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

Tender Documents for Supply of Balance of System items, Installation and Commissioning, Operations and Maintenance for 3MWp SPV grid connected power plant at Velugam,Silvassa,DNH

RFQ Ref: HBSBOS012
RFQ Due Date: 29.09.2014

This Tender Document Contains:
(1) Request For Quotation
(2) Technical Specifications : PS- 439-893
(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)

Note:
Part – I: **To be submitted in a separate sealed cover.**
Part – II: **To be submitted in a separate sealed cover**.
Part-I & Part-II sealed covers should be put in outer envelope and super scribed with RFQ No., RFQ date and due date along with the Name & Address of the tenderer.
Tender document should be dropped in Tender drop box super scribed **"SC&PV-MM,Monday"** kept in reception area of BHEL – Electronics Division, Bangalore.

For any clarification, the following may be contacted:

Mr. H B Srinivasa, Sr.Manager (SC&PV-MM)
Ph: 080-26998495/09449869655
e-mail : srinivasahb@bheledn.co.in

Ms. Iswarya Raveendran, Engineer (SC&PV-MM)
Ph : 080 26998113
e-mail : iswarya@bheledn.co.in

REQUEST FOR QUOTATION

MMI:PU:RF:003

BHARAT HEAVY ELECTRICALS LIMITED
Electronics Division
PB No. 2606, Mysore Road Bangalore - 560026
INDIA

RFQ NUMBER: HBSBOS012

RFQ DATE : 04.SEP.2014

Due Date 29.SEP.2014 Time: 13:00 HRS

VENUE : **NEW ENGG. BLDG**

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

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

1.Submit offer in Two Parts- Technical & Price Bid.
2.Technical Specification PS-439-893 Rev 00 enclosed.
3.Find attached Annexure B(Commercial Terms & Conditions),Annexure B1(Un Priced Bid Format) & Annexure B2 (Price Bid Format).
4.The dates indicated in Delivery Column of RFQ is tentative. Vendor to quote their delivery as indicated in Annexure B.

Sl No.	Description	Qty	Unit	Delivery qty	Delivery Date
1	PS0679042733 PV plant Consumables for 3 MW DNH Supply of MC4 connectors, cable ties, cable ducts, HDPE conduits, cable lugs, hardware, cable trays etc as per clauses 5.05 to 5.16 of PS-439-893 Test Certificate	1	ST	1	09.DEC.2014
2	PS0679042741 Module Cleaning System for 3 MW DNH Supply of items of module cleaning system such as submersible pumps (for bore wells), booster pumps, CPVC pipes with fittings, ball valves, nipples etc as per clauses 5.49 and 5.50 of PS-439-893 Test Certificate	1	ST	1	09.DEC.2014
3	PS0679042750 Auxiliary & data cables for 3-MW DNH Supply of Auxiliary power cables, Data communication cables, etc as per clauses 5.21 to 5.46 of PS-439-893 Test Certificate	1	ST	1	09.DEC.2014
4	PS0679042768 Switch yard equipment for 3 MW-DNH Supply of items of 11kV termination kits, four pole structures, auxiliary transformer, GOS switches, earth switches, LAs (surge suppressors), CTs, PTs, Metering panels, ACSR conductor, CT/PT wiring cables, items of switchyard fencing (fence, gate, angles etc), items for connecting to grid lines, with all related miscellaneous accessories and hardware as per clauses 5.23#5.33 of PS-439-893 Test Certificate	1	ST	1	09.DEC.2014
5	PS0679042776 Earthing System for 3 MW-DNH Supply of items of earthing system for solar array field, control room panels and switchyard equipment including earthing electrodes, GI flats, copper strips all related miscellaneous hardware etc as per clauses 5.39	1	ST	1	09.DEC.2014

For and On behalf of BHEL.

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Sl No.	Description	Qty	Unit	Delivery qty	Delivery Date
	to 5.41 of PS-439-893 Test Certificate				
6	PS0679042784 Lightning Protection equip for 3-MW DNH 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 5.42 and 5.43 of PS-439-893 Test Certificate	1	ST	1	09.DEC.2014
7	PS0679042792 Peripheral lighting for 3-MW DNH 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 5.44 to 5.48 of PS-439-893 Test Certificate	1	ST	1	09.DEC.2014
8	PS0679042806 Miscellaneous items for 3-MW DNH Supply of miscellaneous items such as cable tags, danger boards, cable markers, hoarding board, sign boards, display boards, electrical insulation mat, checkered plates, air conditioner, tool kits, measuring instruments, office furniture etc as per clauses 5.51 to 5.59 of PS-439- 893 Test Certificate	1	ST	1	09.DEC.2014
9	PS0679042814 Fire protection System for 3-MW DNH Supply of safety related items including fire alarm system, fire extinguishers, safety gadgets etc as per clauses 5.60 and 5.61 of PS- 439-893 Test Certificate	1	ST	1	09.DEC.2014
10	PS0679042822 Battery bank for 3-MW DNH Battery bank 110 V / 100 Ah, VRLA - 2 Nos., as per Spec PS-439-893 Test Certificate	1	ST	1	09.DEC.2014
11	PS0679042830 FCBC for 3-MW DNH Battery Charger (FCBC) 110 V / 25 A with inbuilt spare	1	ST	1	09.DEC.2014

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Sl No.	Description	Qty	Unit	Delivery qty	Delivery Date
	charger & DCDB as per Spec PS-439-893 Test Certificate				
12	PS0679042849 ACDB for for 3-MW DNH ACDB for Auxiliary Supply of SPV plant as per Spec PS-439-893 Test Certificate	1	ST	1	09.DEC.2014
13	PS0679042857 Ducting of for 3-MW DNH Ducting of 5 Nos PCUs as per Spec PS-439-893 Test Certificate	1	ST	1	09.DEC.2014
14	PS0679042865 11 kV Cable for 3-MW DNH 11 kV, 3Cx185 sq.mm cables for HT connection from Transformers Secondary to the four pole structure, approx 170 m as per Spec PS-439-893 Test Certificate	1	ST	1	09.DEC.2014
15	PS0679042873 I&C-Pre-Construction activities at DNH I&C: Temporary site office, storage yard, bore wells, unloading/movement of consignments, arranging electrical power / water etc as per PS-439-893	1	AU	1	09.JAN.2015
16	PS0679042881 I&C of LT equipment for 3-MW DNH I&C: Array Cabling and installation of control room panels, terminating at control room panels as per spec PS-439-893	1	AU	1	09.JAN.2015
17	PS0679042890 I&C of Trx & HT panels for 3-MW DNH I&C of power & auxiliary Transformers & HT Panels including foundation as per spec PS-439-893	1	AU	1	09.JAN.2015
18	PS0679042903 I&C of Switch yard for 3-MW DNH viz.,four pole structures, metering panels including ACSR conductor laying, HV cable terminations, Switchyard leveling, jelly spreading, fencing including gates etc as per Spec PS-439-893	1	AU	1	09.JAN.2015
19	PS0679042911 I&C of Earthing Sytem for 3-MW DNH for PV array field, control room panels and switchyard	1	AU	1	09.JAN.2015

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Sl No.	Description	Qty	Unit	Delivery qty	Delivery Date
	equipment & electrical interconnection of earth chambers, laying of copper earth strips in control room etc, Lightning arrestors (ESE) and lightning rod for control room as per Spec PS-439-893				
20	PS0679042920 I&C of Yard Lighting System for 3-MW DNH Yard lights for solar array field, switch yard 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 Spec PS-439-893.	1	AU	1	09.JAN.2015
21	PS0679042938 I&C of Water Cleaning System for 3MW DNH 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 Spec PS-439-893.	1	AU	1	09.JAN.2015
22	PS0679042946 I&C of Miscelleneous Works for 3-MW DNH viz., fire alarm, cable markers and name boards etc as per Spec PS-439-893	1	AU	1	09.JAN.2015
23	PS0679042954 Pre commissioning Inspection for 3MW DNH 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 Spec PS-439-893.	1	AU	1	09.JAN.2015
24	PS0679042962 Commissioning Liasoning for 3-MW DNH Co-ordination and liasoning with state department for necessary approvals & clearances for commissioning,	1	AU	1	09.JAN.2015

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REQUEST FOR QUOTATION

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BHARAT HEAVY ELECTRICALS LIMITED
Electronics Division
PB No. 2606, Mysore Road Bangalore - 560026
INDIA

RFQ NUMBER: HBSBOS012

RFQ DATE : 04.SEP.2014

Due Date 29.SEP.2014 Time: 13:00 HRS

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Sl No.	Description	Qty	Unit	Delivery qty	Delivery Date
	synchronization & post commissioning operation of plant as per spec PS-439-893.				
25	PS0679042970 O&M of 3-MW DNH:1st Year As per Spec PS-439-893	1	AU	1	09.JAN.2016
26	PS0679042989 O&M of 3-MW DNH:2nd Year As per Spec PS-439-893	1	AU	1	09.JAN.2017
27	PS0679042997 O&M of 3-MW DNH:3rd Year	1	AU	1	09.JAN.2018
28	PS0679043004 O&M of 3-MW DNH:4th Year	1	AU	1	09.JAN.2019
29	PS0679043012 O&M of 3-MW DNH:5th Year	1	AU	1	09.JAN.2020

Total Number of Items - 29

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

i). This is only RFQ not an order.
ii). In all correspondence quote RFQ No. & due date.
iii). In Quotation BHEL material code / RFQ Sl. No. should be mentioned clearly.
iv). Quotation Envelope / Fax not superscribed with RFQ No.and due date is liable for rejection.
v). Quotation should remain valid for a minimum peiod of 90 days from due date.
vi). In case of non-receipt of Quotation or regret letter for 3 consecutive RFQs you are liable to be removed from our vendors list.
vii). All Prices should be written in words and numbers.
viii). Excise Chapter Heading should be mentioned for all items where VAT is applicable .

For and On behalf of BHEL.

Technical Specification for

Supply of Balance of System items, Installation and Commissioning,

Operations & Maintenance

For 3 MWp Solar PV grid connected power plant at Velugam, Silvassa, DNH

Approved by : 2/9/14

Revision details : R 00	Prepared	Issued	Date
			02/09/2014

1.0 Pre-Qualification Criteria:

1) 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.
2) The bidder should have achieved average annual financial turnover of Rs. 300 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

Introduction

Bharat Heavy Electricals Limited (BHEL), Electronics Division, Bangalore is setting up a 3 MWp Grid Connected SPV Power Plant at Velugam, Silvassa, Union Territory of Dadra and Nagar Haveli (DNH). 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 250 W_p of mono-crystalline type will be deployed. Electrically, the array will have 5 nearly equal segments, each generating DC power of ~600 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 1.6 MVA 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 11 kV HT panel.

The plant employs 5x630 kW PCUs that export the generated power to 11 kV grid through 3 transformers and LV/HV breaker panels.

The solar array will have 35 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, LT / HT breakers.

Control room building, which is in BHEL scope, is a single storey building having overall dimension of approximately 24 m x 8 m.

(a) The control room houses 5 PCUs (630kW each), 5 LT panels (each panel with an ACB, sometimes will be part of the PCU), a SCADA room (air conditioned), a store room, ACDB panel, battery room, toilets and staircase portion. Remote annunciation panel (RAP) and 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 (LT-Panel sometimes will be a part of PCU. RAP may be sometimes part of SCADA).

Switchyard is located right on the back side of the control room. Switchyard (Approx., overall dimension 16 m x 24 m) comprises of the following major items. A layout of switchyard & control room 3-679-05-00710 is enclosed.

(1) Transformers, 1600kVA, 11kV/xxxV-xxxV, two LV windings: 2 sets
Transformer, 800 kVA, 11 kV/xxxV: 1 set, one LV winding: 1 set
(2) HT breaker panels (VCB panels with 3 incomer panels, 1 outgoer panel, 1 Bus PT panel) – 1 set
(3) Four pole structure – 2 sets (with lightning arrestors, outdoor metering CTs/PTs, one 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 five years from the date of commissioning. BHEL scope of supply is mentioned under section 3.2

Note:
Vendor has to visit the site to assess all the technical and operational requirements and familiarize with the site conditions before quoting.

2.0 Documents enclosed with this specification

1	Single line diagram of overall power plant	3-679-05-00708
2	Site layout with locations of solar array, control room, switchyard	3-679-05-00711
3	Control Room & Switchyard layout	3-679-05-00710
4	Switchyard fence	3-679-05-00748
5	Earth chamber	3-679-05-00718
6	SPV module Drawing	3-679-02-00370
7	Technical specification for VRLA battery & FCBC	Annexure 1
8	Technical specification for ACDB Panel	Annexure 2
9	Technical requirements of PCU air duct arrangement	Annexure 3
10	Technical specification for 11 kV, 3Cx185 sq.mm cable	Annexure 4
11	List of EDEC ineligible items	Annexure 5
13	Lighting Layout	3-679-05-00741
14	Earthing Layout	3-679-05-00734

3.0 Scope of work

3.1 Vendor scope of work (as briefly outlined activities)

The table below indicates the vendor's scope of supply, installation and O&M for 5 years, 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 5.06 to 5.16	1 set
2	Supply of Auxiliary power cables, HT power cable, Data communication cables, 11kV termination kits etc as per clauses 5.21 to 5.46	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 of switchyard fencing (fence, gate, angles etc.,), items for connecting to grid, with all related miscellaneous accessories and hardware as per clauses 5.23–5.33.	1 set
4	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 5.39 to 5.41.	1 set
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 5.42 and 5.43.	1 set
6	Supply of items of module cleaning system such as submersible pumps (for bore wells), booster pumps, CPVC pipes with fittings, ball valves, nipples etc as per clauses 5.49 and 5.50.	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 5.44 to 5.48.	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 5.51 to 5.59.	1 set
9	Supply of safety related items including fire alarm system, fire extinguishers, safety gadgets etc as per clauses 5.60 and 5.61.	1 set
10	Supply of ACDB, Battery, FCBC,DCDB PCU ducting arrangement etc., as per the annexures enclosed	1 set
11	I&C: Temporary site office, storage yard, bore wells, unloading/movement of consignments, arranging electrical power/water etc as per clauses 5.01 to 5.05	1 AU
12	I&C: Interconnection of SPV modules, installation of string monitoring boxes including cable terminations and inspection thereof as per clauses 5.06 to 5.11	1 AU

13	I&C: Formation of cable trenches and laying of 240sq-mm cables, per MW basis, as per clause 5.12 & 5.13	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 5.14 to 5.16	1 AU
15	I&C: Erection of switchyard equipment such as transformers, HT panels, four pole / double pole / single pole structures with GOS / lightning arrestors / drop out fuses, CTs, PTs, metering panels including ACSR conductor laying, HV cable terminations, fire walls, foundations, HT panel sheds, oil pit chambers etc, per MW basis, as per clauses 5.17 – 5.32	1 AU
16	I&C: Switchyard leveling, jelly spreading, fencing including gates as per clauses 5.33 and 5.34.	1 AU
17	I&C: Cable trenches, cable laying, cable terminations for control cables related to remote annunciation and SCADA as per clauses 5.36 to 5.38.	1 AU
18	I&C of earthing system for solar array field, control room panels and switchyard equipment including installation of Chemical earthing electrode, 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 5.39 to 5.43.	1 AU
19	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 5.44 to 5.48	1 AU
20	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 5.49 and 5.50.	1 AU
21	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, Tools kits and instruments, office furniture, fire extinguishers, fire alarm system, security cabin etc as per clauses 5.51 to 5.61.	1 AU
22	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 5.62	1 AU

23	Operations and Maintenance per month : First Year	12 Mon
24	Operations and Maintenance per month : Second Year	12 Mon
25	Operations and Maintenance per month : Third Year	12 Mon
26	Operations and Maintenance per month : Fourth Year	12 Mon
27	Operations and Maintenance per month : Fifth Year	12 Mon

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(L20220-250Wp)(Packed in boxes of each having 16 nos.,)	~ 12128 Nos
2	Solar array structures with modules mounted on the structures: Fixed type structure, with each having 24 Nos of 250Wp modules:	3 MWp
3	Cable, 1Cx 6 sq-mm (connection of PV modules to string monitoring boxes)	required length
4	Cable, 1C x 240sq-mm (for connection from SMBs to PCUs in control room)	required length
5	String monitoring boxes with mounting fixtures	36 sets
6	Power conditioning units (PCUs) of 630 kW	5 sets
7	LT panels (Air circuit breakers)	5 sets
8	Transformers 1600 kVA, 11kV/350V-350V (1 HV winding, 2 LV windings)	2 Nos.
9	Transformer 800 kVA, 11kV/350V (1 HV winding, 1 LV winding)	1 Nos.
10	Cable, 1Cx 300 sq-mm for AC side power connections from PCUs to LT panels up to LV side of transformers	required length
11	HT panels (outdoor kiosk type) including VCBs, CTs, PTs, Relays, C&R panels (3 incomers & 1 outgoer, 1 Bus PT panel) and indoor annunciation at SCADA.	1 set
12	ACDB panel for auxiliary power distribution for plant utility purposes	1 set
13	Battery bank (110V / 100 AH)-2 sets and FCBC double stage charger	1 set
14	Weather monitoring equipment for solar irradiation, wind velocity, ambient temperature, module temperature including supply and termination of data cables for the same. (Cable laying in vendor scope)	1 set
15	SCADA data station with PC, accessories and software	1 set
16	Data cable terminations at SMBs, SCADA data station panel and control desk (supply and laying of data cables shall be in vendor scope)	1 set
17	Control room with plumbing lines, overhead tanks, internal electrical wiring.	1 set
18	Sewerage and septic tank works and interconnections with control room.	1 set
19	Chain link fencing for the entire plant, pathways, approach road, drains, landscaping within the solar plant. (Note: Switchyard fencing with gates is within vendor scope)	-

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.
4.2	First-part shall be techno-commercial bid. Following details shall be furnished: 1. Technical offer with covering letter. 2. Filled-up enclosures as per BHEL formats (meant for first-part) provided in tender. 3. Clause-wise compliance shall be filled-up in the column provided in this specification, with signature and seal on every page. 4. Company brochure. 5. Project implementation time schedule. 6. Stage-wise manpower schedule.
4.3	Second-part shall be price bid with filled up enclosures as per BHEL formats provided in tender.
4.4	In addition to the above instructions, tender document provides detailed instructions for bid submission. Vendor shall submit the bid based on instructions in tender document.

5.0 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	**Setting up of temporary site office** (1) Vendor shall set up a temporary site office for BHEL 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, ten chairs and necessary number of power points, lamps and fans.	
5.02	**Electrical power and water for construction** (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	**Construction of temporary yard for safe storage of all BHEL as well as vendor supplied items** (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, LT panels, HT panels, Battery banks, Battery chargers etc.,), transformers, cables, string monitoring boxes, solar PV modules, spares, tools, instruments etc. (2) Area of storage yard shall be approximately 900 sq-m. Typical size shall be 30m x 30m. However, exact size shall be decided mutually with BHEL based on site conditions. (3) A minimum 400 Sq.m of yard area shall be provided with	

	suitable roof and side covers (asbestos, FRP, steel sheet etc.,) in order to ensure there will not be any water spillage which may damage the equipment. This should be supported by steel poles that shall be grouted using suitable concrete foundations. Height should be appropriately decided to ensure safe operation of hydra for loading/unloading etc., (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. (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. (6) Suitable fencing shall be provided using steel poles at every 3m intervals and barbed wires between the poles. (7) Gate shall be suitably secured to the fencing poles and shall be provided with lock and key. (8) Watch and ward security personnel shall be provided for the yard on round-the-clock basis.	
5.04	**Receipt, unloading, safe storage and movement of BHEL and vendor supplied items:** (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. Loading, shifting and unloading of the BHEL items from a temporary storage yard to this main storage will be in the scope of vendor. Similar arrangements shall also be made by vendor for movements of the items from storage yard to the point of construction. (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. (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. (4) Registers shall be maintained for the yard to keep track of incoming / outgoing items. (5) Vendor shall arrange for necessary insurance for the stored	

	items of vendor supply up to the time of commissioning. (6) BHEL will ensure insurance for all the BHEL supplied items.	
5.05	**Construction of bore wells including hydro survey, water analysis, electrical cabling and plumbing works.** (1) Two bore wells shall be dug at locations as identified by hydrological survey and as certified by BHEL. (2) Bore wells shall be of necessary depth based on water table at the identified locations. (3) Water analysis shall be carried out and report submitted to BHEL. (4) Two Submersible AC centrifugal pumps of 3 HP (3 phase) with all necessary electrical cabling from two bore wells up to control room ACDB panel shall be provided. (5) Casing as required shall be provided for the pump. (6) Pump and the electrical cables shall be in vendor scope of supply. 5Cx 4 sq-mm cable (copper, armoured, PVC) shall be laid underground at a depth of ~600 mm, with sand layers below and above the cable (100 mm each). A brick layer, class-2, 75mm thick shall be laid over the sand layer. Trench shall, then, be closed with refill soil and neatly compacted. (7) Length of cable required ~ 400 m. (8) Pump make: CGL, Suguna, Kirloskar or any other reputed equivalent as shall be approved by BHEL.	
5.06	**Interconnection of SPV modules to form strings** Supply of SPV modules is in BHEL scope. BHEL make, L20220 type, 250 Wp As per drawing 3-679-02-00711 Total quantity = 12128 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: (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, 24 modules shall be connected in series. Each set of connections is called as a series string. Thus, 504 series strings shall be formed with 12096 modules. Remaining 32 modules are stored as spares.	

