ಭಾರತ್ ಹೆವಿ ಎಲೆಕ್ಟ್ರಿಕಲ್ಸ್ ಲಿಮಿಟೆಡ್
भारत हेवी इलेक्ट्रिकल्स लिमिटेड
Bharat Heavy Electricals Limited
(A Government of India Undertaking)
ELECTRONICS DIVISION
P.B.No 2606, Mysore Road, Bangalore - 560 026
An ISO 9001, ISO 14001 & OHSAS 18001 Company

Gram : BHARATELEC
Telex : 0845-2436 BHCE IN
0845-8151 BHCE IN
Fax : 0091 80-26989219
RABMN : 404100000014

Dt.17.10.2014

Addendum to RFQ : HBSBOS022 RFQ Due Date: 20.10.2014
for BOS – Mandya, KPCL

Following revisions / modifications are incorporated in the Tender document :

1. **Corrigendum-2 to Purchase Specification PS-439-895(Page 1 enclosed).**
2. **Due date for the tender is revised to 29.10.2014.**

All other terms and conditions of RFQ remain unchanged.

Sr.MANAGER (SC&PV/MM)

Corrigendum-2 to purchase specification PS-439-895 Rev. 00

#	Tender clauses	Description as in tender	Revised description
1	Annexure-4, specification for PEB, clause 2.0.9, Foundation and platform with cable trench, in page 3 of 7	Required foundation shall be designed by the vendor to safely take the equipment load as per the details given below and drawings shall be furnished for BHEL approval and civil works will be carried out by BHEL.	To be read as "Required foundation shall be designed by the vendor to safely take the equipment load as per the details given below and drawings shall be furnished for BHEL approval and **civil works shall be carried out by the vendor**."

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0845-8151 BHCE IN
Fax : 0091 80-26989219
RABMN : 404100000014

Dt.13.10.2014

Addendum to RFQ : HBSBOS022 RFQ Due Date: 15.10.2014
for BOS- Mandya

Following revisions / modifications are incorporated in the Tender document :

1. **Corrigendum to Purchase Specification PS-439-895(Pages 1-2 enclosed).**
2. **Due date for the tender is revised to 20.10.2014.**

All other terms and conditions of RFQ remain unchanged.

Sr.MANAGER (SC&PV/MM)

Corrigendum-1 to purchase specification PS-439-895 Rev. 00

#	Tender clauses	Description as in tender	Revised description as per this addendum
1	3.1.14 in page 5 of 50	I&C: Temporary site office, storage yard, bore wells, unloading and movement of consignments, arranging electrical power and water for construction etc as per clauses 5.1 to 5.5	To be read as "I&C: Temporary site office, storage yard, unloading and movement of consignments, arranging electrical power and water for construction etc as per clauses 5.1 to 5.6."
2	5.2(2) in page 9 of 50	(2) Vendor shall also establish, on their own, water source such as bore wells, water tankers etc for construction activities.	To be read as "(2) Vendor shall also establish, on their own, water source such as water tankers etc for construction activities."
3	5.40(3) in page 33 of 50	(3) Lines from the bore well to storage tank shall have independent 2-inch non-returnable valves (forged steel) and 2-inch ball valves (forged steel).	To be read as "(3) Lines to storage tank shall have independent 2-inch non-returnable valves (forged steel) and 2-inch ball valves (forged steel)."
4	5.43.1(d) in page 34 of 50	d) For electrical cables of bore well connections	To be read as "d) For electrical cables of pump connections."
5	8.10.1(g) in page 48 of 50	(g) Bore well pump operations to fill the storage tanks.	To be read as "(g) pump operations to fill the storage tanks."
6	5.58	Note to be added.	Note: "Approved vendors for pre-fab building material –KIRBY BUILDING SYSTEMS, LOYAPEB, TATA BLUESCOPE, PEBSPENNAR, Everest Industries Limited, Aster Building Solutions, Satec Envir Engg. or other reputed make for which BHEL approval shall be obtained"
7	Annexure-1 Clause 2.3	Warranty: Vendor shall provide warranty for 42 months from the date of commissioning OR 36 months from the date of supply, whichever is earlier.	To be read as "Warranty: Vendor shall provide warranty for 36 months from the date of commissioning OR 42 months from the date of supply, whichever is earlier."
8	Annexure-1 Clause 3.0(7)	Nickel plate brass for the 3.5C X 120 Sq.mm Al cable for incomer of ACDBs and ougoers to IRDbs. Polyamide cable glands for cables for internal loads of Control room and inverter rooms.	To be read as “Nickel plate brass for incomer of ACDBs and outgoers to IRDBs. Polyamide cable glands for cables for internal loads of Control room and inverter rooms”

9	Annexure-1 Clause 3.0(8)	For ACDB: 3.5 c x120 Sq.mm Al Armored cable (in vendor Scope of supply). For IRDB: 3.5 c x50 Sq.mm Al Armored cable (in vendor Scope of supply).	To be read as "For ACDB: 3.5 c x95 Sq.mm Al Armored cable (in vendor Scope of supply). For IRDB: 3.5 c x50 Sq.mm Al Armored cable (in vendor Scope of supply)."
10	Annexure-2 Clause 2.0.4	Warranty: Vendor shall ensure safe, continuous and trouble-free operation of battery and battery charger, DCDB panel for the period of 36 months from the date of supply or 42 months from the date of commissioning whichever is earlier.	To be read as "Warranty: Vendor shall ensure safe, continuous and trouble-free operation of battery and battery charger, DCDB panel for the period of 42 months from the date of supply or 36 months from the date of commissioning whichever is earlier."
11	Annexure-5 Clause 2.2	Warranty: Vendor shall ensure safe, continuous and trouble-free operation of battery and battery charger, DCDB panel for the period of 36 months from the date of supply or 42 months from the date of commissioning whichever is earlier.	To be read as "Warranty: Vendor shall ensure safe, continuous and trouble-free operation of battery and battery charger, DCDB panel for the period of 42 months from the date of supply or 36 months from the date of commissioning whichever is earlier."

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 10MWp SPV grid connected power plant at Mandya, Karnataka

RFQ Ref: HBSBOS022
RFQ Due Date: 15.10.2014

This Tender Document Contains:
(1) Request For Quotation
(2) Technical Specifications : PS- 439-895
(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,Wednesday"** 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: HBSBOS022

RFQ DATE : 24.SEP.2014

Due Date 15.OCT.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. Refer General Terms & Conditions as per SC&PV- General Terms & Conditions (Page 1 to 14).
2.Technical Specification PS-439-895 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	PS0679043845 PV plant Consumables for 10 MW KPCL Supply of MC4 connectors, cable ties, cable ducts, HDPE conduits, cable lugs, glands, hardware, cable trench, cable trays etc. as per clauses 5.6 to 5.18 Test Certificate	1	ST	1	26.DEC.2014
2	PS0679043853 Auxiliary,HT & data cables for 10MW KPCL Supply of Auxiliary power cables, HT power cables, control cables, data communication cables, Optical fiber cables, 11kV termination kits etc. as per clauses 5.19 and 5.26. Test Certificate	1	ST	1	26.DEC.2014
3	PS0679043861 Switch yard equipment for 10 MW KPCL Supply of auxiliary transformers, items of transformer yard fencing (fence, gate, angles etc.) for transformer area, items for connecting to earthing, with all related miscellaneous accessories and hardware as per clauses 5.27 to 5.41. Test Certificate	1	ST	1	26.DEC.2014
4	PS0679043870 Earthing System for 10 MW KPCL Supply of items of earthing system for solar array field, control room and inverter room panels and transformer yard equipment including Earthing electrodes, GI flats, copper strips, copper earthing cables (green) of min 25sq mm, CPVC pipes, Insulation bushes, heat shrinkable sleeves for control room copper strip earthing and all related miscellaneous hardware etc as per clauses 5.33 to 5.35.	1	ST	1	26.DEC.2014

For and On behalf of BHEL.

REQUEST FOR QUOTATION

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Sl No.	Description	Qty	Unit	Delivery qty	Delivery Date
	Test Certificate				
5	PS0679043888 Lightning Protection equip for 10 MWKPCL Supply of lightning arrestors for solar array field (ESE type) with earthing items as per clause 5.36. Test Certificate	1	ST	1	26.DEC.2014
6	PS0679043896 Peripheral lighting for 10 MW KPCL 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 5.37 to 5.39. Test Certificate	1	ST	1	26.DEC.2014
7	PS0679043900 Module Cleaning System for 10 MW KPCL Supply of items of module cleaning system such as submersible pumps (for bore wells/water sump), booster pumps, water storage tanks, CPVC pipes with fittings, ball valves, nipples etc as per clauses 5.40 and 5.41. Test Certificate	1	ST	1	26.DEC.2014
8	PS0679043918 Miscellaneous items for 10 MW KPCL 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 5.42 to 5.50. Test Certificate	1	ST	1	26.DEC.2014
9	PS0679043926 Fire protection System for 10 MW KPCL Supply of safety related items including fire alarm system, fire extinguishers, safety gadgets etc as per clauses 5.51 and 5.52. Test Certificate	1	ST	1	26.DEC.2014
10	PS0679043934 ACDB, FCBC etc. for 10 MW KPCL Supply of ACDB, Battery, FCBC, PCU ducting arrangement	1	ST	1	26.DEC.2014

For and On behalf of BHEL.

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Sl No.	Description	Qty	Unit	Delivery qty	Delivery Date
	etc., as per the clauses 5.54 to 5.56 and annexures enclosed. Test Certificate				
11	PS0679043942 10KW PV system for 10 MW KPCL Supply of items for 10KW PV plant such as mounting structure, inverter with charge controller, battery bank etc. as per clauses 5.57. (PV modules for the same shall be supplied by BHEL.) Test Certificate	1	ST	1	26.DEC.2014
12	PS0679043950 11KV Transmission line for 10 MW KPCL Supply of items for 11KV overhead transmission line between part-A and Part-B viz. four pole /two pole /single pole structures with GOS switches, lightning arrestors (surge suppressors), ACSR conductor, insulators, cross angles etc., with all related miscellaneous accessories and hardware as per clauses 5.23 to 5.21 and 5.24. Test Certificate	1	ST	1	26.DEC.2014
13	PS0679043969 Pre-fab buildings for 10 MW KPCL Supply of items for pre-engineered type (PEB) control room, inverter room and security rooms including partitions for SCADA room and toilets, internal wiring, air conditioners, light fittings, sanitary items, plumbing etc. as per clause 5.58 Test Certificate	1	ST	1	26.DEC.2014
14	PS0679043977 I&C Pre-Constrn activities at1.5MW KPCL I&C: Temporary site office, storage yard, bore wells, unloading and movement of consignments, arranging electrical power and water for construction etc as per clauses 5.1 to 5.5	1	AU	1	20.JAN.2015
15	PS0679043985 I&C-Array cabling for 10 MW KPCL I&C: Interconnection of SPV modules, cabling from strings to SMBs, installation of string monitoring boxes including cable	1	AU	1	20.JAN.2015

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Sl No.	Description	Qty	Unit	Delivery qty	Delivery Date
	terminations, formation of cable trenches and laying of 1CX185 sq-mm cables and inspection thereof as per clauses 5.6 to 5.13				
16	PS0679043993 I&C of control room equip for 10 MW KPCL I&C: Erection of control room, inverter room and security room electrical panels such as inverters, HT Panels, ACDB, IRDBs, Security Room DBs, FCBC, Battery bank, DCDB, PCU ducting etc., including grouting, erection of cable trays and cable supports, routing and terminations of DC and AC cables up to LV side of transformers in transformer yard etc. as per clauses 5.14 to 5.16 and 5.54 to 5.56.	1	AU	1	20.JAN.2015
17	PS0679044000 I&C of trfr yard equipment for 10MW KPCL I&C: Erection of transformer yard equipment such as transformers, 11KV cable laying and terminations, fire walls wherever required, foundations, Transformer yard leveling, jelly spreading, fencing including gates etc., as per clauses 5.17 to 5.20 and 5.25 to 5.28.	1	AU	1	20.JAN.2015
18	PS0679044019 I&C of HTcable and trench for 10MW KPCL I&C: Cable trenches, cable laying, cable terminations for 11KV cables as shown in SLD between inverter rooms and control room and from control room upto 66KV switchyard as per clauses 5.19 to 5.20 and 5.26.	1	AU	1	20.JAN.2015
19	PS0679044027 I&C of control & data cable for 10MW KPC I&C: Cable trenches, cable laying, cable terminations for control, communication and OFC cables (between IRs and control room) related to inverters, transformers, HT Panels and SCADA as per clauses 5.29 to	1	AU	1	20.JAN.2015

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Sl No.	Description	Qty	Unit	Delivery qty	Delivery Date
	5.32.				
20	PS0679044035 I&C of Earthing Sytem for 10 MW KPCL I&C of earthing system for solar array field, control room panels, inverter room panels and transformer yard equipment including installation of Chemical earthing electrodes, erection & electrical interconnection of earth chambers, earthing of module mounting structures, laying of copper earth strips in control room etc, installation of lightning arrestors (ESE) as per clauses 5.33 to 5.36.	1	AU	1	20.JAN.2015
21	PS0679044043 I&C of YardLighting System for 10MW KPCL I&C of yard lights for approach road, transformer yard and boundary wall 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 5.37 to 5.39.	1	AU	1	20.JAN.2015
22	PS0679044051 I&C of ModuleCleaning Sys for 10MW KPCL I&C of module cleaning system including trenches for pipelines, laying of pipelines from bore wells /water sump to solar array field through water storage tanks, erection of submersible and booster pumps, ball valves, non-returnable valves etc as per clauses 5.40 and 5.41.	1	AU	1	20.JAN.2015
23	PS0679044060 I&C of Misc Works for 10MW KPCL I&C of miscellaneous and safety items such as cable tags, danger boards, cable markers, hoarding board, sign boards, display boards, electrical insulation mat, checkered plates, air conditioners, office furniture, fire extinguishers, fire alarm system etc as per clauses 5.42 to 5.52.	1	AU	1	20.JAN.2015

For and On behalf of BHEL.

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Sl No.	Description	Qty	Unit	Delivery qty	Delivery Date
24	PS0679044078 I&C of 10 KW PV system for 10MW KPCL I&C of items of 10KW PV system such as mounting structure, inverter with charge controller, battery bank etc. as per clause 5.57.	1	AU	1	20.JAN.2015
25	PS0679044086 I&C of 11KV transmsn line for 10MW KPCL I&C of 11KV overhead transmission line between part-A and Part-B as per clauses 5.21 to 5.24.	1	AU	1	20.JAN.2015
26	PS0679044094 I&C of pre-enginrd CntrlRoom for 10MW KP I&C of items for pre-engineered type (PEB) control room, inverter room and security rooms including partitions for SCADA room and toilets, internal wiring, light fittings, sanitary items, plumbing, septic tanks, soak pits etc. as per clause 5.58	1	AU	1	20.JAN.2015
27	PS0679044108 Pre commissioning Insp for 10MW KPCL I&C: Pre-commissioning inspections / checks / tests, MRT tests.	1	AU	1	20.JAN.2015
28	PS0679044116 Commissioning & Liasoning for 10MW KPCL I&C: Coordination with state and central departments such as KPTCL/CEIG/SECI etc. for necessary approvals/ clearances for commissioning, synchronization with grid and post-commissioning operation of the plant as per clause 5.53.	1	AU	1	20.JAN.2015
29	PS0679044124 O&M of 10 MW KPCL:1st Year As per Spec PS-439-895	1	AU	1	20.JAN.2015
30	PS0679044132 O&M of 10 MW KPCL:2nd Year As per Spec PS-439-895	1	AU	1	20.JAN.2015
31	PS0679044140 O&M of 10 MW KPCL:3rd Year As per Spec PS-439-895	1	AU	1	20.JAN.2015

Total Number of Items - 31

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

For and On behalf of BHEL.

REQUEST FOR QUOTATION

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BHARAT HEAVY ELECTRICALS LIMITED
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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.

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It must not be used directly or indirectly in anyway detrimental to the interest to the company

Technical Specification for

Supply of Balance of System items, Installation and commissioning, Operations & Maintenance

For 10 MWp Solar PV grid connected power plant

at Belakavadi, Mandya Dist., Karnataka

Revision details : R 00	Prepared: LNK/BKC	Approved: SLR	Date: 22-09-2014

1.0 Pre-Qualification criteria:

1) The bidder shall have executed electrical, civil and mechanical package of a single, minimum of 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. 900 lakhs in the last three years ending 31st March of the previous financial year. The bidder shall submit the following details along with the bid: a) Audited balance sheets for last three years.

1.1 **Introduction**

Bharat Heavy Electricals Limited (BHEL), Electronics Division, Bangalore is setting up a 10 MWp Grid Connected SPV Power Plant at Belakavadi, Mandya Dist., Karnataka. Overall area of the plant is approx. 55 acres.

The plant will have a solar array field with fixed type of structures. PV modules (285Wp) of poly-crystalline type will be deployed. Electrically, the array will have 16 nearly equal segments, each generating DC power of ~630kWp, which is then inverted by a grid-connected power conditioning unit (PCU) of 630kWp rating. At the ac output level, every two PCUs are combined using a three-winding oil-immersion transformer to form a 1.26 MWp group. Thus, at each 1.26MWp level, two PCUs are connected independently to the two LV windings of the transformer that is connected to 11kV line on the HV side.

The plant employs 16 X 630kW PCUs that export the generated power to 66kV grid through 8 transformers and LV/HV breaker panels.

The plant is divided into two equal parts of 5 MW each (Part-A and Part-B) separated by a valley. The power from Part-B will be transferred to Part-A by means of 11 KV overhead transmission line.

The solar array will have 112 string monitoring combiner boxes (SMBs) that collect the solar PV generated DC power and provide inputs to the 16 PCUs housed within 4Nos. pre-fabricated inverter rooms. Each inverter room consists of 4 Nos. 630KW inverters and associated panels. The plant will have SCADA integration and PC based monitoring desk to gather DC, AC and other parameters from SMBs, PCUs, weather monitoring equipment, transformers, LT / HT breaker panels.

There will be 4 Nos. Inverter rooms and 1 No. Control room building and 2 Nos. security rooms of pre-engineered type which are in vendor's scope. Each inverter room houses 4 PCUs (630 KW each), 2 Nos of HT VCB panels and other associated panels. Control room shall house HT combiner panel, ACDB, FCBC, battery bank, SCADA room (air conditioned), store room and toilets.

There will be 2 Nos. transformers (1600KVA, 11KV/ xxx-xxxV) located one each on either sides the inverter room. A typical layout of transformer yard is enclosed. There will be one auxiliary transformer each of rating 100 KVA, 11KV/415V in both parts A and B areas.

An additional 10KW solar PV plant will be installed on the top of control room /on the ground to supply the auxiliary loads of the plant. The battery bank for this system will be able to supply the internal loads of the plant.

The final output of 10 MWp solar power plant shall be connected to 66KV bus in SFC switchyard of KPCL which is approx. 200 m distance from control room of solar plant. The 66 KV switchyard bay will be in the scope of BHEL.

This technical specification provides requirements of BHEL for supply, installation, commissioning of balance of system items and operation and maintenance of power plant for a period of 3 years. BHEL scope of supply and work is mentioned under section 3.2.

Note:
Vendor shall visit the site to assess all the technical and operational requirements and familiarize with the site conditions before placing the bid.

