.	
9.6	Detailed manpower deployment schedule.	



**PURCHASE SPECIFICATION / PHOTOVOLTAICS  
VRLA BATTERY AND FLOAT- CUM- BOOST CHARGER**

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### 1.0 Introduction

The specification is for DC power supply system consisting of 2 sets Valve regulated lead acid battery and 2 sets float-cum-boost-charger panels. This system is meant for providing DC supply to the control and relay panels for **solar photovoltaic power plant**. The three phase AC input to the battery charger is provided from 33kV / 415V step-down auxiliary transformer through an ACDB distribution board. One set of battery and battery charger will be used at a time, whereas the other battery bank will be used as a standby kept on float mode.

Necessary changeover provision from one FCBC to another FCBC need to be provided in DCDB panel. The DCDB panel should consists necessary measuring instruments for DC voltmeter, DC ammeter with ON/OFF indication.

### 2.0 Scope of supply

#	DESCRIPTION	Quantity
1	Supply of VRLA battery of 110V, 100 AH as per clause 3.0	2 sets
2	Supply of automatic float-cum-boost charger panel with output feeders, as per clause 4.0	2 sets
3	DCDB panel as per clause 5.0	1 set
4	Warranty Vendor shall ensure safe, continuous and trouble-free operation of battery and battery charger for the period of 6 years. Vendor has to repair or replace the faulty components free of cost for the period of 6 years.	-

### 3.0 Specification of VRLA battery: 2 sets

#### 3.1 Technical specification of battery / cell

- (1) Governing standard : IS 15549:2005
- (2) Make of the battery: Exide / HBL / Amara Raja
- (3) Rating: each set of 110V, 100 AH at C/10 rate
- (4) Unit cell voltage: 2V nominal
- (5) No. of cells: 55
- (6) AH of each cell : 100 AH @ C/10
- (7) Depth of discharge: 70%
- (8) Self discharge of cells : Not more than 3% per month
- (9) Application : Deep discharge, continuous operation
- (10) End of life of each cell : 80% of the rated capacity
- (11) Service life: Min 3 years on float service.



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- (12) Supply condition of cells : charged
- (13) Battery cell float voltage : 2.25 V/cell
- (14) Battery cell boost voltage : 2.35 V/cell
- (15) Boost charging period : within 12 hours
- (16) Lead coated copper connectors for cell interconnection

**3.2 Accessories to be supplied along with the cells**

- (1) Battery stand (acid resistant) to mount the cells: 1 No.

**3.3 Documents to be furnished for approval**

- (1) General arrangement showing drawings of individual cells, battery bank layout and overall arrangement with stand.
- (2) Bill of material showing components of battery system with quantities and technical details.
- (3) Quality Assurance Plan indicating lists of tests, relevant standards, acceptance criteria, etc.

**3.4 Tests, certificates and reports:**

- (a) Type test reports as per relevant IS standard to be submitted.
- (b) Routine tests and acceptance tests to be conducted as per quality assurance plan approved by BHEL. Capacity test, as per relevant standard, will be witnessed by BHEL.

**3.5 Documents to be submitted along with consignment:**

- (a) General Arrangement – as built
- (b) Bill of materials – as built
- (c) Operation and instruction manual

**4.0 Specification of battery charger panel: 2 panels**

**4.1 Technical specification of float-cum-boost chargers**

#	Description of parameter	Specifications
1	Input voltage	415 V AC +/- 10%, 3 phase, 4 wire, 50HZ
2	Output voltage	110 V DC nominal
3	Charging current continuous	20 A (Max boost) / stage
4	Charging mode	Float cum boost + trickle
5	Float Voltage	2.25 V/Cell
7	Boost voltage	2.35 V/cell
8	DC output voltage ripple	Not more than 5mV RMS at full load
9	Max ripple current	2% in float mode, 2% in boost mode
10	DC Load regulation	+/- 1%, for +/-10% of supply voltage fluctuation and 0-100% load variation measured at battery terminal.
11	Rectifier circuit	3-phase full wave full-controlled thyristorized & diode bridge
12	Control circuit	Proven solid state / $\mu$ P based
13	Blocking diode	To be provided at output



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14	Type of operation	Auto / Manual
15	Change-over provision upon AC failure	Automatic change-over from boost to float mode
16	Efficiency at: - 25% load - 50% load - 75% load - 100% load	55% 65% 70% 80%
17	LED indication with alarm annunciation on the panel	<b>For the following:</b> Mains ON, Float charger AC ON, Float charger DC ON, Boost charger AC ON, Boost charger DC ON, AC Mains Fail, Float charger DC fail, Boost charger DC fail, DC earth fault, SCR fuse fail, Filter fuse fail, Blocking diode fail, Battery under-voltage, Battery over-voltage, Charger DC overload
18	Meters on the panel	<b>All meters shall be 96 sq-mm 90-deg scale Class 1.5</b> 0-300V AC input voltmeter 0-10A DC float output ammeter 0-20A DC load current ammeter 20-0-20A DC boost charger ammeter Battery charge/discharge ammeter 0-200V DC output voltmeter 100-0-100mA battery leakage ammeter
19	Push button features	For various accept, reset and test options, as applicable
20	MCB and MCCB provisions	Suitably rated MCB and MCCB to be provided at input and output stages, as applicable.
21	Feeder provision at output	Four feeders with 15A MCBs.
22	Selector switches on the panel	Float Auto / Manual, Boost Auto/ Manual, Float / Boost / Autoboot selector switches, power stack1 / power stack 2. Also, Voltmeter / Ammeter selector switches as applicable.
23	Panel construction details	(a) Degree of protection: IP42 (b) 2mm thick CRCA sheet for frames and front door (c) Front door hinged and locked (d) Rear door hinged and bolted (e) Side covers bolted (f) Louvers to be provided on the doors / side covers for ventilation (g) Cable sizing and colour codes: AC / DC cable size as per circuit requirement. AC side colour : Grey DC side colour : Red for positive, Black for negative Electronic control circuits: 0.75 sq-mm grey / red / black, as appropriate. Earth circuit: 0.75 sq-mm, green (h) External cable termination provisions to be provided



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		<p>suitably in front of panel with suitably sized brass bolts.</p> <p>(a) AC input terminals  (b) Battery connection terminals  (c) Feeder terminals for the four feeders</p> <p>(i) Earthing terminals using 25x3 mm aluminium earth bus, with M6 bolt provisions on both sides of panel</p> <p>(j) Base channel: ISMC 75x40x6 mm black.</p> <p>(k) Cable entry: Bottom; base channel shall be sufficiently elevated to facilitate cable entry / exit below the panel.</p> <p>(l) Vendor shall provide holes on gland plates for fixing the cable glands. Vendor shall also provide nickel plated brass glands of single compression type, comet make or equivalent. Gland size will be intimated to vendor at the time of manufacturing.</p> <p>(m) All covers shall have gasket provisions</p> <p>(n) Slots shall be covered by fine wire mesh</p> <p>(o) Paint shade: RAL 7032</p>
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**5.0 Specification DCDB: 1 panel**

#	Description of parameter	Specifications
1	Input voltage	110 V DC
2	Output voltage	110 V DC nominal
3	LED indication	Charger 1 ON, Charger 2 ON
4	Meters on the panel	<b>All meters shall be 6 sq-mm 90-deg scale Class 1.5</b> 0-20A DC load current ammeter 0-200V DC output voltmeter
5	MCB and MCCB provisions	Suitably rated MCB to be provided at input and output stages, as applicable.
6	Selector switches on the panel	Charger 1/ Charger 2 selector switches, Also, Voltmeter / Ammeter selector switches as applicable.
7	Panel construction details	<p>(p) Degree of protection: IP42</p> <p>(q) 2mm thick CRCA sheet for frames and front door</p> <p>(r) Front door hinged and locked</p> <p>(s) Rear door hinged and bolted</p> <p>(t) Side covers bolted</p> <p>(u) Louvers to be provided on the doors / side covers for ventilation</p> <p>(v) Cable sizing and colour codes:  AC / DC cable size as per circuit requirement.  AC side colour : Grey  DC side colour : Red for positive, Black for negative  Electronic control circuits: 0.75 sq-mm grey / red / black, as appropriate.</p>



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		<p>Earth circuit: 0.75 sq-mm, green</p> <p>(w) External cable termination provisions to be provided suitably in front of panel with suitably sized brass bolts.</p> <p>(d) AC input terminals</p> <p>(e) Battery connection terminals</p> <p>(f) Feeder terminals for the four feeders</p> <p>(x) Earthing terminals using 25x3 mm aluminium earth bus, with M6 bolt provisions on both sides of panel</p> <p>(y) Base channel: ISMC 75x40x6 mm black.</p> <p>(z) Cable entry: Bottom; base channel shall be sufficiently elevated to facilitate cable entry / exit below the panel.</p> <p>(aa) Vendor shall provide holes on gland plates for fixing the cable glands. Vendor shall also provide nickel plated brass glands of single compression type, comet make or equivalent. Gland size will be intimated to vendor at the time of manufacturing.</p> <p>(bb) All covers shall have gasket provisions</p> <p>(cc) Slots shall be covered by fine wire mesh</p> <p>(dd) Paint shade: RAL 7032</p>
--	--	---

**6.0 Documents to be furnished for approval**

- (1) General arrangement drawing
- (2) Bill of material with components, quantities and technical details.
- (3) Quality Assurance Plan indicating lists of tests, relevant standards, acceptance criteria, etc.

**6.1 Type tests, routine tests on battery charger:**

Vendor shall provide inspection call, based on which BHEL will visit vendor works for witnessing the routine and type tests as follows.

- (1) Routine tests and acceptance tests to be conducted as per quality assurance plan approved by BHEL. A minimum of following routine tests shall be conducted.
  - (a) Visual inspection as per BoM
  - (b) Insulation resistance test
  - (c) HV test
  - (d) Voltage regulation test at no load and full load
  - (e) System set points: float & boost voltage, overvoltage cutback, charger current limit, battery current limit, float to boost, boost to float, DC undervoltage/ overvoltage indication.
  - (f) Ripple voltage measurement test
  - (g) General checks: Door lamp, socket, heater, etc.
  - (h) Inspection of DC distribution boards

**6.2 Documents to be submitted along with consignment:**

- (1) General Arrangement – as built



**PURCHASE SPECIFICATION / PHOTOVOLTAICS  
VRLA BATTERY AND FLOAT- CUM- BOOST CHARGER**

Annexure-1


Rev No: 00

PAGE : 6 OF 6

- (2) Bill of materials – as built
- (3) Operation and instruction manual

**6.3 Approved make of components**

(1)	Digital Ammeters	Conzerv, ICD or equivalent make
(2)	Digital Voltmeters	Conzerv, ICD or equivalent make
(3)	Pushbuttons	Siemens, Schneider, L&T, Cands, Teknic
(4)	Fuses	Bussmann or equivalent make
(5)	MCBs, MCCBs	Siemens, Schneider, MDS or equivalent make
(6)	Selector switches	Kaycee, Salzer, Switron or equivalent make
(7)	Indicating lamps	Siemens, Schenider, Teknic, L&T, Cands or equivalent make
(8)	Diodes / thyristors	Semikron, Ruttonsha, Hirect or equivalent make

	<b>PURCHASE SPECIFICATION FOR ACDB PANEL FOR AUXILIARY SUPPLY OF SOLAR POWER PLANT</b>	Annexure-2
		Rev No: 00
		PAGE : 1 OF 4

## 1.0 INTRODUCTION

The ACDB panel is to be supplied and installed in the control room of the Solar PV Power Plant. This document provides the technical specification for the ACDB panel that is used for receiving the 415 Volts, three phase, 4 wire AC output from the 100 kVA auxiliary transformer installed in the switchyard and provide distribution of the same to the various loads. It also provides for protection of the control room utility loads and for monitoring of the energy parameters for auxiliary consumption.

This specification should be read in conjunction with drawing no. 3-679-05-00749, the SLD for the ACDB.