	(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, Hellermanntyton, Panduit/equivalent. **Specs:** 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.	
5.07	**Installation of string monitoring boxes** (1) Supply of 36 nos., (1 no., spare) string monitoring boxes (SMB) is in BHEL scope. These are 16-in and 1-out type. (2) Vendor shall install the SMBs in the solar array field. (3) All fixtures including stand, hardware etc required for installation of SMBs are in BHEL scope of supply. (4) Drawings and details of SMBs and the fixtures will be provided to the vendor after placement of purchase order. (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. (6) SMBs shall be fixed on the stands using the hardware that are supplied by BHEL as part of SMB assembly kit. (7) All tools necessary for mounting shall be in vendor scope.	
5.08	**Interconnection of SPV module cable to 6 sq-mm cable:** (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. Overall diameter ~ 9 mm. Diameter under the outer sheath (i.e., over the insulation) ~ 4.8 mm. (2) SPV module is provided with positive and negative cables (4 sq-mm) having male and female parts of MC4 type connectors.	

	(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. (4) MC4 connectors shall have rating of 1000 V_{DC} (IEC), rated current of 30 A, Type approved by TUV Rheinland for product safety. (5) Approved make: Multi-contact (MC4)/ Tyco/ Weidmuller/ equivalent. (6) Total quantity of MC4 connector sets required = 504 sets (each set having a male and a female part) (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. (8) In addition to the above safety margin, vendor shall supply 96 sets extra as spares for contingency use during post-commissioning period. (9) Four sets of tool kits (with plastic box enclosure) shall be supplied and stored at the site as O&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 6 nos., during execution for simultaneous working on the array. Note: For any other equivalent make of plug connectors and tool sets, BHEL approval shall be taken prior to procurement.	
5.09	**Routing of 1Cx 6 sq-mm cable** (1) 6 sq-mm cables connecting the SPV module strings to SMBs shall be neatly routed along the structure. (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, Hellermanntyton, 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. (3) Cables shall not be loosely hanging.	
5.10	**Underground laying of 6 sq-mm cables between the rows** (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. (2) HDPE DWC pipe shall be within scope of vendor supply.	

	(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. (4) Make: Jyoti electricals or reputed make as shall be approved by BHEL. (5) Make, part number, sizes / dimensions shall be submitted to BHEL for approval. (6) Details of cable trench: (a) Trench depth = 600 mm minimum (b) Trench width = 200 mm minimum (c) Bottom layer shall be sand of IS: 383 with 100mm thick. (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 ~ 1500 m.	
5.11	**Connecting the 6 sq-mm cables on input side of SMBs** (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 site will be in the scope of the vendor. Approx., number of male MC4 connectors required for termination at SMBs will be 1100 nos.(92 spares) (4) All necessary tools such as pliers, strippers, crimping tool etc shall be within vendor scope.	
5.12	**Connecting the 240 sq-mm cables on output side of SMBs** (1) Cables of 1Cx240 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 as shall be approved by BHEL. Quantity required ~ 70 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 etc., shall be within vendor scope.	
5.13	**Cable trenches for laying power cables from SMB to control room:** (1) 1Cx240 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. (2) Overall diameter of cable ~ 30 mm. (3) These cables shall be laid underground from the point near SMB to a point close to the control room. (4) Two cables (+, -) from each of the 35 SMBs have to be routed to the control room. (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 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 2000 m. (6) Vendor shall construct the underground trench as follows: (a) Trench depth = 750 mm minimum (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. (c) Sand as per IS: 383 of 100 mm layer thickness shall be laid at the bottom most level of trench. (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.	

	(e) Over the layer of cables, one more layer of sand of 100mm shall be laid. (f) Then, a single layer of class-2 brick of 75 mm thickness shall be laid. (g) Trench shall then be filled up with refill soil. (h) Subsequently, land over the cable trench shall be leveled and compacted suitably.	
5.14	**Installation (indoor) of PCUs, LT panels, battery banks, FCBC battery charger panels, ACDB panels, annunciation panel, 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 (each ~2500 Kg) (b) 630kW LT panels (Air circuit breakers): 5 sets (each ~1000 Kg) (c) Battery bank (110V, 100AH): 2 sets (each ~600 Kg) (d) FCBC battery charger panel: 1 sets (each ~800 Kg) (e) ACDB panel: 1 set (~800 Kg) (f) Annunciation panel: 1 set (~600 Kg) (g) Data station for SCADA: 1 set (~500 Kg) (h) Control desk with PCs and accessories: 1 set (LT panels sometimes will be part of PCU itself) (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 = 750 mm
(f) Normal type trays: 250m 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 to the appropriate placement of these steel sections will be in the vendor's scope.

(6) Suitable cut outs shall be made in the cable trays to provide path for the cable to reach the lower level trays.

(7) Adjacent cable trays shall be interconnected using suitable hardware items that shall be in vendor scope of supply.

(8) Cables shall be laid over the cable trays and neatly dressed using appropriate cable ties etc.

(9) For 240 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.

(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.

(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.

5.15	**Power cable terminations on DC side of PCUs in control room** (1) On DC side, for each PCU, vendor shall carry out the cable terminations for 7 positive and 7 negative input connections – unsleeving, crimping and connecting. (2) BHEL shall supply the cables (1Cx240 sq-mm Aluminium, armoured, XLPE insulation, PVC sheath) (3) Vendor should supply required cable glands (70 nos.,), cable lugs (70 nos.,), bolts, nuts and washers (70 sets) for the termination of these cables at the DC chamber of the PCU. (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. (5) All tools and accessories required to carry out the termination shall be within scope of vendor.	
5.16	**Power cable terminations on AC (LT) side for PCUs and transformers** (1) On AC side, 3-phase 3-wire power cable interconnections shall be made between PCUs, LT panels and transformers using 1Cx300 mm^2 Aluminium, unarmoured, XLPE cable 3 runs per phase. (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 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 = 100 sets. (3) For cable terminations at PCUs/LT panels, Vendor shall supply the cable glands, cable lugs, bolts, nuts, plain washers and spring washers. (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. (5) There are 5 PCUs of 630kW, 5 LT panels with Air Circuit Breakers, 2 nos. of 3-winding Transformers of 1600 kVA and 1 no. of 2-winding transformer of 800 kVA.	

	(6) All tools and accessories required to carry out the termination shall be within scope of vendor. (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.	
5.17	**Foundation pedestals and outdoor installation of 1600 kVA, 11kV/300-300V & 800 kVA 11kV/300V transformers supplied by BHEL** (1) Number of 1600 kVA transformers = 2 sets Number of 800 kVA transformers = 1 set (2) Vendor shall construct RCC foundation for each set of transformer. Following are the requirements : (a) Weight of each transformer ~ 5400 Kg (b) Soil report will be shared up on vendor's request after placing P.O (c) Size of foundation ~ 3000 x 3000 mm (L x B) (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. (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. (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. (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. (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. (4) Vendor shall provide all necessary support and assistance to the representative of transformer manufacturer during installation: (a) Oil filling in all transformers. (b) Measurement of parameters: insulation resistance etc. (c) Connections to marshalling box (5) Vendor shall submit drawing of transformer foundation to BHEL for approval.	
5.18	**Firewalls between transformers** (1) Firewall shall be constructed in between adjacent transformers. (2) Quantity of firewalls = 2 Nos. (3) Soil report will be shared up on vendor's request after placing P.O (4) Length of firewall ~4100 mm; Height ~3500 mm above ground level. (5) Wall shall be 230 mm minimum thick with suitable reinforcing steel and concrete for stability. (6) Foundation for a minimum depth of 900 mm below ground level. This shall include PCC 1:4:8 as the bottom layer. (7) Firewall shall be finished with cement plaster and water proof cement paint of BHEL approved colour all around. (8) Any specific regulations of State Electricity Supply & Transmission Boards/Ceig shall be duly considered. (9) Vendor shall provide the firewall drawing to BHEL for approval.	
5.19	Deleted	

5.20	**Foundation pedestals with slanted roof and outdoor installation of HT panels supplied by BHEL** (1) Number of panels = 5 (3 incomers, 1 outgoer, 1 Bus PT) (2) Vendor shall construct a combined RCC foundation for positioning of these eight panels one adjacent to each other. Following are the requirements: (3) Weight of each panel ~ 1200 Kg (4) Size of foundation ~ 7000 x 4000 mm (L x B). Here, the breadth dimension includes teeth length of ~600 mm. Five teeth are provided each having a width of ~400mm separated from each other by 400-500 mm for providing path for bottom entry of cables to the panels. (5) 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. (6) Foundation pedestal height above the ground level ~ 800 mm that includes M25 concrete with steel rods of 8mm minimum diameter for skin reinforcement all around with inside steel chairs etc. (7) 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. Painting shall be carried out after installation of transformer. (8) Pedestal shall be provided with footsteps as follows: o Overall footprint ~ 1200 x 1200 mm o Five steps of brick masonry, 5 x 160 mm tall o Depth below ground level ~ 150 mm (PCC 1:3:6) (9) HT panels shall be moved from storage yard using cranes, hydra, forklifts and other accessories and placed on the pedestal in such a way that the panel seating is partly on the teeth profiles thereby providing for the power and control cables to enter the panels from bottom side. (10) After the installation of all the panels on the pedestal, vendor shall construct a slanted roof with a minimum clearance height of 3500mm on the lowering side and 4200 mm on the other side above the pedestal. Steel pipes of 75mm diameter x 6mm thick shall be used for vertical supports as well as horizontal reinforcements on the rooftop at an interval of every 2500 mm. (11) The vertical supports shall be secured with suitable	

	concrete foundation. (12) The slanted roof shall be pre-coated weather proof corrugated GI sheet of reputed make and thickness as shall be approved by BHEL. The curved sheets have to be used on front and back side to prevent water splashing during rain to the HT panels. (13) Pedestal and footsteps 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 HT panels. (14) Vendor shall submit the drawing of foundation pedestal with the shed.	
5.21	**Cable trench and laying of power cables in switchyard (both HT and LT cables)** (1) Vendor shall construct underground cable trench (rectangular cross section) for laying the 11kV cables. Outline of switchyard layout 3-679-05-00710 is enclosed. Cable trench shall be (a) between the transformers and incomers of HT panels (3Cx185 sq-mm cables). Total running length of trench = 60 m maximum. (b) between the outgoer of HT panels and the four pole structure (3Cx185 sq-mm cable). Total running length of trench: 15 m maximum, and (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: 10 m maximum. (2) 3Cx185 sq-mm sq-mm 11 kV cable shall be within vendor scope of supply. Brief Specification of cables as follows: (a) Cable, 3Cx185 sq-mm, 11kV, Al conductor, XLPE insulation, armoured, PVC sheath as per IS: 7098-1985 part-2. Quantity required ~ 170 m Detailed Specification enclosed vide Annexure 4 (3) Following shall be considered in trench construction: (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. (b) Trench depth shall be minimum 600 mm. (4) Trench layout and trench drawings shall be submitted to BHEL for approval.	

5.22	**Power cable terminations on AC HT side (11kV)** (1) Vendor shall carry out HT power cable terminations on HV side (11kV) of transformers (3 sets) and HT panels (3 incomers) using 3Cx 185 sq-mm, cable lugs, HT termination kits and all necessary hardware, all of which shall be within vendor scope of supply. (2) For terminations at the outgoer HT panels, the 11kV cable shall be 3Cx185 sq-mm. (3) HT termination kits shall be of 12kV, 3-core, indoor type. Make: Raychem, 3M or reputed equivalent as shall be approved by BHEL. (4) Qty of indoor termination kits = 8 sets for 3Cx185 sq-mm. 1 No., Extra set shall be provided (Each Set containing kit required for 3 phases together). (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 12kV, 3-core, outdoor type. Quantity = 3 set + 1 set spare. Make: Raychem, 3M or reputed equivalent as shall be approved by BHEL. (6) Cable lugs and hardware shall be of dowell's / 3M or reputed equivalent as shall be approved by BHEL. (7) All tools and accessories required to carry out the termination shall be within the scope of vendor. (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.	
5.23	**RSJ poles** (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 per IS: 1852-1985. Beams shall be hot-dip galvanized or suitably painted based on STATE ELECTRICITY SUPPLY & TRANSMISSION BOARDS/CEIG etc requirements. (2) The cross section dimensions of RSJ poles shall be as per STATE ELECTRICITY SUPPLY & TRANSMISSION BOARDS/CEIG etc requirements meant for four pole structures. (3) Vendor shall submit the dimension details of RSJ poles. BHEL approval shall be obtained for the brand and supplier of the poles.	

	(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. (5) Test reports shall be submitted to BHEL. (6) Quantity = 8Nos (four pole structures: 2 sets x 4 Nos) (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 & TRANSMISSION BOARDS/CEIG etc., requirements. RCC foundation shall be up to a level of ~500mm above ground level. (8) Vendor shall submit drawing of RSJ pole foundation for BHEL approval.	
5.24	**Gang operated switch (Air break switch), triple pole, double break, horizontal and centrally rotating type:** (1) Rated voltage: 12kV (2) Operating voltage: 11kV (3) Impulse withstand voltage: 75kV peak (4) Power frequency withstand voltage (1 min): 35kV rms (5) Continuous current rating: 400A (6) Short-time current rating: 40 kA (7) Construction: Triple pole, one or two insulators per pole, double break, centrally rotating type (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. (9) Mounting base: The three poles shall be mounted on a rigid base of MS channel of minimum size of 75x40x6 mm (hot dip galvanized), provided with suitable holes, clamps and bolts to enable firm mounting. (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. (11) Earthing terminals: Two terminals with adequate size to carry full short circuit current; shall be provided on the frame	

	of each pole. (12) Coupling rod: 25mm nominal bore GI pipe medium gauge (13) Operating rod: 32 mm nominal bore GI pipe medium gauge single length 6m. (14) Standard: IS: 9921 part 1 to 4 / IEC 265 part 1 (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. (16) Approved make: Electrolite (Jaipur), Lamco, GR power or reputed equivalent as shall be approved by BHEL. (17) Quantity of GOS switch required as a whole: (a) 3 sets without earth switch (b) 1 set with earth switch (manually operated)	
5.25	**Lightning arrestors for switchyard (Surge suppressors)** (1) Arrestor rating: 9kV, 10kA, Class-3 with IB (2) Type: Metal oxide Gapless lightning arrestor (3) Make: Lamco (Hyderabad), Electrolites (Jaipur) or any other reputed equivalent as shall be approved by BHEL. (4) Standard: IS 3070 (part-3) 1993 & IEC 60099-4 of 2004 (5) Minimum acceptance tests that shall be witnessed by BHEL (a) Power frequency reference voltage test at 3mA (b) Partial discharge test at MCOV x 1.05 (c) Lightning impulse residual voltage test at 100% NDC (d) Functional tests on surge monitor (e) Galvanization test on exposed metal parts - Uniformity, mass, thickness of Zn coating (f) Visual examination and dimensional verification (6) Vendor shall provide inspection call to BHEL. Quality assurance plan shall be submitted prior to inspection call. (7) These lightning arrestors / surge suppressors (3 Nos) shall be mounted on the four pole structures as shown in SLD diagram. (8) Total quantity required = 6 Nos+ 1 extra as spare	
5.26	**Installation of first set of four pole structure with GOS switch** The switchyard comprises of two sets of four pole structure. The installation requirements for the first set are as follows: (1) Vendor shall install four pole structure that carries the following items: (a) RSJ poles with foundation as per clause above : 4 Nos (b) GOS switches (Air break switch), 3 pole, double break,	

	horizontal, centrally operated, 11kV, 400A as per IS:9921 part 1-4, without earth switch: 3 sets and GOS with earth Switch 1 set. (2) Insulators as per IS: 2544 / IEC 273 shall be used wherever required to maintain HV isolation from RSJ poles. (3) CPVC pipes shall be used to guide the XLPE HT cables (11kV, aluminium conductor) reaching the four pole structure from the outgoer of 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 3Cx185 sq-mm cable. Length shall be a minimum of 4m. Quantity of CPVC pipes = 1 No. (4) The XLPE cable shall be connected to one GOS switch. (5) The second GOS switch shall be for connected to the auxiliary transformer that is mounted on cement foundation. Drop out fuse wires with 11kV fuse holders shall be mounted on a suitable mounting arrangement such as base channel of 75x40x6, etc. Rated voltage 12kV, BILL 75kV, copper fuse wire of AWG 30 (~6A melting). Make: Electrolite (Jaipur) or reputed equivalent as shall be approved by BHEL (6) The third GOS switch mounted on the four pole structure is a spare (7) The fourth GOS switch is for closing / opening of the plant as a whole. Hence the output of all other GOS shall be looped and connected to this GOS. GOS switch (Air break switch), 3 pole, double break, horizontal, centrally operated, 11kV, 400A as per IS:9921 part 1-4, interlocked with earth switch (manually operated): 1 set will be installed here. (8) 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.	

	(9) 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. Note: All MS parts of FP structure shall be suitably painted using red oxide and BHEL approved silver colour paint.	
5.27	**Installation of second set four pole structure with GOS switches and Lightning arrestors** The second set of four pole structure is at the end of the plant where the plant can be connected to 11kV grid line. Vendor shall install the second set of four pole structure that carries the following items: (1) RSJ poles with foundation as per clause above: 4 Nos (2) Base channels of 75x40x6 mm minimum shall be used for mounting the lightning arrestors. (3) Insulators as per IS: 2544 / IEC 273 shall be used wherever required to maintain HV isolation from RSJ poles. (4) Lightning arrestors (surge suppressors) of 9kV, 10kA - 3 Nos before and 3 nos., after the metering CT & PT at the overall plant output lines. (5) 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: CL 0.2s, 10VA. 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 or reputed equivalent as shall be approved by BHEL. (6) Suitable arrangement, using base channels min 100x50x6 etc, shall be provided for mounting the CT/PT sets on the four pole structure. Mounting arrangement shall be approved by BHEL prior to procurement. (7) Two metering panels, each having one L&T make 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. Meter Reading Instrument as per IEC-62056, Sands make (CMRI-1006) or BHEL approved equivalent along with optical probes to be provided (1 set). (8) 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. (9) 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. Note: All MS parts of FP structure shall be suitably painted using red oxide and BHEL approved silver colour paint.	
5.28	**Installation of auxiliary transformer on cement foundation:** Vendor shall supply and install : 1. Outdoor, Oil immersion type, ONAN, 3-phase, Dyn11, 100 kVA, 11kV/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: - Winding material: Electrolytic grade copper - HV side delta, LV side star with 4-wire, neutral terminal brought out separately.	

- Highest voltage for equipment: 12 kV rms for HV side, 1.1kV rms for LV side
- Rated short duration power frequency withstand voltage: 28kV rms for HV side, 3kV rms for LV side
- Rated lightning impulse withstand voltage: 75kV peak for HV side
- Off-circuit tap changer on HV side: +/- 5% in steps of 2.5% (-5%, -2.5%, 0, +2.5%, 5%)
- Temperature rise: For max ambient of 40 degC, the maximum allowable temperature rises in oil and winding by thermometer method shall be 45 deg C and 50 deg C respectively.
- BHEL shall witness the temperature rise test and routine tests, for which vendor shall provide inspection call to BHEL in advance.

2. 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.
   - 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.
   - 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.
   - 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
3. Electrical interconnections up to the transformer bushings on HV side shall be made using 3CX185 sq.mm XLPE aluminium conductors.

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.

5.29	**Overhead lines in switchyard using ACSR conductor** (1) Vendor shall supply 7/4.72 DOG type ACSR conductors for use as overhead lines in four pole structures of the switchyard. (2) ASCR conductor shall be as per IS:398 part-II 1996 (3) All electrical interconnection looping in FP structures shall be through stringing / jumpering of ACSR conductors. (4) Vendor shall submit test certificates for ACSR conductors for BHEL scrutiny and acceptance. (5) Total length of ACSR conductor ~ 50m	
5.30	Deleted	
5.31	**Connecting to the 11kV grid line** (1) The 11 kV grid line will be provided at the plant second four pole structure of the SPV plant. (2) Vendor shall supply and install necessary (3) 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, 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.	
5.32	**Power cable terminations at 100 kVA transformer, ACDB panel:** (1) Vendor shall carry out termination on HT side of 100 kVA auxiliary transformer (11kV/415V) using 3Cx 185 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. (2) Vendor shall carry out termination on LT side of 100 kVA auxiliary transformer (11kV/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. (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. (4) Quantity of cable ~ 40 m (5) All tools and accessories required to carry out the termination shall be within the scope of vendor.	