2.0 Documents enclosed with this specification

1	Single line diagram of overall power plant	3-679-05-00737 (AC) & 3-679-05-00738 (DC)
2	Site layout with locations of solar array, control room, inverter room, transformer yard (Autocad drawing of site layout will be provided on request by vendor through e-mail)	3-679-05-00736
3	Control Room Layout	3-679-05-00739
4	Inverter Room and Transformer Yard Layout	3-679-05-00740
5	Transformer yard fencing	3-679-05-00748
6	SPV module Drawing	3-679-05-00736
7	Earth chamber	3-679-05-00718
8	Technical specification for VRLA battery & FCBC	Annexure 1
9	Technical specification for ACDB and IRDBs	Annexure 2
10	Technical requirements of PCU air duct arrangement	Annexure 3
11	Technical specification for pre-engineered control room	Annexure 4
12	Technical specification for Auxiliary transformer	Annexure 5
12	List of EDEC ineligible items	Annexure 6

3.0 Scope of work

3.1 Vendor scope of work

The table below indicates the vendor's scope of supply, installation and O&M for 3 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, glands, hardware, cable trench, cable trays etc. as per clauses 5.6 to 5.18.	1 set
2	Supply of Auxiliary power cables, HT power cables, control cables, data communication cables, Optical fiber cables, 11kV termination kits etc. as per clauses 5.19 and 5.26.	1 set
3	Supply of auxiliary transformers, items of transformer yard fencing (fence, gate, angles etc.) for transformer area, items for connecting to earthing, with all related miscellaneous accessories and hardware as per clauses 5.27–5.41.	1 set
4	Supply of items of earthing system for solar array field, control room and inverter room panels and transformer yard equipment including Earthing electrodes, GI flats, copper strips, copper earthing cables (green) of min 25sq mm, CPVC pipes, Insulation bushes, heat shrinkable sleeves for control room copper strip earthing and all related miscellaneous hardware etc as per clauses 5.33 to 5.35.	1 set
5	Supply of lightning arrestors for solar array field (ESE type) with earthing items as per clause 5.36.	1 set
6	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 5.37 to 5.39.	1 set
7	Supply of items of module cleaning system such as submersible pumps (for bore wells/water sump), booster pumps, water storage tanks, CPVC pipes with fittings, ball valves, nipples etc as per clauses 5.40 and 5.41.	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 5.42 to 5.50.	1 set
9	Supply of safety related items including fire alarm system, fire extinguishers, safety gadgets etc as per clauses 5.51 and 5.52.	1 set
10	Supply of ACDB, Battery, FCBC, PCU ducting arrangement etc., as per the clauses 5.54 to 5.56 and annexures enclosed.	1 set
11	Supply of items for 10KW PV plant such as mounting structure, inverter with charge controller, battery bank etc. as per clauses 5.57. (PV modules for the same shall be supplied by BHEL.)	1 set
12	Supply of items for 11KV overhead transmission line between part-A and Part-B viz. four pole /two pole /single pole structures with GOS switches, lightning arrestors (surge suppressors), ACSR conductor, insulators, cross angles etc.,	1 set

	with all related miscellaneous accessories and hardware as per clauses 5.23 to 5.21 and 5.24.	
13	Supply of items for pre-engineered type (PEB) control room, inverter room and security rooms including partitions for SCADA room and toilets, internal wiring, air conditioners, light fittings, sanitary items, plumbing etc. as per clause 5.58	1 set
14	I&C: Temporary site office, storage yard, bore wells, unloading and movement of consignments, arranging electrical power and water for construction etc as per clauses 5.1 to 5.5	1 AU
15	I&C: Interconnection of SPV modules, cabling from strings to SMBs, installation of string monitoring boxes including cable terminations, formation of cable trenches and laying of 1CX185 sq-mm cables and inspection thereof as per clauses 5.6 to 5.13	1 AU
16	I&C: Erection of control room, inverter room and security room electrical panels such as inverters, HT Panels, ACDB, IRDBs, Security Room DBs, FCBC, Battery bank, DCDB, PCU ducting etc., including grouting, erection of cable trays and cable supports, routing and terminations of DC and AC cables up to LV side of transformers in transformer yard etc. as per clauses 5.14 to 5.16 and 5.54 to 5.56.	1 AU
17	I&C: Erection of transformer yard equipment such as transformers, 11KV cable laying and terminations, fire walls wherever required, foundations, Transformer yard leveling, jelly spreading, fencing including gates etc., as per clauses 5.17 to 5.20 and 5.25 to 5.28.	1 AU
18	I&C: Cable trenches, cable laying, cable terminations for 11KV cables as shown in SLD between inverter rooms and control room and from control room upto 66KV switchyard as per clauses 5.19 to 5.20 and 5.26.	1 AU
19	I&C: Cable trenches, cable laying, cable terminations for control, communication and OFC cables (between IRs and control room) related to inverters, transformers, HT Panels and SCADA as per clauses 5.29 to 5.32.	1 AU
20	I&C of earthing system for solar array field, control room panels, inverter room panels and transformer yard equipment including installation of Chemical earthing electrodes, erection & electrical interconnection of earth chambers, earthing of module mounting structures, laying of copper earth strips in control room etc, installation of lightning arrestors (ESE) as per clauses 5.33 to 5.36.	1 AU
21	I&C of yard lights for approach road, transformer yard and boundary wall 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 5.37 to 5.39.	1 AU
22	I&C of module cleaning system including trenches for pipelines, laying of pipelines from bore wells /water sump to solar array field through water storage tanks, erection of submersible and booster pumps, ball valves, non-returnable valves etc as per clauses 5.40 and 5.41.	1 AU
23	I&C of miscellaneous and safety items such as cable tags, danger boards, cable markers, hoarding board, sign boards, display boards, electrical insulation mat, checkered plates, air conditioners, office furniture, fire extinguishers, fire alarm system etc as per clauses 5.42 to 5.52.	1 AU
24	I&C of items of 10KW PV system such as mounting structure, inverter with charge controller, battery bank etc. as per clause 5.57.	1AU

25	I&C of 11KV overhead transmission line between part-A and Part-B as per clauses 5.21 to 5.24.	1 AU
26	I&C of items for pre-engineered type (PEB) control room, inverter room and security rooms including partitions for SCADA room and toilets, internal wiring, light fittings, sanitary items, plumbing, septic tanks, soak pits etc. as per clause 5.58	1 AU
27	I&C: Pre-commissioning inspections / checks / tests, MRT tests and coordination with state and central departments such as KPTCL/CEIG/SECI etc. for necessary approvals/ clearances for commissioning, synchronization with grid and post-commissioning operation of the plant as per clause 5.53.	1 AU
28	Operations and Maintenance of PV plant for THREE years (36 Months) as per clause 8.0.	36 Mon

Note: The terminal point under the scope of this specification shall be laying and terminating 11KV cable upto the LV side of power transformer of rating 12.5 MVA, 11KV/66KV located in SFC switchyard of KPCL.

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 and commissioning of these items except PV Modules, module mounting structures are within the scope of vendor. However, insurance for these items are within BHEL scope.

#	Scope of work	Qty
1	Solar PV Modules: BHEL make, 285Wp (Type L24270P)	~ 35840 Nos
2	Solar array structures with modules mounted on Fixed type structures (MMS), with each having 20 Nos. of 285Wp modules	10 MWp
3	Cable, 1Cx 6 sq-mm (for connection of PV modules to string monitoring boxes)	approx. 160km
4	Cable, 1C x 185sq-mm (for connection from SMB's up to PCUs in inverter room)	approx. 21 km
5	String monitoring boxes with mounting fixtures	112 sets
6	Power conditioning units (PCUs) of 630 kW rating	16 sets
7	Transformers 1600kVA, 11kV/xxxV-xxxV (1 HV winding, 2 LV windings)	8 Nos.
8	Cable, 1Cx 300 sq-mm for AC side power connections from PCUs to LV side of transformers	approx. 4.2 km
9	HT panels (indoor type) including VCBs, CTs, PTs, Relays as shown in SLD	1 set
10	SCADA system with PC, accessories and software	1 set
11	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
12	Boundary wall for the entire plant, pathways, approach road, drains within the solar plant.	1 set

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.

Note: Wherever approved vendors are provided, in case if it is required to propose additional vendors, the same shall be done with prior approval by BHEL. For all the items wherever approved vendors are not provided, approval of makes shall be obtained from BHEL before placement of P.O on sub-vendors.

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:
5.1	**Setting up of temporary site office** (1) Vendor shall set up two temporary site offices one each in part-A and part-B using porta cabin of minimum 200 sq.ft within 10 days from the date of purchase order to enable speedy commencement of site activities. (2) Cabins shall be retained at the site until completion of 3 months after commissioning. (3) Cabins shall be furnished with essential amenities such as two work tables, six chairs and necessary number of power points, lamps and fans.	
5.2	**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.	
5.3	**Construction of temporary yards for safe storage of all BHEL as well as vendor supplied items** (1) Vendor shall, at suitable locations at the site, as decided based on discussions with BHEL site engineer, construct two temporary yards one each in part-A and part-B for safe storage of BHEL as well as vendor supplied items except for PV modules and module mounting structures. This includes storage of all items such as electrical panels (PCUs, HT panels, Battery banks, Battery chargers, Distribution boards etc), transformers, cables, string monitoring boxes, spares, tools, instruments etc. (2) Area of each storage yard shall be approximately 1500 sq-meters. Typical size shall be 30m x 50m. However, exact size shall be decided mutually with BHEL based on site conditions. (3) An appropriate portion of storage 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) Yards 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 yards on round-the-clock basis.	
5.4	**Receipt, unloading, safe storage and movement of BHEL and vendor supplied items except PV Modules and MMS:** (1) Vendor shall organize all necessary resources such as labour, machinery and tools (cranes, hydra, forklifts, transportation trucks / trolleys, lifting accessories etc.,) for unloading the items received at the site and subsequent movement to the storage yard. Similar arrangements shall also be made by vendor for movements of the items from storage yard to the point of construction. (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. (7) Vendor shall provide necessary documentation and assistance to BHEL for making insurance claim in case of damage /theft of BHEL supplied items.	
5.5	**Construction of pipeline for water supply for O&M including water analysis, electrical cabling and plumbing works.** (1) The water required for O&M period will be provided at a location near to boundary of the plants in part-A and part-B or shall be extended from the nearby NALA/Channel. Vendor shall either construct water sump (if required) and/or pump the water to a water storage tank to store water. (2) Water analysis shall be carried out and reports shall be submitted to BHEL. (3) Pressure pump of required capacity (3 phase) with all necessary electrical cabling up to the ACDB's located in control room/ nearest IR	

	shall be provided. Vendor shall submit the calculations for deciding pump rating and cable size. (4) Casing as required shall be provided for the pump. (5) Pump and the electrical cables shall be in vendor scope of supply. 5 core cable (copper, armoured, PVC) of suitable size depending on pump rating and of required length 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. (6) Pump make: CGL, Suguna, Kirloskar or other make for which BHEL approval shall be taken.	
5.6	**Interconnection of SPV modules to form strings.** Supply of SPV modules is in BHEL scope. 35840 Nos. of BHEL make PV module of L24270P type, 285 Wp shall be supplied. Erection of module 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, 20 modules shall be connected in series for L24270 type. Each set of connections is called as a series string. Thus, 1792 series strings shall be formed with 358400 modules. (d) After placing the purchase order on vendor, BHEL will provide layout drawings that will describe the exact way in which the series strings are formed and interconnected to the respective SMB's. 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. Recommended make: 3M, Phoenix contact, Weidmuller, Hellermanntyton, Panduit. BHEL approval shall be obtained by vendor for use of any other make. **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.	
5.7	**Installation of string monitoring boxes:** (1) Supply of string monitoring boxes (SMB), 112 sets + 2 set spare, is in BHEL scope. These are 16-in and 1-out type. (2) Vendor shall install the SMBs in the solar array field as indicated in array layout. (3) All fixtures (Mounting brackets) and necessary hardware 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 SMBs on to the module mounting structure by drilling/punching (if required) 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 structures 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.	
5.8	**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 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 string. (4) MC4 connectors shall have rating of 1000VDC (IEC), rated current of 30A, Type approved by TUV Rheinland for product safety. (5) Approved makes: Multi-contact/ Tyco/ Weidmuller. The make of MC4 connector (for the 6 sq.mm cable at PV module end) to be supplied shall be same as that of MC4 connector connected to PV module which shall be informed by BHEL after placement of P.O. (6) Total quantity of MC4 connector sets required = 1792 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 206 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 20 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.	
5.9	**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 module mounting structures using cable ties. (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 in trenches. (2) HDPE DWC pipe of required length shall be within scope of vendor supply. (3) Specification of HDPE DWC pipe: As per IEC 61386 part 1-4; Inner Diameter (ID) shall be selected to accommodate the number of 6 sq-mm cables to be guided. However, Inner diameter shall be limited to a minimum of 63mm. (4) Make: Tirupati Plastomatics, Jaipur or reputed make, as approved by BHEL. (5) Make, part number, sizes / dimensions, datasheet 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) Then, a single layer of class-2 brick (burnt clay type) of 75 mm thickness shall be laid. (g) Trench shall, then, be filled with refill soil and compacted. (7) Total length of HDPE DWC pipe required ~ 5000m. Length indicated is as per BHEL estimation. However vendor to procure necessary quantity of HDPE pipes based on the actual requirement and ensure no shortfall in supply during the time of installation.	
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 side will be in the scope of the vendor. Approx., number of male MC4 connectors required for termination at SMBs will be 4000 nos. (including 416 spares). The make of MC4 connector (for the 6 sq.mm cable at SMB end) to be supplied shall be same as that of MC4 connector connected to SMB which shall be informed by BHEL after placement of P.O. (4) All necessary tools such as pliers, strippers, crimping tool etc shall be within vendor scope.	

5.12	**Connecting the 185 sq-mm cables on output side of SMBs** (1) Cables of 1Cx185 sq-mm (Aluminium, armoured, XLPE insulation, PVC sheathed) cables of positive and negative polarities shall be terminated at the output side of SMBs. Supply of this cable is in BHEL scope. Positive and negative cables are identified by the colour of insulation: red and black, respectively. (2) Overall diameter of cable ~ 28.5mm. (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 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 or any other reputed equivalent as shall be approved by BHEL. Quantity required ~ 460 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. Hardware should be SS304. Spring washers should be Zn coated. (6) All necessary tools such as pliers, strippers, crimping tool etc., required to complete the work shall be within vendor scope.	
5.13	**Cable trenches for laying power cables from SMB to inverter room:** (1) 1Cx 185 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) located at the respective inverter rooms. (2) Overall diameter of cable ~ 28.5 mm. (3) These cables shall be laid underground from the point near SMB to inverter room. (4) Two cables (+, -) from each of the 112 SMBs have to be routed to respective inverter rooms. (5) Tentative Array layout with location of SMBs and inverter rooms is enclosed for vendor's reference and for estimation purpose. Exact solar array layout will be provided by BHEL after placing purchase order. Vendor shall prepare and furnish cable routing layout as per standards for approval by BHEL. (6) Vendor shall estimate the length of cable trench. Generally these power cables will be packed 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. (7) Vendor shall construct the underground trench as follows: (a) Trench depth = 750 mm minimum. (b) Trench width shall vary en route to inverter 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 (burnt clay type) 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. The cables shall be laid inside class-B, GI pipes of suitable size under road crossings, drains, sewerage lines, entry of exit points of the buildings or where there are chances of mechanical damage Only terminal cable joints shall be accepted. No cable joints to join two cable ends is acceptable.	
5.14	**Installation (indoor) of PCUs, HT panels, battery banks, FCBC battery charger panels, ACDB, IRDBs, DCDBs and security room distribution panels located inside control room, inverter rooms and security rooms 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, inverter and security rooms: (a) 630kW PCU panels: 16 sets (each ~2500 Kg) (b) HT Switchgear panels as shown in SLD (19 nos. each ~600 Kg) (c) Battery bank (110V, 100AH): 2 sets (each ~600 Kg) (d) FCBC battery charger panel: 2 sets (each ~800 Kg) (e) ACDB panel: 2 set (~400 Kg) (f) IRDB panel: 3 sets(~640 Kg) (g) SCADA panels: 1 set (~500 Kg). (h) Control desk with PCs and accessories: 1 set. (i) DCDB panels: 3 sets. (2) Panels shall be placed over the cable trenches in control room or inverter 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 of required length and corner bends as required within control room and inverter room for laying DC, AC & signal cables over the trays. Vendor shall supply cable trays as follows: (a) Ladder type (for AC&DC) & Perforated type (for Signal) GI cable trays (b) Hot dip galvanized (c) Thickness = 3 mm (d) Depth = 40 mm (e) Width = 750 mm (5) Vendor shall fix the cable trays on the projecting steel sections in cable	

	trench of control room and inverter rooms. Supply and 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 185 sq-mm cables, cable support structure within inverter 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. (10) Similarly, cable ladders shall be provided for 1Cx 300 sq-mm cables to avoid sagging strain, near all the exit points, through which the cables approach transformers placed at the transformer yard. 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 are routed from inverter room to transformers in transformer yard through an opening in the walls of inverter 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 to ensure that cable enters the control room/inverter rooms 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/inverter rooms.	
5.15	**Power cable terminations on DC side of PCUs in inverter room** (1) On DC side, for each PCU, vendor shall carry out the required number of cable terminations for 7 positive and 7 negative inputs connections – unsleeving, crimping and connecting. (2) BHEL shall supply the cables (1Cx185 sq-mm Aluminium, armoured, XLPE insulation, PVC sheath). (3) All cable glands, cable lugs, bolts, nuts and washers shall be supplied by the vendor. (4) 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 and transformers using 3 runs of 1Cx300mm^2 Aluminium, armoured, XLPE insulated cable per phase. BHEL will supply the required cable. (2) For cable terminations at transformer end, vendor shall supply the required number of 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 approved by BHEL. BHEL will furnish the exact diameter of the cable at an appropriate time during the period of execution. Vendor shall make	

	suitable size cut-outs using hole–saw cutters in the gland plates of the tranformers for entry and exit of cables. (3) For cable terminations at PCUs, 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 16 PCUs of 630kW, and 8 Transformers of 1600 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 =8 sets.	
5.17	**Foundation pedestals and outdoor installation of 1600kVA, 11kV/xxx-xxxV transformers supplied by BHEL** (1) Number of transformers = 8 sets. (2) Vendor shall construct RCC foundation for each set of transformer. Design of foundation shall be prepared by the vendor considering soil report that shall be provided by BHEL after placement of PO. Following are the minimum requirements for foundations: (a) Weight of each transformer ~ 4000 Kgs (b) Size of foundation ~ 2000 x 2000 mm (L x B). (c) 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 below ground. (d) 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. (e) 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. (f) 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	**Firewall between 1600 KVA transformer and 100KVA Aux. transformer** (1) Firewall shall be constructed between adjacent transformers at IR-3 in part-B area. (2) Quantity of firewall = 1 Nos. (3) Wall shall be 230mm minimum thick with suitable reinforcing steel and concrete for stability. (4) Height of firewall shall be decided based on the height of inverter transformer after placing on foundation. (5) Foundation for a minimum depth of 900 mm below ground level. This shall include PCC 1:4:8 as the bottom layer. (6) Firewall shall be finished with cement plaster and water proof cement paint of BHEL approved colour all around. (7) Any specific regulations of KPCL/ CEIG shall be duly considered. (8) Vendor shall provide the firewall drawing to BHEL for approval.	
5.19	**Cable trench and laying of power cables (both HT and LT cables) and OFC cables** (1) Vendor shall construct underground cable trench for laying HT and LT cables in transformer yard and array yards as listed below. Outline of transformer yard and overall plant layout is enclosed. Trench shall be constructed: (a) Between the inverter transformers and incomers of HT panels (3Cx185 sq-mm cables). Total running length of trench ~ 120m. (b) Between the outgoer HT panels in respective inverter rooms and their incomers located in control room or other inverter rooms using (3C x400 sq-mm) as indicated in SLD. Total running length of trench~ 800m approximate (c) Between the 100kVA auxiliary transformers located in the transformer yard adjacent to control room to the entry point of control room wall bordering the transformer yard (3Cx 185 sq-mm cable from HV side of transformer to HT panel in control room and 3.5Cx95-mm for connecting LV side of transformer to ACDB panel in control room). Total running length of trench~30m approximate. (d) Between the 100kVA auxiliary transformer located in the transformer yard adjacent to IR-3 to the entry point of the IR-3 room bordering the transformer yard (3Cx 185 sq-mm cable from HV side of transformer to HT panel in inverter room 3 and 3.5Cx95 sq-mm for connecting LV side of transformer to ACDB panel in inverter room 3);	

Total running length of trench~ 30m approximate.

(e) Between the outgoer of control room and the GOS mounted on two pole structure at 66kv switchyard (2 runs of 3Cx400 sq-mm). Total running length of trench: 200m approx. Cable termination shall be in the scope of vendor.

(f) Between the GOS on two pole structure at 66kv switchyard and LV terminals of the 12.5MVA transformer (2 runs of 3Cx400 sq-mm). Total running length of trench: 10m approx. Cable termination shall be in the scope of vendor.

(g) Between the ACDB located at control room in PART-A area and Inverter room DB (IRDB) located at IR-1 and from IR-1 to IRDB at IR-2 and from IR-2 to security room.

(h) Between the ACDB located at inverter room-3 in PART-B area and Inverter room DB(IRDB) located at IR-4 and from IR-4 to security room.

(i) Between the FCBC(Battery bank) located at control room and DCDB's located at inverter room 1 and from inverter room-1 to inverter room -2. (2C x16 sq-mm).

(j) Between the FCBC (Battery bank) located at inverter room 3 and inverter room-4 (2C x16 sq-mm). Total running length of the trench:210m approx.

(2) Vendor shall construct underground cable trench for laying OFC cables from all the inverter rooms (IR-1, 2, 3 and 4) to Control room for communication between SCADA panels. The distance between HT cable trench and OFC cable trench shall be maintained as per relevant standards. OFC cable shall be laid in HDPE DWC pipe of min. ID 25mm which is to be supplied by vendor. Supply, laying and termination of OFC cables shall be in the scope of vendor.

(3) Supply of following cables shall be within vendor scope of supply. Specification of cables is as follows:

(a) HT Cable, 3Cx185 sq-mm, 11KV(UE), Al conductor, XLPE insulation, armoured, PVC sheath as per IS: 7098(latest edition) part-2. Quantity required ~ 1200m.

(b) HT Cable, 3Cx400sq-mm, 11KV(UE), Al conductor, XLPE insulation, armoured, PVC sheath as per IS: 7098(latest edition) part-2. Quantity required ~ 1000m.