## 2.0 SCOPE FOR VENDOR

2.1	Supply of ACDB panel along with necessary spares	1 No
2.2	<b>Warranty</b> Vendor shall provide warranty for 12 months from the date of commissioning or 18 months from the date of supply, whichever is earlier.	Vendor shall express compliance

## 3.0 TECHNICAL SPECIFICATION

S.No	Technical Parameter	BHEL Specification	Vendor Compliance(Yes/No); In case of non-compliance or deviation, vendors shall record their comments
1	Construction Type	Floor resting type ISMC 100 base frame Panel sheets of 2 mm/14 gauge CRCA sheet Hinged door:2mm/14 gauge CRCA sheet Removable door: 1.6mm/16 gauge CRCA sheet Gland Plate : 3mm/10 gauge Lifting hooks(4nos) of adequate capacity Locking provisions with key, no door on rear side Paint colour: RAL 7032 of IS:5	
2	Wiring as per SLD	Drawing No : 3-679-05-00749	
3	Grouting provision	Base channel shall be provided with suitable grouting provision. Necessary grouting bolts with hardware as shall be approved by BHEL, shall be provided by vendor.	
4	Enclosure protection	IP-32 or better	
5	Cable entry and termination	1) The Incoming cable from 100 KVA auxiliary transformer and outgoing cable will be to various plant loads will enter the	



**PURCHASE SPECIFICATION FOR ACDB PANEL FOR AUXILIARY  
SUPPLY OF SOLAR POWER PLANT**

Annexure-2

Rev No: 00

PAGE : 2 OF 4

		<p>ACDB panel from bottom side, in upward direction from the cable trench below</p> <p>2) At site, panel will be seated in such a way that the front portion of the base sits on the ground and the rear portion of the base (up to a maximum of 500 mm) will be exposed to cable trench that is below ground level of panel. This exposed portion only shall be used for cable entry.</p>	
6	Cable entry/exit	Through removable gland plate of 3mm thickness at the bottom of the panel, holes to be drilled in the gland plate for these cables	
7	Cable glands	Nickel plate brass for the 3.5C X 95 Sq.mm Al cable. Polyamide/Nickel plated brass glands for unarmoured/armoured cable for the outgoing cables	
8	Incoming cables	3.5 c x95Sq.mm Al Armored cable (in vendor Scope of Work)	
9	Outgoing Cables	Actual size of the cable need to be decided by the vendor depending upon the site requirement. Typical requirements are as per the SLD	
10	Bus bar	Al bus bar of minimum 200 Sq.mm per phase bus bar supports and insulation i) Support made of FRP/SMC/DMC ii) PVC insulation sleeve with colour coding of red, blue, yellow	
11	Main MCCB	Three phase neutral of 25 KA breaking capacity and 120 Amps rating. Makes: ABB, Schneider, HAVELLS or any other BHEL approved makes	
12	Earth leakage relay	30mA ELCB with CBCT shall be provided. Makes: Prokdvs/Equivalent	
13	MCBs	16A,32 A and 63A both SP and TP and short circuit breaking capacity of 10 kA common neutral. Makles: ABB/Siemens/Schneider/HAVELLS or reputed equivalent as shall be approved by BHEL	
14	Dimensions of panel	To be provided by the vendor along with the bid	
15	Spacing phase to phase, phase to ground spacing	Shall be as per relevant IS standards; Vendor to mention both	
16	Sizes of control cables for internal wiring of the ACDB	Vendor has to furnish	



**PURCHASE SPECIFICATION FOR ACDB PANEL FOR AUXILIARY  
SUPPLY OF SOLAR POWER PLANT**

Annexure-2

Rev No: 00

PAGE : 3 OF 4

17	Voltmeter	Analog/digital type with phase selector switch Make: Rishabh, MECO or approved equivalent with ON/OFF MCB	
18	Ammeter	Analog/digital type with phase selector switch Make: Rishabh, MECO or approved equivalent make	
19	KWH meter	Model EM 6400 with MODBUS 485 output Make : CONZERV or approved equivalent make	
20	LED indications	LED lamp indications( 22.5 mm diameter) shall be provided: - R,Y,B indications to check power at incoming to ACDB - To indicate ON/OFF status of MCCB	
21	Load balancing of phases	As most of the loads are single phase, proper load balancing is required.	
22	Labelling of MCBs	Anodized AL labeling to be provided with nomenclature as per SLD details	
<b>SPARES FOR THE ACDB</b>			
1	Ammeter-1 No.,	In line with SI.No 17 above	
2	Voltmeter-1 No.,	In line with SI.No 18 above	
3	kWH meter-1 No.,	In line with SI.No 19 above	
4	LED indication Lamps	1 no., of each type used in SI.No. 20 above	
5	MCBs	2 no., of each rating used in SI.No. 13 above	

**4.0 DOCUMENT TO BE SUBMITTED ALONG WITH TECHNICAL OFFER**

S.No	Description	Accepted Yes or No
1	Technical offer with covering letter	
2	Filled up compliances with comments clause nos 2.0,3.0 Clause wise compliance shall be filled up in the column provided in this specification, with signature and seal on every page.	
3	General arrangement drawing of ACDB panel showing - Front Elevation and end views with overall dimensions, - Overall dimensions, overall weight, applicable standards.	
4	SLD diagram showing the MCCB, LED indications, push buttons etc.,	
5	Bill of materials mentioning make/part number, rating of individual components, Quantity	

**5.0 DOCUMENTS TO BE SUBMITTED AFTER RECEIPT OF PURCHASE ORDER**

Following document shall be submitted for BHEL approval within seven days from date of purchase order.



**PURCHASE SPECIFICATION FOR ACDB PANEL FOR AUXILIARY  
SUPPLY OF SOLAR POWER PLANT**

Annexure-2

Rev No: 00

PAGE : 4 OF 4

S.No	Description	Accepted Yes or No
1	General arrangement of the ACDB panel showing bottom, front elevation and end views with overall dimensions, positions of MCCBs, Earth Leakage relay, lamps, push buttons, earth terminals etc.,	
2	Panel construction details – frame, door, bus bars, base frame etc.,	
3	BOM with item description, quantity, make, model/ part numbers.	
4	Single line diagram	
5	Drawings showing internal arrangements a) Bus bar arrangements – different views b) Cable terminations	
6	Drawings of gland plates with details of holes for glands	
7	Datasheets of ERL relay, MCCB, voltmeter, ammeter, load manager	
8	Quality Plan	


### 6.0 TESTING AND INSPECTION

Routine test as per relevant standards (IS, IEC) shall be carried out on the ACDB panel and the same shall be witnessed by BHEL. Vendor shall submit quality plan, indicating relevant IS/IEC standards, prior to inviting BHEL for inspection. Following shall be the minimum checks.

S.No	Description	Accepted Yes or No
1	Visual inspection check and bill of material check	
2	Electricity continuity check	
3	Function checks on MCCB, MCBs	
4	HV test	
5	Earth leakage relay functional test	
6	Heat run test	
7	Test reports to be submitted prior to dispatch of the system to site.	
8	Test certificates/ calibration certifications for MCCB, ERL relay	

### 7.0 DOCUMENT TO BE SUBMITTED ALONG WITH CONSIGNMENT AT THE TIME OF DISPATCH

S.No	Description	Accepted Yes or No
1	AS built drawing for ACDB panel	
2	Test reports/ Calibration reports – 2 copies	
3	Operations and maintenance manual – 2 copies	

	<b>PURCHASE SPECIFICATION FOR PCU DUCT ARRANGEMENT</b>	Annexure-3
		Rev No: 00
		PAGE : 1 OF 1

## 1.0 INTRODUCTION

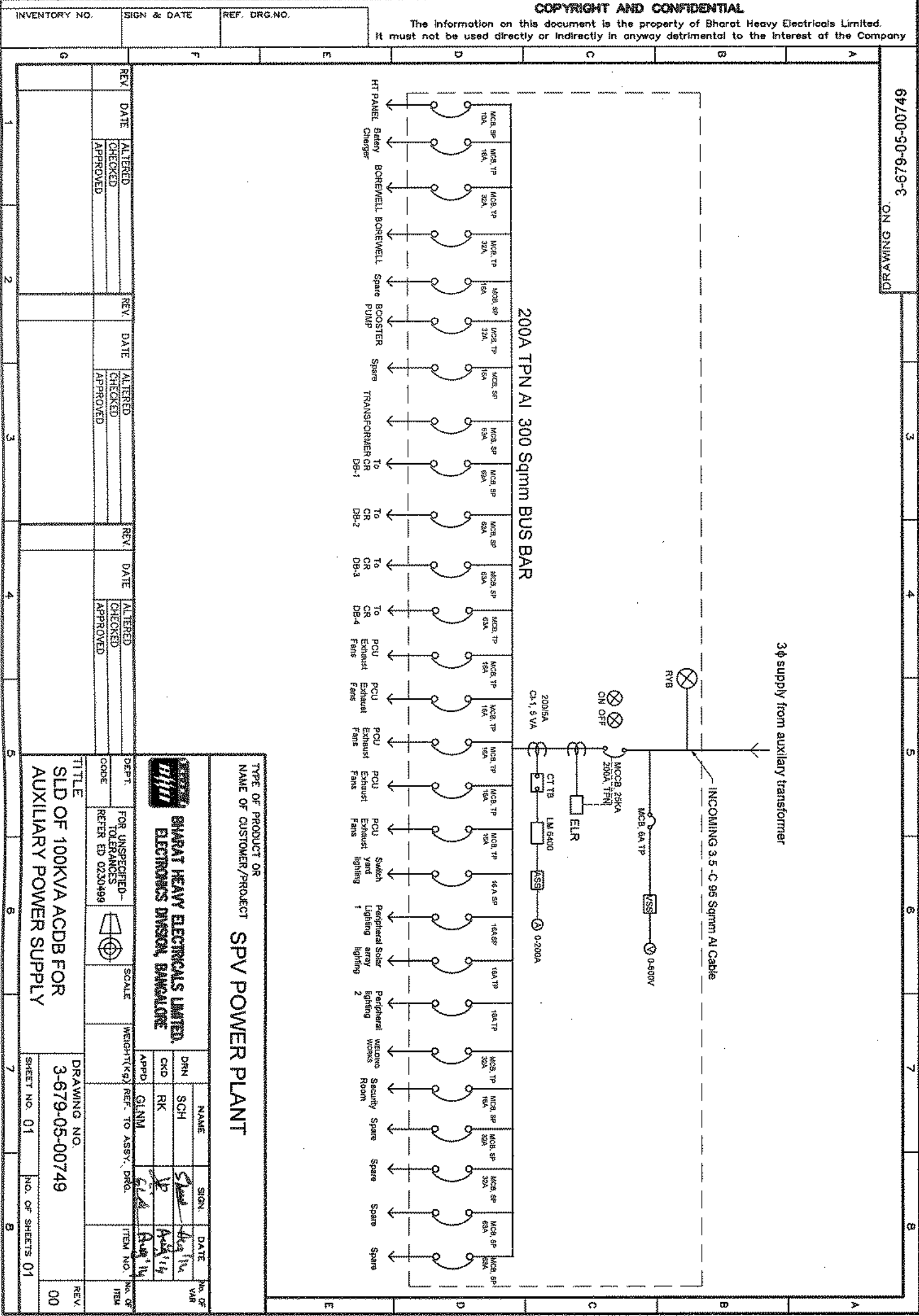
The air ducts along with suitable exhaust fans is to be installed for 5 PCUs in the control room of the 3MW Grid connected SPV Power Plant, OPCL. This document provides the technical requirements for the exhaust fan and for the air duct arrangement required for the 630 KVA inverters installed in the control room.

## 2.0 TECHNICAL SPECIFICATION

SI No	Description	Qty	Vendor compliance (Yes / No) In case of non-compliance or deviation, vendors shall record their comments:
1	Ducts, fans, starters and other accessories including hardware shall be supplied, installed and commissioned at the site by the vendor. The scope shall also include wiring of starters to the AC distribution board in the control room. (cables for wiring is within vendor scope)	5 set	
2	External exhaust fans of suitable wattage and size (the typical heat dissipation of a 630KVA PCU is in range of 57000 – 60000 Btu) shall be fitted into the cut-out of control room walls. These cut-outs will be made by BHEL based on dimensions and positions provided by vendor.	5 set	

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DRAWING NO. 3-679-05-619-3



REV	DATE	ALTERED	REV	DATE	ALTERED	REV	DATE	ALTERED
		CHECKED			CHECKED			CHECKED
		APPROVED			APPROVED			APPROVED

**TYPE OF PRODUCT OR NAME OF CUSTOMER/PROJECT**  
SPV POWER PLANT

**BHARAT HEAVY ELECTRICALS LIMITED,  
ELECTRICALS DIVISION, BANGALORE**

**TITLE**  
SLD OF 100KVA ACDB FOR  
AUXILIARY POWER SUPPLY

DRN	NAME	SIGN.	DATE	NO. OF VAR
SCH	SCH	[Signature]	14/11/14	
RK	RK	[Signature]	14/11/14	

DEPT. FOR UNSPECIFIED- TO BRANCHES REFER ED 0230499

SCALE

WEIGHT(KG) REF. TO ASSY. DRG.

APPRD. GJNM

ITEM NO.