5.33	**Erection of switchyard fencing with gate.** Vendor shall provide all around chain-link fencing to the switchyard with gates at two different locations as shall be decided by BHEL site engineer. (a) Fencing shall be as per BHEL drawing 3-679-05-00748. (b) GI Fence length ~ 60 m (c) Gates shall be with following details: - MS gates – 1 No: o Gate with 5m width (2x2.5m) x 3m height - Frame of 50x50 mm MS pipes with 4 mm thick - Vertical grills of 16 mm square bar at 120mm c/c - Other necessary details such as hinges, padlocks, wheels etc shall be considered. - Gate shall be finished with red oxide (one coat) and paint of approved colour and type. (d) Vendor shall submit drawings of the switchyard gate for BHEL approval.	
5.34	**Erection of Switch Yard:** (1) Switchyard size~ : 24 x 16 sq. m (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 ~ 375 sq-m. (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. (4) Approximate length of WBM road ~ 24 m. BHEL shall provide drawing at an appropriate time during execution. (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.	
5.35	**Support and assistance for SCADA integration for the power plant** (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: (a) String monitoring boxes in solar array field: string current, voltage, box temperature, module temperature,	

	status of SPD and load break switch in SMBs (b) Weather monitoring equipment: solar irradiation, ambient temperature, wind velocity. (c) Power conditioning units: DC input /AC output parameters of inverters, grid data, fault status and events logged, etc (d) LT / HT breaker panels: status of ACB / VCB breakers, status of protection relays of transformers, oil / winding temperatures, AC parameters at 3MW levels, energy generation values. (2) Vendor shall provide support and assistance to BHEL in following activities: (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. (b) Data cable laying from PCUs, LT panels, ACDB panels to SCADA (c) Data cable terminations at PCUs, LT panels, ACDB panels, transformers and HT panels.	
5.36	**Cable trenches for laying data communication cables from SMB to control room.** (1) Data communication cables shall be laid from SMBs to the data station panel in the SCADA room of the centralized control room. (2) Cable specification: - Cable, 1.1kV grade, 2 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 type ST1 conforming to IS:1554 / part-1 with latest amendments up to date. - Approximate outer diameter = 9 mm - Make: Polycab, Advanced cables, Lapp or any other reputed equivalent as shall be approved by BHEL. (3) Cable shall be within vendor scope of supply. (4) Approximate length of cable required ~ 1900 m (5) This cable is meant for RS485 interfacing. The RS485 output of SMBs shall be daisy-chain looped using this cable. Approximately every 7 SMBs shall be daisy-chained to form	

	one cable connection running up to SCADA room. In such a case, since 35 SMBs are there, approximately 5 cables will be running from solar array field to SCADA room. (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. (7) Underground laying shall be ensured even within the daisy-chain looping between adjacent SMBs. (8) Cable trench shall be as per details below: (a) Trench depth = 600mm minimum (b) Trench width shall be 200mm minimum (c) Bottom layer shall be sand as per IS: 383 with 100mm layer thickness. (d) Data cable shall be laid over the sand. (e) Another layer of sand, 100 mm thick, shall be laid. (f) A single layer of brick, class-2, 75mm thick, shall be laid over the sand. (g) Trench, then, shall be filled up with refill soil. (9) Total length of trench ~ 1500 m	
5.37	**Cable trench and laying of data communication cables in switchyard** (1) Following are the data cables in switchyard (a) Transformers to HT panels (b) HT panels to SCADA (c) HT Panels to RAP(can be integrated in SCADA) (d) Transformers to SCADA station (2) These data cables (details under following section), which are within the vendor scope of supply, shall be laid underground as follows: (a) Trench depth = 600mm minimum (b) Trench width shall be 200mm minimum (c) Bottom layer shall be sand as per IS: 383 with 100mm layer thickness. (d) Data cable shall be laid over the sand. (e) Another layer of sand, 100 mm thick, shall be laid. (f) A single layer of brick, class-2, 75mm thick, shall be laid over the sand. (g) Trench, then, shall be filled up with refill soil and suitably compacted.	

5.38	**Data cable terminations in control room and switchyard** (1) Vendor shall carry out data cable terminations at 1600 & 800 kVA transformers, HT panels and Remote annunciation panels, Metering panels, ACDB panels and PCUs. (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.). (3) Terminations at 3 sets of HT panels (Buchholz relay, pressure release valve, low oil level, WTI, OC/EF relay, OV/UV relay, EM6400 meters etc.) for SCADA connections and other terminations from HT panel outgoer and bus PT. (4) Terminations between 5 sets of HT panels and 1 set of SCADA/RAP: Buchholz relay, pressure release valve, low oil level, WTI, OC/EF relay, OV/UV relay etc. (5) Terminations at 5 sets of LT panels (after PCU) for capturing ON/OFF status of ACBs for SCADA purpose. (6) Terminations at 5 PCUs of 630kW for RS485 MODBUS communication cable connections. (7) Terminations at 1 ACDB panel. (8) Terminations at two metering panels in switchyard. (9) 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: 1554 / part-1 with latest amendments up to date. (10) Approximate quantity requirements of cables for the above purposes as follows: 2 Pair x 0.5 sq-mm ~ 700 m (PCUs, transformers to SCADA) 1 pair x 0.5 sq-mm ~ 300 m(LT & HT panel to SCADA) 5 Pair x 0.5 sq-mm ~ 400 m (HT panel to SCADA) 10 Pair x 0.5 sq-mm ~ 450 m (HT panel to RAP/SCADA panel) (11) Make of cables: Polycab, Advanced cables, Lapp or any other reputed equivalent as shall be approved by BHEL. (12) Vendor has to lay the control cable from each transformer to HT panel with 12Cx1.5 sq.mm cable. Cable Specification is as follows: Cable, 1.1kV grade, copper conductor, stranded, PVC type-A insulation, ATC drain wire of 1.5 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: 1554 / part-1 with latest amendments up to date. Approx., length is 100 m (13) Cable lugs and all hardware required for making the above terminations shall be in vendor scope of supply. **Note:** Along with the above activities, DC/AC power supply cable laying and terminations shall be also be carried out for transformers, HT panels and RAP panel using 2Cx2.5 sq-mm(Approx., 400 m) copper, armoured, PVC cables. Cable shall be laid from battery bank (for DC) and ACDB panel (for AC).	
5.39	**Earthing of solar array structures** (1) Vendor shall interconnect solar array structures using welding of 25x6 mm GI strips. Total length of GI strips required ~ 2000 m. (2) Every row of such interconnected structures shall be terminated in a chemical earthing electrode of 3000 mm long, hot dip galvanized and metal coated for rust proof, OD of minimum 50 mm shall be supplied by vendor. (3) Quantity of Earthing electrodes for solar array structures = 54 sets. (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: 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. b) Mix the back filling compound (BFC), as recommended by vendor, with soft soil and throw a handful of the mix into the pit. c) Place the electrode in the kit. d) Throw 2 or 3 Kg of BFC-soil mixture into the pit around the electrode and add a bucket of water. 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. f) After finishing the pit work, pour a few buckets of water	

	around the pit. (5) Earth chambers of brick masonry shall be constructed as per BHEL drawing 3-679-05-00718. All items of earth chambers, including lid, shall be in vendor scope of supply. (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. Length of GI strip ~ 800 m (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. (8) All GI strips and all hardware (nuts, bolts and washers) shall be in vendor scope of supply. (9) BHEL will provide layout drawings showing earth chamber locations.	
5.40	**Earthing lines for control room panels – PCUs, LT panels, Battery banks, FCBC charger, ACDB panels, SCADA panels, Remote annunciation panels, etc.** (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 ~ 30 m. (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. (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. (4) Expansion bolts of appropriate size (Minimum M8) shall be used to fix the insulation bush supports. (5) BHEL will provide the earthing line layout drawing. (6) 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) 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. (7) 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 as per BHEL drawing 3-679-05-00718. These chambers shall be located around the control room. Exact locations will be intimated by BHEL site engineer. (8) 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 ~ 100 m maximum. (9) Routing of 1Cx25 sq-mm cables to Earthing 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. Length of CPVC pipe required = 30m. Number of CPVC joints and elbows shall be as applicable. (10) Expansion bolts, cable lugs and all hardware required for this activity shall be within vendor scope of supply.	
5.41	**Earthing of switchyard equipment.** Vendor shall install chemical earthing electrode Zn coated, Hot dip galvanized, with brick masonry earth chamber for each case as per BHEL drawing 3-679-05-00718. (1) Inverter Transformers body earth – 3 x 2 Nos each = 6 Nos (2) HT panels body earth – 2 Nos (3) FP structure 1, GOS switch body earth – 2 Nos (4) FP structure 2, GOS switch body earth – 2 Nos (5) FP structure 2, Lightning arrestors– 2 Nos (6) FP structure 2, Metering CTs / PTs body earth – 2 Nos (7) FP structure 2, Metering PTs body earth – 2 Nos (8) Metering panel 1 body earth – 2 Nos (9) Aux transformer, body earth – 2 Nos (10) Aux transformer, neutral earth – 1 Nos (11) Switchyard fencing – 3 Nos	

	Total Earthing electrodes required for switchyard = 26 Nos GI strips of 50x6 mm shall be used for forming a grid for all the body earthing in order to achieve a good earth resistance value. Length of GI strip required ~ 150 m. GI strips shall be laid underground at a depth of ~ 500 mm. Earthing electrodes with chemicals, GI strips, all hardware required for making the connections shall be within vendor scope of supply. Vendor shall carry out all the necessary GI strip laying and interconnections. Vendor shall carry out measurement of earth resistance in all the cases that shall be witnessed, verified and certified by BHEL site engineer.	
5.42	**Lightning arrestors (ESE) type** (1) Early streamer emission lightning arrestors as per standards: UNE 21186/NF C-17 102/equivalent Make: Ingesco/ABB/equivalent, with minimum protection radius of 100 m supplied by Pro-lite, with counters and earthing systems. (2) Quantity = 5 sets (3) Lightning arrestors shall be mounted on top of a mast of height 12 m 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. (4) Two earthing chambers per lightning arrestor set using chemical earthing electrodes shall be constructed as per 3-679-05-00718. Total quantity of chemical earthing electrodes for this purpose = 10 Nos. (5) All mechanical and electrical connections, cables, junction boxes, hardware etc shall be within vendor scope. (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.	
5.43	**Lightning arrestor for control room** 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.	
5.44	**Yard lights for switchyard** (1) 10 yard lights (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. (3) Light fitting, Bajaj/Havells/Equivalent make (36 W) shall be supplied and fitted on the GI bend pipes using necessary hardware. (4) CPVC pipe of 1", carrying 3Cx2.5 sq-mm copper, armoured, PVC cable, from ground level up to Junction box. (5) 2 cores used for phase, neutral of yard light. (6) 1 core used for body earth purpose. (7) Junction box shall be at a height of 1m above ground level. (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. (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. (10) Glands shall be located at the bottom side of Junction box. (11) CPVC pipe of 1" shall be provided between junction box and bend pipe to guide the 2Cx1.5 sq-mm cable. (12) It shall be ensured that CFL lamp is well above the fencing height, which is 3m above the ground level. (13) Vendor shall submit general arrangement and detailed drawings with bill of materials / quantities of the overall yard lighting arrangement to BHEL for approval.	
5.45	**Yard lights for solar array field** (1) 20 yard lights – dome type (2) Lighting poles shall be located at distributed locations in the	

	solar array field as per layout that will be provided by BHEL at an appropriate time during period of execution. (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. (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. (5) CPVC pipe of 1-inch, carrying 3Cx2.5 sq-mm copper, armoured, PVC cable from ground level up to Junction box. (6) 2 cores used for phase and neutral for yard light and additional core for body earthing of the pole. (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. (8) Glands, socket shall be located at the bottom side of Junction box. (9) The junction box, cable lugs, steel mounting bracket and all hardware items shall be in vendor scope. (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.	
5.46	**Yard lights for compound wall / chain-link fencing** (1) 45 yard lights (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. (3) Light fitting, Bajaj/Havells/equivalent (36 W) shall be supplied and fitted on the GI bend pipes using necessary hardware. (4) CPVC pipe of 1”, carrying 3Cx2.5 sq-mm copper, armoured, PVC cable, from ground level up to Junction box. (5) 2 cores used for phase and neutral of yard light and 1 core used for body earth purpose. (6) 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. (7) Glands, socket shall be at the bottom side of Junction box. (8) The junction box, cable lugs, mounting bracket for fixing junction box and all hardware items shall be in vendor scope. (9) Junction box shall be at a height of 1m above ground level. (10) CPVC pipe of 1" shall be provided between junction box and bend pipe to guide the 2Cx1.5 sq-mm cable. (11) It shall be ensured that CFL lamp is well above the fencing, which is 3m above the ground level. (12) Vendor shall submit general arrangement and detailed drawings with bill of materials / quantities of the overall yard lighting arrangement to BHEL for approval.	
5.47	**Cable trench formation and laying of cables for yard lights** 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 (1) Trench depth = 600 mm minimum (2) Trench width = 200 mm minimum (3) Sand as per IS: 383 of 100 mm layer thickness shall be laid at the bottom most level of trench. (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. (5) Over the layer of cables, one more layer of sand of 100mm shall be laid. (6) Then, a single layer of class-2 brick of 75 mm thickness shall be laid. (7) Trench shall then be filled up with refill soil. (8) Total length of trench required for yard lights, all the three categories (solar array, switchyard and compound wall / chain link fencing) put together ~ 1500m.	
5.48	**Cable terminations and quantities of cables and CPVC pipes for yard lights** (1) Cable termination: (a) Termination of cables, including unsleeving, crimping, connecting to the junction box and lamp shall be within scope of vendor. (b) Similarly, cables shall be terminated at the ACDB panel within the control room. (c) BHEL will provide the wiring scheme of ACDB panel. (2) Vendor shall supply following lengths of cable:	

	(a) 3Cx 2.5 sq-mm Cu, armoured, PVC cable ~2300m (b) 2Cx 1.5 sq-mm Cu, unarmoured, PVC cable ~ 150m (3) Vendor shall supply following lengths of CPVC pipes: (a) CPVC, 1-inch pipe ~ 300m	
5.49	**Laying of pipelines between bore wells and overhead tank** (1) CPVC pipes (2-inch) shall be laid underground (at depth of ~500 mm) from the two bore wells to overhead tank of control room. (2) All necessary CPVC fittings such as T-joints, bends, nipples, reducers, couplers etc shall be used as applicable. (3) Lines from the two bore wells shall have independent 2-inch non-returnable valves (forged steel) and 2-inch ball valve (forged steel). Further, the lines shall be interconnected to become a single line that shall be laid underground up to overhead tank. (4) Approximate length of CPVC line ~ 260 m (5) Vendor shall submit a detailed water pipeline layout scheme with BoM etc from bore wells to OH tank for BHEL approval.	
5.50	**SPV module cleaning system** (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. (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. (3) Starter and DP switch (1 set) shall be supplied and installed near ACDB panel for operating the 2HP pump. (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 ~ 30 m. (5) CPVC pipelines shall be laid underground (at a depth of ~500 mm below ground level). (6) There shall be 40 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. This riser lines should be having solid PCC foundation work all around to ensure strong base. Ball valve forged steel type, 1-inch, with suitable nipple for connecting the hose pipe, shall be provided at each delivery point. (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. (8) Hosepipes (ribbed, flexible, high pressure) of 50 m long – 3 sets shall be provided for connecting the hose to the nearest 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. (9) Approximate length for 2-inch header line ~ 900 m (10) Approximate length for 1-inch header line ~ 800 m (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.	
5.51	**Identification markings using paint and cable tags, as applicable to the individual cases and as approved by BHEL, shall be provided:** (1) String monitoring junction boxes: Identification marking by way of painting on nearby module structure. (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. (3) Cable sizes with arrow marks in switchyard (for HT cables) using painting. (4) Identification markings for all the earth chambers (using painting) with inscriptions as approved by BHEL. (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, LT panels, Batteries, FCBC chargers, Annunciation panels, ACDB panel etc.	
5.52	**Cable markers** (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: a) For 240 sq-mm cable from string monitoring boxes to control room: Quantity of markers = 75 Nos b) For data communication cables from string monitoring boxes to control room: Quantity of markers = 75 Nos c) For cables of yard lights of solar array field, compound wall/chain-link fencing and switchyard fencing: Qty of markers = 60 Nos d) For electrical cables of bore well connections: Qty of markers = 10 Nos e) For HT (11kV) cables within switchyard: Quantity of markers = 10Nos f) For aux transformer to ACDB panel Quantity of markers = 2 Nos g) For CPVC water pipelines, Quantity = 50 Nos (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. (3) Cable markers shall have a minimum height of 300 mm above the ground level. (4) Cable markers shall be suitably painted.	
5.53	**Hoarding for the solar power plant.** (1) Hoarding for the plant shall be made of 1500x1800x3 mm thick MS plate. Approximate dimension of board 1500x1800 mm. (2) Board shall be given a red oxide coat and painted with black colour for background. Letters shall be written with white colour. (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. (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. (5) Bottom level of board shall be at a height of 1.5m above the ground level. (6) Vendor shall submit the drawing of hoarding arrangement to BHEL for approval.	

5.54 Display boards and sign boards

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
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, LT panels, 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, SCADA room, store room, security room, gents / ladies toilets etc. BHEL will provide the list.	10 Nos

(a) 5mm thick sun board with LG make vinyl sticker (computerized cutting and pasting) shall be used for Sl Nos 4, 5, 8 and 9.

(b) For others, flex banner with design & printing shall be used.

5.55 Electrical insulation mat

(1) Vendor shall supply 12 Nos of electrical insulating mat as follows:

- (a) Make: Vardhman House Private Ltd or reputed equivalent as shall be approved by BHEL.
- (b) As per IS: 15652:2006
- (c) Class B
- (d) Thickness 2.5 mm minimum
- (e) Size = 2m x 1m minimum
- (f) Colour: to be confirmed by BHEL
- (g) Max use voltage = 11kV
- (h) Marking of IS standard on the mat

(2) Test certificate shall be provided by vendor

	(3) Vendor shall lay the mats in front of electrical panels (PCUs, SCADA, ACDB, and FCBC) in control room and outdoor HT (VCB) panels.	
5.56	**Checkered plate for closing the cable trenches (a) behind the panels such as PCUs, ACDB panels etc in control room and also (b) other open areas of cable trench** (1) Plate shall have a suitable handle (welded to the plate) to facilitate ease of lifting and movements. (2) Plate thickness = 6mm (3) Width = 1000 mm, total length required: ~30m 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.	
5.57	**Air conditioner** 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.	
5.58	**Tool kits and instruments** Vendor shall supply the following tool kits and instruments: **A. Measuring instruments**	

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

Note: Make / model number etc shall be approved by BHEL prior to procurement.

B. Tool kits

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,	1 Set

	mechanical gear power, hand operated		
4	Crimping tool up to 6 sq-mm cable	1 set	
5	Drilling machine AC, hand operated, with bit size up to 20 mm of reputed make	1 set	
6	Measuring Tape, 5m	1 Nos	
7	Measuring Tape, 50 m	1 Nos	
8	Allen Key set	2 Set	
9	Adjustable spanner 2-inch size	2 No	
10	Hammer	1 Nos	
11	Rough file kit	1 Set	
12	Platform balance, 50Kg range, 100g accuracy	1 No	
13	Cutting Pliers	2 Nos	
14	Nose Pliers	2 Nos	
15	Vacuum cleaner, of industrial type, for control room sweeping / cleaning.	1 No	
16	Personal Desktop Computer of the latest configuration along with a UPS and a laser printer	1 No.,	

Note: Prior to procurement, vendor shall obtain approval from BHEL for the make and specification of the items.

5.59 **Office furniture**

1	Executive table, wooden type, complete with draws and side racks	1 sets
2	Chairs, swivel type, with arm rest	10 Nos
4	PC table with chairs	1 set
5	Storage almirahs	1 Nos
6	Filing cabinets	1 Nos

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.

5.60 **Fire alarm system for control room**

(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.

(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.

(3) Smoke detectors shall be of conventional / optical / photoelectric type. It shall not be of ionization type that employs radioactive materials.

(4) Electrical hooters shall sound the alarm upon detection of smoke by the detectors.

(5) Manual call point shall be with high-gloss finish, alarm LED provision, breakable glass unit, hammer and chain.