(c) LT Cable, 3.5Cx95 sq-mm, 1.1KV, Al conductor, PVC insulation, armoured, PVC sheath as per IS: 1554 (latest edition) part-1. Quantity required ~ 200m

(d) LT Cable, 3.5Cx50 sq-mm, 1.1KV, Al conductor, PVC insulation, armoured, PVC sheath as per IS: 1554 (latest edition) part-1. Quantity required ~ 1000m

(e) LT Cable, 2Cx16 sq-mm, 1.1KV, Al conductor, PVC insulation, armoured, PVC sheath as per IS: 1554 (latest edition) part-1. Quantity required ~ 750m

(f) Optical fiber cable (OFC)- Multi-mode, Armoured, Total quantity required ~ 1800m

	(4) 11 KV cables will be unearthed grade suitable for use in medium resistance earthed system, with 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, single / multicore conforming to IS 7098 (Part II) IEC-60502 for constructional details and tests. The HT cable with insulation screen/armour insulated at one end should with stand the system fault current. (5) LT Power Cable shall be 1100V, grade, single / multicore, stranded aluminum conductor, XLPE, insulated with PVC inner sheath and outer sheath made on FRLS PVC compound. The armouring will be of Aluminum / galvanized steel round wire. (6) Vendor shall lay these cables layer wise providing adequate separation as per the relevant IS standards. Vendor shall indicate the IS standards employed. Trench layout and trench drawings shall be submitted to BHEL for approval. (7) Half-cut RCC hume pipes shall be provided over HT cables in transformer yard. (8) Trench layout and trench drawings shall be submitted to BHEL for approval.	
5.20	**Power cable terminations on AC HT side (11kV)** (1) Vendor shall carry out HT power cable terminations on HV side (11kV) of 1600 kVA transformers (8 sets) and HT panels using 3Cx 185 sq-mm cables and 3Cx400 sq-mm for connection between the HT panels as indicated in SLD. Cable lugs, HT termination kits and all necessary hardware, all of which shall be within vendor scope of supply. HT termination kits shall be of 12kV, 3-core, indoor type. Make: Raychem, 3M or reputed equivalent as shall be approved by BHEL. (2) Quantity of termination kits = 26 Nos for 3Cx185 sq-mm, 6 Nos for 3Cx400 sq-mm. Extra spare quantities shall be provided (2 + 1 Nos respectively). Quantity indicated above is the exact requirement. Vendor shall ensure procurement of additional quantity of termination kits, if required at no additional cost to BHEL to tide over any contingencies during installation. (3) The outgoer cable 3Cx400 sq mm from IR-3 is terminated onto a two pole structure from where the overhead transmission lines are laid across the valley. The overhead transmission lines get terminated onto another two pole structure on other side of the valley ie PART-A side where the overhead transmission lines get connected to 3Cx400 sq mm underground cable. Vendor shall carry out cable terminations at incoming and outgoing of the 2-pole structure located on LV side of 12.5 MVA transformer in 66 KV switchyard. For this, the HT termination kits shall be of 12kV, 3-core, outdoor type. Quantity = 6 sets + 1 set spare. Make: Raychem, 3M or reputed equivalent as shall be approved by BHEL. (4) Cable lugs and hardware shall be of dowell's / 3M or reputed equivalent	

	as shall be approved by BHEL. (5) All tools and accessories required to carry out the termination shall be within the scope of vendor. (6) 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.	
5.21	**CONNECTING PART-A AND PART-B THROUGH 11KV OVERHEAD TRANSMISSION LINE:** (1) As indicated in the Array layout and SLD, overhead transmission line has to be laid across the valley for transmitting the power generated in PART-B area to part-A. Length of transmission line ~500m. (2) 11 kV poles of appropriate height shall be used for line supports. The poles shall be of sufficient height to maintain safe clearance during/after stringing. The height of the poles shall be fixed in consultation with KPCL and got approved before procurement. ACSR COYOTE conductor shall be used for the 11 kV line. The line passes through steep gradient, hence care shall be taken by the contractor while designing the foundation and stringing. Standard span of the line shall be adopted. Double Pole arrangement shall be employed in between poles wherever applicable as per standards. There is no crossing over of the telephone lines by the 11 kV line. (3) For this purpose the 3Cx400 sq mm underground cable from IR-3 has to be terminated onto a two/four pole structure near the northern end of PART-B and again onto a two/four pole structure on PART-A where the overhead ACSR conductor gets connected to underground a 3Cx400 sq mm cable to be terminated onto one of the two incomers of HT panels located in control room. (4) Vendor shall design the transmission line considering electrical, mechanical and other affecting parameters as per all the governing standards and prevailing local electricity department's standards. Vendor shall submit the detailed design analysis for transmission line during detailed engineering for BHEL approval. (5) Optical fiber cable from IR-3 in part-B shall be laid upto CMCS (control room) in part-A along with the overhead transmission line across the valley on the same poles for SCADA communication purpose. Vendor shall consider the required clearances between ACSR conductor and OFC cable as per relevant standards. (6) The vendor shall decide if four pole/double structure is required and the number of PSC poles required/span between poles based on the design which has to be submitted to BHEL for approval during detailed engineering. (7) Pre-stressed concrete poles of solid rectangular type suitable for use in 11KV transmission lines as per prevailing local state regulating authority/Transco's standards. The cross section dimensions of PSC poles shall be as per STATE ELECTRICITY SUPPLY & TRANSMISSION BOARDS/CEIG etc. requirements meant for four pole/two pole structures. (8) All necessary overhead line accessories such as disc insulators, pin	

	insulators, stay sets, connectors, ASCR conductor etc, as applicable shall be supplied by the vendor. (9) PSC poles shall be as per IS: 1678-1998 (Specification for pre-stressed concrete poles), IS: 2905-1989 (Method of test for concrete poles) and IS: 7321-1974 (Code of practice for selection, handling and erection of concrete poles). (10) PSC poles shall be provided with earth wire of 8 SWG GI, eye-hooks / holes for ease of transport and handling. (11) Vendor shall provide the supplier details of PSC pole and obtain BHEL approval before procurement. (12) Test certificate as per IS standards shall be submitted to BHEL. (13) Vendor shall submit the dimension details of PSC poles. BHEL approval shall be obtained for the brand and supplier of the poles. (14) 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. (15) PSC poles shall be installed with an RCC foundation as follows: - Depth of foundation below ground level = 1.55m minimum. - PCC bed of 760x760x75 mm at the bottom of pit - Size of RCC: 760x610 mm minimum - Concrete pedestal above ground level: 500 mm minimum with sloped coping on top - Vendor shall submit drawing for four pole structure including foundations for BHEL approval - Concrete mix shall be M20 grade (16) Foundation of PSC poles shall be in line with STATE ELECTRICITY SUPPLY & TRANSMISSION BOARDS/CEIG etc., requirements. (17) Vendor shall submit drawing of PSC pole foundation for BHEL approval.	
5.22	**Supply and Installation of two sets of four pole/two pole structure with GOS switches and Lightning arrestors:** The transmission line consists of two four/two pole structures. . The installation requirements are as follows: (1) Vendor shall supply and install four pole/two pole structures that carries the following items: (a) Pre stressed concrete poles with foundation as per clause 5.21. (b) GOS switches (Air break switch), 3 pole, double break, horizontal, centrally operated, 12kV, 400A as per IS:9921 part 1-4, without earth switch: 2 sets (c) Lightning arrestors (surge suppressors) of 9kV, 10kA, class-3: - 3 Nos for the two/four pole at PART-A of the plant. - 3 Nos for the two/four pole at PART-B of the plant. (2) Insulators as per IS: 2544 / IEC 273 shall be used wherever required to maintain isolation from PSC poles. (3) The underground 3Cx400sq-mm XLPE cables shall be connected to GOS switches. The other end of the GOS switch shall be connected to ASCR connector. (4) All hardware fittings and accessories, which are essential to fulfill the functional requirements of the four pole/two 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 KPCL requirement shall be provided by the vendor. (5) Vendor shall submit general arrangement and detailed drawings with bill of materials/quantities of the four pole/two pole structure set with individual item description, quantity, make, specs / ratings etc for BHEL approval. Note: All MS parts of FP/DP structure shall be suitably painted using red oxide and BHEL approved silver colour paint.	
5.23	**Lightning arrestors for transmission line and switchyard (Surge suppressors)** (1) Arrestor rating: 9kV, 10kA, Class-3 with IB. (2) Type: Metal oxide Gapless lightning arrestor. (3) Make: Lamco (Hyderabad), Electrolite (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 (9 Nos) shall be mounted on the four pole/two pole structures and at the change over points from UG cable to OH line. (8) Total quantity required = 12 Nos. (6 Nos for transmission line and 3 Nos. for two pole in 66 KV switchyard) + 3 Nos. extra for spares.	
5.24	**Overhead lines across the valley from PART-A to PART-B sections using ACSR conductor :** (1) Vendor shall supply ACSR conductors for use in overhead lines in four pole, double pole and single pole structures. (2) ASCR conductor shall be as per IS:398 part-II 1996. (3) All electrical interconnection in FP/DP/SP structures shall be through stringing of ACSR conductors. (4) Vendor shall submit test certificates for ACSR conductors for BHEL scrutiny and acceptance. (5) Vendor shall indicate the type of ACSR conductor employed and the design calculations at the time of detailed engineering. Total length of ACSR conductor is 1500m approximately. **Strain Insulators and pin insulators:** a. The insulators used for stringing shall be of porcelain and be homogeneous, free from laminations, cavities and other flaws	

	imperfections that might affect the mechanical or dielectric quality. Free from defects, thoroughly vitrified and smoothly glazed. Insulators shall have a good lustre and uniform brown colour. The glaze shall be unaffected by sudden changes in temperature and by atmospheric pollution of ozone, acids, alkali, dust etc., The Min. Electro- mechanical strength of the strain insulator shall be 45kN. b. The insulators shall be designed to avoid excessive concentration of electrical stresses in any section or across leakage surfaces. When operating at normal rated voltage, there shall be no electrical discharge between the conductors and bushing which would cause corrosion or damage to the conductors, insulators or supports by the formation of substances produced by chemical action. c. Each insulator shall have marking as per the applicable standards All metal parts shall be made of malleable iron or open hearth or electric furnace steel and hot dip galvanized. Castings shall be free from blow holes, cracks and such other defects. The strain insulators shall be Tongue and clevis or ball and socket type. Technical parameters of 11kV pin insulators. System voltage - 11 kV Highest system voltage - 12 kV Power frequency withstand voltage – 28 kV. Lightning impulse voltage – 75 kV rms Creepage distance - 25/30 mm per kV. **Strain insulator hardwares/ Pins for pin insulators:** a) All hardware shall be drop forged from high carbon steel. b) All ferrous parts shall be hot dip galvanised. c) Tongue and clevis or ball and socket type insulators shall be used. d) Fittings intended to connect two dissimilar metals, shall be designed to avoid harmful bi-metallic corrosion under service conditions. e) Minimum breaking strength of insulator hardware shall not be less than that of the insulator.	
5.25	**Supply and Installation of auxiliary transformers :** Vendor shall supply and install 2 nos of auxiliary transformers. Location: (A)ONE no. auxiliary transformer at the transformer yard adjacent to control room in PART-A area. (B)ONE no. auxiliary transformer at the transformer yard adjacent to INVERTER ROOM - 3 in PART-B area. The supplied transformers shall conform to the following technical specifications: (1) Outdoor, Oil immersion type, ONAN, 3-phase, Dyn11, 100kVA, 11kV/415V (+/-10%), 50Hz +/- 3% transformer, Class A insulation, percent impedance 4.5%, cable box with bottom side cable entry on HV side and LV side, as per IS: 2026 for auxiliary power consumption to internal utilities of the power plant. For detailed technical specification, please referAnnexure-5.	

	(2) Electrical interconnections up to the transformer bushings on HV side shall be made using a 3Cx185 sq mm, XLPE, 11kv, underground cables. Termination kits shall be supplied by the vendor. (3) On LV side, suitable supporting arrangement shall be provided to route the cable, 3.5C X 95 sq-mm, Al conductor, armoured, 1100V, PVC insulation, PVC sheath cable as per IS: 1554 (part-1).The arrangement shall provide for suitable clips, clamps etc to ensure neat dressing of the cable. (4) Transformer shall be mounted on a suitable RCC foundation which is in the scope of vendor. The mounting arrangement and foundation details shall be submitted by the vendor for approval by BHEL. The transformer located in PART B area shall be mounted adjacent to the 1.6MVA inverter transformer. A firewall between the two transformers is to be constructed. The barrier shall extend at least 300mm above highest transformer bushing and pressure relief vent and lengthwise 600mm beyond the transformer including any radiator and tap changer enclosure. (5) Vendor shall submit general arrangement and detailed drawings with bill of materials / quantities with individual item description, quantity, make, specs / ratings etc for BHEL approval. Approved makes: Schneider/ PETE/ Kamat/ Universal or reputed equivalent, as approved by BHEL.	
5.26	**Power cable terminations at 100kVA 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, 11KV (UE), XLPE insulation, PVC sheath cable as per IS: 7098 (part-2). HT cable and cable termination kit shall be within vendor scope of supply. (2) Vendor shall carry out termination on LT side of 100kVA auxiliary transformer (11kV/415V) using 3.5Cx 95 sq-mm, Al conductor, armoured, 1100V, XLPE 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 and IR3. Vendor shall supply the necessary cable glands, cable lugs and hardware for ACDB end as well. (4) Quantity of cable ~ 200m. (5) All tools and accessories required to carry out the termination shall be within the scope of vendor.	
5.27	**Erection of transformer yard fencing with gate.** Vendor shall provide all around chain-link fencing to the transformer yard with gate at nine different locations as indicated in the layout. i. Fencing shall be as per BHEL drawing enclosed ii. GI Fence length ~ 200m iii. Gates shall be with following details: - MS gates - 9 Nos each of 1m width x 3m height. - 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. - Frame of 50x50mm MS pipes with 4mm thick - Vertical grills of 16mm square bar at 120mm c/c iv. Vendor shall submit drawing of the gate for BHEL approval.	
5.28	**Transformer yard leveling, jelly spreading and WBM road** (1) After installation of transformer yard equipment such as transformers, vendor shall level the ground with an appropriate magnitude and direction of slope to facilitate draining of rain water away from transformer yard. Accordingly, to prevent stagnation of water within transformer yard, vendor shall, wherever necessary, fill up the land with suitable soil and compact the filled-up portions either manually or with rollers, as applicable, as per site conditions, to achieve required slope. (2) Stone jellies of 20mm or 40mm shall be spread uniformly with a layer of minimum 100 mm thick throughout the transformer yard area. Approximate area for stone jelly spreading ~ 400 sq-m.	
5.29	**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, energy generation values. (e) 66KV switchyard: status of breakers, status of protection relays of transformers, oil/winding temperatures, energy export to the grid from ABT meters etc. (2) Vendor shall provide support and assistance to BHEL in following activities: (a) Formation of underground cable trenches and cable laying and termination for data communication cables from SMBs to SCADA, from transformers/ HT panels to SCADA, OFC cables from various inverter rooms to control room. (b) Formation of underground cable trench for laying OFC and control cables (CT signal to 66KV C&R panel) from 66kv switchyard to control room in the plant. Approx distance~200m. Necessary cables for transmitting the 11kv CT data from solar plant to the 66kv switchyard required for transformer protection as indicated in the SLD shall be supplied by vendor. Termination of the same shall be in the vendor scope. (c) Data cable laying from PCUs, LT panels, ACDB panels to SCADA. (d) Data cable terminations at PCUs, LT panels, ACDB panels,	

	transformers and HT panels. (e) Laying and termination of Optical fiber cables in SCADA panels at all inverter rooms to Control room.	
5.30	**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 conductor, 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 ~ 3200 m (5) This cable is meant for RS485 interfacing. The RS485 output of SMBs shall be daisy-chain looped using this cable. Approximately every 10 SMBs shall be daisy-chained to form one cable connection running up to SCADA room. In such a case, since 112 SMBs are there, approximately 11 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 and compacted. (9) Total length of trench ~ 2500m	
5.31	**Cable trench and laying of data communication cables in transformer yard** (1) Following are the data cables in transformer yard (a) Transformers to HT panels (b) HT panels to SCADA (c) Transformers to SCADA (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 (burnt clay type), 75mm thick, shall be laid over the sand. (g) Trench, then, shall be filled up with refill soil and suitably compacted.	
5.32	**Data cable terminations in control room and transformer yard** (1) Vendor shall carry out data cable terminations at 1600 kVA transformers, HT panels, ACDB panels and PCUs. (2) Terminations at marshalling box of 16 sets of 1600kVA transformers and 8 incomers of HT panels (Buchholz relay, pressure release valve, low oil level, WTI, OTI etc). (3) Terminations at HT panels (Buchholz relay, pressure release valve, low oil level, WTI, OC/EF relay, OV/UV relay, EM6400 meters etc) for transformer protection and SCADA. (4) Terminations at 16 PCUs of 630kW for RS485 MODBUS communication cable connections. (5) Terminations at 2 ACDB panels. (6) 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, 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. (7) Approximate quantity requirements of cables for the above purposes as follows: 2 Pair x 0.5 sq-mm ~ 1500 m (PCUs, transformers to SCADA) 5 Pair x 0.5 sq-mm ~ 750 m (HT panel to SCADA) 2 Core x 2.5 sq-mm ~ 1000 m (HT panel to SCADA) (8) Supply and termination of control cables from HT panels to transformer: 12core X 1.5 sq-mm ~300m. (9) 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. (10) Make of cables: Polycab, Advanced cables, Lapp or any other reputed equivalent as shall be approved by BHEL. (11) 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., 500 m) copper, armoured, PVC	

	cables which is in vendor scope of supply. Cable shall be laid from FCBC (for DC) and ACDB panel (for AC).	
5.33	**Earthing of solar array structures** (1) Vendor shall interconnect solar array structures using welding of 25x6 mm GI strips. (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) Vendor to ensure that every earthed structure is provided with two alternate paths to earth. Accordingly, vendor shall provide suitable number of earth pits and ensure that the earth resistance of all earthed structures is less than 1 ohm. (4) Earth pit shall be drilled and 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 enclosed. 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, using 50x6 mm GI strip that shall be laid underground. (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 (50x6mm) 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. For each earth pit, necessary Test Point shall have to be provided. (8) All GI strips, earthing electrodes and all hardware (nuts, bolts, washers of SS304) shall be in vendor scope of supply.	

	(9) Vendor shall provide layout drawings showing earth chamber locations during detailed engineering.	
5.34	**Earthing lines for control room and inverter room panels – PCUs, LT panels, Battery banks, FCBC charger, ACDB panels, SCADA panels, DCDB panels, etc.** (1) 50x4 copper strips shall be laid in the cable trenches of control room. Copper strips of required length shall be in vendor scope of supply. (2) Strips shall be covered by heat-shrinkable sleeves. Sleeves and 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. (4) Expansion bolts of appropriate size (Minimum M8) shall be used to fix the insulation bush supports. (5) Vendor shall provide the earthing line layout drawing. Minimum one No. earthing pit shall be considered for each of control room and inverter room panels such as PCUs, HT panels, ACDB, battery charger etc. All the earth chambers shall be interconnected using 50X4 copper earth strip. (6) Copper strips shall be connected to the earthing terminals of all the control room and inverter room panels using 25 sq-mm copper, unarmoured, PVC cables that shall be supplied by the vendor. Cable lugs and hardware (bolts, nuts, washers etc shall be of SS304) required for connecting the ~~6~~ 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) Required number of copper earthing electrodes shall be supplied and installed. Vendor shall submit the earthing calculations as per standards. Earth chambers of brick masonry shall be constructed as per BHEL drawing. (8) These chambers shall be located near the control and inverter room. Exact locations will be intimated by BHEL site engineer. (9) Connection between earth chamber and copper earthing strip shall be made using cable, 1Cx 25sq-mm, copper, unarmoured, 1100V, PVC cables as per IS:1554 (part-1) that shall be in vendor scope of supply. (10) Routing of 1Cx25 sq-mm cables to electrode earth chambers shall be using 1-inch CPVC pipes, joints, bends and elbows that shall be in vendor scope of supply. Routing shall be underground outside the inverter and control room, at a depth of ~450mm below the ground level. Required length of CPVC pipe shall be supplied. Number of CPVC joints and elbows shall be as applicable. (11) Expansion bolts, cable lugs and all hardware required for this activity shall be within vendor scope of supply.	
5.35	**Earthing of transformer yard equipment and fencing.** Vendor shall install chemical earthing electrode Zn coated, Hot dip galvanized, with brick masonry earth chamber for each case as per BHEL drawing enclosed. (1) Invertetr Transformers body earth – 8x 2 Nos each = 16 Nos. (2) FP/DP structure 1, GOS switch body earth – 2 Nos (3) FP/DP structure 2, GOS switch body earth – 2 Nos (4) FP/DP structure 1, Lightning arrestors – 2 Nos	

	(5) FP structure 2, Lightning arrestors– 2 Nos (6) Aux transformer, body earth – 2 x 2Nos each=4Nos. (7) Aux transformer, neutral earth – 2 x 2Nos each=4Nos. (8) Transformer yard fencing – Quantity as required 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. Extra number of electrodes may be supplied and installed if the overall resistance in switchyard shall be more than 1 ohm. GI strips shall be laid underground at a depth of ~ 500 mm. Earth electrodes with chemicals, GI strips, all hardware required for making the connections shall be within vendor scope of supply. Vendor shall carry out all the necessary GI strip laying and interconnections to form earth mat under the ground at a depth of ~ 500 mm. Vendor shall carry out measurement of earth resistance in all the cases that shall be witnessed, verified and certified by BHEL site engineer.	
5.36	**Lightning arrestors (ESE) type** (1) Early streamer emission lightning arrestors as per standards: UNE 21186 and NF C-17 102, Make: Ingesco/ABB/equivalent as shall be approved by BHEL, with minimum protection radius of 100 m. with counters and earthing systems. (2) Quantity : As required to cover the entire area of the plant (part-A and part-B). (3) Lightning arrestors shall be mounted on top of a mast of height 12m minimum above ground level using MS pipe of 100 mm minimum average diameter with painted finish; Each mast shall be secured by three steel stay wires that are suitably grouted. Masts shall have appropriate steel base plate for mounting on an RCC concrete foundation pedestal of 450x450 mm size, 1m depth below ground level, 300mm minimum above ground level, PCC 1:4:8 as the bottom layer (~100 mm thick), steel rods of diameter 8mm minimum, concrete M25 with four J bolts (M16) of 750mm long, with nuts and washers. (4) Minimum two earthing chambers per lightning arrestor set using chemical earthing electrodes shall be constructed as per BHEL drawing enclosed. drawing enclosed. (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.	
5.37	**Yard lights for transformer yard, approach roads, pathways and compound wall (periphery lighting):** (1) Vendor shall supply and install required number of lights in switchyard, approach road, pathways and compound wall to maintain minimum LUX requirement of 20 LUX. (2) Light fitting, Bajaj/Havells/Equivalent make (36 W) shall be supplied and fitted on the GI bend pipes/poles using necessary hardware. (3) Adequate spacing between the poles shall be provided to ensure the	

	minimum lux requirement. (4) Underground armoured, PVC insulated, copper three core cables of suitable size and required length shall be laid for power supply. Supply of these cables is in the scope of the vendor. Vendor shall submit cable sizing calculation for approval. (5) Junction box shall be at a height of 1m above ground level. MCB of suitable rating along with junction box shall be provided for each pole. (6) The Junction box shall be made of stainless steel (IP65), Dust & vermin Proof and shall have suitable brass or copper made connector terminal., MCB (1A, single pole) of Schneider or reputed make, 2 glands (nickel plated brass single compression) for 3-core cable, 1 gland (polyamide) for 2Cx1.5 sq-mm copper, unarmoured, PVC cable. (7) The junction box, cable lugs, steel bracket for mounting the box on the lighting pole and all hardware items shall be in vendor scope. (8) Glands shall be located at the bottom side of Junction box. (9) Necessary underground cabling work is in the scope of the vendor. (10) Vendor shall submit the lighting layout, lighting illumination calculations, cable trench layout, shadow calculation, foundation pedestal details, detailed BOM for BHEL approval. (11) Supply of necessary hardware such as nuts, bolts, washers (SS304) is in the scope of vendor. (12) Vendor to ensure the lighting arrangement does not cast shadows on the PV modules. (13) All necessary tools and tackles shall be in the scope of vendor.	
5.38	**Cable trench formation and laying of cables for yard lights** Vendor shall construct the underground trench of required length 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.	
5.39	**Cable terminations and supply 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. (2) Vendor shall supply following cables of required length: (a) 3-Core, Cu, armoured, PVC cable (size of cable shall be finalized based on cable sizing calculation to be submitted by vendor) (b) 2Cx 1.5 sq-mm Cu, unarmoured, PVC cable (3) Vendor shall supply following CPVC pipes of required length: (a) CPVC, 1-inch pipe	