DRAWING NO. 3-679-05-00749

SHEET NO. 01 NO. OF SHEETS 01

REV. 00

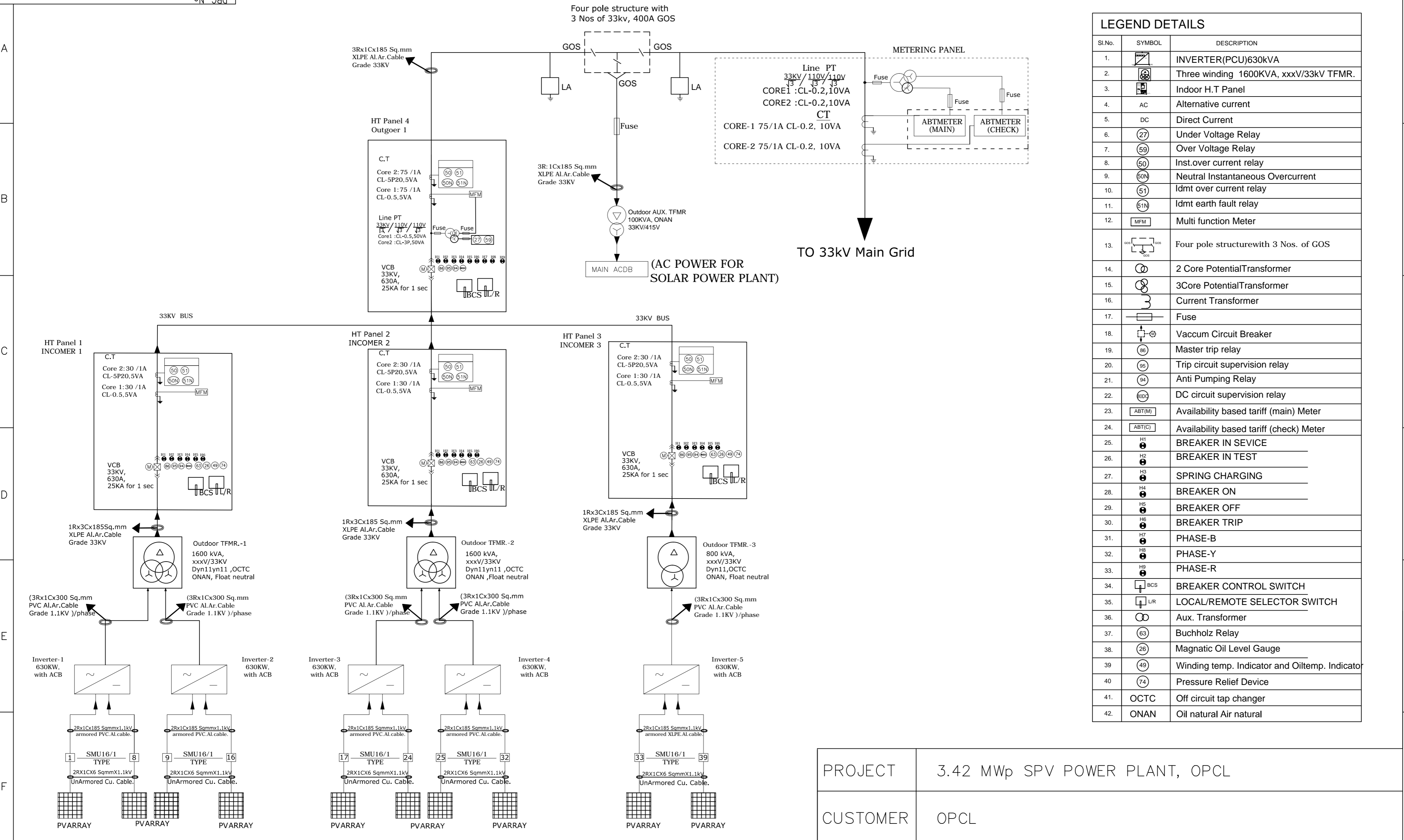
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REF. DRG. No.

SIGN. & DATE

INVENTORY No.



LEGEND DETAILS		
Sl.No.	SYMBOL	DESCRIPTION
1.		INVERTER(PCU)630kVA
2.		Three winding 1600KVA, xxxV/33kV TFMR.
3.		Indoor H.T Panel
4.	AC	Alternative current
5.	DC	Direct Current
6.		Under Voltage Relay
7.		Over Voltage Relay
8.		Inst. over current relay
9.		Neutral Instantaneous Overcurrent
10.		Idmt over current relay
11.		Idmt earth fault relay
12.		Multi function Meter
13.		Four pole structure with 3 Nos. of GOS
14.		2 Core Potential Transformer
15.		3Core Potential Transformer
16.		Current Transformer
17.		Fuse
18.		Vacuum Circuit Breaker
19.		Master trip relay
20.		Trip circuit supervision relay
21.		Anti Pumping Relay
22.		DC circuit supervision relay
23.		Availability based tariff (main) Meter
24.		Availability based tariff (check) Meter
25.		BREAKER IN SERVICE
26.		BREAKER IN TEST
27.		SPRING CHARGING
28.		BREAKER ON
29.		BREAKER OFF
30.		BREAKER TRIP
31.		PHASE-B
32.		PHASE-Y
33.		PHASE-R
34.		BREAKER CONTROL SWITCH
35.		LOCAL/REMOTE SELECTOR SWITCH
36.		Aux. Transformer
37.		Buchholz Relay
38.		Magnetic Oil Level Gauge
39.		Winding temp. Indicator and Oiltemp. Indicator
40.		Pressure Relief Device
41.	OCTC	Off circuit tap changer
42.	ONAN	Oil natural Air natural

PROJECT	3.42 MWp SPV POWER PLANT, OPCL
CUSTOMER	OPCL

REV.	ALTERED	CHECKED	APPROVED	REV.	DATE	NAME	SIGN	DATE
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FIRST ISSUE				DRAWN	SAN			280814
				CHECKED	VJ			280814
				APPROVED	PRV			280814

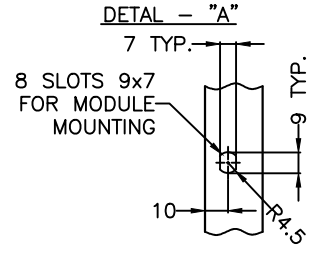
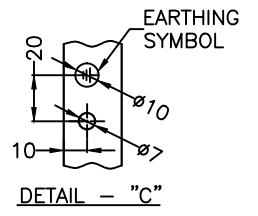
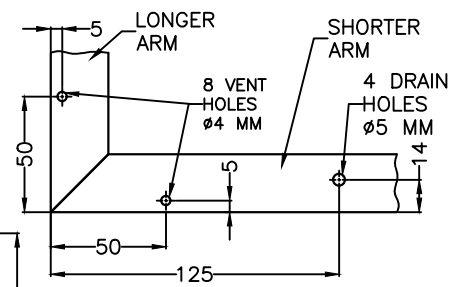
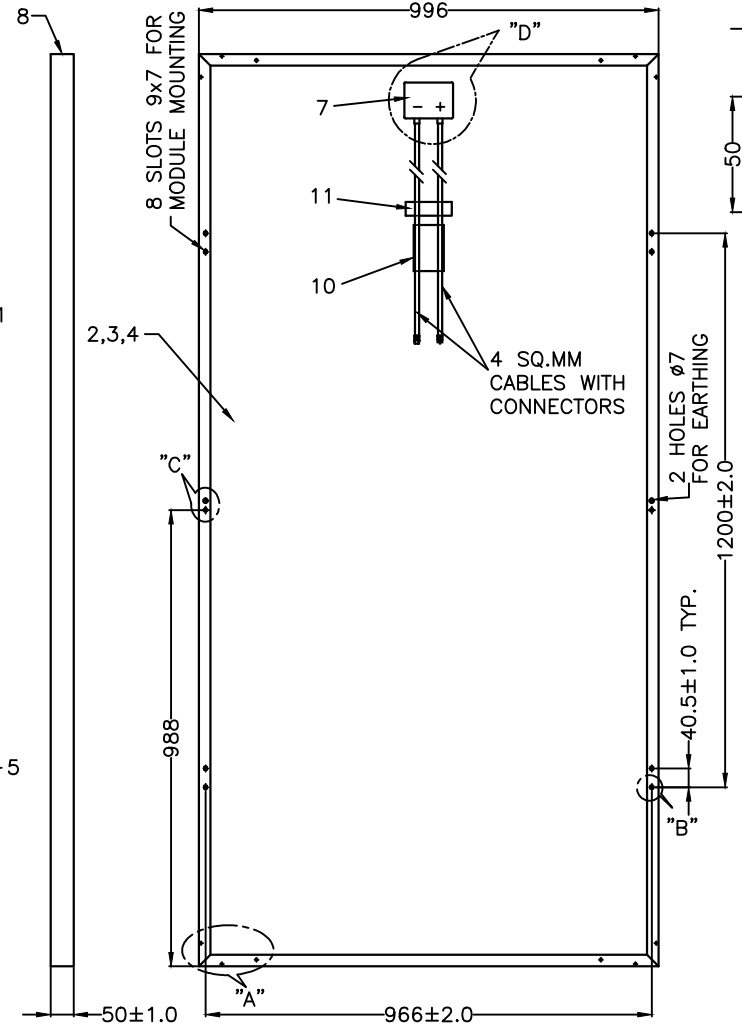
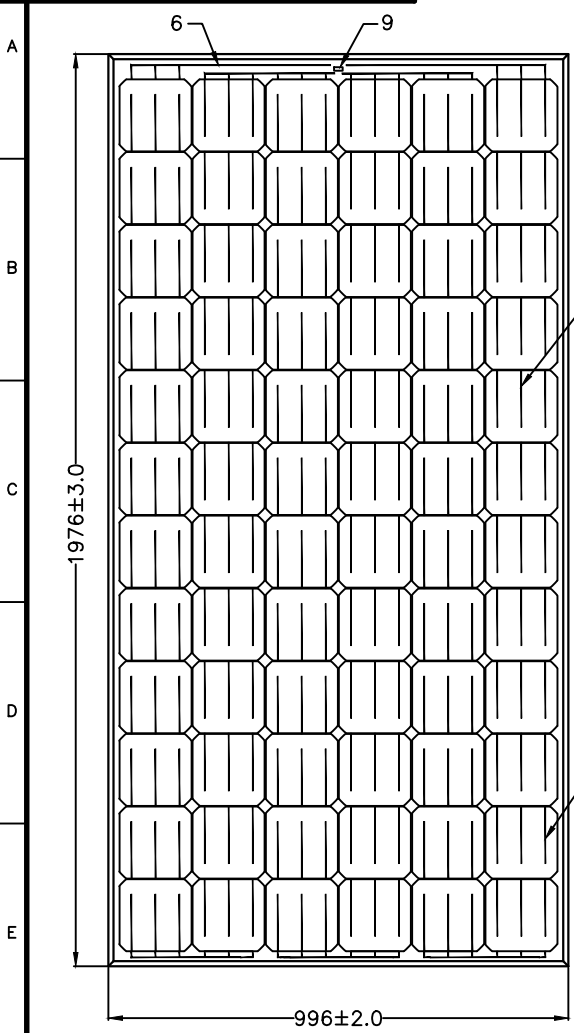
BHARAT HEAVY ELECTRICALS LIMITED.  
ELECTRONICS DIVISION, BANGALORE

TITLE:	SINGLE LINE DIAGRAM FOR 3.42 MWp SOLAR PHOTO VOLTAIC PLANT		No. OF SHEETS	01
			SHEET No.	01
DRG. NO.	BHEL DRG. No. 3-679-05-00747			REV
				00

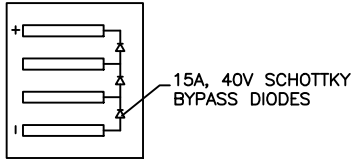
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DRAWING NO. 3 679 02 00371



PART	DESCRIPTION
11	RFID TAG
10	MODULE RATING STICKER
9	PV MODULE SL. NO. STICKER
8	ANODISED ALUMINUM EDGE FRAME
7	JUNCTION BOX WITH CABLES & CONNECTORS
6	BUS BAR
5	INTERCONNECTS
4	BACK SHEET
3	EVA SHEET
2	HIGH TRANSMISSION TEMPERED GLASS
1	72 Nos. OF 156 mm MONO CRYSTALLINE SILICON SOLAR CELLS CONNECTED IN SERIES



TYPE OF PRODUCT OR NAME OF CUSTOMER/PROJECT

DRN	NAME	SIGN.	DATE	No. OF VAR
CKD	SM	Sd/-	22.06.2013	
APPD	SR	Sd/-	22.06.2013	

REV.	DATE	ALTERED	SAN	REV.	DATE	ALTERED	SAN	REV.	DATE	ALTERED	SAN	DEPT. SC&PV	FOR UNSPECIFIED-TOLERANCES REFER ED 0230499	SCALE	WEIGHT(Kg)	REF. TO ASSY. DRG.	ITEM NO.	No. OF ITEM
02	031213	CHECKED	NAR	01	091113	CHECKED	NAR	00						1 : 10				
		APPROVED	SR			APPROVED	SR											