(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.

(7) Spares: Smoke detectors – 2 Nos, Manual call point – 2 Nos, Hooter – 2 No.,

(8) Locations of sensors shall include cable trenches of control room as well.

(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.

5.61 Other safety related items

(1) Safety gadgets

1	Gas Mask	2 Nos
2	First Aid Box with essential medicines and bandage cotton, antibiotic cream, Dettol, etc.	2 sets
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
7	Rain Coat	2 Nos

(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.

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
2	Carbon di-oxide (CO_2) 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.	4 sets

5.62 **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:**

(A) Vendor shall carry out following minimum pre-commissioning checks:

(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.

(2) Verification of earthing for all these electrical equipment.

(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. (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. (5) Insulation resistance measurements (megger tests) for all the electrical equipment of control room and switchyard. (6) Functional checks for LT panels (Air circuit breakers): ACB on/off operations, spring charging, LED indications, etc. (7) Functional checks for PCUs: Vendor shall support the PCU engineer during the pre-commissioning tests. (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. (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. (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. (11) Functional checks on SCADA software: mimic diagrams, trend graphs, remote accessibility etc. (12) Earth resistance measurements at the electrode chambers for solar array, control room panels and switchyard equipment. (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 & 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 (c) Auxiliary transformers: IR tests, ratio tests. (d) Relays in HT panels: open/close, tripping, and 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. (2) Appropriate testing agency shall be arranged for the tests. (3) Vendor shall coordinate / liaison with concerned STATE ELECTRICITY SUPPLY & TRANSMISSION BOARDS/MRT departments to fix up test schedules and witness by their representatives. (4) Vendor shall prepare and submit the reports to MRT departments and obtain their approval through necessary liaison activities. (C) Vendor shall coordinate and liaison with STATE ELECTRICITY SUPPLY & TRANSMISSION BOARDS/CEIG etc., prepare and submit the applications with necessary enclosures on behalf of BHEL and obtain their approval: (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 (D) Vendor shall take approval of BHEL for appointing Electrical consultant for the entire SPV plant and switch yard to comply with CEIG norms and getting approvals. (E) 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. **Note:** Scope of coordinating with state departments such as STATE ELECTRICITY SUPPLY & 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.	
5.63	**Supply and installation of FCBC, Battery bank & DCDB** Two sets of FCBC and two sets of battery bank, along with DCDB is to be supplied by the vendor and is to be installed in the control room. For technical specification and installation instructions refer Annexure 1	
5.64	**Supply and installation of ACDB Panel** The ACDB panel is to be supplied by the vendor and is to be installed in the control room. For technical specification of ACDB Panel and installation instructions; refer Annexure 2	
5.65	**PCU Ducting** The supply and installation of 5 sets of Air Ducts for 5 PCUs installed in the control room is in the scope of vendor. For technical requirements of PCU air duct arrangement; refer Annexure 3	

6.0 Vendor scope of supply

Items that are within the vendor scope of supply have already been indicated in various clauses of section 5.0 above. However, for the sake of quick reference and convenience for the vendor, the list of supply items extracted from section 5.0 is consolidated in the table below. In case of any discrepancies, clause 5.0 shall only be considered.

Only a brief description of the item is provided here. Detailed specifications are provided only under section 5.0. Hence, the respective clause number, where the specification is provided, is also indicated in the following table.

In certain cases, approximate quantities are only mentioned. This is for the purpose of providing guidance to vendors. Such quantities shall, therefore, be considered only indicative. Vendor shall, however, take into account the exact quantities that shall be required to meet the functional requirements of I&C activities as per clause 5.0.

Sl.No.	Item description	Total QTY Required	Units
1	**Supply of MC4 connectors, cable ties, cable ducts, HDPE conduits, cable lugs, hardware, cable trays etc as per clauses 5.05 to 5.16**		
	MC4 connectors (Male + Female) at PV array	600	sets
	MC4 connectors (Male only) at SMB	1100	sets
	Tool kits for MC4 connectors	4	sets
	Cable Ties	1	lot
	HDPE DWC pipe 2" ID for underground laying of 6 sq-mm cables between the rows	1500	m
	Metal Cable glands for 1CX240 sq mm Al.cable at PCU.	70	Nos.,
	Bimetallic lug Cable lugs, hardware for 1Cx240 sq-mm AL.AR.cables (SMB=70 + pcu=70+ spares=10)	150	Nos.,
	Cable trays in control room: perforated GI, hot dip galvanized, 3 mm thick, 40 mm depth, 750 mm width. 30 mtr X 3 levels with necessary corner bends	90	mtr
	Cable support structure for 1Cx240 sq-mm AL.ARM. Cables; Cable ladders for 1Cx 300 sq-mm AL.ARM cables at PCUs and LT panels and h/w for grouting control room panels	1	lot
	Cable lugs, hardware for 1Cx 3Rx300 sq-mm cables connection on PCU AC side & LV side of transformers	100	sets
	Cable lugs and hardware at both ends of 1C x 25 sq-mm;Metal Cable glands for 1CX300 sq mm Al.cable at PCU, LT panel & transformer(90 sets); Hardware requirements for foundation positioning/anchoring of transformers(3 sets)	1	lot
	CPVC pipe, 1-inch, for 1Cx 25 sq-mm cable earthing	30	mtrs
	CPVC joints, bends, elbows for 1Cx 25 sq-mm cable; Expansion bolts, hardware for insulation bush supports(25 Sets)	1	lot
	Cable glands, cable lugs, hardware etc for LV side of Aux transformer	1	set
	Cable glands, cable lugs, hardware etc for ACDB panel.	1	set
2	**Supply of items of module cleaning system such as submersible pumps (for bore wells), booster pumps, CPVC pipes with fittings, ball valves, nipples etc as per clauses 5.49 and 5.50.**		
	Submersible pump 3-phase, 3HP for bore wells-2 Nos; Valves such as ball valves, non-returnable valves etc for bore wells to OH tank-2 Nos., in each circuit	2	set

	CPVC pipe, 2-inch, for module cleaning system (from bore well to control room and for main header line around the array)	900	m
	CPVC pipe, 1 inch, for module cleaning system (for providing raisers from the main head line)	800	m
	CPVC fittings T-joints, bends, reducers etc for 1" CPVC pipes	1	lot
	CPVC fittings T-joints, bends, nipples, reducers, couplers etc for bore wells to OH tank	1	lot
	Centrifugal booster pump, 3 phase, 2HP with starter, DP switch, cables, hardware etc (For pumping water from Over head tank to array)	1	set
	Gate valves, forged steel type, 2-inch for the main header line;Ball valves, forged steel type, 1-inch with nipples Hose pipes ribbed, flexible (50 m)-3 Nos.,	1	lot
3	**Supply of 11kV termination kits Auxiliary power cables, Data communication cables, etc as per clauses 5.21 to 5.46**		
	Termination kits, 12kV indoor type with cable lugs, hardware (for 3Cx 185 sq-mm cable) for TFMR & HT panel Incomer + outgoer.	9	sets
	Termination kits, 12kV outdoor type with lugs, hardware (for 3Cx 185 sq-mm cable) at GOS	4	sets
	Cable, 5Cx 4 sq-mm, Cu, armoured, PVC, from ACDB to 3 hp Submersible pump	400	m
	Cable, 5Cx 2.5 sq-mm for 3Phase, 2 hp centrifugal pumps	30	m
	Cable 1 pair x 2.5 sq-mm, copper, PVC with flexible corrugated electrical conduit for CT, PT connection to metering panel with necessary length.	1	set
	Cable 3.5Cx 95 sq-mm , AL, ARM. PVC insulation, PVC sheath, 1.1 kv	40	m
	Data cable 2 pair x 0.5 sq-mm from SMB to SCADA	1900	m
	Data cable 2 pair x 0.5 sq-mm (PCUs to SCADA;LT Panel to SCADA & Trx to SCADA)	450	m
	Data cable 1 pair x 0.5 sq-mm (LT Panel to SCADA)	150	m
	Data cable 12C x 0.5 sq-mm (Trx to HT panels)	100	m
	Data cable 5 pair x 0.5 sq-mm (HT panels to SCADA)	400	m
	Data cable 1 pair x 0.5 sq-mm (HT Panel to SCADA)	150	m
	Data cable 2 pair x 0.5 sq-mm from HT Panel to SCADA	150	m
	Data cable 2 pair x 0.5 sq-mm from Bus PT to SCADA	50	m
	Control Cable from HT Panel to RAP 2Cx2.5 sq.mm	200	m

	Data cable 10 pair x 0.5 sq-mm (HT panel to RAP)	450	m
	Data cable 5 pair x 0.5 sq-mm (FCBC&UPS to SCADA)	50	m
	Data Cable 2 Pairx0.5 sq.mm(Fire alarm to SCADA)	50	m
	Cable 2Cx 2.5 sq-mm, CU, armrd, PVC, 1.1 kv for DC & AC supply to TFMR, HT panels & RAP	200	m
	Cable 1Cx 25 sq-mm, CU, PVC, 1.1 kv, Green, un-armrd, for body earthing of Equipments to CU strip & CU strip to earthing	100	m
4	**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 of switchyard fencing (fence, gate, angles etc.), items for connecting to grid lines, with all related miscellaneous accessories and hardware as per clauses 5.23–5.33**		
	Auxiliary transformer 100 kVA, 11kV/415V ONAN	1	No.,
	ACSR conductor DOG type, 7/4.72	50	m
	RSJ-I beams (Rolled steel joist beams) Supporting BOQ items of four pole structure such as disc insulators, cross-arms / base channels, connectors, HV drop out fuses in each phase at auxiliary transformer, CPVC pipe, hardware etc.	8	Nos
	GOS switches 400A, 11kV without earth switch	4	Set
	GOS air break switches 400A, 11kV with earth switch	1	set
	Lightning arrestors for switchyard 9kV, 10kA class-3	7	Nos
	Outdoor CTs / PTs (3 each) with two metering cores: Either 1 combined set or individual 1-phase CTs / PTs Metering panel with ER300P 1 no., Main meter and 1 no., Check meter including license with MRI instrument, optical probes	1	set
	GI fence for switchyard; Steel angles, strips, hardware etc. for switchyard fencing	60	m
	MS gate 5m wide x 3m tall for switchyard Stone jelly 20mm/40mm for switchyard: Approx. area 300 sq-m x 100 mm layer thickness	1	No.,
5	**Supply of items of earthing system for solar array field, control room panels and switchyard equipment including Earthing electrodes, GI flats, copper strips all related miscellaneous hardware etc as per** clauses 5.39 to 5.41.		

	GI strip 25x6 for structure earthing at solar array-inter structure	2000	m
	GI strip 50x6 for structure earthing at solar array-b/w array earth pits	800	m
	3 m length and min 50 mm dia Zn coated electrode with chemicals and earth chamber materials for solar array structures	60	set
	50x 4 copper strips for control room panel earthing	30	m
	3 m length and min 50 mm dia Zn coated electrode with chemicals and earth chamber materials for control room equipment	10	sets
	GI strip 50x6 mm for switchyard equipment earthing	150	mtrs
	3 m length and min 50 mm dia Zn coated electrode with chemicals and earth chamber materials for control room equipment	20	set
6	**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 5.42 and 5.43**		
	Lightning arrestors (ESE)(Protection radius of 100 m and above required) with counter, Masts for Lightning arrestors (ESE) with hardware and Stay wire sets for LA (ESE): three wire sets per LA	5	set
	Earthing electrode with chemicals and earth chamber materials for lightning arrestors (ESE)	10	set
	Lightning rod with earthing set for control room	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 5.44 to 5.48.**		
	Yard lights with fittings for **compound wall and switch yard** with 25NB bend pipes, junction boxes, 1-inch CPVC pipe, glands, sockets, cable lugs, hardware etc	75	set
	Cable 2Cx 2.5 sq-mm, CU, ARMD, PVC for yard light system(ACDB to JB at pole)	2300	mtrs
	Cable 2Cx 1.5 sq-mm, CU, Un-Armd, PVC for yard light system, from pole JB to Lamp	150	mtrs
	CPVC pipe, 1-inch size, for yard light system (JB to Light)	150	mtrs
	CPVC pipe, 1 inch size, for yard light system (from ground to Pole JB)	110	mtrs
		0	

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 **5.51 to 5.59.**		
	Cable tags, aluminium plate for all SMBs, electrical panels	1	set
	Danger boards for SMBs, electrical panels, transformers	1	set
	Cable markers for cable trenches of 240 sq-mm in solar array on every 10 Mtrs interval (80 Nos), data cable in solar array (25 Nos), bore well cable (4 Nos), 11kV cable (10 Nos), yard lights cable (100 Nos), Aux transformer LV cable (2 Nos),CPVC water pipeline (50 Nos).	1	set
	Hoarding plate at the plant entrance with mounting items	1	set
	Display boards	1	set
	Electrical insulation mat 2m x 1m x 2.5 mm thick	12	Nos
	Checkered plate 6 mm thick,1000 mm max width inside CR	30	mtrs
	Air conditioner, split type, 1.0 T	1	No
	Tool kits and instruments	1	set
	Office furniture	1	set
9	**Supply of safety related items including fire alarm system, fire extinguishers, safety gadgets etc as per clauses** 5.60 and 5.61.		
	Fire alarm system with spares	1	set
	Safety gadgets and Fire extinguishers	1	set
10	Battery bank 110 V/100 Ah	2	Set
11	Battery Charger (FCBC) 110 V / 25 A with DCDB	2	No
12	ACDB	1	No
13	Ducting of PCUs 5 Nos	1	set
14	11 kV, 3Cx185 sq.mm cables for HT connection from Transformer Secondary to the four pole structure	170	m
15	**I&C: Temporary site office, storage yard, bore wells, unloading/movement of consignments, arranging electrical power/water etc as per clauses 5.01 to 5.05**		
	Setting up of Temporary site Office	1	AU
	Electrical power for construction	1	AU

	Water for construction	1	AU
	Construction of Temporary Yard for safe storage of all BHEL & vendor supplied items	1	AU
	Receipt, Unloading, Safe storage & movement of BHEL and vendor supplied items	1	AU
	Construction of Bore well including Hydro survey, water analysis, Electrical cabling & plumbing works	1	AU
16	**I&C: Array Cabling and installation of control room panels, terminating at control room panels**		
	Inter connection of SPV modules to form strings	1	AU
	Installation of SMBs	1	AU
	Inter connection of SPV module cable to 6 sq mm cable & routing of 6 sq mm cable up to SMBs & including underground laying between the rows wherever reqd.	1	AU
	Termination of 240 sq mm cable (+ve & -ve) at SMB and laying cable upto CR .	1	set
	Trench formation for 240 sq mm cable laying from SMB to PCU at CR	1	set
	Installation of PCU, RAP, SCADA panel, Control desk, Battery Bank, FCBC, ACDB, WMS, Pyranometer.	1	set
	Installation of Cable trays in cable trench at CR	1	set
	Power cable termination at DC & AC side of PCU, Transformer LT side by laying cable on trays & routing them neatly by using cable ties.	1	set
17	**I&C of Transformers & HT Panels**		
	Foundation pedestals & outdoor installation of transformer as per the SPEC	1	set
	Firewall between Transformers	1	AU
	Foundation pedestals with slanted roof & outdoor installation of HT panels supplied by BHEL as per SPEC	1	AU
	Cable trench formation & laying of power cables & Termination in HT yard as per BHEL SPEC	1	AU
	Power and Data cables laying in cable tray at HT yard , neatly routing & Termination at HT panels & Transformers.	1	AU
18	**I&C of Switch yard:**		

	Installation of RSJ poles as per SPEC	8	AU
	Installation of GOS as per SPEC	1	AU
	Installation of LA on four pole structure	1	AU
	Installation of ACSR conductors at four pole structures , Termination to main 11 KV Grid	1	AU
	Erection of switch yard fencing with gate as per SPEC	1	AU
	Switch yard levelling, Jelly spreading & WBM road formation as per spec	1	AU
19	**I&C of Earthing Sytem:**		
	Earthing of PV array structures	1	AU
	Earthing of all Electrical equipments of CR(PCU, Battery bank, FCBC, SCDA, RAP,ACDB etc)	1	AU
	Earthing of switch yard equipments (Transformer, HT panel, four pole structure, metering panel, HT yard fence ctc)	1	AU
	Earthing of LA's (ESE type at PV array & Cu Globe at CR)	1	AU
20	**I&C of Yard Lighting System:**		
	Installation of lights at solar plant periphery,PV array & Switch yard	1	AU
	Cable trench formation and cable laying for all lightings at switch yard, PV array & Compound wall	1	AU
21	**I&C of Water Cleaning System:**		
	Laying of pipe lines between Bore well to Over head tank	1	AU
	SPV module cleaning system as SPEC	1	AU
22	**I&C of Miscelleneous Works:**		
	Identification markings using paints & cable tags as per spec	1	AU
	Cable markers as per spec	1	AU
	Hoarding plate at the plant entrance with mounting items	1	AU
	Display boards & Sign boards	1	AU
	Checkered plate for closing the Trenches behind panels at CR	1	AU
	Air conditioner installation at SCADA room	1	AU

	Fire alarm system Installation	1	AU
23	**Pre commissioning Inspection**	1	AU
24	**Co-ordination with state department for necessary approvals & clearances for commissioning , synchronization & post commissioning operation of plant as per Spec**	1	AU
25	**O&M for the 1st year**	1	AU
26	**O&M for the 2nd year**	1	AU
27	**O&M for the 3rd year**	1	AU
28	**O&M for the 4th year**	1	AU
29	**O&M for the 5th year**	1	AU

7.0 Tests at manufacturer / sub-vendor works and witnessing by BHEL

7.1	BHEL shall witness routine / acceptance tests performed at 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, 11kV without earth switch 4) Gang operated switch 400A, 11kV with earth switch 5) Lightning arrestors 9kV, 10kA 6) Outdoor CTs / PTs – combined unit / individual units 7) Tri vector meter ER300P 8) Auxiliary transformer 100 kVA, 11kV/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 4 sq-mm, 1100V, Cu, PVC, armoured, PVC, FRLS 15) Cable 5Cx 2.5 sq-mm, 1100V, Cu, PVC, armoured, PVC, FRLS 16) Cable 2Cx 1.5 sq-mm, 1100V, Cu, PVC, armoured, PVC, FRLS 17) Cable 3Cx 2.5 sq-mm, 1100V, Cu, PVC, armoured, PVC, FRLS 18) Cable 1Cx 1.5 sq-mm, 1100V, Cu, PVC, armoured, PVC, FRLS 19) Cable 3Cx 185 sq-mm, 11kV, Al, XLPE, armoured, PVC, FRLS 20) Data cables 0.5 sq-mm (1 pair, 5 pair, 10 pair, 12 core), Twisted pair, PVC, shielded, armoured, PVC, FRLS and all other data cables	

	21) Chemical earthing electrodes 22) Lightning arrestor (ESE) 23) Submersible pump 3HP 24) Booster pump 2HP 25) Ball & gate valves 26) CPVC pipes 1-inch, 2-inch 27) Air conditioner 28) Fire alarm system 29) Fire extinguishers 30) Electrical insulation mat 31) 12kV 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.	

8.0 General conditions applicable during installation and commissioning phase

8.1	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.	
8.2	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).	
8.3	All machinery such as cranes, hydra, JCBs, forklifts, transport trucks, trolleys etc necessary for movement of materials shall be organized by the vendor.	
8.4	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.	
8.5	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.	
8.6	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.	
8.7	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.	
8.8	Vendor shall maintain updated labour register, with name, age, qualification, salary, attendance details etc at the site. Vendor has to satisfy all the statutory requirements as per the labour law regulations in the state	
8.9	Vendor shall use danger boards, wherever required, to ensure safety of the persons during the work at site.	
8.10	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.	
8.11	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.	
8.12	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.	
8.13	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.	
8.14	No child labour shall be employed for execution of the present contract.	
8.15	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.	

8.16	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.	
8.17	Any deviations shall be discussed with BHEL site engineers and implementation shall be taken up only after approval from BHEL.	
8.18	Vendor shall submit periodic status report, on daily as well as weekly consolidated basis, to BHEL on the progress of the contract.	
8.19	Vendor has to design all the foundations required as per this specification based on the soil report and site conditions and to be submitted to BHEL for approval before construction. However, minimum requirements are specified in this specification for ready reference. Soil report will be made available to vendor after placement of PO upon request.	
8.20	Supply and installation of all auxiliary supply cables from ACDB to various plant equipment viz., FCBC,PCU ducting exhaust fans etc., shall be in the scope of the vendor which will be intimated from time to time	
8.21	In case project is not completed as per BHEL scope due to reasons arising out of materials from BHEL end/vendor's end, contractor has to complete the job at later stage without any extra charges. No overrun charges shall be paid in case of extension of project schedules	
8.22	Vendor has to pay the plant electricity consumption charges, internet & telephone charges etc during the O&M period.	