5.40	**Laying of pipelines between Water outlet at boundary or from nearby NALA to water storage tanks** The water required for maintenance of the plant shall be provided at a location near to boundary of the plants **or** water shall be extended from the nearby NALA/Channel. The vendor shall make arrangements for the supply of water from the water outlet point or NALA/Channel to the plant site. Necessary pipings/water lifting pumps of suitable capacity shall be arranged by the vendor. The following size of pipes and fittings shall be used in the water pumping system: (1) CPVC pipes (2-inch) shall be laid underground (at depth of ~500 mm) from water outlet that shall be provided by KPCL at a location near to plant boundary in part-A and part-B to water storage tanks respective parts. (2) All necessary CPVC fittings such as T-joints, bends, nipples, reducers, couplers etc shall be used as applicable. (3) Lines from the bore well to storage tank shall have independent 2-inch non-returnable valves (forged steel) and 2-inch ball valves (forged steel). (4) Vendor shall submit a detailed water pipeline layout scheme with BOM etc. from KPCL water outlet to storage tank for BHEL approval. (5) Vendor shall supply and install 4 nos. of water storage tanks each of 5000 liters capacity. (6) Pump of required capacity and required type for pumping from nearby NALA / KPCL water outlet to storage tank shall be supplied by vendor.	
5.41	**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) Two numbers of suitable centrifugal 3-phase booster pumps of required capacity shall be supplied and installed at a suitable location (one each) in PART-A and PART-B areas to draw the water from storage tank to solar array field for solar PV module cleaning. Vendor shall furnish design/pressure calculations for selection of pump size. One spare pump shall also be supplied. (3) Starter and DP switch (2 set-1 set each for PART-A and PART-B) shall be supplied and installed near ACDB panel in control room in PART-A area and inverter room-3 in PART B area 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 and IR-3 shall be in vendor scope. Cable of required dimension, Cu, armoured, PVC cable shall be supplied and used. (5) CPVC pipelines shall be laid underground (at a depth of ~500 mm below ground level). (6) There shall be adequate nos of delivery points for module cleaning. At these delivery points, 1-inch riser lines shall be provided to tap the water	

	from underground line to the delivery point ~300 mm above ground level. Ball valve forged steel type, 1-inch, with suitable nipple for connecting the hose pipe, shall be provided at each delivery point. (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) of 50m long shall be provided for connecting the hose to the nearest ball valve/nipple. The other end shall be provided with nozzle/appropriate gun to direct the pressurized water on the module for cleaning.6 such sets shall be provided. (9) Vendor shall ensure adequate pressure of water is available for module cleaning. (10) Vendor shall submit detailed scheme with BOM etc. for module cleaning system from storage tank to solar array field.	
5.42	**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 transformer yard 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 transformer yard (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, ACDB panel etc.	
5.43	**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 at appropriate locations for following cases: a) For 185 sq-mm cable from string monitoring boxes to respective inverter rooms b) For data communication cables from string monitoring boxes to control room c) For cables of yard lights of solar array field, compound wall/chain-link fencing and transformer yard fencing d) For electrical cables of bore well connections e) For HT (11kV) cables within transformer yard f) For aux transformer to ACDB panel g) For CPVC water pipelines (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.

5.44 Hoarding for the solar power plant. (2 Nos.-one each in part-A and part-B)

(1) Hoarding for the plant shall be made of 1500x1800x 3mm 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.

5.45 Display boards and sign boards

1	Board displaying instruction chart for restoration of person from Electric Shock	Qty as required
2	Board displaying instruction chart for artificial respiration	Qty as required
3	Board displaying dos and don'ts.	Qty as required
4	Board displaying fire extinguishers details and operations	Qty as required
5	"No smoking" board	Qty as required
6	Board showing list of O&M staff with name, qualification and work responsibility	2 Nos
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	2 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 transformer yard etc.	Qty as required
9	Identification boards, of suitable sizes, within control room such as scada room, store room, battery room, security room, gents / ladies toilets, pantry etc shall be supplied by vendor. BHEL will provide the list.	Qty as required

(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.

Required number of danger notice plates shall be provided wherever necessary Suitable size of each Danger Notice plates shall be provided as per statutory requirement , made of mild steel sheet and at least 2mm

	thick, and vitreous enameled white on both sides, and with inscription in signal red colours on front side as required. The inscriptions shall be in Kannada and English language.	
5.46	**Electrical insulation mat** (1) Vendor shall supply required number of electrical insulating mats 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: Black. (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, LT, HT, FCBC, ACDB panels) in control and inverter rooms.	
5.47	**Checkered plate for closing the cable trenches (a) behind the panels such as PCUs, LT panels, VCB panels , ACDB panels etc in inverter and 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 max, total length as required (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.	
5.48	**Air conditioner** Vendor shall make partition for SCADA room using aluminium and glass. Details of partition shall be submitted to BHEL for approval. Vendor shall provide false ceiling inside SCADA room with suitable lighting fixtures. Split air conditioner of 1.5T 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.	
	AIR CIRCULATOR TYPE STAND FAN: Vendor shall supply 2 No. air circulator type stand fan for each room. The fan will have atleast 4040 mm sweep, 1420 RPM. The fan shall be fitted with suitable regulator & a power suitable power cord. The fan shall have height adjustable stand. Standard Polar / Khaitan / Usha make shall have to be supplied with prior approval of BHEL.	
5.49	**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		3 Nos
3	AC-DC Clamp Meter	Lutron/equivalent	DM-6506	3 Nos
5	Digital thermometer (wall hanging)	Reputed Make		2 Nos
6	Megger – 5KV	Shanti Electric Instruments, Nippen/equivalent		1 Nos
7	Electrical Tester	Reputed Make		4 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	4 Nos each
2	Screwdriver Set	2 Set
3	Crimping tool with Dye range 50-400sq-mm cable, mechanical gear power, hand operated	1 Set
4	Crimping tool up to 6 sq-mm cable	2 set
5	Drilling machine AC, hand operated, with bit size up to 20 mm	1 set
6	Measuring Tape, 5m	4 Nos
7	Measuring Tape, 50 m	2 Nos
8	Allen Key set	2 Set
9	Adjustable spanner 2-inch size	2 No
10	Hammer	4 Nos
11	Rough file kit	2 Set
12	Platform balance, 50Kg range, 100g accuracy	1 No
13	Cutting Pliers	4 Nos
14	Nose Pliers	4 Nos
15	Vacuum cleaner, of industrial type, for control room sweeping / cleaning.	1 No.
16	Blowers for cleaning the panels	1 No.

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

5.50 Office furniture

1	Executive table, wooden type, complete with draws and side racks	2 sets
2	Chairs, swivel type, with arm rest	10 Nos
4	PC table with chairs	1 set
5	Storage almirahs	2 Nos
6	Filing cabinets	2 Nos
7	Aqua Guard or approved make water purifiers	2 Nos.

Make: Godrej or reputed equivalent as shall be approved by BHEL. BHEL approval shall be obtained, for the type of office furniture, for which catalog

	with model numbers, sizes / dimensions etc shall be submitted to BHEL.	
5.51	**Fire alarm system for control room and inverter rooms:** (1) Fire alarm system with smoke detectors, hooters, manual call points, an electronic control panels and interconnection wiring shall be supplied and installed. Make: Zicom/ Notifier /Ravel or any other reputed equivalent as shall be approved by BHEL. (2) Control panels 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, min. 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 – 1 No. (8) Locations of sensors shall include cable trenches of control room and inverter rooms as well. (9) Sufficient quantity of sensors, alarms, hooter, manual call points etc. shall be supplied and installed as per the necessary statutory requirements. Vendor should ensure the design of fire protection system in line with the regulations of the Fire Safety department of the state. (10) Vendor shall submit fire alarm layout/scheme along with the detailed BOM to BHEL for approval. **(11)** Fire alarm control panels shall have provision for RS-485 output so that status can be monitored in plant SCADA system.	
5.52	**Other safety related items** **(1) Safety gadgets:**	

1	Gas Mask	4 Nos
2	First Aid Box with essential medicines and bandage cotton, antibiotic cream, Dettol, etc.	4 set
3	Hand Gloves 11 KV for GOS operation	4 sets
4	Hand Gloves 1KV for Maintenance of SMB	4 sets
5	Discharge rod	4 Nos
6	Safety Helmet	10 Nos
7	Rain Coat	4 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. Quantities mentioned below are minimum. Vendor to comply the requirements of statutory bodies.

1	Dry powder fire extinguisher (stored pressure type)	Capacity: 10 Kg IS: 2171, IS:10658 CM/L-7759096 Suitability for Class A, B & C fire, related to solid combustibles, flammable liquid and gases.	15 Nos
2	Carbon di-oxide (CO2) type fire extinguisher with trolley	Capacity: 9 Kg IS: 2878 Suitability for Class B&C fires Involving flammable liquids & gases, electronic equipment.	15 Nos
2	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.	10 sets

5.53 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/DP/SP structure items (GOS, LAsetc), 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, inverter room and transformer yard.

(6) Functional checks for PCUs: Vendor shall support the PCU engineer during the pre-commissioning tests.

(7) 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.

(8) Functional checks for HT panels:
(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/SCADA (g) indications on windows, alarm accept/reset operations /SCADA.
(b) Verification of interlock operations related to incomer and outgoer VCBs.

(9) 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.

(10) Functional checks on SCADA software: mimic diagrams, trend graphs, remote accessibility etc.

(11) Earth resistance measurements at the electrode chambers for solar array, control room panels and transformer yard 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/SECI 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, primary injection tests.
(e) Lightning arrestors: IR tests
(f) 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 STATE ELECTRICITY SUPPLY & TRANSMISSION BOARDS/MRT/CEIG/SECI 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.	
5.54	**Supply and installation of FCBC, Battery bank and DCDBs (2 sets- one each in part-A & part-B)** 1 No. FCBC and one set of battery bank (5 Nos. battery cells for each set shall be supplied as spare) are to be supplied at each part (part-A and part-B) by the vendor and are to be installed in the control room in part-A and in IR-3 in part-B. In part-A, FCBC and battery bank in control room shall provide DC supply to DCDBs at IR-1 and IR-2. Similarly in part-B, FCBC and battery bank in IR-3 shall provide DC supply to DCDB at IR-4. For detailed technical specifications, refer Annexure 1.	
5.55	**Supply and installation of ACDB Panels (2 Nos.), IRDB panels (3 Nos.) and security room DBs (2 Nos.)** The ACDB, IRDB, security room DBs are to be supplied by the vendor and is to be installed in the control room, inverter room and security rooms. For detailed technical specification of ACDB and IRDB Panels; refer Annexure 2. **ACDB shall have provision for inputs from auxiliary transformer and 10KW PV system to supply the internal loads and periphery lighting with a changeover switch.**	
5.56	**PCU Ducting** The supply and installation of 16 sets of Air Ducts for 16 PCUs installed in the control room is in the scope of vendor. For technical requirements of PCU air duct arrangement, refer Annexure 3.	
5.57	**Supply, installation and commissioning of 10KW PV system for auxiliary consumption of the solar plant** The auxiliary power requirements of the plant shall be supplied through 10KW PV system that shall be installed either on roof top or on ground. PV modules required for this system shall be supplied by BHEL. All other components such as structure, Junction box, charge controller cum inverter (10 KW rating), battery (120V, 300AH), cables shall be supplied by the vendor. Vendor shall carry out installation and commissioning of the system.	
5.58	**Pre-engineered (pre-fab) type control room, inverter room, security rooms**	

	Vendor shall supply and install the pre-engineered type building for control room (1 No. of Approx. 150 sq.m), inverter rooms (4 Nos. each of approx. 120sq.m), security rooms (2 Nos. each of 16 sq.m) including foundation works, partitions for SCADA room and toilets. Layout of control room is enclosed. Civil foundation for pre-fab building shall be designed to take the load of all the equipment inside the buildings. Vendor shall suitably design the height of foundation (finished floor level) taking into consideration the possibility of water logging in the surrounding area. Drawing along with design shall be furnished to BHEL for approval. Cable trenches shall be constructed in the foundation of inverter and control rooms as per the equipment layout drawing that will be provided by BHEL. Vendor shall make partitions for SCADA room in control room using aluminium channels, gypsum board and glass. Details of partition shall be submitted to BHEL for approval. Vendor shall provide air-conditioner of 1.5 tonnes (min. 4 star BEE rated) and false ceiling inside the SCADA room with suitable lighting fixtures. Vendor shall also carry out the internal wiring with switchboards, electrical fittings, light points, fan points, luminaires, fans etc. Vendor shall furnish the electrical layout of all rooms for BHEL approval. Vendor shall supply and install required plumbing and sanitary items of reputed make for toilets. Toilets shall be provided in Control room in part-A, Inverter room-3 in part-B and in 2 Nos. security rooms which will be located one each in part-A and part-B. Construction of soak pits and septic tanks as required shall be in vendor's scope. Inspection chambers for letting out sewage and sullage are to be constructed. Septic tank to be provided with RCC lid with ventilation pipe. PVC pipes of 160mm dia for transmission of sewage to be used. The toilet room in Control room shall have separate partitions for gents and ladies, each shall contain a Western commode (W.C) and wash basin with mirror. The layout shall be as shown in the control room layout drawing enclosed. The toilet rooms in IR-3 and security rooms shall contain 1 No. W.C, wash basin with mirror. Vendor s Make of all the items shall be approved by BHEL. For detailed technical specification of pre-fab buildings; refer Annexure 4.	

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

6.1	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 to BHEL in advance. 1) HDPE DWC pipe 2) Pre-stressed concrete (PSC) poles 3) Gang operated switch 400A, 11kV without earth switch 4) Lightning arrestors 9kV, 10kA 5) Auxiliary transformer 100kVA, 11kV/415V, ONAN 6) Disc insulators and other overhead line accessories 7) ACSR conductor 8) All cables under vendor scope (LT, HT, data, control, OFC and communication cables) 9) Earthing electrodes 10) Lightning arrestor (ESE) 11) Submersible pump 12) Centrifugal Booster pump 13) Ball valves 14) CPVC pipes 15) Air conditioner 16) Fire alarm system 17) Fire extinguishers 18) Electrical insulation mat 19) 12kV termination kits (indoor, outdoor) 20) Items of 10 KW PV system 21) ACDB, IRDB 22) FCBC, Battery bank, DCDB 23) PCU Ducting material 24) Pre-engineered building materials **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.	

7.0 General conditions applicable during installation and commissioning phase

7.1	As already mentioned in previous clauses, vendor shall organize power supply on their own. Accordingly, DG sets of suitable capacity shall be deployed by the vendor for construction works.	
7.2	Water required for construction works shall be organized by vendor. Pipe lines from NALA, which are deliverables of vendor as part of this contract, shall be laid in the beginning stages so that NALA water can be used for the construction purposes. In case water from NALA is not available, vendor shall make their own alternate arrangements (tankers etc).	
7.3	All machinery such as cranes, hydra, JCBs, forklifts, transport trucks, trolleys etc necessary for movement of materials shall be organized by the vendor.	
7.4	All necessary tools and tackles such as crimping tool (including heavy duty tools for crimping copper cables up to 300 sq-mm), screw driver set, power	

	screwdrivers, cutting pliers, nose pliers, spanner sets, adjustable spanners, hole saw cutter set, bending tools, torque wrenches, hack saw blades, pipe wrenches, flat / round files, HV termination tools, drilling machines, welding machines, concrete mixers, steel bar bending tools / templates for RCC works, spade, shovel, hammer etc shall be organized by the vendor.	
7.5	All necessary measuring instruments such as digital multimeters, electrical testers, meggers (1kV, 2.5kV, 5kV), lamp load testers for solar array string measurements, earth resistance meters, weighing machines, water level indicators etc shall be organized by the vendor.	
7.6	Vendor shall make their own arrangements for necessary food, drinking water and accommodation for their labour and employees posted at the site. Similarly, food and drinking water required at the site, during the construction operations, shall also be in scope of vendor.	
7.7	Vendor shall organize all necessary steps to meet statutory requirements such as labour license, PF, ESI etc and also ensure compliance with relevant acts such as minimum wages act, income tax act, employee insurance act etc for their labour deployed at site.	
7.8	Vendor shall maintain updated labour register, with name, age, qualification, salary, attendance details etc at the site. Vendor has to satisfy all the statutory requirements as per the labour law regulations in the state.	
7.9	Vendor shall use danger boards, wherever required, to ensure safety of the persons during the work at site.	
7.10	Vendor shall adhere to all necessary safety norms such as use of helmet, goggles, hand gloves, gumboots, aprons etc. It is the ultimate responsibility of the vendor in all respect to prevent accidents at the site and safeguard their labour from accidents.	
7.11	Vendor shall, at the completion of every work, clear off the debris, which resulted out of the work. In case of excavation work such as cable trench etc, vendor shall finish the land neatly with necessary leveling, rolling etc.	
7.12	Vendor shall carry out the work without causing inconvenience to other contract groups at the site. In case of conflicts with other groups, vendor shall ensure that the matter is resolved at once amicably so that the progress of work is not affected.	
7.13	Any damages on the building, structures etc attributable to the acts of labour / employees of vendor shall be rectified and made good by the vendor at their own cost.	
7.14	No child labour shall be employed for execution of the present contract.	
7.15	**Any miscellaneous materials, which are found essential for technical completion of the contract as per regulations/standards but not mentioned explicitly in this specification, shall be deemed to be included in the specification. Accordingly, such materials shall be included by the vendor as part of the offer.**	
7.16	**In certain cases, approximate quantities are only mentioned. This is for the purpose of providing guidance to vendors and are as per BHEL estimation. 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.**	

7.17	Special instruction for earthing: In compliance with Rule 33 and 61 of Indian Electricity Rules, 1956 (as amended up to date), all non-current carrying metal parts shall be earthed with two separate and distinct earth continuity conductors to an efficient earth electrode. Accordingly, all cases such as cable support structures, cable ladders, cable trays (control room) etc shall be earthed.	
7.18	Any deviations shall be discussed with BHEL site engineers and implementation shall be taken up only after approval from BHEL.	
7.19	Vendor shall submit periodic status report, on daily as well as weekly consolidated basis, to BHEL on the progress of the contract.	
7.20	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.	
7.21	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.	
7.22	All cable terminations shall be done in such a way that bending radius of the cable is strictly as per IS: 1255	
7.23	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	
7.24	Vendor has to pay the plant electricity consumption charges, internet & telephone charges etc during the O&M period.	
7.25	Vendor shall prepare and submit as-built drawings after execution of works.	

8.0 Operations and Maintenance

8.1	Date of commencement of operations and maintenance : Zero date for O&M shall be the actual date on which the complete 10 MWp is commissioned with synchronization / export of power to 66kV grid and completion of all the works in the scope of the vendor.	
8.2	Period for O&M: Vendor shall operate and maintain the power plant for a period of THREE years from the zero date as above.	
8.3	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 handle technical and operational / crisis problems. (ii) Six 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) Eight unskilled persons for regular house-keeping (cleaning / mopping etc) and water cleaning of SPV modules.

(iv) **Note:** At least two among the technical personnel shall essentially be a certified / licensed person for HT operations (11kV minimum). This is a mandatory requirement.

(b) Security personnel

(i) Minimum six security guards with competence to handle tough situations and safeguard the plant from miscreants. Among these, four shall be deployed during night time and two during day time.

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 local administration/KPCL.
9. O&M personnel at site shall be deemed to be aware of damages and risks incidental to conditions of BHEL 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 plant operation (6:00 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.	
8.4	O&M operations – daily basis (1) Water cleaning of SPV modules (2) Control room and inverter room cleaning – dry sweeping, wet mopping (3) Water wash cleaning of toilets, urinals. (4) 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. (5) 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. (6) Drinking water to be arranged for O&M personnel at site.	
8.5	O&M activities – weekly basis (1) Removal of garbage from solar array field, transformer yard, roads, drains, pathways, sand buckets; logging in registers with signatures of operating persons and in-charge. (2) Monitoring and logging of fire extinguisher levels / pressures as per BHEL formats	
8.6	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, transformer yard 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.	

8.7	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.	
8.8	O&M activities – half yearly basis (1) Cleaning of water storage tanks	
8.9	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 transformer yard gate / fencing, earthing chambers, other steel structures within control room and transformer yard if required 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 transformer yard.	
8.10	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 (b) VCB on/off: local operations from outdoor HT panel and remote operations from indoor remote annunciation panel (c) Settings of numerical relays in HT panels: review and revision in consultation with BHEL. (d) ACB 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 storage tanks. (2) Coordinating, on behalf of BHEL, and obtaining renewal of statutory	

	licenses, clearances and approvals from state departments such as KPCL / KPTCL/ 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.	

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

9.1	BHEL approval shall be obtained for the following technical documents, which shall be submitted to BHEL in phased manner based on priority sequence of activities. However, it shall be ensured that all documents are submitted within 10 days from date of purchase order.	
9.2	Vendor, make, model number / part number, specification / sizes / dimensions / drawings / datasheets of all the vendor supplied items.	
9.3	General arrangement drawings / schemes / layouts etc with bill of materials / quantities shall be submitted for the following (list is indicative and not limited to): (1) Transformer foundation pedestal (2) Firewall (3) Cable support structure for 1Cx300 sq-mm cables between inverter	

	room and transformers (4) Design of 11KV transmission line (5) Cable trench layout in array yard, transformer yard (6) PSC pole foundation (7) Double pole structure set (8) Single pole structure set (9) Drawings related to 10KW PV system (10) Details of OFC cable (11) Lightning arrestor arrangement with foundation details (12) Yard lights –transformer yard, compound wall/chain link fencing, approach road. (13) Water pipeline layout from bore wells/sump to storage tank (14) Water pipeline layout from storage tank to solar array field for module cleaning system with pressure calculations (15) Fire alarm system scheme / layout (16) Cable support structures and cable ladders within control room and inverter rooms	
9.4	Quality assurance plans for items listed under clause 7.0	
9.5	Detailed activity-time chart for project implementation.	
9.6	Detailed manpower deployment schedule.	