TITLE: **PHOTOVOLTAIC MODULE-L24270**  
**156mm Mono Solar Cell (Corner Block Type)**

DRAWING NO. **3 679 02 00371**

02	031213	APPROVED	SR	01	091113	APPROVED	SR	00										
DIM 1976±3.0 WAS 1998±3.0				PART NOS. CHANGED IN DRAWING				FIRST ISSUE										

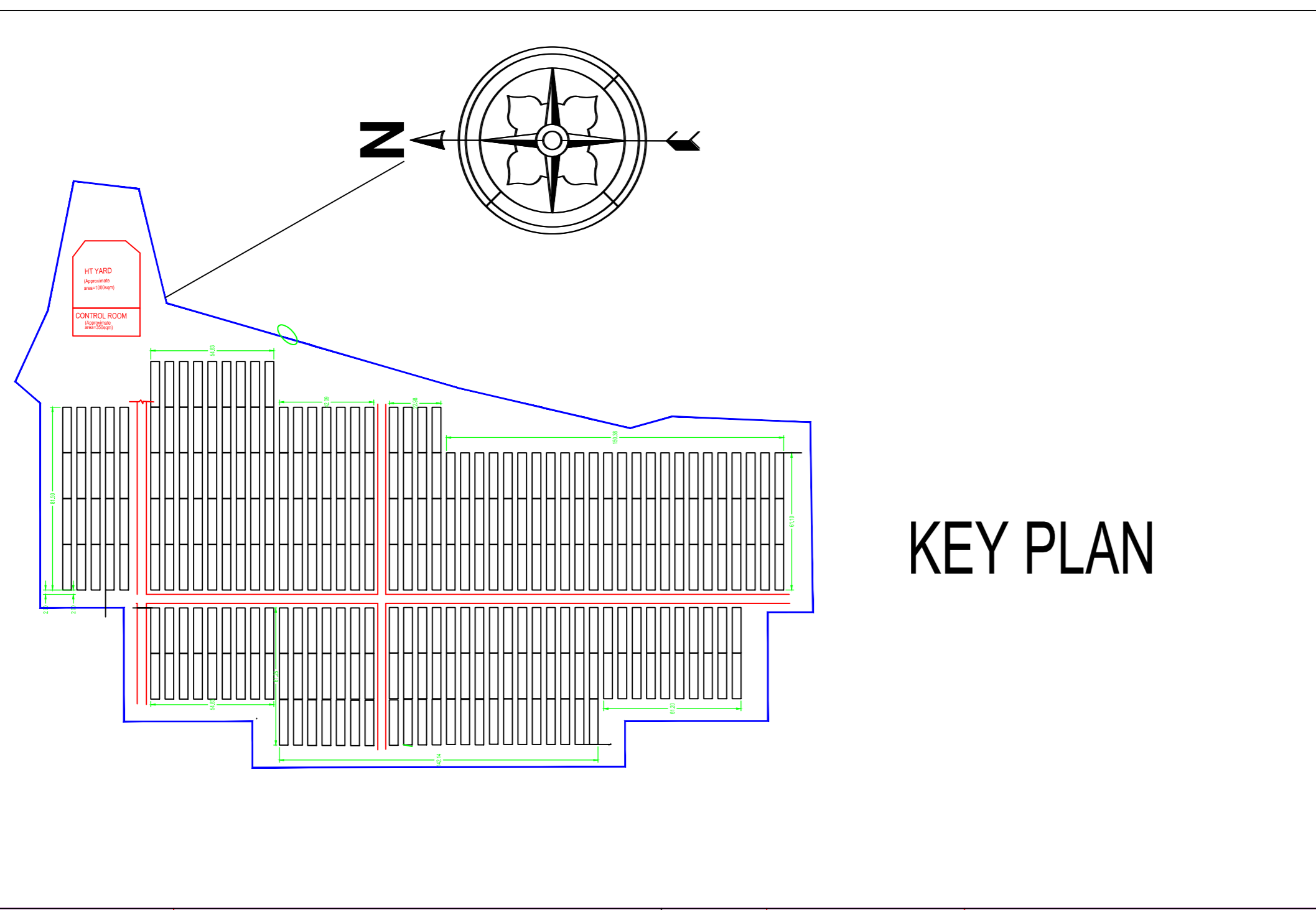
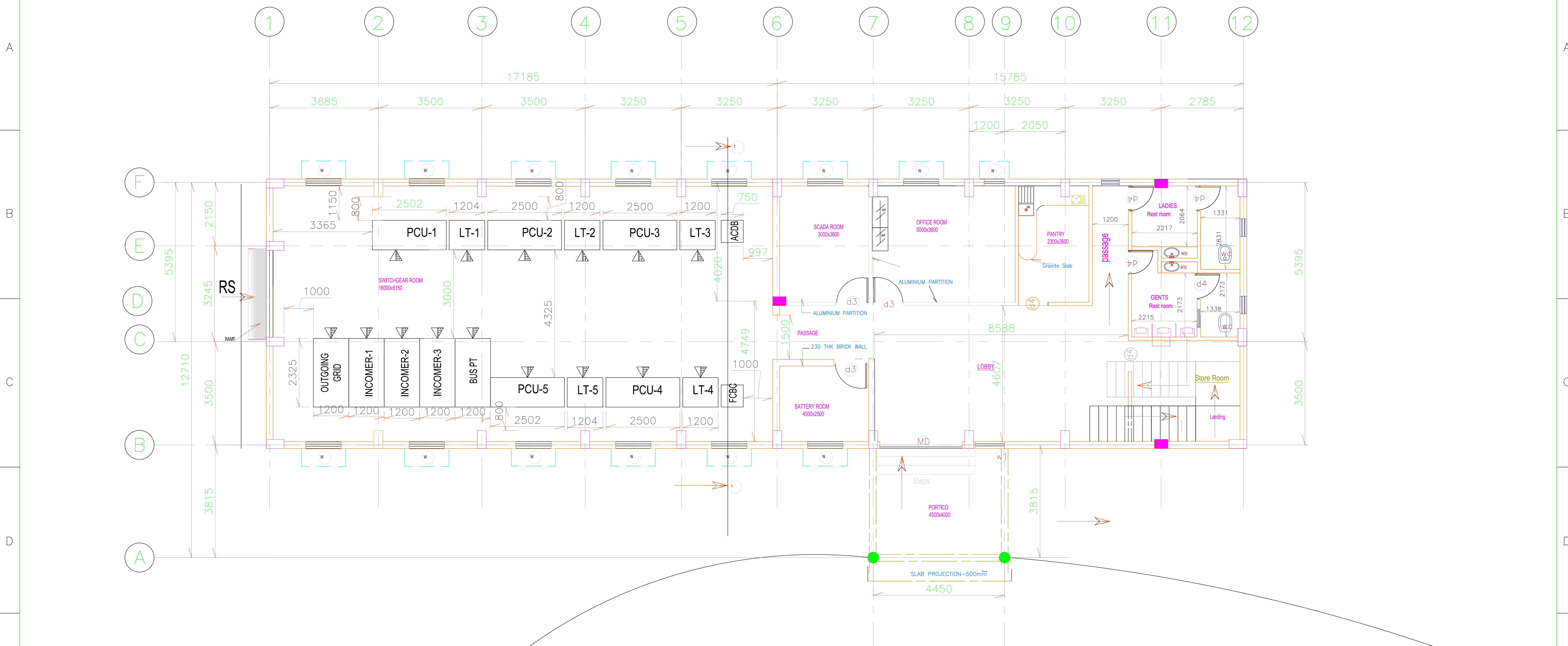
SHEET NO. 01 NO. OF SHEETS 01



BHEL-OPCL-CR-AR-01  
DRG. No.

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PRODUCED BY AN AUTODESK EDUCATIONAL PRODUCT



Control Room Built up Area = 305Sqm  
Portico Built up Area = 18.0Sqm

- GENERAL NOTES :
1. ALL DIMENSIONS ARE IN MM.
  2. SCALE:1:100
  3. DO NOT SCALE THE DRAWING; ONLY WRITTEN DIMENSIONS TO BE FOLLOWED.
  4. ANY DISCREPANCY IN THE DRAWING SHALL BE BROUGHT TO THE NOTICE OF RELEVANT ENGINEER.
  5. READ THIS DRAWING ALONG WITH RELEVANT ARCHITECTURAL/STRUCTURAL DRAWING.

### GROUND FLOOR PLAN

PROJECT: OPCL-3.4MW-SPV PLANT  
CUSTOMER: OPCL-Ravulapally village, Mominpet Mandal, Telangana

**BHARAT HEAVY ELECTRICALS LIMITED.**  
ELECTRONICS DIVISION, BANGALORE

REV.	DATE	ALTERED		REV.	DATE	ALTERED		NAME	SIGN	DATE
		CHECKED	APPROVED			CHECKED	APPROVED			

DRAWN	DC	07.08.2014
CHECKED	HCS	07.08.2014
APPROVED	PR	07.08.2014

<p><b>CONTROL ROOM LAYOUT</b></p>	No. OF SHEETS	01
	SHEET No.	01
DRG. No.	BHEL-OPCL-CR-AR-01	
REV	00	

COMMERCIAL TERMS & CONDITIONS				
RFQ No.HBSBOS021 DATED : 24.09.2014 DUE DATE(TECH BID) : 15.10.2014				
Sl No.	Terms	BHEL Term	Confirmation	Deviation / Remarks
1	Bidding	(a) Bid has to be submitted as Two Part – in two sealed covers-Techno Commercial Bid(Part-1) & Price Bid (Part-II)- clearly written on each cover both put in a single sealed envelope super-scribed with RFQ No. and Due date.	Agree / Not agree	
		(b) Annexures B & B1 to be submitted along with technical bid (Part-1) & Annexure B2 to be submitted along with Price bid (Part-II).	Agree / Not agree	
		(c) Clause-wise compliance to BHEL Purchase specification along with all documents as called in Technical specification to be submitted along with Technical Bid(Part-1).	Agree / Not agree	
2	Price Basis	Firm i.e., from the date of PO to completion of supply if I&C is not applicable. If I&C is in supplier's scope, then the prices shall remain Firm till commissioning & handing-over of the complete system. (PVC clause not acceptable).	Agree / Not agree	
3	Terms of Delivery	Free On Road Basis to OPCL Site	Agree / Not agree	
4	Delivery Period	(a) Supply : 10 weeks from Drawing Approval Drawing Submission: 1 week from PO Date	Agree / Not agree	
		(b)I&C: 4 weeks from Supply Date.	Agree / Not agree	
5	Payment Term	(a)Supply : 80% payment of Supply Value + 100% Taxes shall be made with 45 days credit from the date of receipt of material at site. 10% on completion of I&C and certification. Balance 10% on execution of PBG valid for warranty period + 6 months claim period from any of the BHEL Consortium banks.	Agree / Not agree	
		(b)I&C : 90% of basic I&C value + 100% Taxes & Duties on completion of I&C and certification line item wise on pro-rata basis. Balance 10% on execution of PBG valid for warranty period+ 6 months claim period from any of the BHEL Consortium banks.	Agree / Not agree	
		(c) O&M : 100% O&M charges are payable on monthly basis against report certified by BHEL	Agree / Not agree	
		(d)For any deviation in payment term, the offer will be liable for loading as per Clause 25A(ii) of Enquiry-General Terms & conditions (Doc Ref : SCPV/BOS/01-Rev 00)	Agree / Not agree	
6	Excise Duty	(a) To confirm whether applicable. If applicable, indicate prevailing rate of Excise duty.	Applicable / Not applicable	Prevailing rate of Excise duty : ..... %
		(b) BHEL is trying to avail Customs Duty & Excise duty exemption. Successful bidder shall support with all relevant documents.	Agree / Not agree	
7	Sales Tax	(a) To confirm whether applicable. If applicable, indicate prevailing rate of Sales Tax against Form C.	Applicable / Not applicable	Prevailing rate of Sales Tax : ..... %
		(b) For issue of form "C", vendor has to furnish "E1/E2" form. Please confirm that "E1/E2 Sale form" will be submitted.	Agree / Not agree	
8	Value Added Tax	Since it is inter-state movement of goods, VAT is not applicable. Only CST against form C is applicable	Applicable / Not applicable	
		OR Both are in the same State, VAT is applicable please indicate VAT applicable.	Applicable / Not applicable	Prevailing rate of VAT : ..... %
9	Octroi	To confirm whether applicable, if applicable indicate current rate of Octroi.	Applicable / Not applicable	Octroi_____%