9.0 Operations and Maintenance

9.1	Date of commencement of operations and maintenance Zero date for O&M shall be the actual date on which the complete 3 MWp is commissioned with synchronization / export of power to 11kV grid and completion of all the works in the scope of the vendor.	
9.2	Period for O&M: Vendor shall operate and maintain the power plant for a period of five years from the zero date as above.	
9.3	O&M personnel	

	1. Vendor shall deploy following minimum personnel: (a) Technical / administrative / office personnel (i) 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. (ii) 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. (iii) One unskilled persons for regular house-keeping (cleaning / mopping etc) and water cleaning of SPV modules. **Note:** At least one among the technical personnel shall essentially be a certified / licensed person for HT operations (11kV minimum). (b) Security personnel (i) Minimum five security guards with competence to handle 24x7 tough situations and safeguard the plant from miscreants. 2. Vendor shall provide separately identifiable uniforms for the respective office staff and security guards. 3. Similarly, O&M personnel shall be provided with raincoats, toolsets, earthing rods, safety gloves, safety goggles, gumboots, helmets and all other personal protective equipment (PPE) that will be relevant to ensure human safety. 4. Names, qualification, work responsibility of personnel shall be listed on a display board within control room. 5. Attendance register shall be maintained for both the teams. 6. Vendor shall ensure statutory requirements such as ESI, PF and labour license for their O&M personnel posted at site. 7. BHEL shall have right to disallow any O&M employee, if found unfit to perform. BHEL instructions issued in writing shall be binding on vendor who shall replace the person. 8. O&M personnel at site shall conform to general regulations in force at site and to any special instructions from BHEL's customer.	

	9. O&M personnel at site shall be deemed to be aware of damages and risks incidental to conditions of DNH land and works from time to time and BHEL shall not be responsible for any injury to personnel arising there from. 10. Training to O&M personnel It is the absolute responsibility of vendor to ensure imparting of necessary training to their O&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&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. 11. Availability of O&M personnel at power plant (a) Vendor shall ensure that operating staff are present in the power plant during 7:30 AM – 6:30 PM every day. (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 run under competent supervision on all days. (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. 12. O&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.	
9.4	O&M operations – daily basis (1) Water cleaning of SPV modules (2) Control room cleaning – dry sweeping, wet mopping (3) Cleaning of toilets, urinals (4) Gardening of landscaping areas: watering of plants, trimming of plants as applicable and necessary. (5) Logging of DC, AC, grid parameters (current, voltage, power, energy) at PCUs & HT panels, transformer temperatures, equipment tripping/ breakdown, grid outage etc as per BHEL formats. (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. (7) Reporting the energy generation data to BHEL. (8) Drinking water to be arranged for O&M personnel at site.	
9.5	O&M activities – weekly basis (1) Removal of garbage from solar array field, switchyard, roads, drains, pathways, sand buckets; Cutting of the grass/shrubs falling on the PV modules in the PV array; logging in registers with signatures of operating persons and in-charge. (2) Monitoring and logging of fire extinguisher levels / pressures as per BHEL formats	
9.6	O&M activities – monthly basis (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. (2) Earthing resistance measurements for solar array structures, control room equipment, switchyard equipment, lightning arrestors (ESE): measured values shall be recorded in registers and reported to BHEL as per BHEL approved recording formats. (3) Submission of values / status of plant parameters and events for the corresponding month, as below, as per BHEL approved formats: a. Daily values of solar array strings (SMB parameters) b. Daily values of weather parameters (solar energy, wind speed, ambient temperature) c. Daily energy generation d. Events (with date, time) of faults / tripping / breakdown of equipment e. Events (with date, time) of grid outage f. Events (with date, time) of equipment damages, accidents and thefts g. Activities of module cleaning (4) Monthly reports shall be submitted to BHEL for all the above data. (5) Energy generation / meter reading report to be prepared and submitted to the concerned department (STATE ELECTRICITY SUPPLY & TRANSMISSION BOARDS etc). Signatures from BHEL's customer and substation representatives shall be obtained wherever required.	

9.7	O&M activities - quarterly basis (1) Cleaning of PCUs, LT panels, HT panels, battery chargers etc. to remove accumulated dust. (2) Monitoring and status review, followed by rectification / calibration / replenishment / replacement actions as necessary and applicable for following: (a) Spare items of all electrical equipment (b) First aid box items - medicines and accessories (c) Safety gadgets (d) Tool kits and measuring instruments (e) Yard lights (f) Pumps, starters (g) Control room appliances: air conditioners, lights, fans, exhaust fans, switch boards etc (3) Pest control for control room (rats, snakes etc) – sprays, chemicals, medicines etc to be applied wherever required. (4) Submission of quarterly report on above activities to BHEL.	
9.8	O&M activities – half yearly basis (1) Cleaning of overhead tanks	
9.9	O&M activities – yearly basis (1) BDV measurements for oil samples from all the transformers and submission of report to BHEL. (2) Filtration of oil to be arranged, if required, based on BDV measurement report. (3) Lubrication of moving contacts (VCBs, GOS switches, Earth switches etc) with appropriate grease etc (4) Cleaning of sewerage lines, septic tanks (if found necessary) (5) Painting of main gate, switchyard gate / fencing, earthing chambers, other steel structures within control room and switchyard, as intimated by BHEL based on conditions of rusting etc. (6) Checking tightness of hardware in solar array structures and tightening wherever required. (7) Checking tightness of power cable terminations in SPV modules (MC4), SMBs, electrical panels of control room and switchyard	
9.10	O&M activities - as and when required (contextual basis) (1) Monitoring and operation of plant electrical equipment as and when required: (a) GOS Air break switches (with / without earth switch) (b) VCB on/off: local operations from outdoor HT panel and remote operations from indoor remote	

annunciation(SCADA) panel

(c) Settings of numerical relays in HT panels: review and revision in consultation with BHEL.

(d) ACB and MCCB on/off operations on LT side

(e) PCU operations: emergency close, LCD displays (selection of settings, monitoring the DC/AC/event/fault status parameters), operation of duct fans

(f) Battery and battery charger operations

(g) Bore well pump operations to fill the overhead tanks

(2) Coordinating, on behalf of BHEL, and obtaining renewal of statutory licenses, clearances and approvals from state departments such as State Electricity Supply & Transmission Boards/CEIG/etc.

(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.

(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.

(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.

(6) Coordinating with sub-station upon grid failures, line problems etc and implementing the needful steps to restore the plant to normal operation.

(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

(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.

(9) Accidents: immediate reporting to BHEL, coordinating with

	hospitals, logging of events (data, time) and maintaining records. (10) Procurement of all O&M consumables for fulfilling the activities detailed above will be in the scope of vendor.	

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

10.1	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.	
10.2	Vendor make, model number / part number, specification / sizes / dimensions / drawings / datasheets of all the vendor supplied items as listed in clause 6.0.	
10.3	General arrangement drawings / schemes / layouts etc with bill of materials / quantities and design calculations shall be submitted for the following: (1) Transformer foundation pedestal (2) Firewalls (3) HT panel foundation pedestal with shed (4) Trench details for HT cables & data cables of switchyard (5) Cable support structure for 1Cx300 sq-mm cables between control room and transformers (6) RSJ pole foundations (7) Four pole structure sets (1 and 2) (8) Lightning arrestor arrangement with foundation details in the PV array (9) Water pipeline layout from bore wells to OH tank with pressure calculations (10) Water pipeline layout from OH tank to solar array field for module cleaning system with pressure calculations (11) Fire alarm system scheme / layout (12) Cable support structures and cable ladders within control room	
10.4	Quality assurance plans for items listed under clause 7.0	
10.5	Detailed activity-time chart for project implementation.	
10.6	Detailed manpower deployment schedule.	

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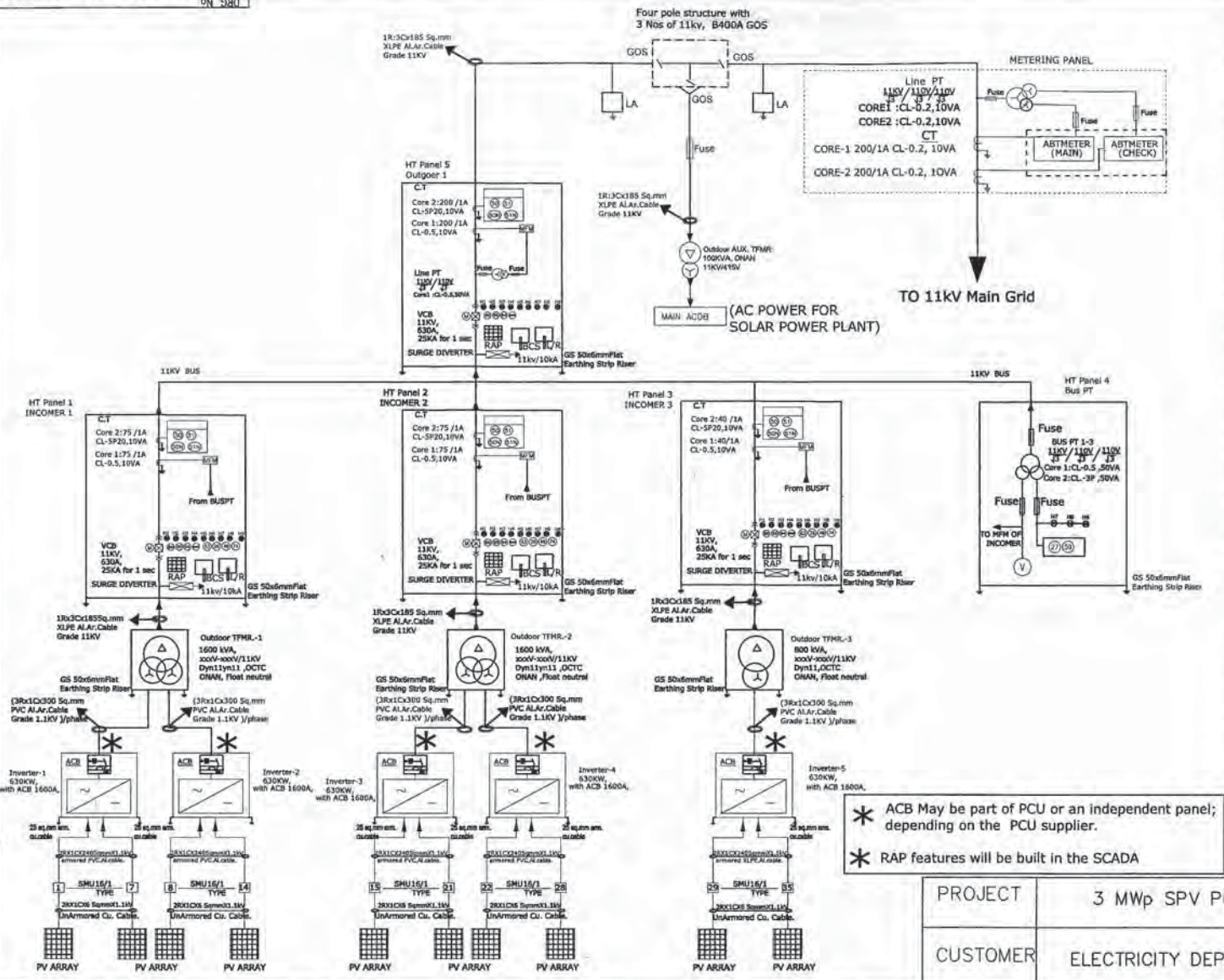


LEGEND DETAILS		
Sl.No.	SYMBOL	DESCRIPTION
1.		INVERTER(PCU)630kVA
2.		Air Circuit Breaker 1600 A, TP,EDO
3.		Three winding 1600KVA, xxxV/11kV TFMR.
4.		Outdoor H.T Panel
5.		Bus P.T Panel
6.	AC	Alternative current
7.		Remote annunciation panel (RAP)
8.	DC	Direct Current
9.	27	Under Voltage Relay
10.	59	Over Voltage Relay
11.	50	Inst.over current relay
12.	50N	Neutral Instantaneous Overcurrent
13.	51	Idmt over current relay
14.	51N	Idmt earth fault relay
15.	MFM	Multi function Meter
16.		Four pole structurewith 3 Nos. of GOS
17.		2CorePotentialTransformer
18.		3Core PotentialTransformer
19.		Current Transformer
20.		Fuse
21.		Vaccum Circuit Breaker
22.	68	Master trip relay
23.	95	Trip circuit supervision relay
24.	94	Anti Pumping Relay
25.	74DCC	DC circuit supervision relay
26.	ABTM	Availability based tariff (main) Meter
27.	ABTC	Availability based tariff (check) Meter
28.	H1	BREAKER IN SEVICE
29.	H2	BREAKER IN TEST
30.	H3	SPRING CHARGING
31.	H4	BREAKER ON
32.	H5	BREAKER OFF
33.	H6	BREAKER TRIP
34.	H7	PHASE-B
35.	H8	PHASE-Y
36.	H9	PHASE-R
37.	BCS	BREAKER CONTROL SWITCH
38.	L/R	LOCAL/REMOTE SELECTOR SWITCH
39.		Aux. Transformer
40.	63	Buchholz Relay
41.	26	Magnatic Oil Level Gauge
42.	49	Winding temp. Indicator and Oiltemp. Indicator
43	74	Pressure Relief Device
44	OCTC	Off circuit tap changer
45	ONAN	Oil natural Air natural

* ACB May be part of PCU or an independent panel; depending on the PCU supplier.

* RAP features will be built in the SCADA

REV.	01	ALTERED	SCH	REV.	DATE
		CHECKED	GLNM		
		APPROVED	BNR		

01 . CTs at metering panel changed to 200/1A & PTs of 10 VA.
02. LAs of Two sets considered.
03. Surge diverter at HT panels of 10kA considerd.
04. Voltage for MFM of INCOMER panels is from BUSPT considerd.

	NAME	SIGN	DATE
DRAWN	SCH		18.8.14
CHECKED	GLNM		18.8.14
APPROVED	BNR		18/8/14

DEPT.	CODE
SC&PV	439

PROJECT	3 MWp SPV POWER PLANT,DADAR & NAGAR HAVELI
CUSTOMER	ELECTRICITY DEPARTMENT–DADAR & NAGAR HAVELI

BHARAT HEAVY ELECTRICALS LIMITED.
ELECTRONICS DIVISION, BANGALORE

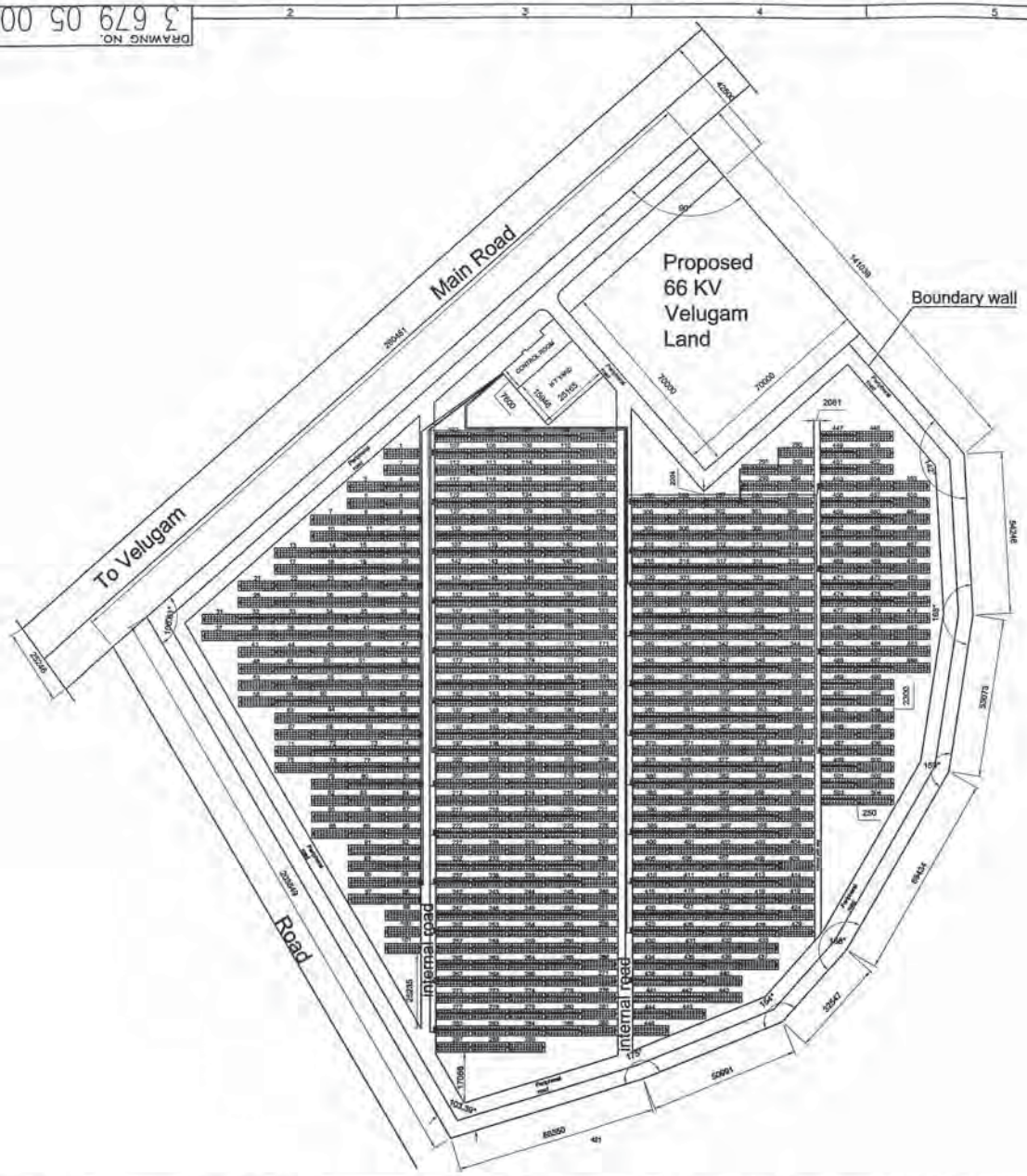
TITLE: SINGLE LINE DIAGRAM FOR 3 MWp SOLAR PHOTO VOLTAIC PLANT

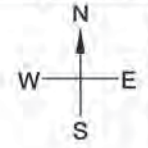
No. OF SHEETS	01
SHEET No.	01

DRG.NO. | BHEL DRG. No. 3-679-05-00708 | REV 01

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

DRAWING NO. 3 679 05 00711



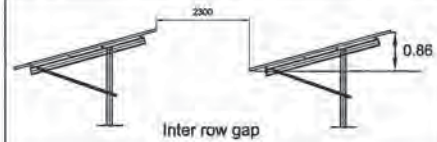


ARRAY DETAILS

PV ARRAY CAPACITY	3 MWp
Total no.of PV Modules (250Wp)	12096 nos
PV Modules in series string	24 nos
Total No. of strings	504 nos
Series strings/630kW	101/100
No. of Inverters (630kW)	5 nos
String Monitoring Units (SMU)	35 nos

LEGEND

3.22 / X	2x12-250W STRUCTURE-504 nos
SMU	STRING MONITORING UNIT
CR 25x8 m	CONTROL ROOM
H T YARD 25x16 m	H T YARD



Note:

Peripheral Road - 5 meter wide

Internal Road - 5 meter wide

Internal Path way - 2 meter wide

REV.	DATE	ALTERED / CHECKED / APPROVED

TYPE OF PRODUCT OR NAME OF CUSTOMER/PROJECT: 3 MW SPV POWER PLANT FOR DADAR & NAGAR HAVELI

BHARAT HEAVY ELECTRICALS LIMITED
ELECTRONICS DIVISION, BANGALORE

	NAME	SIGN.	DATE
DRN	SCH		Aug'14
CKD	ASN		Aug'14
APPD	GLNM		Aug'14

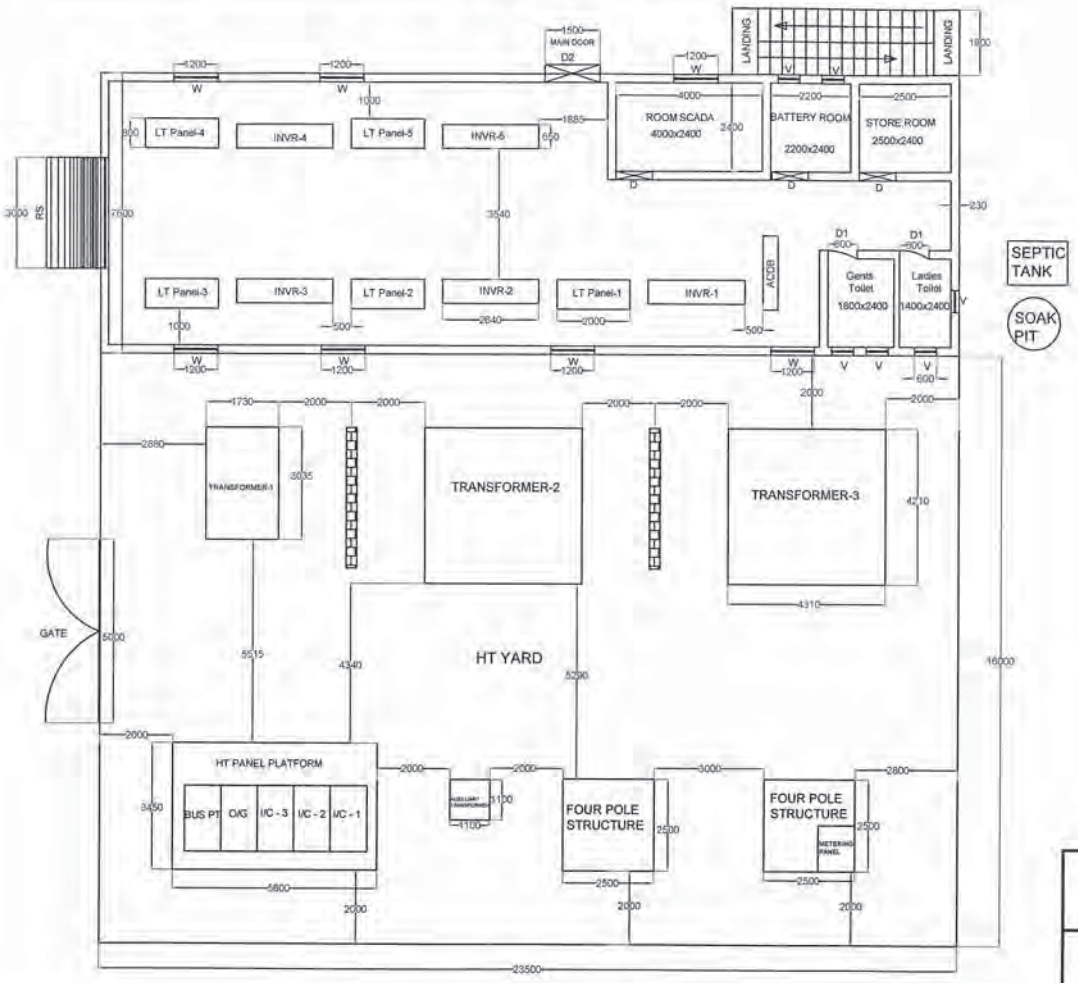
DEPT. SCPV | CODE 439 | FOR UNSPECIFIED TOLERANCES REFER ED 0230499 | SCALE SLR | WEIGHT(Kg) 1 : 1 | REF. TO ASSY. DRG. | ITEM NO. | No.OF ITEM

TITLE: 3 MW ARRAY LAYOUT

DRAWING NO. 3 679 05 00711 | REV. 00

SHEET NO. 01 | NO. OF SHEETS 01

DRG. No. 3-679-05-00710



TENATIVE DIMENSIONS
AREA OF THE BUILDING = 179 Sq mm
1) Inverter (630 KVA) = 2640(L) x 650 (B) x 2130 (H)
2) HT Panel & Bus PT = 3450(W) x 5600(L) x 5000 (H)
3) Transformer 1= 1730(L) x 3035 (B) x 2200 (H)
Transformer 2 & 3 = 4310(L) x4210 (B) x 3300 (H)
4) 4 POLE Structure = 2500(W) x 2500 (L)
5) Incommer / Outgoer / Bus PT = 1000(W) x 2000 (L)
6) LT Panel = 2000(L) x 800 (W)
7) ACDB = 2000 (L) x 800 (W)
8) AUXILLARY TRANSFORMER = 1100 (L) x 1100 (W) x 1500 (H)
9) Speptic Tank Dimension = 3000(L) x 1500 (B)
10) Soak Pit Dia = 2500 mm
11) Window (W) = 1200 x 1200 mm
12) Door (D) = 1000 x 2100 mm
13) Door (D1) = 800 x 2100 mm
14) Door (D2) = 1500 x 2100 mm
15) Ventilator (V) = 600 x 650 mm
16) Watch Tower 1 No On Control Room Roof Top
Note : CONTROL ROOM DIMENSION MAY VARY DEPENDS UPON INVERTER SUPPLIER.

PROJECT	3 MW SOLAR PHOTO VOLTAIC POWER PLANT - DADAR & NAGAR HAVELI
CUSTOMER	ELECTRICITY DEPARTMENT DADRA & NAGAR HAVELI
CONTRACTOR	

REV.	DATE	ALTERED / CHECKED / APPROVED	REV.	DATE

	NAME	SIGN	DATE
DRAWN	SCH		Aug'14
CHECKED	RK		Aug'14
APPROVED	GLNM		Aug'14

BHARAT HEAVY ELECTRICALS LIMITED.
ELECTRONICS DIVISION, BANGALORE

DEPT. SC&PV | CODE 439

TITLE: CONTROL ROOM & HT YARD LAYOUT

No. OF SHEETS 01 | SHEET No. 01

DRG.NO. | BHEL DRG. No. 3-679-05-00710 | REV 00

REF. DRG. No.

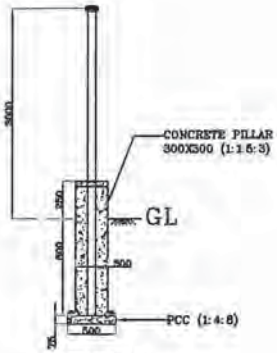
SIGN. & DATE

INVENTORY No.

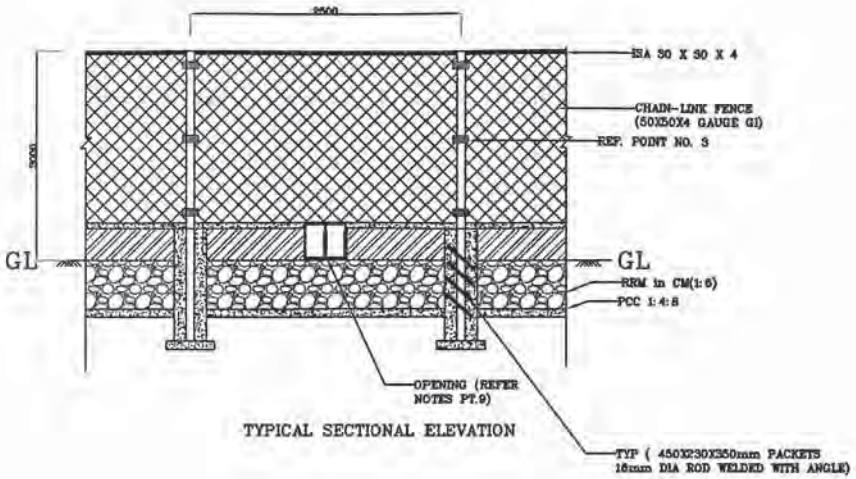
FIRST ANGLE PROJECTION

(ALL DIMENSIONS ARE IN mm)

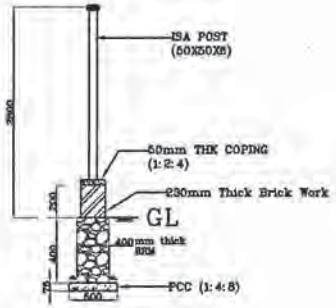
DRG. NO. 3-679-05-00748



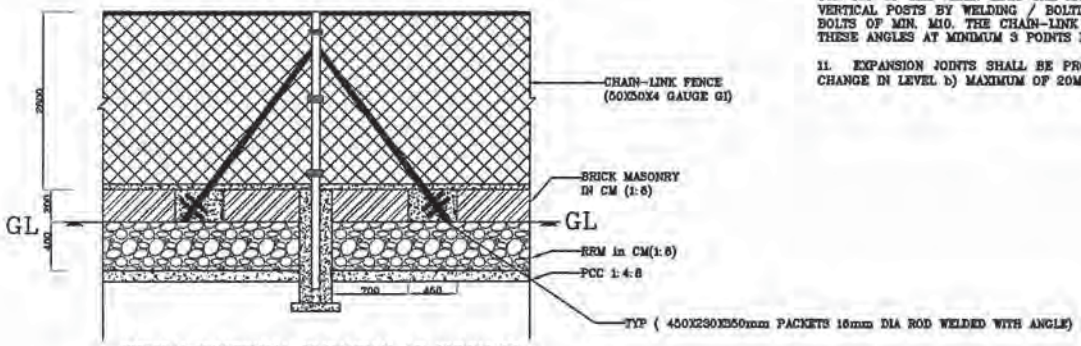
SECTION AT PILLAR



TYPICAL SECTIONAL ELEVATION



SECTION AT TOE-WALL



TYPICAL SECTIONAL ELEVATION AT EVERY 20m

NOTES:

1. VERTICAL POSTS SHALL BE MS ANGLE POSTS AND SHALL CONFORM TO IS: 808-1989.

2. VERTICAL POSTS SHALL HAVE SUITABLE PROVISIONS BY WAY OF NOTCHES OR HOLES TO FIX BARBED WIRES.

3. CHAIN-LINK MESH SHALL BE SECURED TO VERTICAL POSTS BY EMPLOYING MS FLAT STRIPS (30mm WIDE, 4mm THICK AND 100mm LONG) AT TOP, BOTTOM AND CENTER USING MS ZINC PLATED HARDWARE.

4. VERTICAL POSTS SHALL BE GIVEN A SECONDARY COAT OF SYNTHETIC ENAMEL PAINT OVER A PRIMER COAT OF RED-OXIDE.

5. BRICKWORK SHALL BE COMMON BURNT CLAY BRICKS CLASS DESIGNATION 7.5 IN CEMENT MORTAR 1:6.

6. MASONRY ABOVE GROUND LEVEL SHALL BE PLASTERED IN 12mm THICK CEMENT MORTAR 1:6 OVERLAID BY 2 COATS OF WATER PROOFING CEMENT PAINT OF REQUIRED SHADE.

7. ISA 40 X 40 X 6 mm THICK LONG STRUTS (1900 mm LONG) SHALL BE PROVIDED AT EVERY 20 METER INTERVAL. STRUT SHALL BE AFFIXED TO VERTICAL POST AT ONE END & OTHER END SHOULD BE EMBED IN C.C - 1:1.5:3 GRADE (450 X 230 X 350 mm)

8. CORNER POSTS SHALL BE PROVIDED USING THE METHODOLOGY AS MENTIONED IN POINT-7.

9. OPENINGS OF SIZE 350 X 250MM WITH MS GRILLS/RODS SHALL BE PROVIDED, ABOVE GL, TO FACILITATE DRAINAGE OF WATER AWAY FROM SWITCH YARD PREMISES. REQUIRED SIZE OPENING WITH MS GRILL/RODS SHALL BE PROVIDED WHERE THE SITE DRAINS CROSSES THE FENCING. THE SIZE WILL BE AS PER THE CROSSING DRAIN SECTION.

10. ISA 30 X 30 X 4 RUNNING SUPPORT SHALL BE PROVIDED AT THE TOP OF THE CHAIN-LINK. THE ANGLES SHALL BE FIXED TO THE VERTICAL POSTS BY WELDING / BOLTING WITH HIGH TENSILE STEEL BOLTS OF MIN. M10. THE CHAIN-LINK FENCE SHALL BE AFFIXED TO THESE ANGLES AT MINIMUM 3 POINTS IN EACH SPAN OF 2.5M.

11. EXPANSION JOINTS SHALL BE PROVIDED IN WALL AT a) EVERY CHANGE IN LEVEL b) MAXIMUM OF 20M

REF. DRG. No.

SIGN. & DATE

INVENTORY No.

PROJECT: SOLAR PHOTO VOLTAIC PLANT

CUSTOMER:

REV.	DATE	ALTERED / CHECKED / APPROVED
00		

REV	NAME	SIGN	DATE
00			
DRAWN	SCH		Jul'14
CHECKED	RK		Jul'14
APPROVED	GLNM		Jul'14

DEPT. CODE

BHARAT HEAVY ELECTRICALS LIMITED.
ELECTRONICS DIVISION, BANGALORE

TITLE:

CHAIN-LINK FENCING DRAWING

No. OF SHEETS	01
SHEET No.	01

DRG. No. 3-679-05-00748

REV 00

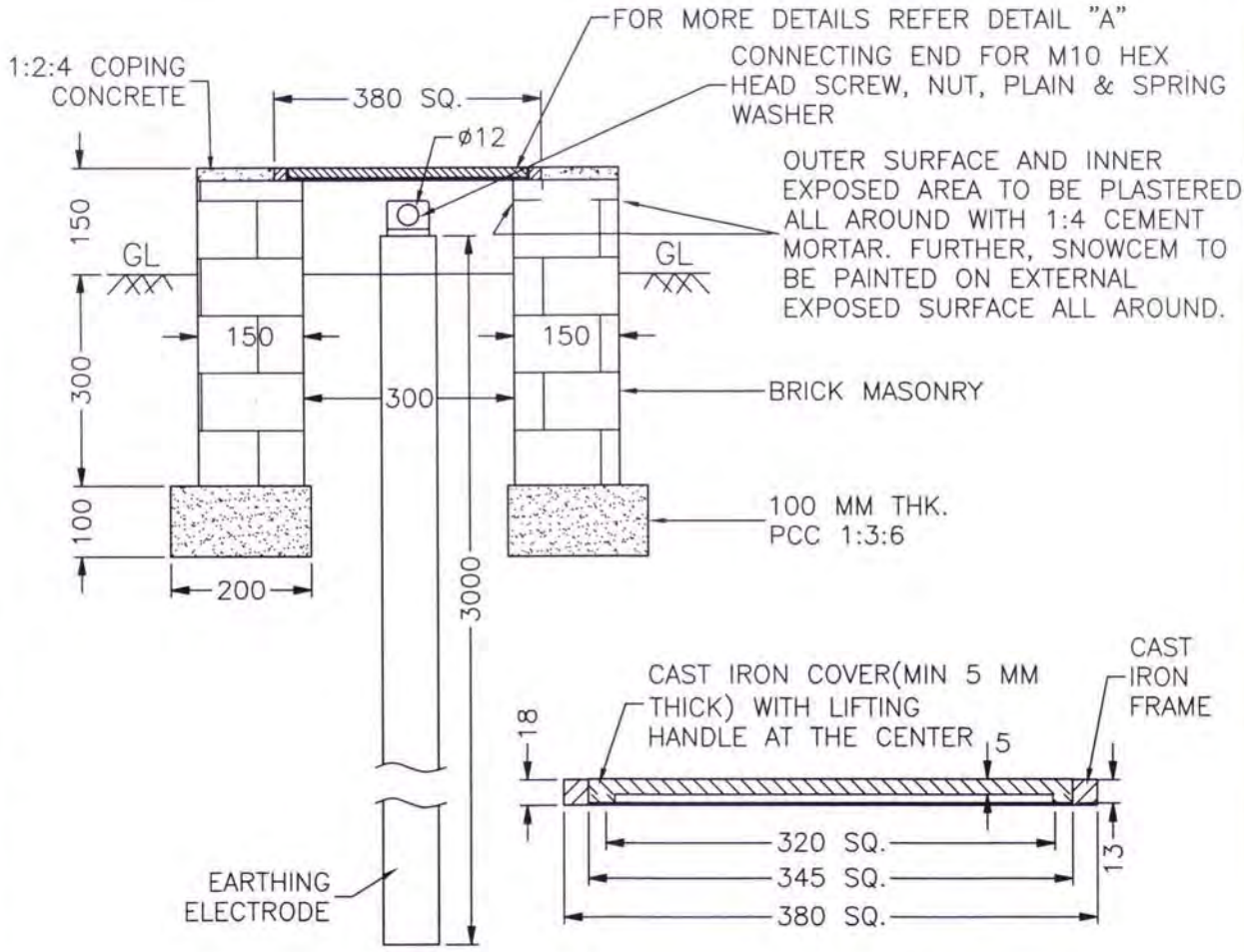
FIRST ANGLE PROJECTION

(ALL DIMENSIONS ARE IN MM)

REV.	DATE	ALTERED / CHECKED / APPROVED

REV.	DATE	ALTERED / CHECKED / APPROVED
00	210513	First Issue

ADDITIONAL INFORMATION	
STATUS OF DRAWING	
DISTRIBUTION OF PRINTS	



DETAIL "A"

REF. DRG.NO.							
REMARKS	ITEM NO.	DESCRIPTION	STD.	MATERIAL CODE / MATERIAL SPECN.	A / C	UNIT	UNIT Wt.(Kg) / QUANTITY

SIGN & DATE

BHARAT HEAVY ELECTRICALS LIMITED,
ELECTRONICS DIVISION, BANGALORE

	NAME	SIGN.	DATE	No. OF VAR
DRN	VCP		JUL'14	
CKD	GLNM		JUL'14	
APPD	BNR		JUL'14	

INVENTORY NO.

DEPT.	SCALE	WEIGHT (Kg)	REF. TO ASSY. DRG.	ITEM NO.	No. OF ITEM
SC&PV	NTS				
CODE 439					

FOR UNSPECIFIED TOLERANCES REFER ED 0230499

TITLE: **EARTHING CHAMBER FOR CHEMICAL EARTHING**

DRAWING NO. **3-679-05-00718** REV. 00

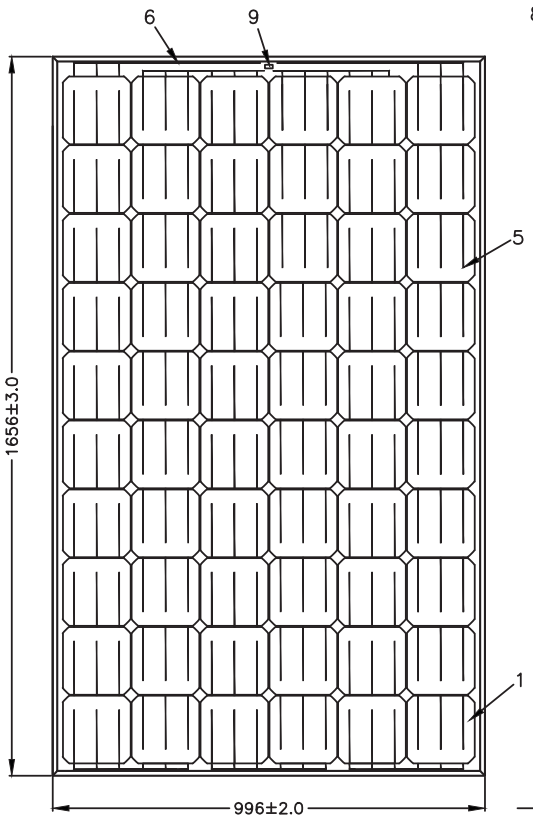
SHEET NO. 01 NO. OF SHEETS 01

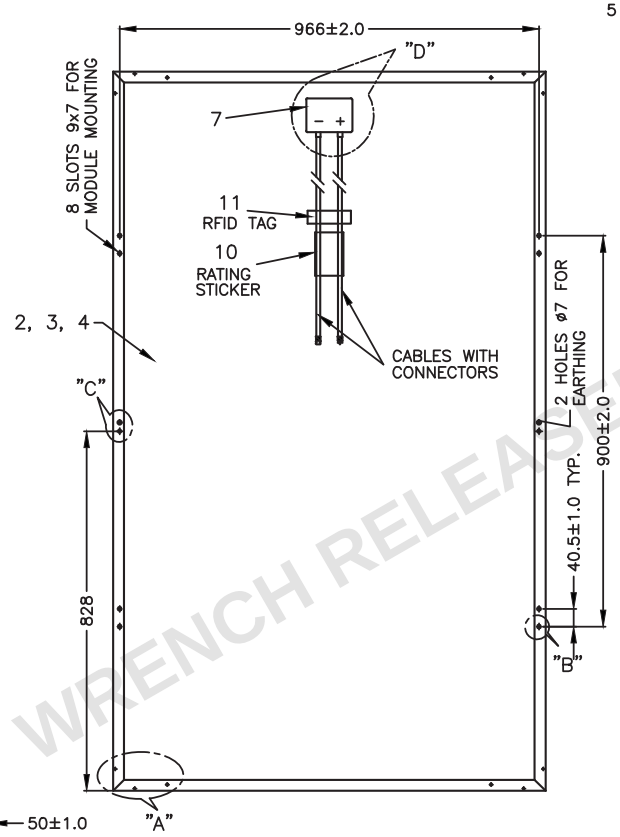
A4 SIZE

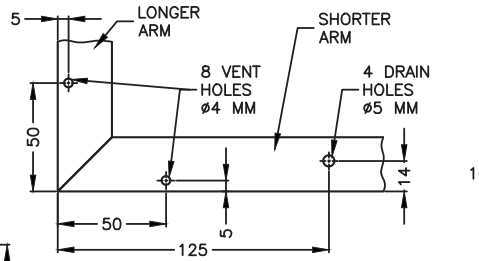
FIRST ANGLE PROJECTION

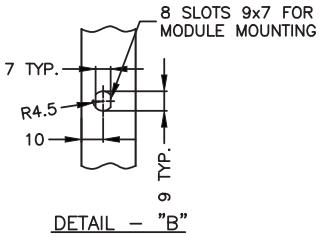
ALL DIMENSIONS ARE IN mm

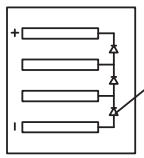
DRAWING NO. 3 679 02 00370











DETAIL "D"

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	60 Nos. OF 156 mm MONO CRYSTALLINE SILICON SOLAR CELLS CONNECTED IN SERIES

TYPE OF PRODUCT OR
NAME OF CUSTOMER/PROJECT

BHARAT HEAVY ELECTRICALS LIMITED.
ELECTRONICS DIVISION, BANGALORE

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

REV.	DATE	ALTERED / CHECKED / APPROVED
00		FIRST ISSUE

DEPT. SC&PV
CODE 439
FOR UNSPECIFIED– TOLERANCES REFER ED 0230499
SCALE 1 : 10
WEIGHT(Kg)
REF. TO ASSY. DRG.
ITEM NO.
No. OF ITEM

TITLE
PHOTOVOLTAIC MODULE–L20220
156mm Mono Solar Cell (Corner Block Type)

DRAWING NO. 3 679 02 00370
REV. 00
SHEET NO. 01
NO. OF SHEETS 01

REF. DRG.NO.
SIGN & DATE
INVENTORY NO.