10.0 Codes and Standards:

IS:7098 (Part -I)	Specification for XLPE insulated PVC sheathed cables. Part-I: For working voltages upto 3.3 KV
IS:7098 (Part -II)	Specification for XLPE insulated PVC sheathed cables. Part-II: For working voltages upto 3.3 KV upto and including 33 KV.
IS:1554 (Part-I)	Specification for PVC insulated cables for working voltages up to and including 1100V
IS : 3975	Low Carbon Galvanized steel wires, formed wires and tapes for armouring of cables.
IS : 4905	Methods for random sampling.
IS : 5831	PVC insulation and sheath of electrical cables.
IS : 8130	Conductors for insulated electrical cables and flexible cords.
IS : 10418	Specification for drums for electric cables.
IS : 10810	Methods of tests for cables.
IS: 2705	Current transformers.
IS: 3156	Voltage Transformers
IS:2026	Power Transformers
IS: 1255	Code of practice for installation and maintenance of power cables up to and including 33 KV rating

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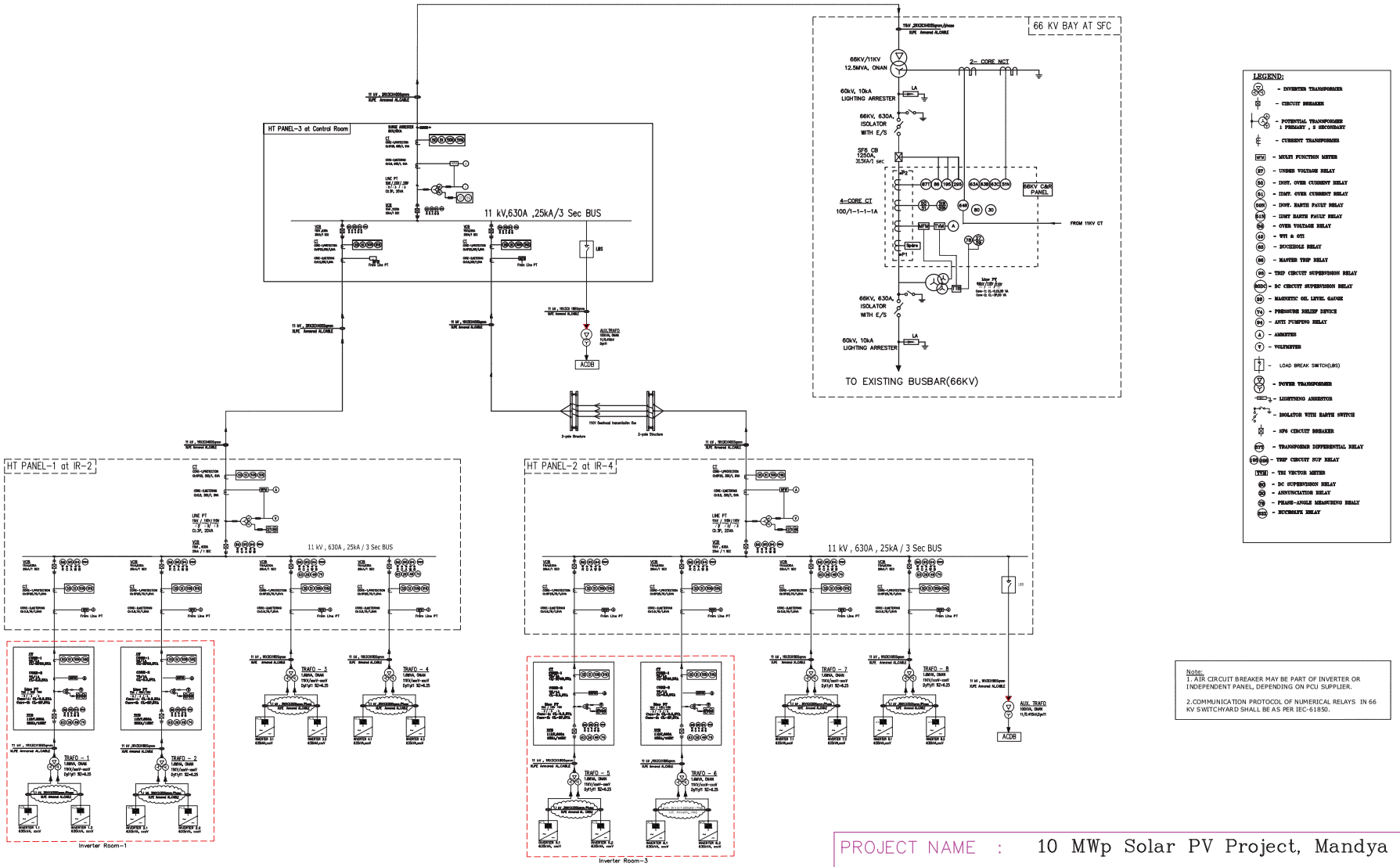

Note:
1. AIR CIRCUIT BREAKER MAY BE PART OF INVERTER OR INDEPENDENT PANEL, DEPENDING ON PCU SUPPLIER.

2.COMMUNICATION PROTOCOL OF NUMERICAL RELAYS IN 66 KV SWITCHYARD SHALL BE AS PER IEC-61850.

PROJECT NAME : 10 MWp Solar PV Project, Mandya
CUSTOMER NAME : KPCL

REV.	DATE	ALTERED / CHECKED / APPROVED	REV.	DATE	ALTERED / CHECKED / APPROVED

	NAME	SIGN	DATE
DRAWN	ANJ		
CHECKED	LNK		
APPROVED	SLR		

DEPT. | CODE

BHARAT HEAVY ELECTRICALS LIMITED.
ELECTRONICS DIVISION, BANGALORE

TITLE:
AC SINGLE LINE DIAGRAM OF 10 MWp SPV PLANT

No. OF SHEETS: 5
SHEET No.: 1

WBS. No.

DRG. No. 3-679-05-00737

REV 00

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

PRODUCED BY AN AUTODESK EDUCATIONAL PRODUCT

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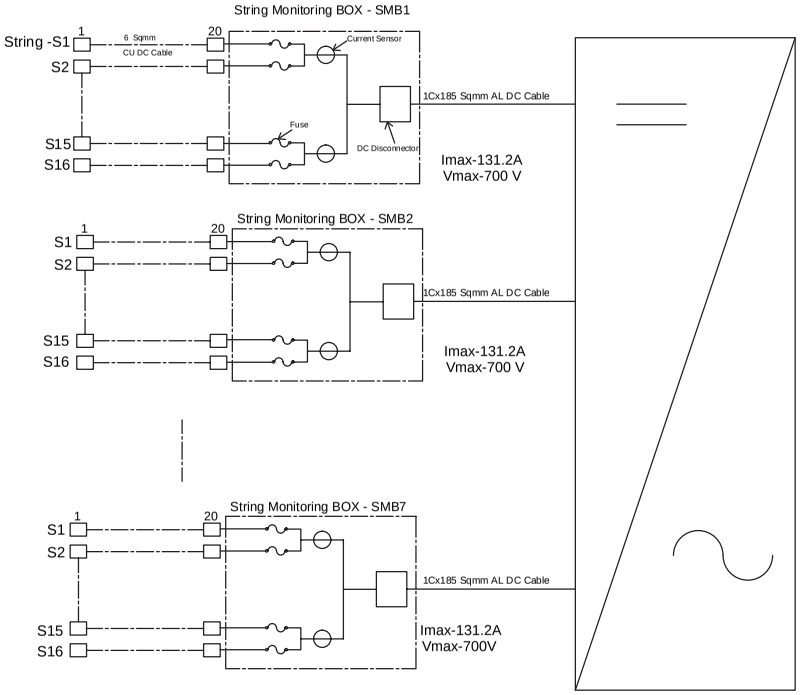
DRG. No. 3-679-05-00738

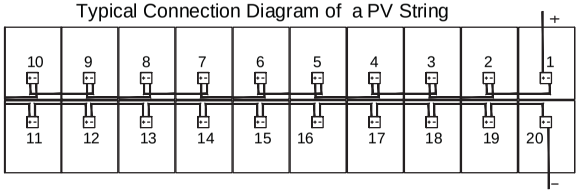
Inverters Specification

Nominal Output Power : 630 KVA
Max.DC Voltage : 1000 V



Note:
Scheme for one Inverter is shown in SLD.Same scheme applicable to remaining all 16 Inverters.

Typical Connection Diagram of a PV String



MODULE PARMETER

Power - 285Wp
Imp -8.2 A
Vmp - 35V
Isc -8.5A
Voc - 42V

INVERTER	
Module Type	Mono Crystalline
BHEL Model	L24270P
No. of modules in one string	20
Total no. of modules/Inverter	2240
No. of String/Inverter	112
No. of Module mounting structures / Inverter	112
String Monitoring Box (SMB) System	16 in 1 out
No. of SMBs/Inverter	7
Rating of Inverter	630 kVA
Cable Size-String to SMB	1Cx6 mm Copper Cable
Cable Size-SMB to Inverter	1Cx185 sq mm Al armored cable

PRODUCT : 10MW Solar Photovoltaic Power Plant
CUSTOMER: KPCL,MANDYA

REV.	DATE	ALTERED / CHECKED / APPROVED	REV.	DATE	ALTERED / CHECKED / APPROVED

	NAME	SIGN	DATE
DRAWN			
CHECKED			
APPROVED			

DEPT.	CODE
SC&PV	439

BHARAT HEAVY ELECTRICALS LIMITED.
ELECTRONICS DIVISION, BANGALORE

TITLE: DC SINGLE LINE DIAGRAM

No. OF SHEETS	1
SHEET No.	1

WBS. No.

DRG. No. 3-679-05-00738

REV 00

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

PRODUCED BY AN AUTODESK EDUCATIONAL PRODUCT

DRAWING NO. 3 679 05 00736

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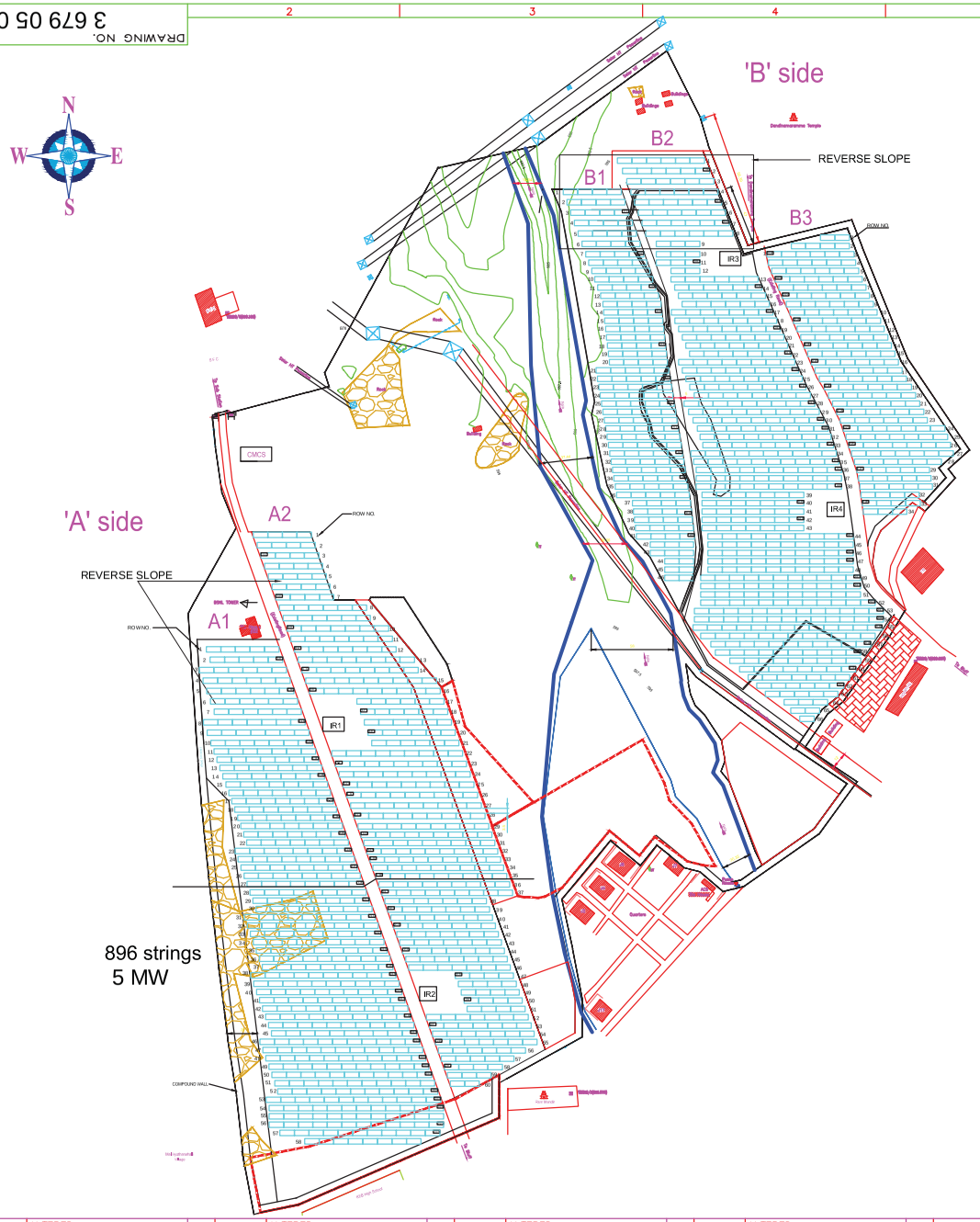

ARRAY DETAILS

PV ARRAY CAPACITY	10 MWp
Total no.of PV Modules (285Wp)	35840 nos
PV Modules in series string	20 nos
Total No. of strings	1792 nos
Series strings/630kW	112 nos
No. of Inverters (630kW)	16 nos
String Monitoring Units (SMU)	

LEGEND

10.2 / 3.87 / x2	2x10-285 W STRUCTURE
IR-T1 12x10	Inverter Rooms (Type1) +Tr.Room & SY, -2 nos
IR-T2 15x10	Inverter Rooms (Type2) +Tr.Room & SY, -2 nos
CMCS	Centralised Main Control System 220 sq.mtrs (RCC Type)

Inter Row gap - 3.5m -for Reverse slope area

Inter Row gap - 2.0 m -for Normal area

REV.	DATE	ALTERED / CHECKED / APPROVED

PROJECT: 10 MWp SPV POWER PLANT
CUSTOMER : KPCL, MANDYA

BHARAT HEAVY ELECTRICALS LIMITED
ELECTRONICS DIVISION, BANGALORE

	NAME	SIGN.	DATE
DRN	ASN		Aug'14
CKD	SLR		Aug'14
APPD	MS		Aug'14

DEPT. SC&PV
CODE 439
FOR UNSPECIFIED— TOLERANCES REFER ED 0230499
SCALE NTS
WEIGHT(Kg)
REF. TO ASSY. DRG.
ITEM NO.
No.OF VAR
No.OF ITEM

TITLE
10MWp PV ARRAY LAYOUT

DRAWING NO. 3 679 05 00736
REV. 00
SHEET NO. 01
NO. OF SHEETS 01

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

PRODUCED BY AN AUTODESK EDUCATIONAL PRODUCT

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DRAWING NO. 3-679-05-00739

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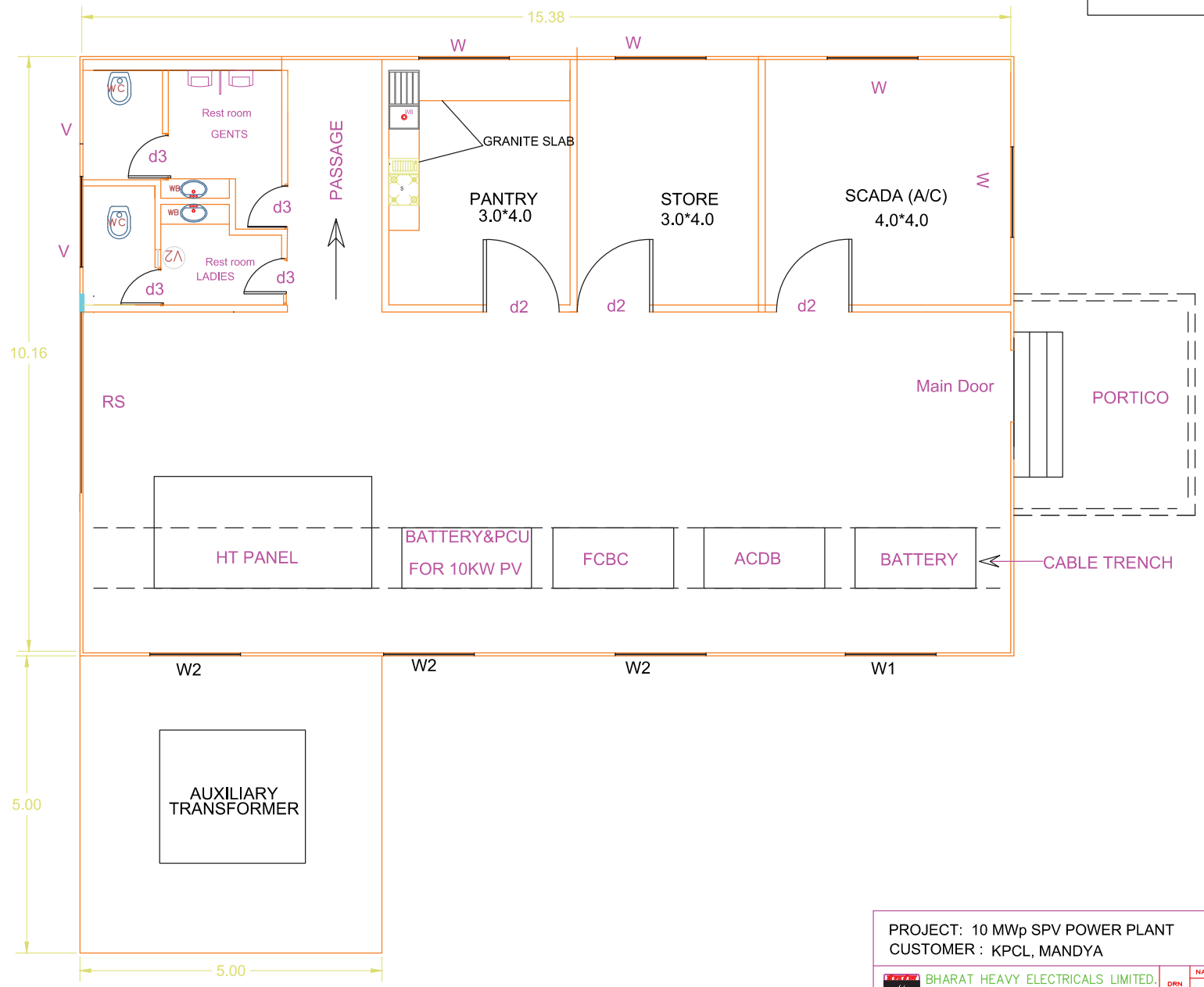

PROJECT: 10 MWp SPV POWER PLANT
CUSTOMER : KPCL, MANDYA

BHARAT HEAVY ELECTRICALS LIMITED.
ELECTRONICS DIVISION, BANGALORE

	NAME	SIGN.	DATE	No.OF VAR
DRN				
CKD				
APPD				

REV.	DATE REVISED	ALTERED / CHECKED / APPROVED

DEPT. / CODE: FOR UNSPECIFIED— TOLERANCES REFER ED 0230499

SCALE | WEIGHT(Kg) | REF. TO ASSY. DRG. | ITEM NO. | No.OF ITEM

TITLE: CONTROL ROOM LAYOUT

DRAWING NO. 3-679-05-00739

REV.

SHEET NO. | NO. OF SHEETS

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

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LAYOUT FOR INVERTOR ROOMS-2&4

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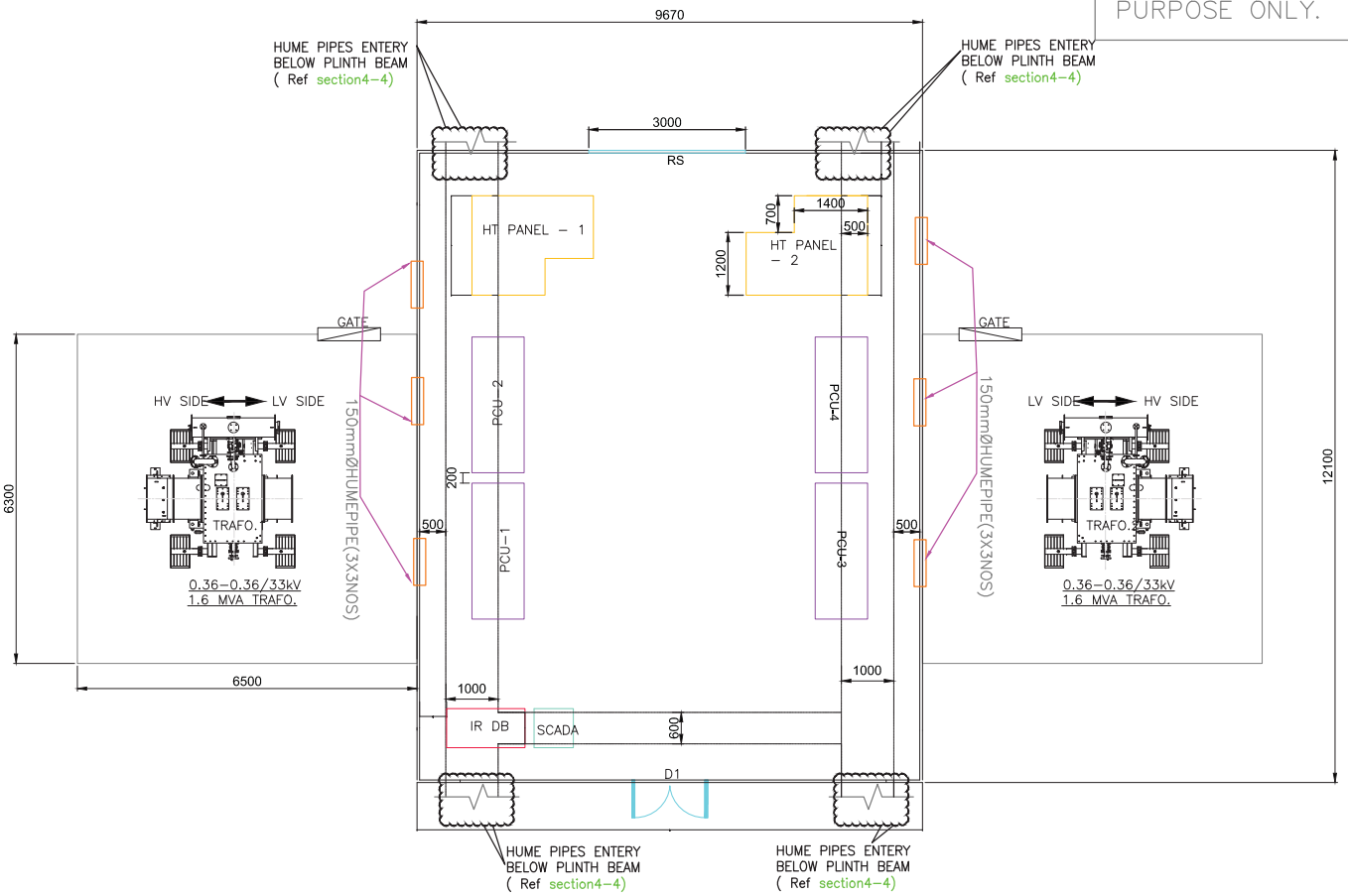

PRODUCT : 10 MW Solar Photovoltaic Power Plant, Mandya
CUSTOMER: KPCL,Mandya

REV.	DATE	ALTERED / CHECKED / APPROVED
REV.	DATE	ALTERED / CHECKED / APPROVED

	NAME	SIGN	DATE
DRAWN			
CHECKED			
APPROVED			

DEPT. SC&PV | CODE 439

BHARAT HEAVY ELECTRICALS LIMITED.
ELECTRONICS DIVISION, BANGALORE

TITLE: INVERTER ROOM LAYOUT

No. OF SHEETS 02
SHEET No. 01

WBS. No.