AUTHORISED SIGNATORY WITH SEAL

COMMERCIAL TERMS & CONDITIONS				
RFQ No.HBSBOS021 DATED : 24.09.2014 DUE DATE(TECH BID) : 15.10.2014				
Sl No.	Terms	BHEL Term	Confirmation	Deviation / Remarks
10	Service Tax	To confirm whether applicable, if applicable indicate current rate of Service Tax.	Applicable / Not applicable	Prevailing rate of Service Tax ..... %
		Furnish following : Service Tax Regn. No. Confirmation that Service Tax register is maintained.	Applicable / Not applicable	Service Tax Regn. No.....
11	Freight	Freight shall be included (since it is on FOR basis to site) in unit rate quoted.	Agree / Not agree	
12	Insurance	Transit Insurance will be in vendor's scope.	Agree / Not agree	
13	Evaluation of L1 vendor	Over all L1 of Supply + I&C +O&M on "FOR" basis to site will only be considered.	Agree / Not agree	
		The percentage of Supply, Civil works and I&C values shall be in the range indicated below(approximately,with overall tallying to 100% ) : (a) Supply : 46-49% (b) I&C :46-49 % (c) O&M : 4-5%	Agree / Not agree	
14	Warranty	<b>(a) Warranty for Supply</b> : 18 months from date of supply or 12 months from I&C whichever is earlier. <b>(b) Workmanship / I&amp;C</b> : 12 months from I&C <b>(c) O&amp;M</b> : 6 months commencing from date of Commissioning.	Agree / Not agree	
15	Pre Shipment Inspection	Pre Shipment Inspection will be carried out by BHEL/Customer for which test report shall be sent one week in advance.	Agree / Not agree	
16	Penalty	(a) 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%. For Supply, Pre Shipment Inspection Call Letter Date (Receipt of test report) will be treated as delivery for purpose of penalty.	Agree / Not agree	
		( b )For any deviation in penalty term, the offer will be liable for loading as per Clause 25.B of Enquiry-General Terms & conditions (Doc Ref : SCPV/BOS/01-Rev 00)	Agree / Not agree	
17	Road Permit	Road permit if applicable will be given by BHEL before Dispatch of ordered Items	BHEL	
18	Despatch Documents	Complete set of despatch documents in 3 sets shall be forwarded to BHEL directly. Despatch documents include Commercial Invoice, Excise Invoice (if ED is applicable), Lorry receipt (L/R), Packing list, Warranty certificate, Insurance intimation letter, & Original Performance Bank Guarantee (Directly from issuing bank to BHEL). One set of Invoice, Packing list and L/R shall be faxed immediately after despatch to BHEL-EDN, Bangalore.	Agree / Not agree	
19	Other terms & conditions	For any other Terms and Conditions, kindly refer to the enclosed Enquiry-General Terms & Conditions of BHEL (Doc Ref : SCPV/BOS/01-Rev 00)	Agree / Not agree	
20	Reverse Auction	BHEL reserves the right to conduct Reverse Auction. Procedure for the same will be informed by BHEL .	Agree / Not agree	
21	Shipment	Kindly indicate the state from where the shipment will take place	State/Place	
22	Validity	Quotation should remain valid for a period of 90 days from the due date	Agree / Not agree	
23	PBG	(a)PBG shall be furnished in the BHEL prescribed format. (b) Deviation if any Please specify	Agree / Not agree	

Address of Site:

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Page 2 of 2

ORISSA POWER COMPANY LIMITED 3.42 MW  
SITE ADDRESS:RAVAL PALLI VILLIAGE  
SADASHIV PET ,MOMMINPET MANDAL  
RANGAREDDY DIST  
TELANGANA

TECHNICAL BID ENCLOSURE FOR COMPLIANCE OF QUOTE								
RFQ No.HBSBOS021 DATED : 24.09.2014 DUE DATE(TECH BID) : 15.10.2014								
SI No.	DESCRIPTION	QTY	UNIT	QUOTED	TAXES			Remarks
					ED %	CST%	VAT %	
							SERVICE TAX %	
1	PS0679043390: Supply of MC4 connectors, cable ties, cable ducts, HDPE conduits, cable lugs, hardware, cable trays etc as per clauses 5.05 to 5.15 of BHEL spec PS-439-924.	1	ST	YES/NO			NA	Taxes Included
2	PS0679043403: Supply of LT Power cable, LT control cables, LT Auxiliary power cables, HT power cable, Data communication cables, 33kV termination kits etc as per clauses 5.19 to 5.42 of BHEL spec PS-439-924.	1	ST	YES/NO			NA	Taxes Included
3	PS0679043411: Supply of items of four pole structures including auxiliary transformer, GOS switches, earth switches, lightning arrestors (surge suppressors), CTs, PTs, Metering panels, ACSR conductor, CT/PT wiring cables, items for connecting to grid, with all related miscellaneous accessories and hardware as per clauses 5.21 -5.30 of BHEL spec PS-439-924.	1	ST	YES/NO			NA	Taxes Included
4	PS0679043420: Supply of items of earthing system for solar array field, control room panels and switchyard equipment including earthing electrodes, GI flats, copper strips, CPVC pipes, Insulation bushes, heat shrinkable sleeves for control room copper strip earthing, all related miscellaneous hardware etc as per clauses 5.35 to 5.37 of BHEL spec PS-439-924.	1	ST	YES/NO			NA	Taxes Included
5	PS0679043438:Supply of lightning arrestors for solar array field (ESE type) with earthing items and lightning rod with earthing items for control room as per clauses 5.38 and 5.39 of BHEL spec PS-439-924.	1	ST	YES/NO			NA	Taxes Included
6	PS0679043446: Supply of items of module cleaning system such as booster pumps, CPVC pipes with fittings, ball valves, nipples etc as per clauses 5.45 of BHEL spec PS-439-924.	1	ST	YES/NO			NA	Taxes Included
7	PS0679043454: Supply of items for yard lighting system such as pole pipes, lamps, lamp fittings, CPVC pipes, junction boxes, cable lugs, related accessories, hardware etc as per clauses 5.40 to 5.44 of BHEL spec PS-439-924.	1	ST	YES/NO			NA	Taxes Included
8	PS0679043462: Supply of miscellaneous items such as cable tags, danger boards, cable markers, hoarding board, sign boards, display boards, electrical insulation mat, checkered plates, air conditioners, tool kits, measuring instruments, office furniture etc as per clauses 5.46 to 5.54 of BHEL spec PS-439-924.	1	ST	YES/NO			NA	Taxes Included
9	PS0679043470: Supply of safety related items including fire alarm system, fire extinguishers, safety gadgets etc as per clauses 5.55 and 5.56 of BHEL spec PS-439-924.	1	ST	YES/NO			NA	Taxes Included
10	PS0679043489:Supply of ACDB, DCDB, Battery, FCBC with battery, PCU ducting arrangement etc, as per Annexure 1,2 and 3 of BHEL spec PS-439-924.	1	ST	YES/NO			NA	Taxes Included
11	PS0679043497: I&C: Temporary site office, storage yard, unloading/movement of consignments, arranging electrical power / water etc as per clauses 5.01 to 5.04 of BHEL Spec PS-439-924.	1	AU	YES/NO	NA	NA	NA	Taxes Included
12	PS0679043500: I&C: Interconnection of SPV modules, installation of string monitoring boxes including cable terminations and inspection thereof as per clauses 5.05 to 5.11 of BHEL Spec PS-439-924.	1	AU	YES/NO	NA	NA	NA	Taxes Included
13	PS0679043519: I&C: Formation of cable trenches and laying of 185sq-mm cables, as per clause 5.12 of BHEL spec PS-439-924	1	AU	YES/NO	NA	NA	NA	Taxes Included
14	PS0679043527:I&C: Erection of control room electrical panels including grouting, erection of cable trays and cable supports, routing and terminations of DC and AC cables up to LV side of transformers in switchyard etc as per clauses 5.13 to 5.15 of BHEL Spec PS-439-924.	1	AU	YES/NO	NA	NA	NA	Taxes Included
15	PS0679043535: I&C: Erection of switchyard equipment such as transformers, four pole, lightning arrestors / drop out fuses, CTs, PTs, metering panels including ACSR conductor laying, HV cable terminations, fire walls, foundations, oil pit chambers, leveling, jelly spreading, etc, as per clauses 5.16 - 5.30 of BHEL.Spec PS-439-924.	1	AU	YES/NO	NA	NA	NA	Taxes Included
16	PS0679043543: I&C: Cable trenches, cable laying, cable terminations for control cables related to remote annunciation and SCADA as per clauses 5.32 to 5.34 of BHEL Spec PS-439-924.	1	AU	YES/NO	NA	NA	NA	Taxes Included
17	PS0679043551: I&C of earthing system for solar array field, control room panels and switchyard equipment including installation of earthing electrode, earth mat, erection & electrical interconnection of earth chambers, laying of copper earth strips in control room etc, installation of lightning arrestors (ESE) and lightning rod for control room as per clauses 5.35 to 5.39 of BHEL Spec PS-439-924	1	AU	YES/NO	NA	NA	NA	Taxes Included
18	PS0679043560: I&C of yard lights for solar array field, switchyard and compound wall/chain link fencing including cable trenches, cable laying and cable terminations at the yard lighting poles as well as ACDB panel in control room etc as per clauses 5.40 to 5.44 of BHEL Spec PS-439-924.	1	AU	YES/NO	NA	NA	NA	Taxes Included
19	PS0679043578: I&C of module cleaning system including trenches for pipelines, laying of pipelines from bore wells to solar array field through overhead tanks, erection of pumps, ball valves, non-returnable valves etc as per clauses 5.45 of BHEL Spec PS-439-924.	1	AU	YES/NO	NA	NA	NA	Taxes Included
20	PS0679043586: I&C of miscellaneous and safety items such as cable tags, danger boards, cable markers, hoarding board, sign boards, display boards, electrical insulation mat, checkered plates, air conditioners, office furniture, fire extinguishers, fire alarm system, as per clauses 5.46 to 5.56 of BHEL Spec PS-439-924.	1	AU	YES/NO	NA	NA	NA	Taxes Included
21	PS0679043594: I&C: Pre-commissioning inspections / checks / tests, MRT tests and coordination with state departments STATE ELECTRICITY SUPPLY & TRANSMISSION BOARDS/CEIG etc, for necessary approvals / clearances for commissioning, synchronization with grid and post-commissioning operation of the plant as per clause 5.57 of BHEL Spec PS-439-924.	1	AU	YES/NO	NA	NA	NA	Taxes Included
22	PS679043608: Operations and Maintenance per month	6	AU	YES/NO	NA	NA	NA	Taxes Included
23	**Freight Charge including Service Tax on Freight(12.36% on 25% of Freight Value)		LUMPSUM	YES/NO	NA	NA	NA	Included
24	**Insurance		LUMPSUM	YES/NO	NA	NA	NA	Included

NOTE: 1.YOUR QUOTED PRICES SHALL BE on "FREE ON ROAD" basis to OPCL Site.

2.PLEASE INDICATE TAXES : ED, VAT/CST, SERVICE TAX CLEARLY APPLICABLE AS ON DATE.

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

4. \*ED shall not be considered as the project is under MNRE approval. Hence all inclusive rate for Supply is to be quoted without ED for SI No.1-10. However, the percentage of taxes considered against each item may pls be indicated in the column of Taxes for the purpose of availing Tax Credit.

5.Over all L1 of Supply + I&C + O&M on "FOR" basis to site will only be considered.