FORM No. A3–02

A3 SIZE

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 11kV / 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.

(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 / µP based
13	Blocking diode	To be provided at output

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	**For the following:** 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	**All meters shall be 96 sq-mm 90-deg scale Class 1.5** 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 / Autoboost 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

		suitably in front of panel with suitably sized brass bolts. (a) AC input terminals (b) Battery connection terminals (c) Feeder terminals for the four feeders (i) Earthing terminals using 25x3 mm aluminium earth bus, with M6 bolt provisions on both sides of panel (j) Base channel: ISMC 75x40x6 mm black. (k) Cable entry: Bottom; base channel shall be sufficiently elevated to facilitate cable entry / exit below the panel. (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. (m) All covers shall have gasket provisions (n) Slots shall be covered by fine wire mesh (o) Paint shade: RAL 7032

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	**All meters shall be 6 sq-mm 90-deg scale Class 1.5** 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) Degree of protection: IP42 (q) 2mm thick CRCA sheet for frames and front door (r) Front door hinged and locked (s) Rear door hinged and bolted (t) Side covers bolted (u) Louvers to be provided on the doors / side covers for ventilation (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.

		Earth circuit: 0.75 sq-mm, green (w) External cable termination provisions to be provided suitably in front of panel with suitably sized brass bolts. (d) AC input terminals (e) Battery connection terminals (f) Feeder terminals for the four feeders (x) Earthing terminals using 25x3 mm aluminium earth bus, with M6 bolt provisions on both sides of panel (y) Base channel: ISMC 75x40x6 mm black. (z) Cable entry: Bottom; base channel shall be sufficiently elevated to facilitate cable entry / exit below the panel. (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. (bb) All covers shall have gasket provisions (cc) Slots shall be covered by fine wire mesh (dd) Paint shade: RAL 7032

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

(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

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	**Warranty** 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	

		ACDB panel from bottom side, in upward direction from the cable trench below 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.	
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	

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	
SPARES FOR THE ACDB			
1	Ammeter-1 No.,	In line with Sl.No 17 above	
2	Voltmeter-1 No.,	In line with Sl.No 18 above	
3	kWH meter-1 No.,	In line with Sl.No 19 above	
4	LED indication Lamps	1 no., of each type used in Sl.No. 20 above	
5	MCBs	2 no., of each rating used in Sl.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 colum 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.

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 decription, 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

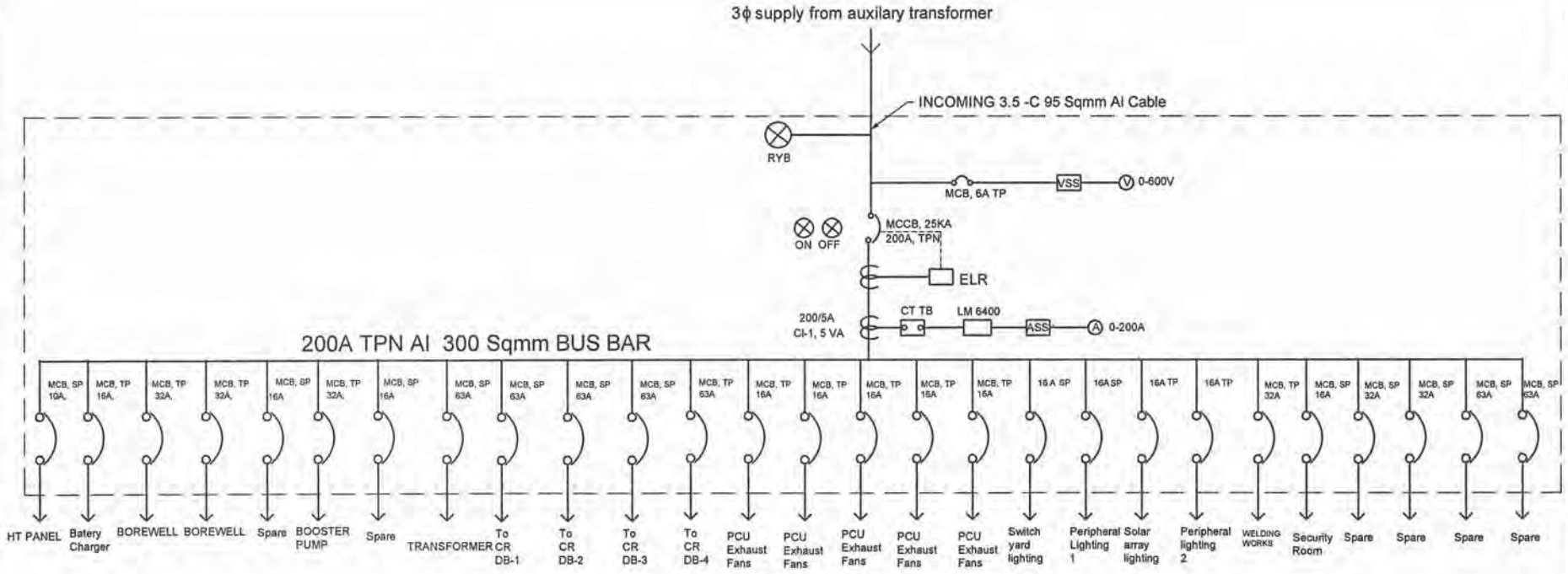
Routine test as per relevant standards (IS, IEC) shall be carried out on the ACDB panel and the same shall be witnessed by BHEL. Vendor shall submit quality plan, indicating relevant IS/IEC standards, prior to inviting BHEL for inspection. Following shall be the minimum checks.

S.No	Description	Accepted Yes or No
1	Visual inspection check and bill of material check	
2	Electricity contunity 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	

DRAWING NO. 3-679-05-00749



TYPE OF PRODUCT OR NAME OF CUSTOMER/PROJECT	SPV POWER PLANT		
BHARAT HEAVY ELECTRICALS LIMITED, ELECTRONICS DIVISION, BANGALORE			
DRN	SCH	Sd	Aug'14
CKD	RK	Sd	Aug'14
APPD	GLNM	Sd	Aug'14
DEPT. / CODE	FOR UNSPECIFIED–TOLERANCES REFER ED 0230499	SCALE	
WEIGHT(Kg)	REF. TO ASS'Y. DRG.	ITEM NO.	No. OF ITEM
TITLE	SLD OF 100KVA ACDB FOR AUXILIARY POWER SUPPLY		
DRAWING NO.	3-679-05-00749	REV.	00
SHEET NO. 01	NO. OF SHEETS 01		

REV.	DATE	ALTERED / CHECKED / APPROVED

REF. DRG.NO. | SIGN & DATE | INVENTORY NO.

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, DNH. 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

Sl 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	

#	Particular	BHEL specification
1	Item description	11KV (UE) grade cable, 3 core x 185 sq-mm, stranded & compacted aluminium conductors, extruded semi-conducting compound screen, extruded XLPE insulated, extruded semi-conducting compound with a layer of non-magnetic metallic tape for insulation screen, extruded PVC (Type ST-2) FRLS inner sheath, Aluminum / galvanized steel round wire armored extruded PVC (Type ST-2) FRLS outer sheathed conforming to IS 7098 (Part II), IEC-60502 for constructional details and tests.
2	Applicable standards	As per IS: 7098 (part-2) 1985
3	Voltage grade	11KV, unearthed cable.
4	**Conductor**	As per IS: 8130-1984
a)	Material	Class 2, stranded, compacted plain aluminium conductor (grade H4).
b)	Cross sectional area	185 sq-mm
c)	No of strands (minimum)	30 wires as per IS 8130-1984
d)	Conductor Screen Material	extruded semiconducting compound
5	**Insulation**	As per IS: 7098 (part-2) 1985
a)	Material	Cross linked polyethylene (XLPE)
b)	Nominal insulation thickness	5.5 mm as per IS 7098 (part-2) 1985
c)	Tolerance on thickness	As per IS: 7098 (part-2) 1985
f)	Max. conductor temperature	90^{o}C – Normal continuous operation 250^{o}C – Short circuit condition
g)	Core identification (insulation colour)	Red, Yellow, Blue
h)	Insulation screen material	extruded semi-conducting compound with a layer of non-magnetic metallic tape

6	**Inner Sheath and Fillers**	As per IS: 7098 (part-2) 1985
a)	Thickness of inner sheath	As per IS: 7098 (part-2) 1985
b)	Colour of inner sheath	Black
c)	Material of inner sheath and filler	Extruded PVC compound Type ST-2 as per IS: 7098 (part-2) 1985
7	**Armour**	As per IS: 7098 (part-2) 1985
a)	Armour material	Aluminum / galvanized steel round wire complying with the requirements of IS:3975-1979.
b)	Armour thickness (Nom)	As per IS: 7098 (part-2) 1985
8	**Outer sheath**	
a)	Material	Extruded PVC compound Type ST-2, FR-LS confirming to the requirements of of IS:5831-1984.
b)	Thickness of outer sheath	As per IS: 7098 (part-2) 1985
c)	Colour of outer sheath	Black
d)	Overall diameter of cable	Vendor shall indicate dimension. Allowable tolerance shall be +/- 2 mm over declared value.
9	Ovality at any cross section shall be kept to a minimum so as to have circular cross section of cable.	
10	**Minimum bending radius**	15 D as per IS: 1255(1983).
11	**FR properties**	
a)	Minimum Oxygen index	Min 29 %, as per IS 10810 Part 58
b)	Minimum Temperature index	As per IS 10810 Part 64
c)	Flammability	As per IEC-60332 Part-3
12	**Test Reports**	Test reports shall be provided before dispatch to site.

Annexure - 5

List of ineligible items which should not be included in the Total BoM to be submitted to MNRE by the Solar Power Developers for issue of Excise Duty Exemption Certificate and Concessional Custom Duty Certificate

Category I: Civil Work items like Cement, TMT(Saria), Pre-Fabricated/Pre Engineered Building, Inverter Exhaust Ducting and Machinery required for Civil Work such as Ramming Machine, Fork Lift etc.

Category II: Earthing Material like GI Earthing Strip, Earthing Electrode, Earthing Pit for Array Yard, Earthing Hook etc.

Category III: Plant Lighting Material like CFL, Tube-lights etc., Cable for lighting, Switch Board for lighting, Plant Lighting Transformer, LT AC Lighting Distribution Board, Lighting Pole, Lighting Fitting, Lighting Junction Board, Pathway Street Light Poles, Fixtures, Boundary Street Light Fixtures.

Category IV: Lightning Arrestors.

Category V: Items for Plant Security like Boundary Wall/Fencing, Watch Towers, Main Gate, C.C.T.V. Camera etc.

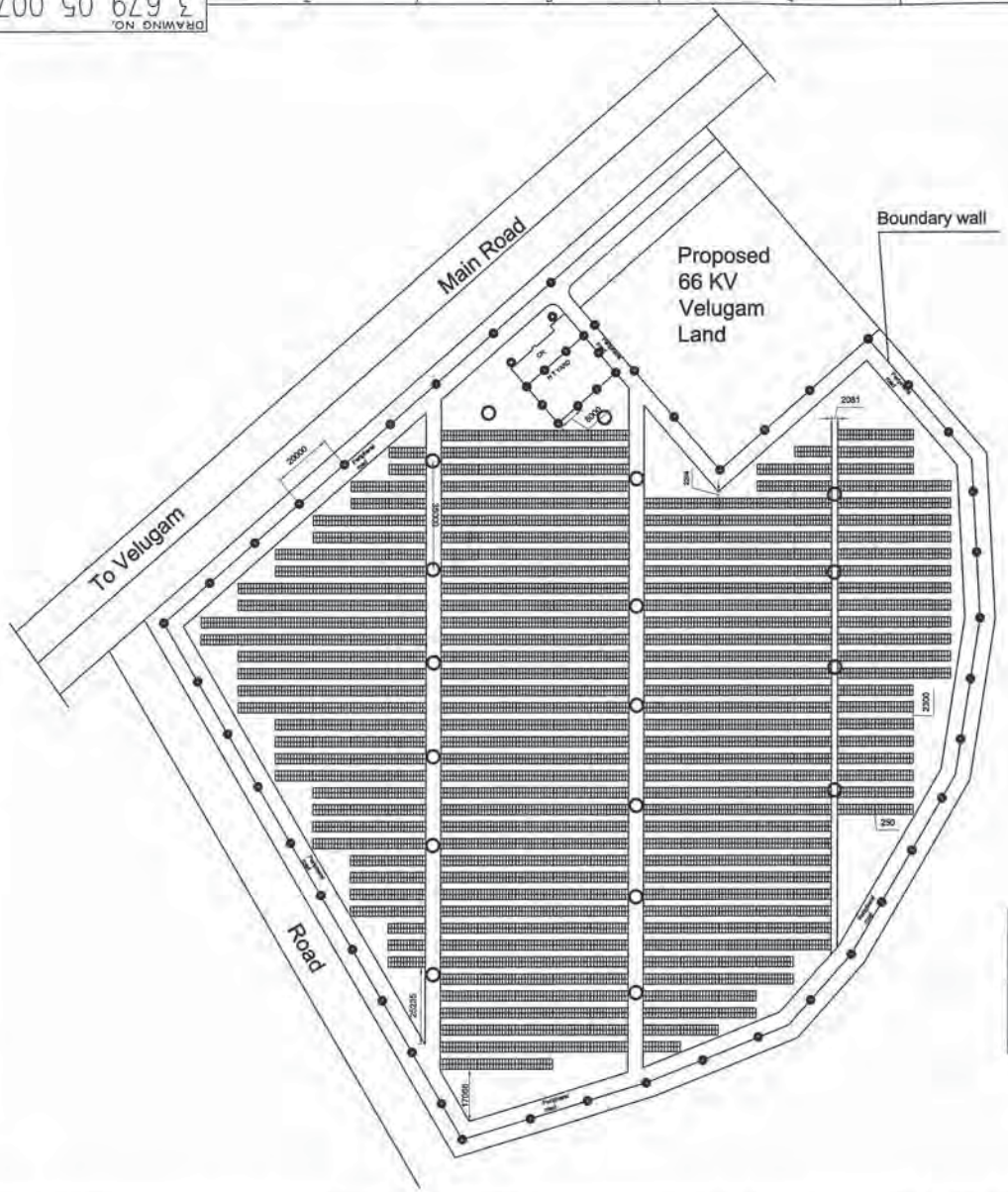
Category VI: Miscellaneous items like ISI marked Rubber Gloves, Sand, Sand Filled Bucket, Fire Fighting Equipments, etc.

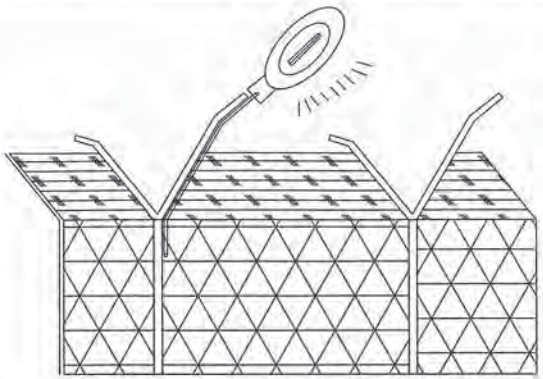
Note: - **This is an illustrative list and not exhaustive. Any item/part/component found ineligible on a future date can also be included in this list.**

FIRST ANGLE PROJECTION

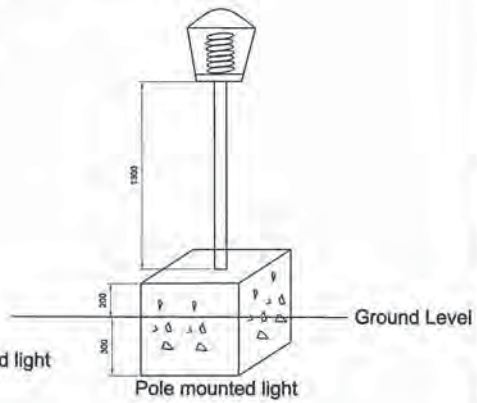
DRAWING NO. 3 679 05 00741

ALL DIMENSIONS ARE IN mm





Fence mounted light



Pole mounted light

Pole mounted light

N
W E
S

o	Fence mounted light	55 No.s
○	Pole mounted light	20 No.s

REV.	DATE	ALTERED / CHECKED / APPROVED

TYPE OF PRODUCT OR NAME OF CUSTOMER/PROJECT: 3 MW SPV POWER PLANT FOR DADAR & NAGAR HAVELI

BHARAT HEAVY ELECTRICALS LIMITED
ELECTRONICS DIVISION, BANGALORE

	NAME	SIGN.	DATE
DRN	SCH		9.09.14
CKD	RK		9/9/14
APPD	GLNM		9.9.14

DEPT. SCPV
CODE 439

FOR UNSPECIFIED TOLERANCES REFER ED 0230499

SCALE: SLR

WEIGHT(Kg): 1 : 1

REF. TO ASSY. DRG.

ITEM NO.