DRG. No. 3-679-05-00739

REV 00

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SIGN. & DATE
INVENTORY No.
DRG. No.
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DRG. No.

LAYOUT FOR INVERTER ROOMS-1&3

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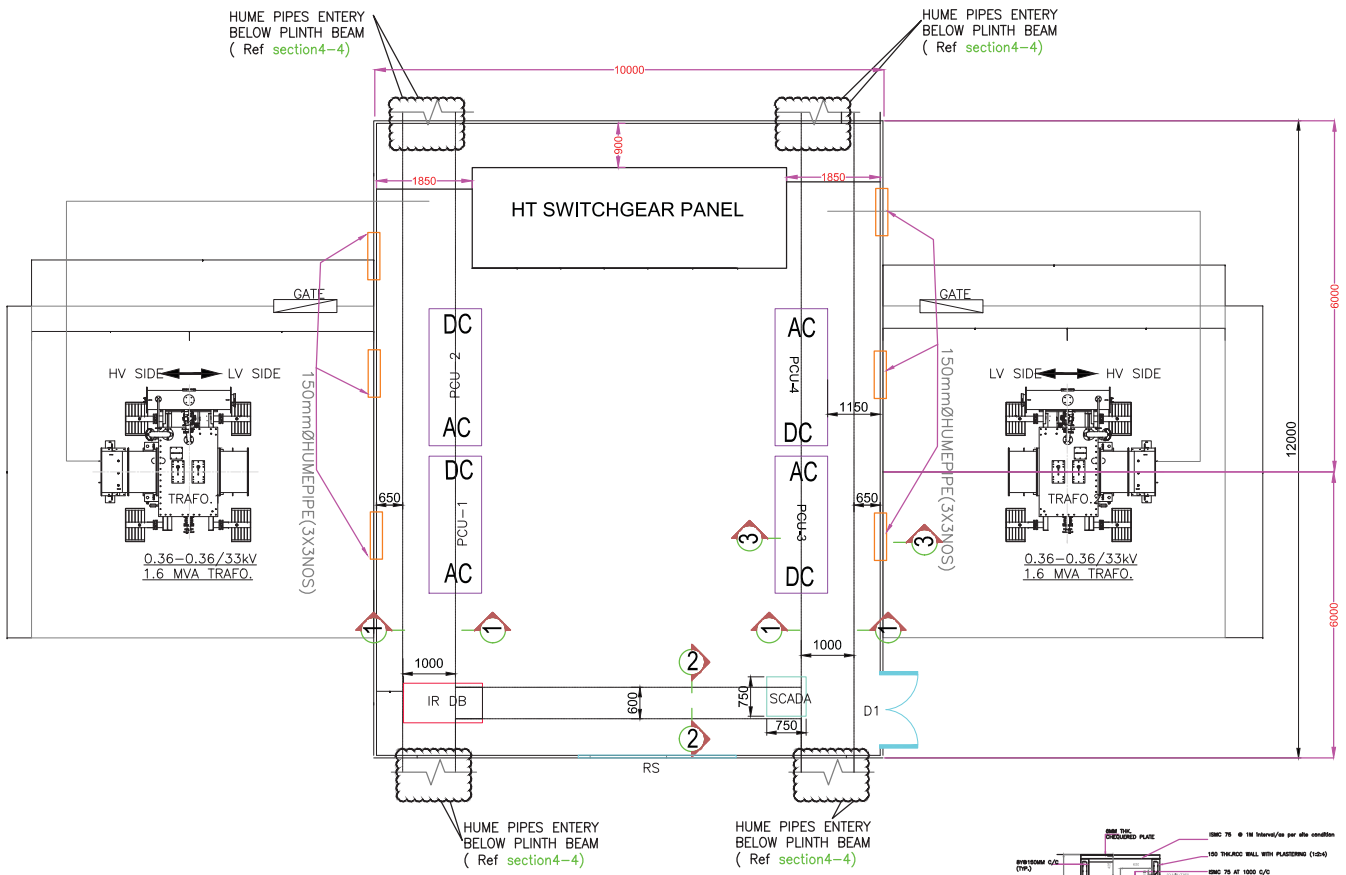

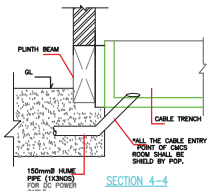

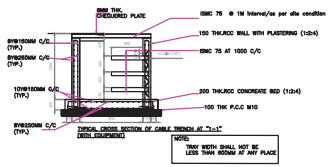

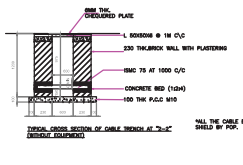

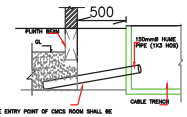

PRODUCT : 10 MW Solar Photovoltaic Power Plant, Mandya
CUSTOMER: KPCL,Mandya

REV.	DATE	ALTERED / CHECKED / APPROVED	REV.	DATE	ALTERED / CHECKED / APPROVED

	NAME	SIGN	DATE
DRAWN			
CHECKED			
APPROVED			

DEPT. SC&PV | CODE 439

BHARAT HEAVY ELECTRICALS LIMITED.
ELECTRONICS DIVISION, BANGALORE

TITLE: INVERTER ROOM LAYOUT

No. OF SHEETS 02

SHEET No. 02

WBS. No.

DRG. No. 3-679-05-00739

REV 00

SIGN. & DATE

INVENTORY No.

REF. DRG. No.

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FIRST ANGLE PROJECTION

(ALL DIMENSIONS ARE IN mm)

DWG No. 3-679-05-00748

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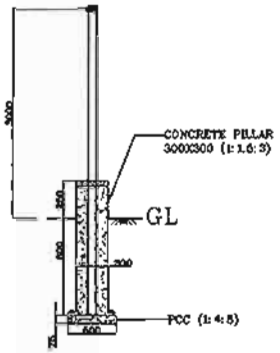
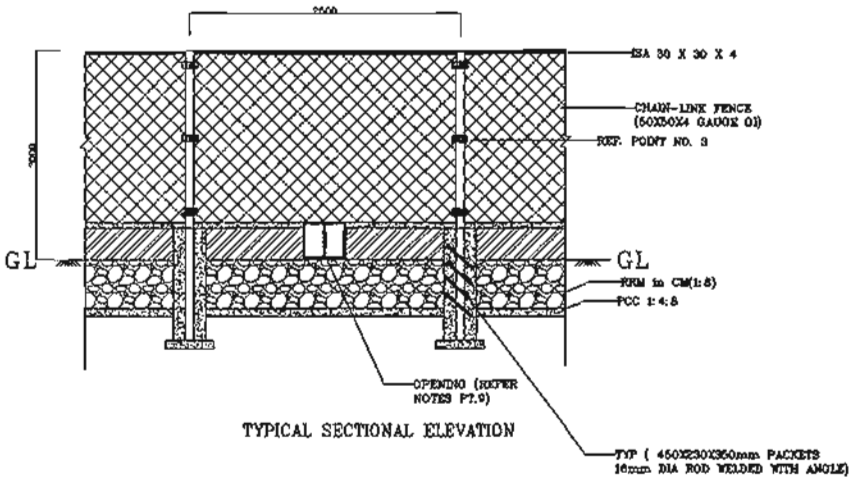
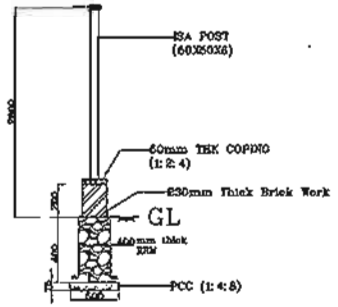


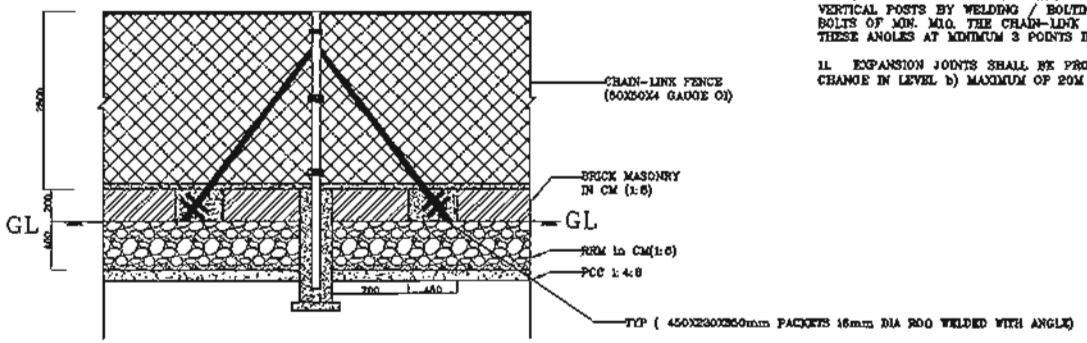
SECTION AT PILLAR



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.

REV.	DATE	ALTERED / CHECKED / APPROVED	REV.	DATE	ALTERED / CHECKED / APPROVED
00					

REV	NAME	SIGN	DATE
00			
DRAWN	SCH		Jul'11
CHECKED	RK		Jul'11
APPROVED	GLNM		Jul'11

DEPT. | CODE

PROJECT: SOLAR PHOTO VOLTAIC PLANT

CUSTOMER:

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

DRAWING NO. 3 679 02 00373

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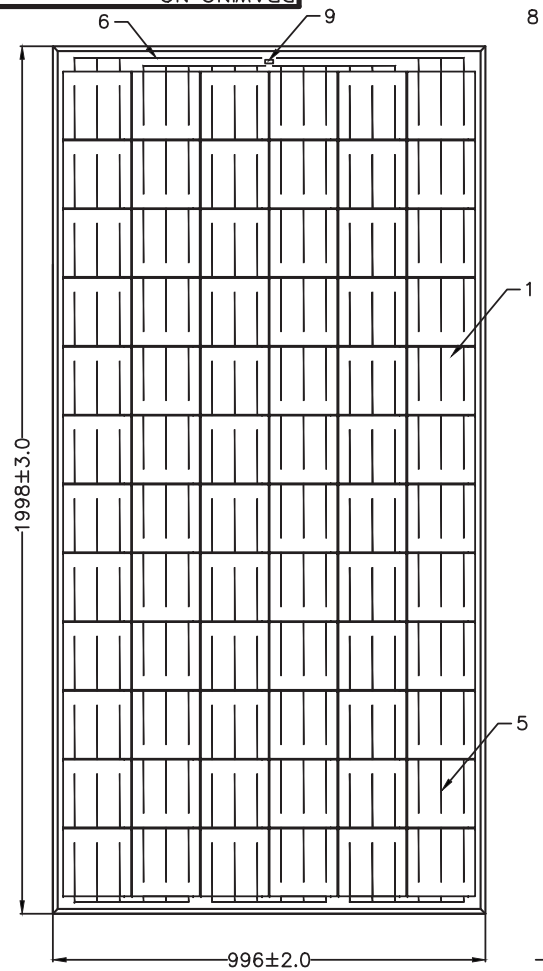
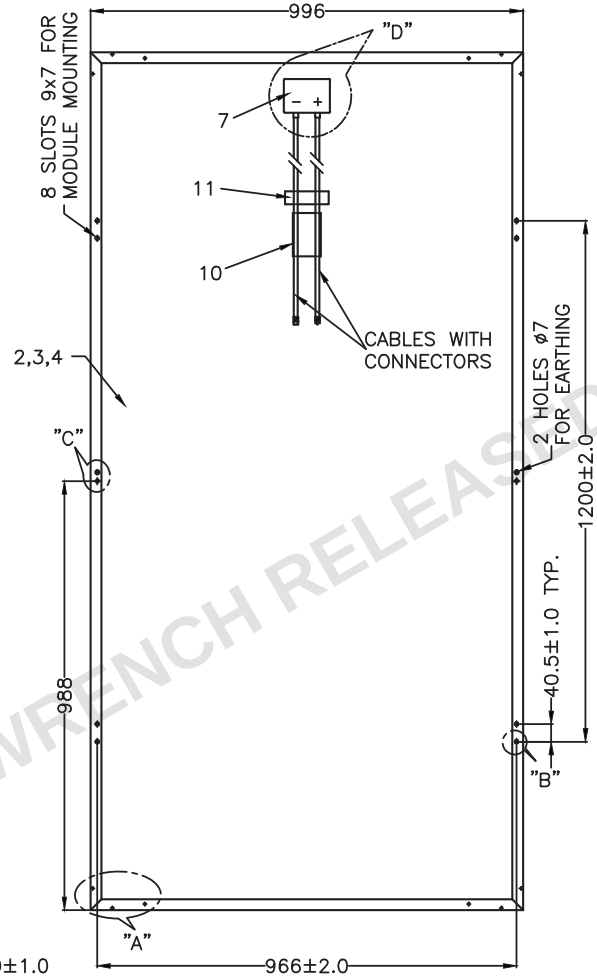
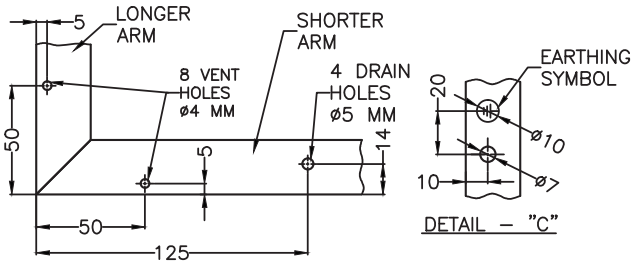
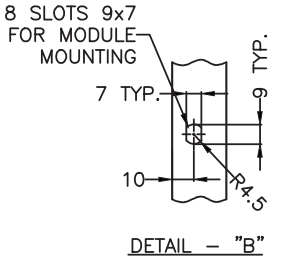
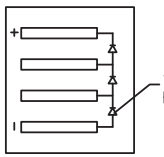








DETAL – "B"



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

WRENCH RELEASED

TYPE OF PRODUCT OR NAME OF CUSTOMER/PROJECT

BHARAT HEAVY ELECTRICALS LIMITED.
ELECTRONICS DIVISION, BANGALORE

	NAME	SIGN.	DATE	No. OF VAR
DRN	MANI	Sd/–	10-07-2013	
CKD	SM	Sd/–	10-07-2013	
APPD	SR	Sd/–	10-07-2013	

REV.	DATE	
		ALTERED
		CHECKED
		APPROVED

REV.	DATE		
01	091113	ALTERED	SAN
		CHECKED	NAR
		APPROVED	SR

PART NOS. CHANGED IN DRAWING

REV.	DATE	
00		ALTERED
		CHECKED
		APPROVED

FIRST ISSUE

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

TITLE
PHOTOVOLTAIC MODULE–L24270P
156mm Multi Solar Cell (Corner Block Type)

DRAWING NO. 3 679 02 00373 REV. 01

SHEET NO. 01 NO. OF SHEETS 01

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

FORM No. A3–02

A3 SIZE

FIRST ANGLE PROJECTION

(ALL DIMENSIONS ARE IN MM)

REV.	DATE		REV.	DATE		ADDITIONAL INFORMATION	
		ALTERED			ALTERED		
		CHECKED	00	210513	CHECKED	STATUS OF DRAWING	
		APPROVED			APPROVED		
			First Issue			DISTRIBUTION OF PRINTS	

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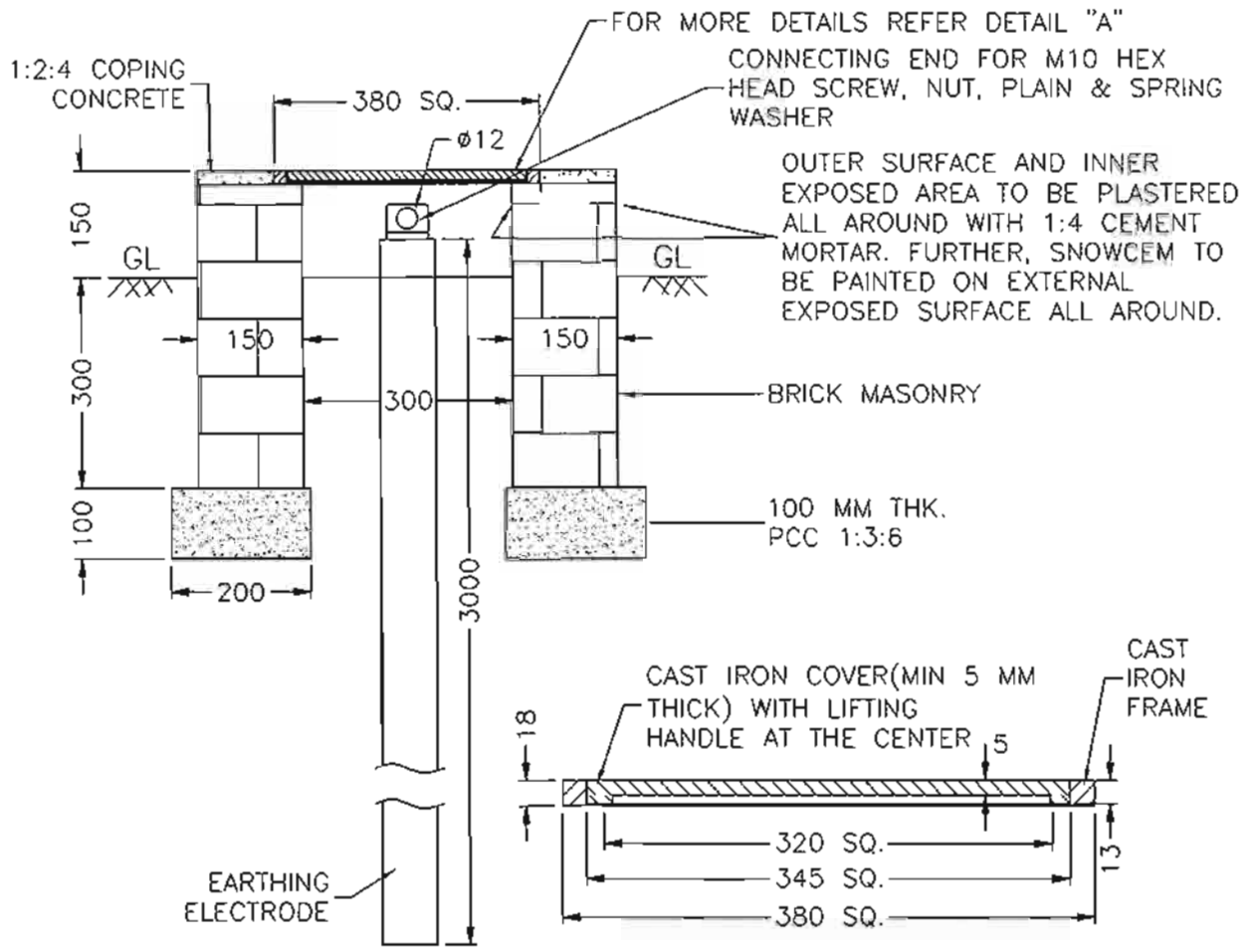

DETAIL "A"

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

SIGN & DATE

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

BHARAT HEAVY ELECTRICALS LIMITED.
ELECTRONICS DIVISION, BANGALORE

INVENTORY NO.

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

TITLE: **EARTHING CHAMBER FOR CHEMICAL EARTHING**

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

SHEET NO. 01 NO. OF SHEETS 01

A4 SIZE

ANNEXURE-1

1.0 INTRODUCTION

The ACDB panels are to be installed in the control room of the 10MW Grid connected SPV Power Plant at the PART-A area and in the Inverter Room-3 (IR-3) of PART-B area. IRDBs are to be installed one each in IR-1, IR-2 and IR-4.
This document provides the technical specification for the ACDB panel that is used for receiving the 415 V, three phase, 4 wire AC output from the 100KVA auxiliary transformers installed in the control room transformer yard in PART-A area and inverter room-3 transformer yard located in PART-B area and provide distribution of the same to the various loads. This document also describes the specification of IRDBs located at IR-1, IR-2 and IR-4 for supply of auxiliary power to internal loads of respective inverter rooms. ACDB and IRDBs also provide protection of the control room and inverter room utility loads and for monitoring of the energy parameters.
This specification should be read in conjunction with the SLD for the ACDB.