AUTHORISED SIGNATORY WITH SEAL

TECHNICAL BID ENCLOSURE FOR COMPLIANCE OF QUOTE										
RFQ No.HBSBOS021 DATED : 24.09.2014 DUE DATE(TECH BID) : 15.10.2014										
Sl No.	DESCRIPTION	QTY	UNIT	UNIT RATE (Rs.)	TOTAL RATE (UNIT RATE*QTY) (Rs.)	TAXES			Remarks	
						ED %	CST%	VAT %		SERVICE TAX %
1	PS0679043390: Supply of MC4 connectors, cable ties, cable ducts, HDPE conduits, cable lugs, hardware, cable trays etc as per clauses 5.05 to 5.15 of BHEL spec PS-439-924.	1	ST						NA	Taxes Included
Unit Rate in Words Rs.										
2	PS0679043403: Supply of LT Power cable, LT control cables, LT Auxiliary power cables, HT power cable, Data communication cables, 33kV termination kits etc as per clauses 5.19 to 5.42 of BHEL spec PS-439-924.	1	ST						NA	Taxes Included
Unit Rate in Words Rs.										
3	PS0679043411: Supply of items of four pole structures including auxiliary transformer, GOS switches, earth switches, lightning arrestors (surge suppressors), CTs, PTs, Metering panels, ACSR conductor, CT/PT wiring cables, items for connecting to grid, with all related miscellaneous accessories and hardware as per clauses 5.21 -5.30 of BHEL spec PS-439-924.	1	ST						NA	Taxes Included
Unit Rate in Words Rs.										
4	PS0679043420: Supply of items of earthing system for solar array field, control room panels and switchyard equipment including earthing electrodes, GI flats, copper strips, CPVC pipes, Insulation bushes, heat shrinkable sleeves for control room copper strip earthing, all related miscellaneous hardware etc as per clauses 5.35 to 5.37 of BHEL spec PS-439-924.	1	ST						NA	Taxes Included
Unit Rate in Words Rs.										
5	PS0679043438:Supply of lightning arrestors for solar array field (ESE type) with earthing items and lightning rod with earthing items for control room as per clauses 5.38 and 5.39 of BHEL spec PS-439-924.	1	ST						NA	Taxes Included
Unit Rate in Words Rs.										
6	PS0679043446: Supply of items of module cleaning system such as booster pumps, CPVC pipes with fittings, ball valves, nipples etc as per clauses 5.45 of BHEL spec PS-439-924.	1	ST						NA	Taxes Included
Unit Rate in Words Rs.										
7	PS0679043454: Supply of items for yard lighting system such as pole pipes, lamps, lamp fittings, CPVC pipes, junction boxes, cable lugs, related accessories, hardware etc as per clauses 5.40 to 5.44 of BHEL spec PS-439-924.	1	ST						NA	Taxes Included
Unit Rate in Words Rs.										
8	PS0679043462: Supply of miscellaneous items such as cable tags, danger boards, cable markers, hoarding board, sign boards, display boards, electrical insulation mat, checkered plates, air conditioners, tool kits, measuring instruments, office furniture etc as per clauses 5.46 to 5.54 of BHEL spec PS-439-924.	1	ST						NA	Taxes Included
Unit Rate in Words Rs.										
9	PS0679043470: Supply of safety related items including fire alarm system, fire extinguishers, safety gadgets etc as per clauses 5.55 and 5.56 of BHEL spec PS-439-924.	1	ST						NA	Taxes Included
Unit Rate in Words Rs.										
10	PS0679043489:Supply of ACDB, DCDB, Battery, FCBC with battery, PCU ducting arrangement etc., as per Annexure 1,2 and 3 of BHEL spec PS-439-924.	1	ST						NA	Taxes Included
Unit Rate in Words Rs.										
11	PS0679043497: I&C: Temporary site office, storage yard, unloading/movement of consignments, arranging electrical power / water etc as per clauses 5.01 to 5.04 of BHEL Spec PS-439-924.	1	AU			NA	NA	NA		Taxes Included
Unit Rate in Words Rs.										
12	PS0679043500: I&C: Interconnection of SPV modules, installation of string monitoring boxes including cable terminations and inspection thereof as per clauses 5.05 to 5.11 of BHEL Spec PS-439-924.	1	AU			NA	NA	NA		Taxes Included
Unit Rate in Words Rs.										
13	PS0679043519: I&C: Formation of cable trenches and laying of 185sq-mm cables, , as per clause 5.12 o BHEL spec PS-439-924	1	AU			NA	NA	NA		Taxes Included
Unit Rate in Words Rs.										
14	PS0679043527:I&C: Erection of control room electrical panels including grouting, erection of cable trays and cable supports, routing and terminations of DC and AC cables up to LV side of transformers in switchyard etc as per clauses 5.13 to 5.15 of BHEL Spec PS-439-924.	1	AU			NA	NA	NA		Taxes Included
Unit Rate in Words Rs.										

15	PS0679043535: I&C: Erection of switchyard equipment such as transformers, four pole, lightning arrestors / drop out fuses, CTs, PTs, metering panels including ACSR conductor laying, HV cable terminations, fire walls, foundations, oil pit chambers, leveling, jelly spreading, etc, as per clauses 5.16 - 5.30 of BHEL Spec PS-439-924.	1	AU			NA	NA	NA		Taxes Included
Unit Rate in Words Rs.										
16	PS0679043543: I&C: Cable trenches, cable laying, cable terminations for control cables related to remote annunciation and SCADA as per clauses 5.32 to 5.34 of BHEL Spec PS-439-924.	1	AU			NA	NA	NA		Taxes Included
Unit Rate in Words Rs.										
17	PS0679043551: I&C of earthing system for solar array field, control room panels and switchyard equipment including installation of earthing electrode, earth mat, erection & electrical interconnection of earth chambers, laying of copper earth strips in control room etc, installation of lightning arrestors (ESE) and lightning rod for control room as per clauses 5.35 to 5.39 of BHEL Spec PS-439-924	1	AU			NA	NA	NA		Taxes Included
Unit Rate in Words Rs.										
18	PS0679043560: I&C of yard lights for solar array field, switchyard and compound wall/chain link fencing including cable trenches, cable laying and cable terminations at the yard lighting poles as well as ACDB panel in control room etc as per clauses 5.40 to 5.44 of BHEL Spec PS-439-924.	1	AU			NA	NA	NA		Taxes Included
Unit Rate in Words Rs.										
19	PS0679043578: I&C of module cleaning system including trenches for pipelines, laying of pipelines from bore wells to solar array field through overhead tanks, erection of pumps, ball valves, non-returnable valves etc as per clauses 5.45 of BHEL Spec PS-439-924.	1	AU			NA	NA	NA		Taxes Included
Unit Rate in Words Rs.										
20	PS0679043586: I&C of miscellaneous and safety items such as cable tags, danger boards, cable markers, hoarding board, sign boards, display boards, electrical insulation mat, checkered plates, air conditioners, office furniture, fire extinguishers, fire alarm system, as per clauses 5.46 to 5.56 of BHEL Spec PS-439-924.	1	AU			NA	NA	NA		Taxes Included
Unit Rate in Words Rs.										
21	PS0679043594: I&C: Pre-commissioning inspections / checks / tests, MRT tests and coordination with state departments STATE ELECTRICITY SUPPLY & TRANSMISSION BOARDS/CEIG etc., for necessary approvals / clearances for commissioning, synchronization with grid and post-commissioning operation of the plant as per clause 5.57 of BHEL Spec PS-439-924.	1	AU			NA	NA	NA		Taxes Included
Unit Rate in Words Rs.										
22	PS679043608: Operations and Maintenance per month	6	AU			NA	NA	NA		Taxes Included
Unit Rate in Words Rs.										
23	**Freight Charge including Service Tax on Freight(12.36% on 25% of Freight Value)	LUMPSUM		INCLUDED						
24	**Insurance	LUMPSUM		INCLUDED						

NOTE: 1.YOUR QUOTED PRICES SHALL BE on "FREE ON ROAD" basis to OPCL Site.

2.PLEASE INDICATE TAXES : ED, VAT/CST, SERVICE TAX CLEARLY APPLICABLE AS ON DATE.

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

4. \*ED shall not be considered as the project is under MNRE approval. Hence all inclusive rate for Supply is to be quoted without ED for SI No.1-10. However, the percentage of taxes considered against each item may pls be indicated in the column of Taxes for the purpose of availing Tax Credit.

5.Over all L1 of Supply + I&C + O&M on "FOR" basis to site will only be considered.

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**Bharat Heavy Electricals Ltd.,**  
(A Government of India undertaking)  
**Electronics Division**  
PB No.2606, Mysore Road, Bangalore-560026, India

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**Enquiry - General Terms & Conditions (Two part bid)**

**I. Enquiry / Request for Quotation (RFQ):**

- (a) Any Purchase Order resulting from this enquiry shall be governed by **these general terms and conditions listed below and special terms and conditions, if any, along with this enquiry** of Bharat Heavy Electricals Limited, Electronics Division, Bangalore-560026 (**hereinafter referred to as BHEL EDN**).
- (b) Any of the terms and conditions not acceptable to vendor, shall be explicitly mentioned in the quotation. Otherwise, it will be treated as that all terms and conditions of this enquiry are acceptable.
- (c) If counter terms and conditions are offered by vendor, BHEL EDN shall not be governed by such terms and conditions, unless it is agreed and incorporated in the Purchase Order of BHEL EDN.
- (d) Any deviation to the terms and conditions not mentioned in the quotation by vendor in response to this enquiry will not be considered, if put forth subsequently or after issue of order, unless clarification is sought for by BHEL EDN and agreed upon in the Purchase Order of BHEL EDN.
- (e) BHEL EDN reserves the right to adopt Reverse Auction for the enquiry sent, at its discretion.
- (f) BHEL EDN shall be at liberty to cancel the tender at any time, before ordering, without assigning any reason.
- (g) Any specific terms and conditions to be complied will be mentioned in RFQ.**

**II. General Terms and conditions:**

**1. TWO PART BID:** Quotation shall be submitted in two part bid i.e.

**(a) Techno-commercial i.e., Un-priced Bid (in one sealed envelope):**

Techno-commercial bid shall be submitted with complete description of the equipment, specification compliances to the enquired specification and all the commercial terms & conditions indicated in the **COMMERCIAL TERMS (ANNEXURE -A for Foreign Purchase and ANNEXURE-B for Indigenous Purchase)**. Any other enclosure, which the vendor wishes to submit like product catalogue, technical literature etc., may also be submitted in a sealed envelope super scribed clearly as **“TECHNO-COMMERCIAL BID” with RFQ No. and DUE DATE**. An un-priced copy of price bid (without price) as per **ANNEXURE A-1 for Foreign Purchase and ANNEXURE B-1 for Indigenous Purchase** shall also be enclosed with the techno-commercial bid for evaluation of commercial terms.

**The vendor shall not give the price in the technical bid.**

Confirmation to BHEL specifications shall be indicated by the vendor in the respective columns provided in the purchase specification wherever applicable. Deviations to the specification / item description, if any shall be brought out clearly indicating **“DEVIATION TO BHEL SPECIFICATION”** without fail as a part of technical offer.

Compliance to Pre-qualification criteria (if applicable) shall also be enclosed with the Techno-commercial bid.

Manufacturer's name, their trade mark and brand, part number, alternate material to the one asked in enquiry, if any, should be mentioned in quotation and illustrative leaflets giving technical particulars etc. are to be attached to facilitate consideration and technical evaluation of the quotation. BHEL EDN material code number (as in enquiry) shall be indicated for each item quoted.

**(b) Price Bid (in one sealed envelope):**

Price bid should contain basic unit prices, discount if any, applicable taxes & duties, packing & forwarding charges (if applicable), Freight & insurances (if applicable), FOB charge (if applicable) etc., in a sealed envelope super scribed clearly as **“PRICE BID” with RFQ No. and DUE DATE**.

It is preferred to indicate the rates in both figures and words. In such case, if there is a difference / discrepancy

**Signature of tenderer / with seal**

between the rates in figures and words, guidelines as per Annexure H shall be followed. **Price bid shall be quoted as per ANNEXURE A-2 for Foreign Purchase and ANNEXURE B-2 for Indigenous Purchase.**

**(c) Tender Offer (above two envelopes inside another sealed envelope):**

Both these sealed envelopes [(a) Techno-commercial i.e., un-priced Bid and (b) Price Bid] shall be kept in a single sealed envelope and super scribed clearly with **RFQ No. and DUE DATE.**

2. The above sealed envelope (Tender) shall reach our office on or before the due date by 13:00 hrs. Quotations are to be dropped in the tender box marked for the OPENING ON respective days i.e., **MONDAY (BOX No.4)/ WEDNESDAY (BOX No.6)/ FRIDAY (BOX No.8)** kept at BHEL-EDN's Reception area of our works with caption "**CE, SC & PV, DEFENCE**". **Quotations also can be dispatched by Couriers / Registered post / FAX / e-mail to the Purchase Executive indicated in the RFQ at the risk of vendor / bidder.**

Quotation through courier / register post / fax / email when addressed to the specific fax number and email address given in the enquiry, to be sent well in advance to enable BHEL EDN purchase personnel to drop in the tender box before the scheduled opening date and time. Vendor is fully responsible for lack of secrecy on information of such quotations. Vendor shall confirm with the concerned purchase executive after sending the offer regarding such delivery mode to ensure participation. BHEL EDN is not responsible for any delay in receipt of quotation sent by vendor through post/fax/email.

Late Tenders i.e., Tenders received after due date & time will be rejected.