TITLE: LIGHTING LAYOUT

DRAWING NO. 3 679 05 00741

REV. 00

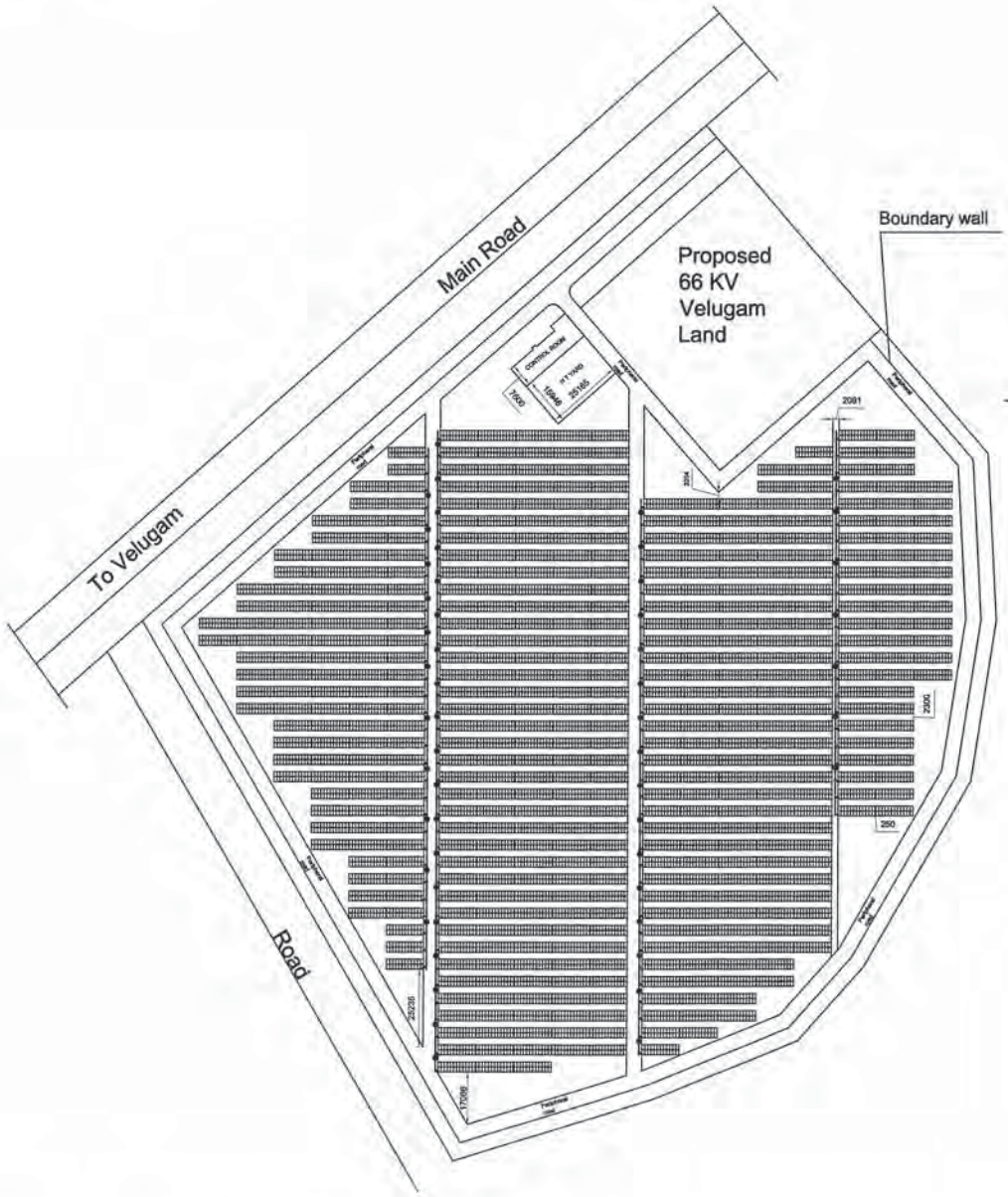
SHEET NO. 01 NO. OF SHEETS 01

A2 SIZE

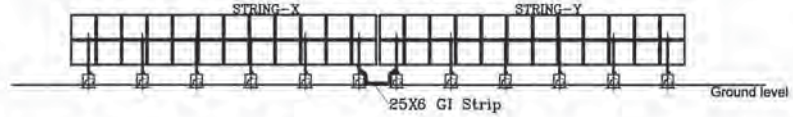
FIRST ANGLE PROJECTION

DRAWING NO. 3-679-05-00734

ALL DIMENSIONS ARE IN mm



ELEVATION VIEW OF
STRING TO STRING CONNECTION



——	25X6 GI Strip	2000 mtr
═══	50X6 GI Strip	800 mtr
O	EARTHING ELECTRODE	54 No.s

Note : Control room & HT Yard Earthing is Not Included

TYPE OF PRODUCT OR NAME OF CUSTOMER/PROJECT: 3 MW SPV POWER PLANT - DADAR & NAGAR HAVELI

BHARAT HEAVY ELECTRICALS LIMITED
ELECTRONICS DIVISION, BANGALORE

	NAME	SIGN.	DATE
DRN	SCH	Sheed	Aug'14
CKD	RK		Aug'14
APPD	GLNM		Aug'14

DEPT. SCPV
CODE 439

FOR UNSPECIFIED TOLERANCES REFER ED 0230499

SCALE SLR

WEIGHT(Kg) 1 : 1

REF. TO ASSY. DRG.

ITEM NO.

TITLE: EARTHING LAYOUT

DRAWING NO. 3-679-05-00734

REV. 00

SHEET NO. 01 NO. OF SHEETS 01

A2 SIZE

INVENTORY NO. | SIGN. & DATE | REF. ORG.NO.

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

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, 2nd 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.

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 2nd 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 CONDTITIONS 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.

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ANNEXURE- C

LIST OF INTERNATIONAL AIRPORTS

Sl. No	Country	Air Ports
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

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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.

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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

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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.

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ANNEXURE – G

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.

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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 discrepancybetween the unit price and the total price (which is obtained by multiplying the unit price by thequantity), the unit price shall prevail and the total price corrected accordingly, unless in theopinion 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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Annexure B

COMMERCIAL TERMS & CONDITIONS (to be enclosed with TECHNO-COMMERCIAL BID) (For Indigenous Purchase Orders)				
RFQ No.HBSBOS012 RFQ DATE : 04.09.2014 DUE DATE : 29.09.2014 FOR 3MW GI SPV Plant at DNH				
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.	Acceptable / Not acceptable	
		(b) Documents as called in Pre-Qualification Criteria (Clause 1.0 of PS-439-893) to be submitted along with technical bid(Part-1).	Acceptable / Not acceptable	
		(c) Annexures-B & B1 to be submitted along with technical bid (Part-1) & Annexure-B2 to be submitted along with Price bid (Part-II).	Acceptable / Not acceptable	
		(d) 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).	Acceptable / Not acceptable	
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).	Acceptable / Not acceptable	
3	**Terms of Delivery**	Free On Road Basis to Project site :Velugam,Silvassa,DNH	Acceptable / Not acceptable	
4	**Delivery Period**	**(a)** Supply : Completion within eight (8) weeks from the date of Drawing Approval. Drawing Submission : Progressively from (1) week from PO date-itemwise before commencement of work..	Acceptable / Not acceptable	
		(b) I&C : Completion within four(4) weeks from supply date.	Acceptable / Not acceptable	
5	**Payment Term**	**(a)Supply** : Payment of 80% basic 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.	Acceptable / Not acceptable	
		(b)I&C : 90% on completion of I&C and certification line item wise on pro-rata basis.Balance 10% on execution of PBG valid for warranty/guarantee period + 6 months claim period from any of the BHEL Consortium banks.	Acceptable / Not acceptable	
		(c) O&M: 100% O&M charges are payable on quarterly basis against report certified by BHEL	Acceptable / Not acceptable	
		(d) For any other deviation loading will be done as per clause 25(A) of Enquiry - General Terms & Conditions (Ref : SCPV/BOS/01-Rev 00)	Acceptable / Not acceptable	
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.	Acceptable / Not acceptable	
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 against Form c: ..... %
		(b) For issue of form "C", vendor has to furnish "E1/E2" form.Please confirm that "E1/E2 Sale form" will be submitted.	Acceptable / Not acceptable	
		(c) Wherever E1/E2 transactions are made, CST paid by sub vendor will not be reimbursed (As it is input cost to vendor)	Acceptable / Not acceptable	
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	CST applicable @.....%
		OR		
		Both are in the same State, VAT is applicable please indicate VAT applicable.	Applicable / Not applicable	VAT applicable @.....%
9	**Octroi**	To confirm whether applicable, if applicable indicate current rate of Octroi.	Applicable / Not applicable	Octroi_____%
10	**Service Tax**	To confirm whether applicable, if applicable indicate current rate of Service Tax.Furnish Service Tax Regn. No. Confirmation that Service Tax register is maintained.	Applicable / Not applicable	Service Tax _____% Service Tax Regn. No. …….. S.Tax Register maintained : Yes/No

AUTHORISED SIGNATORY WITH SEAL

Annexure B

COMMERCIAL TERMS & CONDITIONS (to be enclosed with TECHNO-COMMERCIAL BID) (For Indigenous Purchase Orders)				
RFQ No.HBSBOS012 RFQ DATE : 04.09.2014 DUE DATE : 29.09.2014 FOR 3MW GI SPV Plant at DNH				
Sl No.	**Terms**	**BHEL Term**	**Confirmation**	**Deviation / Remarks**
11	**Freight**	Freight charges shall be included in unit rate quoted(since it is on FOR basis to site).	Acceptable / Not acceptable	
12	**Insurance**	Transit insurance is in vendor scope in addition to the insurance as per Clause 5.04(5) of PS-439-893.Insurance charges shall be included in the unit rate quoted.	Acceptable / Not acceptable	
13	**Evalution of L1 vendor**	(a)Over all L1 of Supply + I&C + O&M on "FOR" basis to site will only be considered.	BHEL	
		(b) 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 : 37-40% (b) I&C : 26-29% (c) O&M : 31-33%	Acceptable / Not acceptable	
14	**Warranty**	(a) Supply : 18 months from the date of supply or 12 months from the date of I&C whichever is earlier. (b) Workmanship & I&C : 24 months from the date of I&C.	(a) Acceptable / Not acceptable (b) Acceptable / Not acceptable	
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.	Acceptable / Not acceptable	
16	**Penalty**	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. For other activities the activity completion date as certified by Engg. will be considered for penalty calculation.	Acceptable / Not acceptable	
		For any deviation, loading will be done as per Clause 25.B of Enquiry - General Terms & Conditions(Ref : SCPV/BOS/01-Rev 00)	Acceptable / Not acceptable	
17	**Road Permit**	Road permit if applicable will be given by BHEL before Dispatch of ordered Items	BHEL	
18	**PBG**	(a)PBG shall be furnished in the BHEL prescribed format. (b) Deviation if any Please specify	Acceptable / Not acceptable	
19	**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.	Acceptable / Not acceptable	
20	**Reverse Auction**	BHEL reserves the right to conduct Reverse auction.Procedure for the same will be informed by BHEL . Please confirm your acceptance for reverse auction.	Acceptable / Not acceptable	
21	**Other terms & conditions**	For any other Terms and Conditions, kindly refer to the enclosed Enquiry - General Terms & Conditions(Ref : SCPV/BOS/01-Rev 00)	Acceptable / Not acceptable	
22	**Validity**	(a) Quotation should remain valid for a period of 90 days from the due date	Acceptable / Not acceptable	
		(b)Deviation if any Please specify	(b)	
23	**Bank Charges**	(a) All Bank charges to respective accounts	Acceptable / Not acceptable	
		(b) Deviation if any Please specify	(b)	
24	**Shipment**	Kindly indicate the state from where the shipment will take place.This is for the purpose of assessment of Tax.	State : ……	

NOTE : For R C PURAM, HYDERABAD:Two options shall be quoted with respect to Taxation only:
(a). BHEL EDN, Bangalore will release formal Purchase Order & arrange payment with Non-concessional CST(VAT of Material Originating State.)
(b). BHEL EDN, Bangalore will issue Letter of Intent(LOI) & BHEL RC Puram, Hyderabad will release formal PO & arrange payment with 2% CST against Form C.

AUTHORISED SIGNATORY WITH SEAL

Annexure B1

TECHNICAL BID ENCLOSURE FOR COMPLIANCE OF QUOTE : UNPRICED BID

RFQ No.HBSBOS012 RFQ DATE : 04.09.2014 DUE DATE : 29.09.2014 FOR 3MW GI SPV Plant at DNH

Sl No.	Material	Short Text	Quantity	Unit	Quoted	Taxes				Remarks
						**ED %	CST %	VAT %	Service Tax %	
A. SUPPLY										
1	PS0679042733	PV plant Consumables for 3 MW DNH	1	ST	YES / NO	NA			NA	Taxes Included
2	PS0679042741	Module Cleaning System for 3 MW DNH	1	ST	YES / NO	NA			NA	Taxes Included
3	PS0679042750	Auxiliary & data cables for 3-MW DNH	1	ST	YES / NO	NA			NA	Taxes Included
4	PS0679042768	Switch yard equipment for 3 MW-DNH	1	ST	YES / NO	NA			NA	Taxes Included
5	PS0679042776	Earthing System for 3 MW-DNH	1	ST	YES / NO	NA			NA	Taxes Included
6	PS0679042784	Lightning Protection equip for 3-MW DNH	1	ST	YES / NO	NA			NA	Taxes Included
7	PS0679042792	Peripheral lighting for 3-MW DNH	1	ST	YES / NO	NA			NA	Taxes Included
8	PS0679042806	Miscellaneous items for 3-MW DNH	1	ST	YES / NO	NA			NA	Taxes Included
9	PS0679042814	Fire protection System for 3-MW DNH	1	ST	YES / NO	NA			NA	Taxes Included
10	PS0679042822	Battery bank for 3-MW DNH	1	ST	YES / NO	NA			NA	Taxes Included
11	PS0679042830	FCBC for 3-MW DNH	1	ST	YES / NO	NA			NA	Taxes Included
12	PS0679042849	ACDB for for 3-MW DNH	1	ST	YES / NO	NA			NA	Taxes Included
13	PS0679042857	Ducting of for 3-MW DNH	1	ST	YES / NO	NA			NA	Taxes Included
14	PS0679042865	11 kV Cable for 3-MW DNH	1	ST	YES / NO	NA			NA	Taxes Included
B.I&C										
1	PS0679042873	I&C-Pre-Construction activities at DNH	1	AU	YES / NO	NA	NA	NA		Taxes Included
2	PS0679042881	I&C of LT equipment for 3-MW DNH	1	AU	YES / NO	NA	NA	NA		Taxes Included
3	PS0679042890	I&C of Trx & HT panels for 3-MW DNH	1	AU	YES / NO	NA	NA	NA		Taxes Included
4	PS0679042903	I&C of Switch yard for 3-MW DNH	1	AU	YES / NO	NA	NA	NA		Taxes Included
5	PS0679042911	I&C of Earthing Sytem for 3-MW DNH	1	AU	YES / NO	NA	NA	NA		Taxes Included
6	PS0679042920	I&C of Yard Lighting System for 3-MW DNH	1	AU	YES / NO	NA	NA	NA		Taxes Included
7	PS0679042938	I&C of Water Cleaning System for 3MW DNH	1	AU	YES / NO	NA	NA	NA		Taxes Included
8	PS0679042946	I&C of Miscelleneous Works for 3-MW DNH	1	AU	YES / NO	NA	NA	NA		Taxes Included
9	PS0679042954	Pre commissioning Inspection for 3MW DNH	1	AU	YES / NO	NA	NA	NA		Taxes Included
10	PS0679042962	Commissioning Liasoning for 3-MW DNH	1	AU	YES / NO	NA	NA	NA		Taxes Included
C.O&M										
1	PS0679042970	O&M of 3-MW DNH:1st Year	1	AU	YES / NO	NA	NA	NA		Taxes Included
2	PS0679042989	O&M of 3-MW DNH:2nd Year	1	AU	YES / NO	NA	NA	NA		Taxes Included
3	PS0679042997	O&M of 3-MW DNH:3rd Year	1	AU	YES / NO	NA	NA	NA		Taxes Included
4	PS0679043004	O&M of 3-MW DNH:4th Year	1	AU	YES / NO	NA	NA	NA		Taxes Included
5	PS0679043012	O&M of 3-MW DNH:5th Year	1	AU	YES / NO	NA	NA	NA		Taxes Included

D. Freight Charges including Service Tax @ 12.36% on 25% of Freight Value : Included in Unit rate

E. Insurance Charges : Included in Unit rate

****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 all Supply items.**
However, the prevailing rate of ED shall be indicated in Sl No.6 of Annexure B.

NOTE :

1.Your quoted prices shall be on "FOR" basis to site.

2.The quoted prices shall be inclusive of all Taxes & Duties, Packing & Forwarding charges,Freight & Insurance.

3.However, the percentage of taxes considered against each item may pls be indicated in the column for Taxes for the purpose of availing Tax Credit.

4. The above format only shall be used for compliance.No changes are acceptable.(Reproducing on your letter head is acceptable.)

Authorized Signatory with seal

Annexure B2

PRICE BID												
RFQ No.HBSBOS012 RFQ DATE : 04.09.2014 DUE DATE : 29.09.2014 FOR 3MW GI SPV Plant at DNH												
Sl No.	Material	Short Text	Quantity	Unit	Unit Rate (Rs.)	Total Value (Rs.) (Unit Rate X Qty)	Taxes				Remarks
							**ED %	CST %	VAT %	Service Tax %	
A. SUPPLY											
1	PS0679042733	PV plant Consumables for 3 MW DNH	1	ST			NA			NA	Taxes Included
	Unit Rate in words :										
2	PS0679042741	Module Cleaning System for 3 MW DNH	1	ST			NA			NA	Taxes Included
	Unit Rate in words :										
3	PS0679042750	Auxiliary & data cables for 3-MW DNH	1	ST			NA			NA	Taxes Included
	Unit Rate in words :										
4	PS0679042768	Switch yard equipment for 3 MW-DNH	1	ST			NA			NA	Taxes Included
	Unit Rate in words :										
5	PS0679042776	Earthing System for 3 MW-DNH	1	ST			NA			NA	Taxes Included
	Unit Rate in words :										
6	PS0679042784	Lightning Protection equip for 3-MW DNH	1	ST			NA			NA	Taxes Included
	Unit Rate in words :										
7	PS0679042792	Peripheral lighting for 3-MW DNH	1	ST			NA			NA	Taxes Included
	Unit Rate in words :										
8	PS0679042806	Miscellaneous items for 3-MW DNH	1	ST			NA			NA	Taxes Included
	Unit Rate in words :										
9	PS0679042814	Fire protection System for 3-MW DNH	1	ST			NA			NA	Taxes Included
	Unit Rate in words :										
10	PS0679042822	Battery bank for 3-MW DNH	1	ST			NA			NA	Taxes Included
	Unit Rate in words :										
11	PS0679042830	FCBC for 3-MW DNH	1	ST			NA			NA	Taxes Included
	Unit Rate in words :										
12	PS0679042849	ACDB for for 3-MW DNH	1	ST			NA			NA	Taxes Included
	Unit Rate in words :										
13	PS0679042857	Ducting of for 3-MW DNH	1	ST			NA			NA	Taxes Included
	Unit Rate in words :										
14	PS0679042865	11 kV Cable for 3-MW DNH	1	ST			NA			NA	Taxes Included
	Unit Rate in words :										
B.I&C											
1	PS0679042873	I&C-Pre-Construction activities at DNH	1	AU			NA	NA	NA		Taxes Included
	Unit Rate in words :										
2	PS0679042881	I&C of LT equipment for 3-MW DNH	1	AU			NA	NA	NA		Taxes Included
	Unit Rate in words :										
3	PS0679042890	I&C of Trx & HT panels for 3-MW DNH	1	AU			NA	NA	NA		Taxes Included
	Unit Rate in words :										
4	PS0679042903	I&C of Switch yard for 3-MW DNH	1	AU			NA	NA	NA		Taxes Included
	Unit Rate in words :										

Authorized Signatory with seal

Annexure B2

PRICE BID												
RFQ No.HBSBOS012 RFQ DATE : 04.09.2014 DUE DATE : 29.09.2014 FOR 3MW GI SPV Plant at DNH												
Sl No.	Material	Short Text	Quantity	Unit	Unit Rate (Rs.)	Total Value (Rs.) (Unit Rate X Qty)	Taxes				Remarks
							**ED %	CST %	VAT %	Service Tax %	
B.I&C											
5	PS0679042911	I&C of Earthing Sytem for 3-MW DNH	1	AU			NA	NA	NA		Taxes Included
	Unit Rate in words :										
6	PS0679042920	I&C of Yard Lighting System for 3-MW DNH	1	AU			NA	NA	NA		Taxes Included
	Unit Rate in words :										
7	PS0679042938	I&C of Water Cleaning System for 3MW DNH	1	AU			NA	NA	NA		Taxes Included
	Unit Rate in words :										
8	PS0679042946	I&C of Miscelleneous Works for 3-MW DNH	1	AU			NA	NA	NA		Taxes Included
	Unit Rate in words :										
9	PS0679042954	Pre commissioning Inspection for 3MW DNH	1	AU			NA	NA	NA		Taxes Included
	Unit Rate in words :										
10	PS0679042962	Commissioning Liasoning for 3-MW DNH	1	AU			NA	NA	NA		Taxes Included
	Unit Rate in words :										
C.O&M											
1	PS0679042970	O&M of 3-MW DNH:1st Year	1	AU			NA	NA	NA		Taxes Included
	Unit Rate in words :										
2	PS0679042989	O&M of 3-MW DNH:2nd Year	1	AU			NA	NA	NA		Taxes Included
	Unit Rate in words :										
3	PS0679042997	O&M of 3-MW DNH:3rd Year	1	AU			NA	NA	NA		Taxes Included
	Unit Rate in words :										
4	PS0679043004	O&M of 3-MW DNH:4th Year	1	AU			NA	NA	NA		Taxes Included
	Unit Rate in words :										
5	PS0679043012	O&M of 3-MW DNH:5th Year	1	AU			NA	NA	NA		Taxes Included
	Unit Rate in words :										
D. Freight Charges including Service Tax @ 12.36% on 25% of Freight Value : Included in Unit rate											
E. Insurance Charges : Included in Unit rate											

****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 all Supply items.**
However, the prevailing rate of ED shall be indicated in Sl No.6 of Annexure B.

NOTE :
1.Your quoted prices shall be on "FOR" basis to site.
2.The quoted prices shall be inclusive of all Taxes & Duties, Packing & Forwarding charges,Freight & Insurance.
3.However, the percentage of taxes considered against each item may pls be indicated in the column for Taxes for the purpose of availing Tax Credit.
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