2.0 SCOPE OF VENDOR:

2.1	Supply of ACDB panel.	2 nos
2.2	Supply of IRDB panels.	3 Nos.
2.3	Warranty: Vendor shall provide warranty for 42 months from the date of commissioning OR 36 months from the date of supply, whichever is earlier.	Vendor shall express compliance.

3.0 TECHNICAL SPECIFICATIONS:

Sl No	Technical Parameter	BHEL Specification	Vendor compliance (Yes/No); Incase of non-compliance or deviation, vendor 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 Gland Plate : 3mm/10 gauge Lifting hooks (4nos) of adequate capacity. Locking provisions with key, no door on rear side.	

		Paint colour: RAL series. Vendor to mention paint shade to be used along with the bid.	
2	Wiring as per SLD	Drawing No:BH-KP10-ACDB	
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-42	
5	Cable entry and termination	1) The Incoming cable from 100KVA auxiliary transformer and outgoing 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 max. 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 120 Sq.mm Al cable for incomer of ACDBs and ougoers to IRDbs. Polyamide cable glands for cables for internal loads of Control room and inverter rooms.	
8.	Incoming cables	For ACDB: 3.5 c x120 Sq.mm Al Armored cable (in vendor Scope of supply). For IRDB: 3.5 c x50 Sq.mm Al Armored cable (in vendor Scope of supply).	
9.	Outgoing Cables	Actual size and qty of cables required for internal loads of control room and Inverter rooms needs to be decided by vendor based on the site requirement. Typical requirements are indicated in the SLD. 3.5 c x50 sq. mm for outgoing cables from ACDB to IRDBs(in vendor Scope of supply).	
10.	Bus bar	Al bus bar of minimum 300 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. Vendor to furnish calculations	

		for bus bar dimensions which has to be submitted to BHEL for approval at the time of detailed engineering.	
11.	Main MCCB	Three phase neutral of 25 KA breaking capacity and 120 Amps rating. Makes: ABB, Schneider, HAVELLS or any other BHEL approved make.	
12.	Earth leakage relay	30mA ELCB with CBCT shall be provided. Makes: Prokdvs/Equivalent.	
13.	MCBs	16A, 32A and 63A both SP and TP and short circuit breaking capacity of 10 kA common neutral. Make: ABB/Siemens/Schneider/HAVELLS or reputed equivalent as shall be approved by BHEL.	
14.	Dimensions of panel	To be indicated by the vendor along with bid.	
15.	Spacing phase to phase, phase to ground spacing	Shall be as per relevant IS standards; Vendor to mention the appropriate spacing and the IS standard considered along with the offer.	
16.	Sizes of control cables for internal wiring of the ACDB.	Vendor 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.	Multifunction meter	Model EM 6400 with MODBUS 485 output Make : CONZERV or approved equivalent	
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	

23.	**Special requirement**	**ACDB at Control room shall also have provision to take input from 10KW PV system inverter installed at site. Critical loads such as SCADA, HT panels, lighting of control room, periphery lighting shall be powered from 10KW system. A changeover switch shall be provided to shift these loads to auxiliary transformer supply when the 10 KW inverter supply is not available.**	
SPARES:			
1.	Ammeter-1 No.	In line with Sl.No 17 above	
2.	Voltmeter-1 No.	In line with Sl.No 18 above	
3.	MFM meter-1 No.	In line with Sl.No 19 above	
4.	LED indication lamps	3 no., of each type used in Sl.No. 20 above	
5.	MCB's.	3 no., of each rating used in Sl.No. 13 above	

4.0 DOCUMENT TO BE SUBMITTED ALONG WITH TECHNICAL OFFER

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

5.0 Technical description:

AC distribution panels (ACDB and IRDBs) shall be made of sheet steel panel complete with all the equipments specified herein with 3 phase insulation aluminum bus bar and neutral system self supporting, free standing, steel doors at the front and rear, painted as per requirement, completely wired and provided with 16A, 3 pin power plug and sockets industrial type, cubicle heating by space heaters with thermostat and panel lighting.

5.1 CONSTRUCTION FEATURES:

The Board shall be of best quality CRCA sheet steel of 2mm SWG enclosed and shall be fully dust and vermin proof, providing a degree of protection of IP-42 for indoor DBs and IP-55 for outdoor DBs as per IS-2147/8623. Distribution boards shall be provided with hinged doors with handle and locking facility for switch on interlock of doors. Doors shall be gasketted all round with Neoprene gaskets. All accessible live connections / metals shall be shrouded and it shall be possible to change/replace individual MCB/Fuse units from the front of the board without danger of coming into contact with live parts space and suitable removable type cable entry plates shall be provided for top/bottom entry of cable through gland as specified. The DB shall have two earthing terminals each to suit the purchaser's earthing. As all illumination AC/DC DBs are of wall mounted type, suitable brackets with anchor fasteners for mounting the same on wall shall be provided at the back of the DBs. The DPs/DBs shall be wall mounted or floor mounted type and shall be decided based on the location.

These boards shall have space heaters, name plate, danger boards etc. The required cable glands for the cables shall also be supplied with DBs. The incoming MCCBS shall be hand operated, air break, quick make and quick break type with short circuit breaking capacity of not less than 50kA. The HRC fuses (provided as back up) shall also have the breaking capacity of not less then 50kA.

Anodised aluminum plate engraved with finalised single line diagram shall be fixed on the doors of the distribution boards.

The Outgoing MCBs shall conform to IS-8828 (latest edition) and shall have a minimum interrupting rating of 10 kA.

6.0 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	

7.0 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.

Sl 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	

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

Sl No	Description	Accepted Yes or No
1	As built drawing for ACDB panel	
2	Test reports/Calibration reports-2 copies.	
3	Operation and Maintenance manual -2 copies.	

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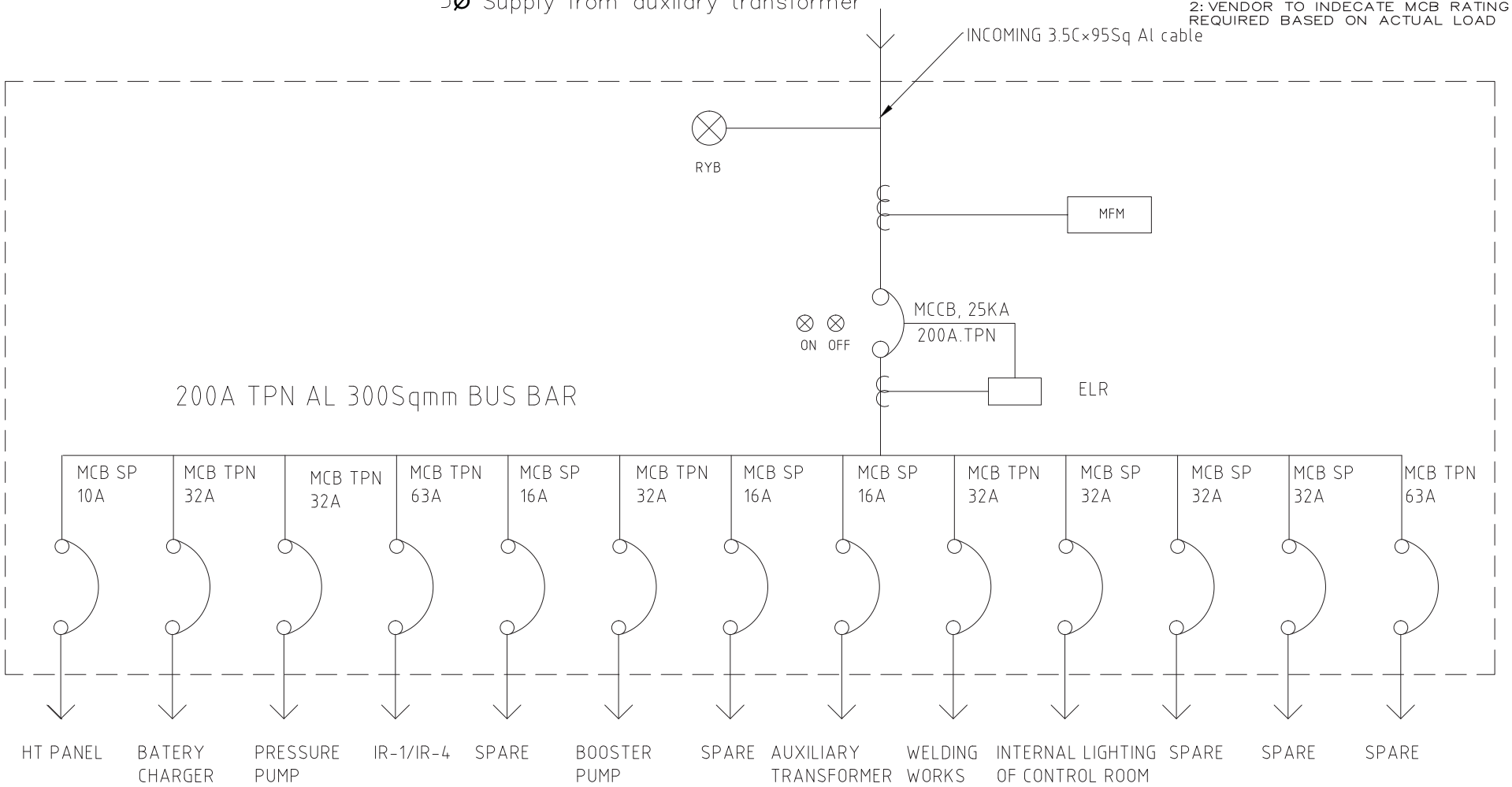
NOTE 1: THIS DRAWING IS INDICATIVE & FOR TENDER PURPOSE ONLY.
2: VENDOR TO INDECATE MCB RATING REQUIRED BASED ON ACTUAL LOAD



TYPE OF PRODUCT OR NAME OF CUSTOMER/PROJECT: SPV POWER PLANT.

BHARAT HEAVY ELECTRICALS LIMITED.
ELECTRONICS DIVISION, BANGALORE

	NAME	SIGN	DATE
DRN	KSB		
CKD	LNK/BKC		
APPD	SLR		

NO.OF YAR

REV.	DATE	ALTERED / CHECKED / APPROVED
REV.	DATE	ALTERED / CHECKED / APPROVED
REV.	DATE	ALTERED / CHECKED / APPROVED

DEPT. / CODE	FOR UNSPECIFIED TOLERANCES REFER ED 0230499	SCALE	WEIGHT (Kg)	REF. TO. ASSY. DRG	ITEM NO.	NO.OF ITEM

SLD 100KVA ACDB FOR AUXILIARY POWER SUPPLY

DRAWING NO: BH-KP10-ACDB

REV. 00

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

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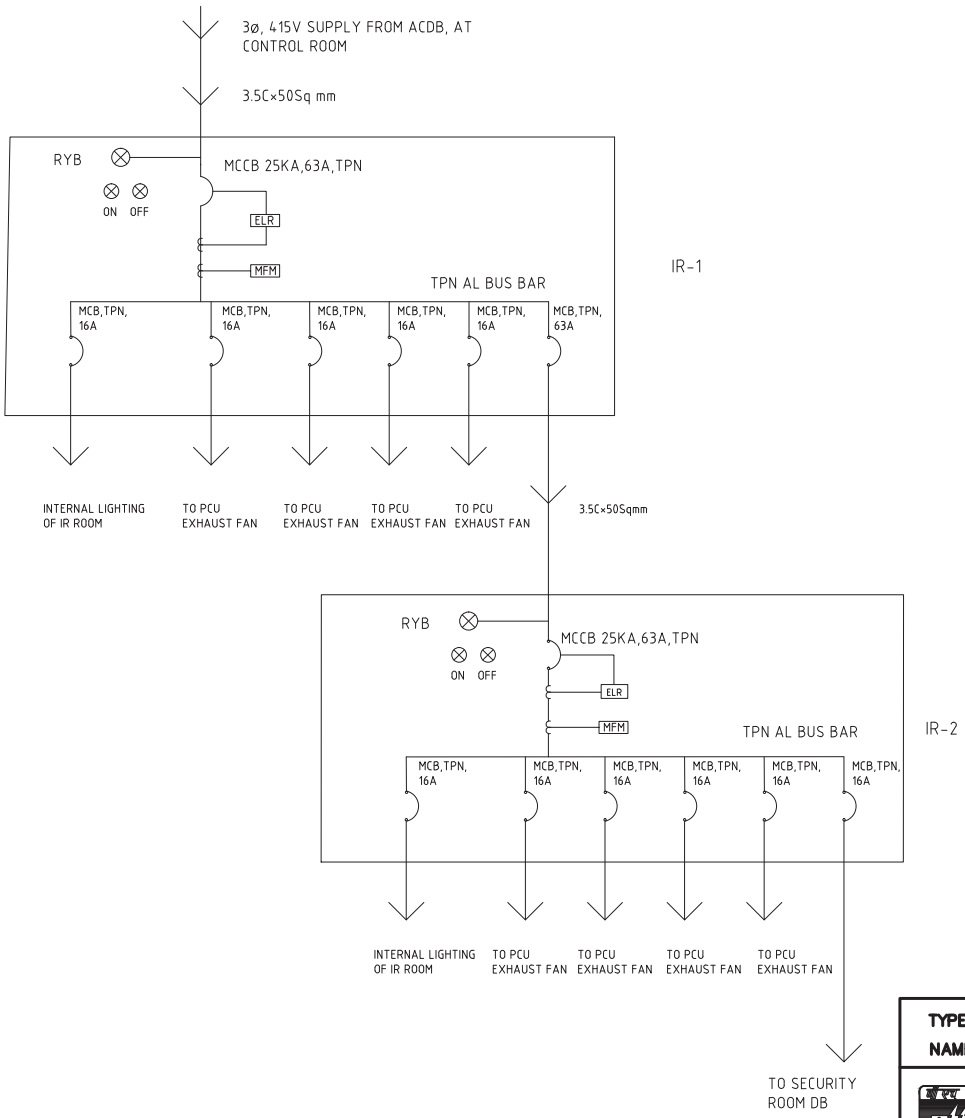
DRG. No.

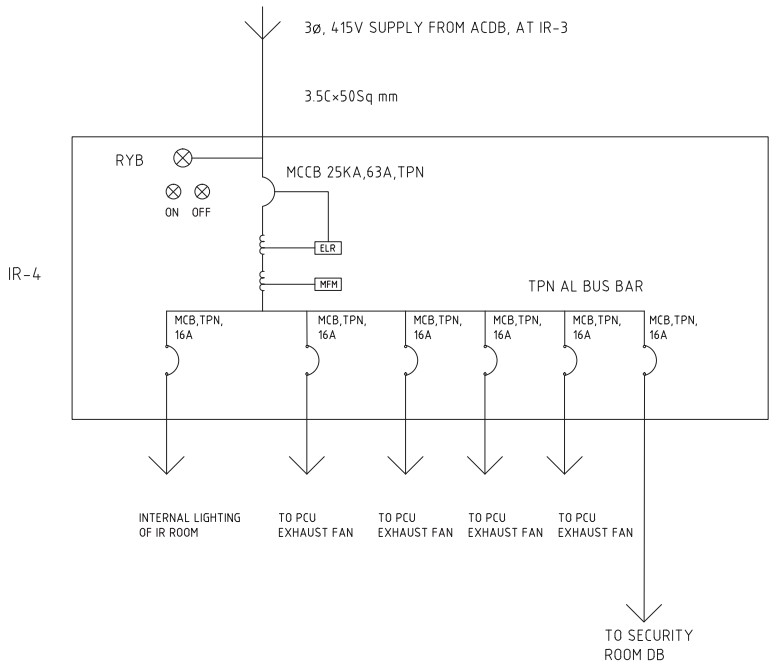
AC AUXILIARY DISTRIBUTION SCHEME

NOTE 1: THIS DRAWING IS INDICATIVE & FOR TENDER PURPOSE ONLY.
2: VENDOR TO INDECATE MCB RATING REQUIRED BASED ON ACTUAL LOAD

PART-A AREA



PART-B AREA



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

BHARAT HEAVY ELECTRICALS LIMITED.
ELECTRONICS DIVISION, BANGALORE

	NAME	SIGN	DATE	NO.OF YAR
DRN	KSB			
CKD	LNK/BKC			
APPD	SLR			

REV.	DATE	ALTERED / CHECKED / APPROVED

DEPT. / CODE	FOR UNSPECIFIED TOLERANCES REFER ED 0230499	SCALE	WEIGHT (Kg)	REF. TO. ASSY. DRG	ITEM NO.	NO.OF ITEM

SLD FOR AC DISTRIBUTION SCHEME

DRAWING NO: BH-KP-10-IRDB

REV. 00

REF. DRG. No. FLREF

SIGN. & DATE

INVENTORY No.

PRODUCED BY AN AUTODESK EDUCATIONAL PRODUCT

ANNEXURE-2

1.0 INTRODUCTION

The specification is for DC power supply system consisting of 2 sets of Valve regulated lead acid battery and 2 sets float-cum-boost-charger panels. This system is meant for providing DC supply to the HT 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. Necessary auto and manual changeover provision from float charging to float cum boost charging shall be provided in FCBC panel. The DCDB panel should consist of necessary measuring instruments for DC voltmeter, DC ammeter with ON/OFF indication.

1.01 Location:

(A) One set of battery bank and FCBC shall be placed in control room in PART-A area.

(B) One set of battery bank and FCBC shall be placed in INVERTER ROOM-3 in PART-B.

2.0 Scope of supply

#	DESCRIPTION	Quantity
1	Supply of VRLA battery of 110V,100AH with spares 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	3 sets.
4	Warranty Vendor shall ensure safe, continuous and trouble-free operation of battery and battery charger, DCDB panel for the period of 36 months from the date of supply or 42 months from the date of commissioning whichever is earlier .	-

3.0 Specification of VRLA battery:

Vendor to supply 2 sets of battery banks of 110V, 100AH. Each battery bank shall comprise of 55 Nos. of 2V VRLA batteries connected in series. Vendor to supply suitable rack arrangement for mounting the batteries. Along with the two sets of battery bank, 10Nos. of batteries shall be supplied as spares.

3.1: Technical specification of battery/cell:

(1) Governing standard : IS 15549:2005

(2) Make of the battery: Exide / HBL / Amara Raja/Equivalent.

(3) Rating: each set of 110V, …..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: 50%

(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.

Vendor to ensure the following specification:
The vendor shall take the prior approval of BHEL for all design and sizing and make of the batteries and the supporting system equipments.

DC system will be used for electrical control of equipment and indications on the control panel, communication system, DC lighting.
The battery is sized considering the following:

1. Momentary load for 1 minute
2. Emergency load for 2 hours
3. Continuous load for 10 hours

Under normal conditions, the battery will be on float charger. The float charger will be connected to a distribution board and meets the requirements of DC load. In case of additional demand of load on AC supply failure, the battery will meet the requirement of DC loads.
The boost charger will charge the fully discharged battery in 12 hours before bringing it back on float charge.
The batteries provided shall be suitable for the control and protection, emergency lighting, operation of breakers etc. and shall meet all the requirements of the plant wherever DC supply is required.

3.2 Accessories to be supplied along with the cells
(1) Battery stand (acid resistant) to mount the cells: 2 Nos.

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.

3.14 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.

3.15 Documents to be submitted along with consignment:

(a) General Arrangement – as built

(b) Bill of materials – as built

(c) Operation and instruction manual - 2 copies.

4.0 Specification of battery charger panel: 2 panels

4.11 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
6	Boost voltage	2.35 V/Cell
7	DC output voltage ripple	Not more than 5mV RMS at full load
8	Max ripple current	2% in float mode, 2% in boost mode
9	DC Load regulation	+/- 1%, for +/-10% of supply voltage fluctuation and 0-100% load variation measured at battery terminal.
10	Rectifier circuit	3-phase full wave full-controlled thyristorized & diode bridge
11	Control circuit	Proven solid state / µP based
12	Blocking diode	To be provided at output
13	Type of operation	Auto / Manual
14	Change-over provision upon AC failure	Automatic change-over from boost to float mode
15	Efficiency at: - 25% load - 50% load - 75% load - 100% load	 55% 65% 70% 80%
16	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.
17	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
18	Push button features	For various accept, reset and test options, as applicable
19	MCB and MCCB provisions	Suitably rated MCB and MCCB to be provided at input and output stages, as applicable.
20	Feeder provision at output	Four feeders with 15A MCBs.
21	Selector switches on the panel	Float Auto / Manual, Boost Auto/ Manual, Float / Boost / Auto boost selector switches. Also, Voltmeter / Ammeter selector switches as applicable.
22	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: 3 panels

Location :

(A) One no. each DCDB panel shall be placed in INVERTER ROOM-1 and INVERTER ROOM-2 in PART-A area.

(B) One no. DCDB panel shall be placed in INVERTER ROOM-4 in PART-B area.

(C) Vendor to refer drawing for DC distribution scheme.

#	Description of parameter	Specifications
1	Input voltage.	110 V DC.
2	LED indication	Supply ON/OFF status.
3	Meters on the panel	All meters shall be 6 sq-mm 90-deg scale Class 1.5 0-200V DC voltmeter.
4	MCB and MCCB provisions	Suitably rated MCB to be provided at input and output stages, as applicable. The incoming feeder of DC DBs shall consist of 2 pole MCCBs with back up HRC fuses
5	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) Cable sizing and colour codes: DC side colour : Red for positive, Black for negative. Electronic control circuits: 0.75 sq-mm grey / red /

		black, as appropriate. (e) Earth circuit: 0.75 sq-mm, green. (f) External cable termination provisions to be provided suitably in front of panel for terminating the DC incomers and DC outgoers. (g)Suitable earthing terminals to be provided for the panel. (h)Provision for wall mounting of DCDB panel has to be provided. (g)Cable entry and exit: Vendors shall provide gland plates with brass cable glands of single compression type for incomer and outgoer feeders of 2c x16 sq-mm. Also vendor must provide suitable cable glands required for DC cables to be connected to HT panels for which 2c x6sq mm copper, PVC cables shall be supplied by the vendor. The conduit required for wiring the same shall be supplied by vendor. (h)Paint shade: RAL series. Vendor to indicate the paint shade used along with offer.