3. The rate quoted shall be in units stated in the enquiry. Where quotation is in terms of unit other than that in enquiry, relationship between the two units must be furnished in the quotation.
4. As far as possible, the quotations shall be free from corrections / overwriting. Corrections / overwriting, if any should be signed by authorized person with the company seal. Any typographical errors, totaling mistakes, currency mistakes, multiplication mistakes, summary mistakes observed in your priced bids, BHEL may consider whichever is beneficial to BHEL for evaluation. Vendor shall doubly ensure that the quote is correct and complete. The corrections / overwriting if any shall be signed with the seal.
5. Quotations are to be duly signed. Unsigned bids/offers are liable for rejection.
6. Tenders will be opened at **13:30 hrs** & the venue is New Engineering Building, 2<sup>nd</sup> floor, MM conference hall, BHEL EDN, Bangalore. All the tenderers or their authorized representatives (with authorization letter from their principals) may witness opening of techno-commercial bid on the due date.
7. After evaluation of techno-commercial bids, price bids of only those which are technically & commercially accepted, will be opened on a subsequent date, which will be intimated to the concerned in advance for witnessing of price bid opening.
8. The quantity in each item to be purchased may vary from quantity enquired according to the actual requirement at the time of placing the purchase order.

**9. DUN & BRADSTREET REPORT (for Foreign purchase):**

In case of foreign vendors, BHEL reserves the right to verify the Dun & Bradstreet report during techno-commercial scrutiny. Please mention DUN Number in **Techno-Commercial bid.**

**10. Payment of Agency Commission to Indian Agent (for Foreign purchase):**

- a. BHEL shall deal directly with foreign vendors, wherever required, for procurement of goods. However, if the foreign principal desires to avail of the services of an Indian agent, then the foreign principal should ensure compliance to regulatory guidelines - which require mandatory submission of an Agency Agreement.
- b. It shall be incumbent on the Indian agent and the foreign principal to adhere to the relevant guidelines of Government of India, issued from time to time.

**Signature of tenderer / with seal**

- c. The Agency Agreement should specify the precise relationship between the foreign OEM / foreign principal and their Indian agent and their mutual interest in the business. All services to be rendered by agent/ associate, whether of general nature or in relation to the particular contract, must be clearly stated by the foreign supplier/ Indian agent. Any payment, which the agent or associate receives in India or abroad from the OEM, whether as commission or as a general retainer fee should be brought on record in the Agreement and be made explicit in order to ensure compliance to laws of the country.
- d. Any agency commission to be paid by BHEL to the Indian agent shall be in Indian currency only.
- e. Tax deduction at source is applicable to the agency commission paid to the Indian agent as per the prevailing rules.
- f. In the absence of any agency agreement, BHEL shall not deal with any Indian agent (authorized representatives / associate / consultant, or by whatever name called) and shall deal directly with the foreign principal only for all correspondence and business purposes.
- g. The “Guidelines for Indian Agents of Foreign Suppliers” shall apply in all such cases.
- h. The supply and execution of the Purchase Order (including indigenous supplies/ service) shall be in the scope of the OEM/ foreign principal. The OEM/ foreign principal should submit their offer inclusive of all indigenous supplies/ services and evaluation will be based on ‘total cost to BHEL’. In case OEM/ foreign principal recommends placement of order(s) towards indigenous portion of supplies/ services on Indian supplier(s)/ agent on their behalf, the credentials/ capacity/ capability of the Indian supplier(s)/ agent to make the supplies/ services shall be checked by BHEL as per the extant guidelines of Supplier Evaluation, Approval & Review Procedure (SEARP), before opening of price bids. It will be the responsibility of the OEM/ foreign principal to get acquainted with the evaluation requirements of Indian supplier/ agent as per SEARP available on [www.bhel.com](http://www.bhel.com).

The responsibility for successful execution of the contract (including indigenous supplies/ services) lies with the OEM/ foreign principal. All bank guarantees to this effect shall be in the scope of the OEM/ foreign principal.

#### 11. Installation & Commissioning:

- (a) Scope will be as per Purchase Specification. I&C value should be quoted separately by bidders.
- (b) Wherever, Service Tax is applicable –
- (c)
  1. The Tenderers shall furnish the Service Tax Registration Number in their offer.
  2. If the Tenderer is not having Service Tax Registration Number, he shall submit an undertaking to the effect that,
    - a. in case he is awarded the contract, he shall register with Service Tax Authorities and furnish the Registration Number before commencement of work, OR
    - b. his turnover value is below the threshold limit prescribed by the Service Tax Act and in case he is awarded the contract, whenever his turnover crosses the threshold limit at any time during the execution of the contract, he shall forthwith register with Service Tax Authorities and furnish the Registration Number to BHEL. (This sub-clause is NOT applicable where the taxable turnover of the present tender is above the prescribed threshold limit).
  3. Any offer not complying with the above clauses is liable to be rejected.
  4. The above clauses apply even where the price quoted is “inclusive of taxes”.
  5. If the Service Tax Registration Number is not furnished to BHEL before the first bill is submitted (except as provided in Clause 2(b) above), the bills will not be passed (even if the price is “inclusive of taxes”).
  6. In case of contracts involving multiple bills, every bill (commencing with the 2<sup>nd</sup> bill) shall be accompanied with a declaration that the contractor has discharged his tax liability on the earlier bill (i) by paying the money to the Government (along with Challan details) or (ii) by utilization of Input Service Tax Credit available with him or (iii) being exempt as his turnover continues to be below the threshold limit. In the absence of such a declaration, the bill shall not be passed.
  7. In case of contracts involving a single bill, the bill shall be accompanied with an undertaking that the contractor shall discharge his tax liability on that bill as per law.

12. **TOTAL COST TO BHEL:** Purchase order will be placed on the lowest quotation (L1) only among the technically & commercially accepted quotations. Lowest quotation (L1) is determined on the basis of the total cost to BHEL. Loading Factors for deviation to BHEL Commercial terms and conditions will be considered.

Signature of tenderer / with seal

For Foreign offers, the Exchange rate (TT selling rate of SBI) shall be taken as under.

Single part bids	Date of Tender opening
Two/Three part bid	Date of Part-1 bid opening
Reverse Auction	Date of Part-1 bid opening

If the relevant day happens to be a bank holiday, then the forex rate as on the previous bank (SBI) working day shall be taken.

- (1) If Freight is quoted extra, original money receipt from Transporter shall be submitted for payment of Freight charges.
- (2) C-form : For issue of form "C", vendor has to furnish "E1/E2" form.

## 12. **FIRM PRICE:**

Rates quoted should be firm from the date of offer, till completion of supply. No enhancement in the rates and changes in the techno-commercial terms will be allowed once the quotation is accepted and order is placed.

If Installation & Commissioning is in vendor's scope, then the price shall remain FIRM till commissioning & handing over of the complete system.

## 13. **TERMS OF PAYMENT:**

**1. SUPPLY FOR FOREIGN PURCHASE:** Payment will be made against "SIGHT DRAFT" on presentation of documents to our bankers . Payment through LC is also made subject to loading factors as per Clause 25 (A). For LC payment bank charges within India will be borne by BHEL and outside India will be to vendor's account.

The payment terms are as follows:

### **SIGHT DRAFT PAYMENT (direct payment):**

#### **SUPPLY :**

(a) **I&C not included in vendor's scope** : 90% payment of Supply value + 100% Taxes shall be made with 45 days credit from the date of receipt of material at site. Balance 10% on execution of PBG valid for warranty period + 6 months claim period from any of the BHEL Consortium banks.

(b) **Supply & I&C in vendor's scope** : 80% payment of Supply value + 100% Taxes shall be made with 45 days credit from the date of receipt of material at site. 10% on completion of I&C and certification line item wise on pro-rata basis. Balance 10% on execution of PBG valid for warranty period + 6 months claim period from any of the BHEL Consortium banks..

### **(B) FOR INDIGENOUS PURCHASE (DIRECT PAYMENT):**

#### **1. For Supply :**

(a) **I&C not included in vendor's scope** : 90% payment of basic Supply value + 100% Taxes and duties shall be made with 45 days credit from the date of receipt of material at site. Balance 10% on execution of PBG valid for warranty period + 6 months claim period from any of the BHEL Consortium banks. PBG value shall be 10% of basic supply PO value.

(b) **Supply and I&C in vendor' scope** : 80% payment of basic Supply value + 100% Taxes and duties shall be made with 45 days credit from the date of receipt of material at site. 10% on completion of I&C and certification line item wise on pro-rata basis. Balance 10% on execution of PBG valid for warranty period + 6 months claim period from any of the BHEL Consortium banks. PBG value shall be 10% of basic supply PO value.

**2. For I&C:** 100% on completion of I&C and certification line item wise on pro-rata basis.

**3. Civil Works :** 90% on completion of activity milestone and certification line item wise from site-in charge. Balance 10% against PBG for 10% of basic Civil value valid warranty period + 6 months claim period from any of the BHEL Consortium banks. PBG value shall be 10% of basic civil PO value.

**4. O&M :** 100% O&M charges are payable as per RFQ terms against report certified by BHEL.

If PBG cannot not be submitted, vendors can also accept for the final 10% payment, payable after the warranty period + 6 months of claim period against supplementary invoice subject to the completion of commissioning (if applicable) as PBG is linked to

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Warranty period.

For any deviation in payment term, the offer will be loaded as per Clause 25.00.

**5. ADVANCE PAYMENT: Quotations with “Advance payment/Inland LC” shall be rejected.**

**14. PENALTY:**

Failure to supply within the delivery time as per purchase order will make the vendor liable to an unconditional penalty of 0.5 % (half percent) per week at the basic price of the goods for the undelivered quantity, subject to a maximum of 10%.

Supply : Date of issue of pre -shipment inspection/ call letter with supporting documents like test reports/conformance to test carried by the vendor will be treated as date of dispatch for the purpose of penalty calculation wherever Pre-Inspection is carried out.

For all other activities, the actual date of completion of activity as certified by concerned site-incharge will be considered for the purpose of penalty calculation.

**15. PBG:**

Performance Bank Guarantee (PBG) to be submitted on non-judicial stamp paper as per the BHEL prescribed format given in **ANNEXURE-E for Foreign Purchase and Annexure-F for Indigenous Purchase** for 10% of the total supply value obtained from any BHEL member (consortium) banks indicated in **ANNEXURE-G**.

**The Bank Guarantee shall be submitted directly to the concerned Purchase Executive by the issuing Bank with their forwarding letter.** BHEL will verify independently with the bank to establish the authenticity. Alternately, standby LC issued from approved banker can also be considered.

**16. TERMS OF DELIVERY:**

**(a)FOR IMPORTED PURCHASE:**

Price offered shall be for goods packed and delivered **FOB** Seaport,/FCA International Airport including packing, forwarding, Handling, Ancillary charges like processing of Sight Draft, negotiation charges of bank, Export declaration, Certificate of origin etc.

Packing shall be Air/Sea worthy, best suitable for trans-shipment and to take care of transit damages. If containerized, no. of containers & size of container shall be mentioned. Packing weight (gross & net) Packing dimensions shall be given prior to shipment to ascertain whether the consignment can be carried on standard cargo in contract or as ODC.

Wooden packing material for all the foreign consignments should be treated as per ISPM-15 & **Fumigation / Phytosanitary certificate** to be submitted to the freight forwarders/ BHEL along with the invoice, B/L, packing list etc.

Vendors shall indicate the name of International Airport/Seaport. Approved Airports are as per **Annexure-C**. The consignment shall be handed over to BHEL approved freight forwarder as mentioned in PO.

**(b) FOR INDIGENOUS PURCHASE:**

Equipment shall be delivered on “FOR SITE” basis, inclusive of freight, packing, insurance & forwarding charges.

Packing shall be Road / Rail / Air / Sea worthy, best suitable for transshipment and to take care of transit damages.

Smaller consignments can be dispatched through Courier services/ RPP with the prior approval of the purchasing Executive.

**17. DELIVERY REQUIREMENT:**

Delivery date mentioned in RFQ is tentative. Actual requirement is as per RFQ terms & conditions.

**18. VALIDITY:**

Quotation should remain valid for a period of **90 days** from the date of technical bid opening.

**19. POST-ORDER REQUISITES:**

- a. Vendor shall give an Order Acknowledgement indicating the delivery date within one week of receipt of PO.
- b. Pre-shipment inspection at vendor’s works, if required, will be carried out by BHEL/Customer. Required assistance will have to be provided by the vendor at the time of pre-shipment inspection.
- c. Test certificates, Calibration certificates and warranty certificates as stipulated at the time of ordering shall be furnished.

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- d. Items shall be dispatched by Air worthy /Sea worthy/ Road worthy packing. Any damage and later rejection, due to poor / improper packing shall be to vendor's account.
- e. Any damage/rejection should be made good or replaced immediately without any extra cost to BHEL such as freight, duties, taxes etc. The liability is restricted to the value of the order.
- f. Wherever commissioning is involved, it shall be carried out by the vendor's qualified engineers. Scope of work includes installation, commissioning and start-up trials till satisfactory performance level is reached as certified by BHEL.
- g. BHEL will not be responsible for any loss, damage or injuries to vendor's personnel sustained during installation / commissioning / start-up trials. Vendor shall ensure compliance with all statutory requisites as laid down by local bodies, state & Central Government. Vendor shall indemnify BHEL for all damages/ losses to various personnel during their presence in BHEL's premises for whatever purpose.
- h. Suitable markings & damage control indicating devices shall be provided where applicable.
- i. Equipment shall comply with the standard requirements of ISO 14001 & OHSAS 18001.

**20. RISK PURCHASE:**

The purchaser at his discretion may also make purchase of the materials NOT supplied in time at the RISK & COST of the supplier. In this event, it will be obligatory on the part of the supplier who fails to supply the goods in time to make good to BHEL any loss due to such risk purchase.

**21. GENERAL TERMS AND CONDITIONS GOVERNING REVERSE AUCTION (RA):**

- (a) BHEL reserves the right to go for Reverse Auction (RA) instead of opening the sealed envelope price bid, submitted by the bidder. This will be decided after techno-commercial evaluation. All bidders to give their acceptance for participation in RA.  
Non-acceptance to participate in RA may result in non-consideration of their bids, in case BHEL decides to go for RA.
- (b) In case BHEL decides to go for Reverse Auction, only those bidders who have given their acceptance to participate in RA will be allowed to participate in the Reverse Auction. Those bidders who have given their acceptance to participate in Reverse Auction will have to necessarily submit "online sealed bid" in the Reverse Auction. Non-submission of "online sealed bid" by the bidder will be considered as tampering of the tender process and will invite action by BHEL as per extant guidelines in vogue."
- (c) **Kindly refer to Annexure D for Terms & Conditions of Reverse Auction.**
- (d) Vendor shall confirm acceptance for RA in **ANNEXURE A/B**.

**22. REGRET LETTER:** In case any vendor is unable to quote, vendor shall send a regret letter.

**23.** Any dispute arising out of this, shall be referred to the sole arbitration of Head of Dept. Materials Management of group concerned, BHEL EDN or any other officer nominated by him and his award shall be final and binding on the parties. The venue of the arbitration in all cases shall be Bangalore, India.

**24.** Any legal suit in respect of this enquiry lies in the court of Jurisdiction of Bangalore (India) only.

**25. LOADING FACTORS:**

Loading factors as detailed below will be added to the quoted price (basic) to evaluate the lowest quote for non compliance of BHEL standard commercial term.

**A (i). For non compliance of standard Terms of payment (For Foreign Purchase Orders)**

Sl. No.	BHEL standard term	If you quote	Loading factor in % for non-compliance
1	80% against "SIGHT DRAFT" + 20% after commissioning and against PBG(where both commissioning & PBG are applicable)	Payment through Letter of Credit (LC)	10%

**In general, if the quote is through L/C, it shall be opened 30 days prior to dispatch and valid for 3 months.**

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***A(ii).For non compliance of standard Terms of payment (For Indigenous Purchase Orders)***

Sl. No.	BHEL standard term	If you quote	Loading factor in % for non-compliance
1	As per RFQ Terms	Any other Payment term	10%

***B.For non compliance of standard Terms of Penalty***

Sl. No.	BHEL standard term	If you quote	Loading factor for non-compliance
1	Penalty of 0.5% per week subject to max. of 10% on the basic value of the items not supplied /delayed	Other than the above.	Loading Factor 10%-Quoted Max %

**26. Non Compliance of Warranty terms** : Offers not complying with Warranty terms as per RFQ Terms is liable for rejection.

**ANNEXURE- C*****LIST OF INTERNATIONAL AIRPORTS***

<b>Sl. No</b>	<b>Country</b>	<b>Air Ports</b>
1	Austria	Vienna, Linz, Graz
2	Australia	Sydney, Melbourne, Perth
3	Belgium	Antwerp, Brussels
4	Canada	Toronto, Montreal
5	China	Shanghai
6	Cyprus	Lamaca
7	Czech Republic	Prague (Via Frankfurt)
8	Denmark	Copenhagen
9	Egypt	Cairo
10	Finland	Helsinki
11	France	Paris (Rossy), Lyon
12	Germany	Darmstadt, Manheim, Nurnberg, Hamburg, Stuttgart, Munich, Koln, Dusseldorf & Hannover, Frankfurt, Berlin
13	Hong Kong	Hong Kong
14	Italy	Rome, Milan, Turin, Bologna, Florence
15	Ireland	Dublin
16	Israel	Telaviv
17	Japan	Tokyo, Osaka
18	Malaysia	Kuala lumpur, Penang
19	Netherlands	Amsterdam, Rotterdam
20	New Zealand	Auckland
21	Norway	Oslo
22	Oman	Muscat
23	Philippines	Manila
24	Romania	Bucharest
25	Russia	Moscow
26	Saudi Arabia	Riyad
27	Singapore	Singapore
28	Slovakia	Bartislowa
29	South Africa	Johannesburg, Durban
30	South Korea	Kimpo
31	Spain	Barcelona
32	Sweden	Stockholm, Gothenburg, Milano
33	Switzerland	Basle, Zurich, Geneva
34	Taiwan	Taipei
35	U.A.E.	Dubai
36	U.K.	Landon (Heathrow), Newcastle, Oxford, Cheltham, Bristol, Welling borough, Birmingham, East Midland, Manchester, Leeds, Glasgow.
37	U.S.A.	New York, Chicago, San Francisco, Los Angeles, Atlanta
38	Ukraine	Kiev

**Annexure - D****Terms & Conditions of Reverse Auction**

Against this enquiry for the subject item/ system with detailed scope of supply as per enquiry specifications, BHEL may resort to "REVERSE AUCTION PROCEDURE" i.e., ON LINE BIDDING (THROUGH A SERVICE PROVIDER). The philosophy followed for reverse auction shall be English Reverse (No ties).

- (1) For the proposed reverse auction, technically and commercially acceptable bidders only shall be eligible to participate.
- (2) Those bidders who have given their acceptance for Reverse Auction (quoted against this tender enquiry) will have to necessarily submit 'online sealed bid' in the Reverse Auction. Non-submission of 'online sealed bid' by the bidder for any of the eligible items for which techno-commercially qualified, will be considered as tampering of the tender process and will invite action by BHEL as per extant guidelines in vogue.
- (3) BHEL will engage the services of a service provider who will provide all necessary training and assistance before commencement of on line bidding on internet.
- (4) In case of reverse auction, BHEL will inform the bidders the details of Service Provider to enable them to contact & get trained.
- (5) Business rules like event date, time, bid decrement, extension etc. also will be communicated through service provider for compliance.
- (6) Bidders have to fax the Compliance form (annexure IV ) before start of Reverse auction. Without this, the bidder will not be eligible to participate in the event.
- (7) In line with the NIT terms, BHEL will provide the calculation sheet (e.g., EXCEL sheet) which will help to arrive at "Total Cost to BHEL" like Packing & forwarding charges, Taxes and Duties, Freight charges, Insurance, Service Tax for Services and loading factors (for non-compliance to BHEL standard Commercial terms & conditions) for each of the bidder to enable them to fill-in the price and keep it ready for keying in during the Auction.
- (8) Reverse auction will be conducted on scheduled date & time.
- (9) At the end of Reverse Auction event, the lowest bidder value will be known on auction portal.
- (10) The lowest bidder has to fax/e-mail the duly signed and filled-in prescribed format for price breakup including that of line items, if required, (Annexure VII) as provided on case-to-case basis to Service provider within two working days of Auction without fail.
- (11) In case BHEL decides not to go for Reverse Auction procedure for this tender enquiry, the Price bids and price impacts, if any, already submitted and available with BHEL shall be opened as per BHEL"s standard practice.
- (12) Bidders shall be required to read the "Terms and Conditions" section of the auctions site of Service provider, using the Login IDs and passwords given to them by the service provider before reverse auction event. Bidders should acquaint themselves of the „Business Rules of Reverse Auction", which will be communicated before the Reverse Auction.
- (13) If the Bidder or any of his representatives are found to be involved in Price manipulation/ cartel formation of any kind, directly or indirectly by communicating with other bidders, action *as per extant BHEL guidelines*, shall be initiated by BHEL and the results of the RA scrapped/ aborted.
- (14) The Bidder shall not divulge either his Bids or any other exclusive details of BHEL to any other party.
- (15) In case BHEL decides to go for reverse auction, the H1 bidder(s) (whose quote is highest in online sealed bid) may not be allowed to participate in further RA process.

**Signature of tenderer / with seal**

**ANNEXURE-E****PERFORMANCE BANK GUARANTEE  
(FOR FOREIGN PURCHASE ORDERS)  
BANK NAME AND ADDRESS**

Bharat Heavy Electricals Limited (BHEL),  
Electronics Division,  
PB No. 2606,  
Mysore Road,  
BANGALORE- 560 026  
INDIA  
Dear Sirs,

**Ref: CONTRACT PERFORMANCE GUARANTEE.**

WHEREAS you have entered into a contract reference No PO NO. \_\_\_\_\_ with M/s \_\_\_\_\_ having its registered office at \_\_\_\_\_ for the supply of \_\_\_\_\_ as detailed in your purchase order No. \_\_\_\_\_ which is hereinafter referred to as "the said contract" and WHEREAS M/s \_\_\_\_\_ has undertaken to produce a Bank Guarantee for 10% ( Ten Percent ) of \_\_\_\_\_ the contract price amounting to \_\_\_\_\_ ( \_\_\_\_\_ ) to secure its obligations to Electronics Division, BHEL having its registered office at New Delhi for the performance of the contract including the warranty of the equipment supplied, We \_\_\_\_\_ Bank \_\_\_\_\_ hereby expressly, irrevocably and unreservedly undertake and guarantee as principal obligors on behalf of M/s \_\_\_\_\_ that in the event Bharat Heavy Electricals Ltd. (B.H.E.L.) declares to us in writing that M/s \_\_\_\_\_ has not fulfilled any obligation according to the contractual obligation of the said contract, to pay you on demand and without demur to Bharat Heavy Electricals Ltd., Electronics Division , Mysore Road, P.B.No. 2606, Bangalore-560 026, India an amount of \_\_\_\_\_ (in words \_\_\_\_\_ ) subject to as may be determined below:

- 1) Notwithstanding any right M/s. \_\_\_\_\_ may have directly against you or any disputes raised by M/s \_\_\_\_\_, Your written demand shall be conclusive evidence to us that repayment is due under the terms of the said contract and shall be binding on us.
- 2) We shall not be discharged or released from this undertaking and Guarantee by any arrangements, variations made between you and M/s. \_\_\_\_\_ with or without our consent and Knowledge or by any alterations in the obligations of M/s. \_\_\_\_\_ by any forbearance whether as to payment, time, performance or otherwise.
- 3) This guarantee shall remain valid until the end of twenty-four weeks after the close of the warranty period or until the same is reported by BHEL to us whichever is earlier.
- 4) We agree and undertake not to revoke this guarantee during its validity unless discharged in writing by you subject to the provision of clause (7) below.
- 5) This guarantee shall be a continuing guarantee subject to the foregoing and shall not be discharged by any change in the constitution of the Bank or M/s. \_\_\_\_\_.
- 6) This guarantee shall be governed by and constructed in accordance with the Laws of India.
- 7) At any time \_\_\_\_\_ Bank may render this guarantee null and void by paying to Bharat Heavy Electricals Ltd. the full amount being \_\_\_\_\_ (in words \_\_\_\_\_ )

**Note:**

- (1) To be executed in 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

Signature of tenderer / with seal

**ANNEXURE - F****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/Nationalized 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 / authorized 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

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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 authorized 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 CHARTEREDBANK
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

The above list is tentative and is subject to change from time to time.  
The Purchase Executive shall be contacted for confirmation of the same.

### **DISCREPANCY IN WORDS & FIGURES – QUOTED IN PRICE BID**

Following guidelines will be followed in case of discrepancy in words & figures-quoted in price bid:

- (a) If, in the price structure quoted for the required goods/services/works, there is discrepancy between the unit price and the total price (which is obtained by multiplying the unit price by the quantity), the unit price shall prevail and the total price corrected accordingly, unless in the opinion of the purchaser there is an obvious misplacement of the decimal point in the unit price, in which case the total price as quoted shall govern and the unit price corrected accordingly.
- (b) If there is an error in a total corresponding to the addition or subtraction of subtotals, the subtotals shall prevail and the total shall be corrected; and
- (c) If there is a discrepancy between words and figures, the amount in words shall prevail, unless the amount expressed in words is related to an arithmetic error, in which case the amount in figures shall prevail subject to (a) and (b) above.
- (d) If there is such discrepancy in an offer, the same shall be conveyed to the bidder with target date upto which the bidder has to send his acceptance on the above lines and if the bidder does not agree to the decision of the purchaser, the bid is liable to be ignored.

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