.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) 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-2 copies.

6.3 Approved make of components

Sl No	ITEM	MAKE
(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

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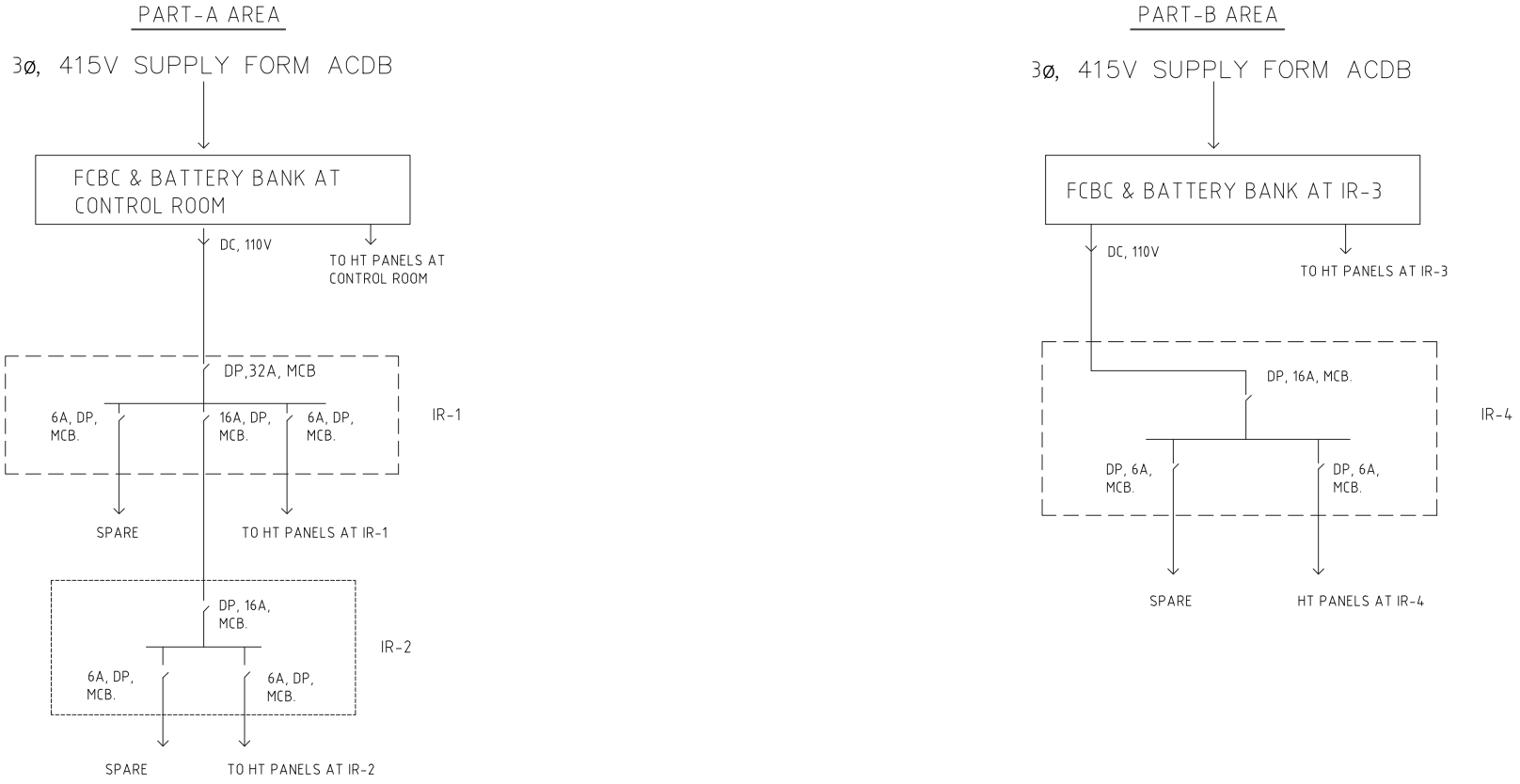
DRG. No. 3-679-05-00712

NOTE 1: THIS DRAWING IS INDICATIVE & FOR TENDER PURPOSE ONLY.
2: VENDOR TO INDECATE MCB RATING REQUIRED BASED ON ACTUAL LOAD

SLD FOR DC DISTRIBUTION SCHEME



TYPE OF PRODUCT OR NAME OF CUSTOMER/PROJECT: SPV POWER PLANT.

BHARAT HEAVY ELECTRICALS LIMITED.
ELECTRONICS DIVISION, BANGALORE

	NAME	SIGN	DATE	NO.OF YAR
DRN	KSB			
CKD	LNK/BKC			
APPD	SLR			

REV.	DATE	ALTERED / CHECKED / APPROVED

DEPT. / CODE	FOR UNSPECIFIED TOLERANCES REFER ED 0230499	SCALE	WEIGHT (Kg)	REF. TO. ASSY. DRG	ITEM NO.	NO.OF ITEM

SLD FOR DC DISTRIBUTION SCHEME

DRAWING NO: BH-KP-10-DCDB

REV. 00

REF. DRG. No. FLREF

SIGN. & DATE

INVENTORY No.

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ANNEXURE-3

SUPPLY AND INSTALLATION OF DUCTING SYSTEM FOR INVERTER ROOMS:

1.0 INTRODUCTION:

The air ducts along with suitable exhaust fans shall be provided for all 16 inverters located in 4 inverter rooms. Each inverter rooms contains four inverters. This document provides the technical requirements for the exhaust fan and ducting required for all the 630KVA inverters installed in the inverter rooms.

2.0 TECHNICAL SPECIFICATION:

Sl No	DESCRIPTION	QTY	VENDOR COMPLIANCE(YES/NO) Vendor to record deviations, if any.
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 inverter room distribution boards. (cables for wiring is within vendor scope).	16 nos	
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 inverter room walls. These cut-outs will be made by BHEL based on dimensions and positions provided by vendor.	16 nos	

ANNEXURE- 4

1.0 SCOPE

This document provides the technical specification for Pre-engineered control room and inverter rooms at 10MWp solar power plant at Belakavadi, Mandya Dist.

Sl.No	Item Description	Dimensions (lxbxh)	Quantity
1.	Supply, transportation and erection of Pre-engineered Inverter Room including civil foundation works.	12m X 10m x 4m	4 Nos.
2	Supply, transportation and erection of Pre-engineered control room including civil foundation works.	15m x 10m x 4m	1 No.
3	Supply, transportation and erection of Pre-engineered security room including civil foundation works.	4m x 4mx 3m	2 Nos.

2.0 TECHNICAL SPECIFICATION

S.No	Item	BHEL specification	Vendor acceptance (Yes / No)
2.0.1.	Construction and design	The pre-engineered building shall be double walled metal cladded, weather tight building envelope, suitable for complete life of solar plant. The layout of building shall be designed so as to divert the heat generated from each building outside the building. The building shall be designed for a life of 25 years. The successful bidder shall have to get the structural design done as per the prevailing IS codes. The structural design of inverter room, security room, control room of each identical type shall have to be proof checked by any IIT / NIT and shall be approved by BHEL/KPCL, before the actual start of the work.	
2.0.2.	Structure	The steel structure of the Shelter shall be designed for loads and load combination as per Indian Standards (latest revisions) such as IS: 875, IS: 1893, IS: 800, IS: 456 etc. The steel shall be hot-dipped galvanized with a minimum Z180 coating for load bearing applications and Z120 for non-load bearing applications. Alternately, the steel hot-dipped in Alum/Zinc (with 55% Aluminium and 45% Zinc) can be also used. The applicable codes are ASTM A653 for galvanized and ASTM A792 for Galvalume/Zincalume.	

2.0.3.	Fasteners	Steel bolts, nuts and washers complying with AS 1112:2000. Self-drilling screws complying with AS 3566.1 and AS 3566.2 shall be used. Fasteners required for fixing pre-engineered building to foundation is also in the scope of vendor.	
2.0.4.	Roof	The roofing shall be double skin trapezoidal profile sheet of pre-painted 0.45 mm BMT (Base Metal Thickness) Hi Tensile Zincalume/Galvalume 0.5 TCT, confirming to IS:513 and ASTM A792M/AS1397. Stiffening ribs / subtle fluting for effective water shedding and special male / female ends with full return legs on side laps for purlin support and anti-capillary flute in side lap. Both upper and lower sheets shall be separated through spacers and fastened through zinc /zinc-tin coated self-drilling screws. The fastener size shall be calculated as per the design or manufacturers recommendations. Both sheets shall be sandwiched with an under insulation of 50mm thick glass wool of density 50 kg/m3 with aluminum foil backing and complete with gutters and down take pipes (PVC pipes of 110mm dia for rain water piper). Along with Flashing & Top cap of required size and color complete with all necessary hardware. Roof shall project at least 600 mm outwards from the wall. Roof of PEBs shall be designed take the load of overhead tank wherever toilets are considered.	
2.0.5.	Doors Frames	Door frames shall be of T-iron frame of mild steel Tee-sections as per DSR-2007 item no 10.13. All doors shall be provided with necessary fittings like hinges, handles, mortice locks, tower bolts, stopper, hydraulic door closer, magic eye (for main doors) etc. of CP brass complete as detailed in tender drawing or submitted by bidder in shop drawing and approved by BHEL/KPCL. Powder coated aluminium doors shall be with extruded built up standard tubular sections, appropriate Z sections and other sections of approved make conforming to IS:733 and IS:1285, fixed to Pre-engineered structure including necessary filling up of gaps at junctions with required PVC/neoprene felt etc including hinges / pivots and double action hydraulic floor spring of approved brand and manufacture IS:6315 marked, lock, handle and all necessary fittings. The door entrance shall include Mild Steel single leaf door. The structural steel shall conform to IS: 7452 and IS:2062. The holdfasts shall be made from steel flats (50 mm and 5 mm thick). The fixtures, fastenings and door latch are to be made with same materials.	
2.0.6.	Windows Frame	Aluminum powder coated section, frame shall be of 92x31 mm, minimum 16G thick as per approved design.	

2.0.7.	Ventilators	Aluminum powder coated frame of minimum size 62x25 mm and 16G thick as per approved design. Suitable sunshades made out of approved colour sheet reinforced with Aluminum angle frame of minimum 35x35x4 mm size with soffit of same material will be provided to all external windows and door. The minimum projection for the sunshades will be 450 mm and 300mm wider than the width of the opening. Fresh air intake louvers with filters (IP21) shall be provided for inverter rooms and control room.	
2.0.8.	Plinth Protection	750mm wide plinth protection 50 mm thick of cement concrete 1:3:6 (1cement : 3 coarse sand : 6 graded stone aggregate 20 mm nominal size) over 75 mm bed of dry brick ballast 40 mm nominal size well rammed and consolidated and grouted with fine sand including finishing the top smooth, shall be provided around the Pre-Engineered Structure.	
2.0.9.	Foundation and platform with cable trench	Required foundation shall be designed by the vendor to safely take the equipment load as per the details given below and drawings shall be furnished for BHEL approval and civil works will be carried out by BHEL. a. each Inverter Room -15 Tons b. Control Room-8 Tons c. Each Security Room-1 Ton Cable trench details shall be furnished during detailed engineering.	
2.0.10	Floor Finish	Flooring, including preparation of surface, cleaning etc shall be of cement concrete flooring as per IS 2571-1970 with ironite hardener. The building floor shall be atleast 50cm above the ground level. For control room, flooring shall be of industrial grade vitrified tiles.	
2.0.11	Wall Cladding	The walls shall be of double skinned trapezoidal profile sheet of prepainted 0.45 mm BMT (Base Metal Thickness) Hi Tensile Zincalume/Galvalume 0.5 TCT, confirming to IS:513 and ASTM A792M/AS1397. The profile shall be trapezoidal. Both the walls should be separated by spacers system made up of cold formed steel bars and fastened through zinc /zinc-tin coated self drilling screws.	
2.0.12	Wall Insulation	All voids of external and internal metalled walls shall be filled with 50 mm thick Mineral glass Wool/ rockwool insulation of density 50 kg/m3 covered with high strength meshless Aluminium foil with proper supports etc as approved.	

2.0.13	Painting	The exterior sheet (roof as well as wall) shall have total paint thickness of 25 micrometer comprising of 20 micrometer exterior coat of Super Durable Polyester (XRW) and 5 micrometer primers coats. Other faces of sheets shall be painted with 10 micron polyester over 5 micrometer primer coats. The colour shade shall be subject to BHEL/KPCL's approval.	
2.0.14	Lighting	The building shall be provided with electric light to achieve average illumination level of 75 Lux. However building should be designed to utilize maximum natural light during the day. All Compact Florescent Lamp fixtures shall be indoor type & pre-wired comprising of Lamp(s) with lamp holder(s) and Electronic Ballast(s) with metal reflector(s). The lamp fitting shall be covered by Glass or Perspex material. The PF of the electronic ballast shall be more than 0.9. The fixtures should be of reputed make like Philips/Bajaj/Crompton/G.E. etc., however, vendor shall submit the sample of lighting fixtures to BHEL for approval before supply & installation. Alternatively, LEDS may be used after submitting detailed descriptions illumination computations and Test certificates from reputed test centers.	
2.0.15	Provision for Ducting arrangement	Ducting, exhaust fans etc. are required for extracting hot air from inverters which is required for healthy air circulation. Drawings for ducting arrangement shall be provided by BHEL during detailed engineering. Necessary provisions for placing of ducting arrangement shall be provided by the vendor. Supply of ducting materials shall be the in the scope of vendor. For detailed specifications of ducting material, refer annexure-3.	
2.0.16	Point wiring	This shall include all works necessary for wiring to the point of utilization of the load to be applied for the wiring of light, fan or plug point etc., Point wiring shall include all works necessary in complete wiring of a Piano Type switch Circuit of any length from the tapping point from the Junction Box to the following, via the switch. Ceiling Rose in case of all lighting & fan points. Socket Outlet in case of sockets. The followings shall be deemed to be included in the point wiring: Switch & ceiling rose as required, Bushed Conduit or Porcelain tubing or PVC pipe where cable through etc., Earth wire for three pin socket point to the common earth station, all metal blocks, board & boxes sunk type including those required for mounting fan regulator bus excluding	

		those under the DB and control switch, All fixing accessories such as nails, screws, plugs etc., as required., Joint for junction Boxes & connecting the same as required. Indoor point wiring will be casing capping type with 1.1 kV PVC insulated 2 x 1.5mm2 (min. size) copper wire including Wooden switch Board covered with Bakelite Cover, Ceiling Rose supply of wire, casing-capping, appropriate size bare copper earth wire, screw & and other accessories etc., as such where required. The work includes supply of all requisite materials. Standard ISI marked Anchor or equivalent good make materials are to be used for point wiring. PVC casing capping and all accessories shall be of Heavy gauge Polyphone with all accessories and white in colour. Conduit / buses through wall shall be flash after cutting wall and including mending well the damages. Casing capping on wall shall be fixed with suitable screws at an interval not less than 300mm. All out door point wiring will be with hard PVC conduits of approved make. Suitable hard PVC bends, saddles, Tees etc., are to be used for outdoor wiring	
2.0.17	Plumbing and sanitary items	Vendor shall supply and install required plumbing and sanitary items of reputed make for toilets. Toilets shall be provided in Control room in part-A, Inverter room-3 in part-B and in 2 Nos. security rooms which will be located one each in part-A and part-B. Construction of soak pits and septic tanks as required shall be in vendor's scope. Inspection chambers for letting out sewage and sullage are to be constructed. Septic tank to be provided with RCC lid with ventilation pipe. PVC pipes of 160mm dia for transmission of sewage to be used. The toilet room in Control room shall have separate partitions for gents and ladies, each shall contain a Western commode (W.C) and wash basin with mirror. The layout shall be as shown in the control room layout drawing enclosed. The toilet rooms in IR-3 and security rooms shall contain 1 No. W.C, wash basin with mirror. For toilets and pantry, the water required shall be supplied from an overhead tank of min. 1000 litres capacity which shall be mounted on the roof of pre-fab building (wherever toilets are considered). Roof shall be designed take the load of overhead tank. Supply of overhead tanks (sintex or reputed make as approved by BHEL) shall be in the scope of vendor. Required piping and pump connection from and to tank shall be in vendor's scope.	

3.0 GENERAL SPECIFICATION OF CIVIL WORKS

1. Foundation bed concrete for leveling course to be laid in cement concrete 1:4:8 for a depth of 15 Cms.
2. Size stone masonry in cement mortar 1:6 for foundation as per IS specification
3. Size stone masonry in cement mortar 1:6 for basement and the size stones neatly dressed with quoins for a width of 50mm for all the corner stone's on both the edges.
4. Pointing of joints by racking to a depth of 20mm and filled with cement mortar 1:3.
5. Plinth concrete in 1:1.5:3 to be laid as per the approved design drawing.
6. RCC 1:1.5:3 for columns, beams, Lintels to be laid with steel frame work and compacted with needle vibrator.
7. RCC Roof slab to be cast by neatly tieing the reinforcement as per the structural drawing and specified electrical conduits, fan hooks are to be embedded as per the approved drawing. M.S Plate form work for RCC slab is preferred.
8. Table molded bricks with minimum compressive strength of 50 ksc are to be used for burnt brick masonry in CM 1:6. For every 5000 bricks test reports are to be submitted for its suitability
9. 115 mm thick brick wall for partition are to be constructed with CM 1:4 by providing 2 Nos of 6 mm tor steel tied with binders at 30 Cms C/C and extended in main walls.
10. Door frames with Honne / Nandi wood of size 105 X 65 mm with cills wherever necessary and as per the directions of the Engineer in charge.
11. 40mm thick water proof flush doors with one side teak wood veneering as approved by BHEL.
12. Glazed aluminum doors of standard gauge, covered with glass of 5.5.mm thick with aluminum handles, lever, locks, chrome plated floor type door latches, heavy duty double action floor springs as per the approved drawing.
13. For bath and toilets standard make PVC door frames with PVC shutters to be provided.
14. Three way track glazed aluminum windows with ventilators as per standard with necessary guard bars as per the approved drawing.
15. The fixtures for doors, windows and ventilator are to be approved by the Engineer.
16. External Plastering for a thickness of 18mm with CM 1:6 with cement finish.
17. Parapet wall for a height of 85 Cm with 5 Cm thick coping concrete with intermediate brick pillars as per the approved drawings.
18. Granite slab flooring for accommodations wherever necessary as approved by BHEL Engineer.
19. Acid proof flooring tiles for the accommodations wherever necessary as approved by BHEL Engineer.
20. Kota stone flooring for kitchen
21. Cooking platform with RCC slab over laid with 25mm thick black granite slab with sink.
22. 60mm high dadooing above cooking platform with glazed tiles.

23. Anti skid ceramic tiles for flooring in bath and toilets and glazed tiles dadooing for a height up to linter level for bath rooms and 0.90 Mtrs. Height blazed tiles dadooing in toilets.
24. Flagging Concrete : To be laid for a width of 0.90 Mts from the basement in Cc 1:4:8 and plastered with CM 1:4.
25. RCC chajjas projecting 0.75 Mts from brick walls with bearing of 9" on either sides of the openings.
26. Painting: Internal painting with 2 coats of oil bound distemper over a primer coat. External painting to be carried out with 2 coats APEX paint over a coat of under coat. Doors, Window, collapsible gate, rolling shutters, grill works and entrance gates are to be painted with enamel paint over a coat of primer
27. Roof treatment with screed concrete / yalahanka tiles
28. Anti termite treatment for foundation and all round the structure.

Note: The building shall be with concrete construction in compliance with National Building Code and relevant International standards.

4.0 Documents to be submitted after placement of order

The following documents are required to be submitted after placement of purchase order:

1. Detailed GA drawings of Inverter room, security room, control room including plan, elevation for all walls and roof.
2. Foundation design and drawing.
3. Detailed Bill of Material
4. Technical particulars of the material.

5.0 Erection of Pre-engineered buildings

The vendor shall carry out the civil foundation works and erection of Pre- engineered buildings at site after supplying the required material to site.

6.0 Testing and inspection

The material shall be tested as per relevant IS/international standards. BHEL/ KPCL shall witness the testing at vendor's works. Test reports shall be submitted for all the bought out material to BHEL.

ANNEXURE-5

1.0 INTRODUCTION

This document provides the technical specification for auxiliary transformers that are located at control room in PART-A area and at inverter room-3 in PART-B area.

2.0 SCOPE OF VENDOR:

2.1	Supply of and installation of outdoor type, 100KVA, 11KV/440V, 3 Phase, 50 Hz Auxiliary Transformers	2 Nos.
2.2	Warranty: Vendor shall provide warranty for 42 months from the date of commissioning OR 36 months from the date of supply, whichever is earlier.	Vendor shall express compliance.

3.0 Technical parameters:

3.1 The transformer shall have the following ratings:

Sl No.	Technical Particulars	
1.	Type	Outdoor type/ Step Down
2.	No. Of windings	Two
3.	No. of pahses	Three
4.	System Freequency	50 Hz
5.	Rating	100 kVA
6.	HV winding Voltage	11 KV
7.	LV winding Voltage	0.415 KV
8.	Vector Group	Dyn11
9.	Nuetral	Effectively Earthed
10.	Type of cooling	AN
11.	Core	CRGO

12.	Impedence voltage at Normal Tap	4.5 %
13.	Tap Changing gera type	Off Circuit
14.	No, of taps provided	- 5% to + 5%
15.	Power frequency with stand voltage	
A	LV winding	28 KV rms
B	HV winding	3 kV rms

i. Transformer includes all the mountings, fittings and accessories specifically described under this section and necessary spares as indicated in schedules enclosed along with this contract document.
ii. The Transformer shall be complete in all respects and include all components and accessories even though not specifically mentioned in the specification but which are essential for the satisfactory performance of the Transformer in accordance with the technical specification and the guaranteed performance figures indicated under guaranteed technical particulars.
iii. The contractor shall complete the different schedules forming part of these specifications.
iv. The transformer shall be designed to facilitate operation, inspection, maintenance and repairs. All apparatus shall be designed to ensure satisfactory operation under such sudden variations of frequency, load and voltage as may be met with under working conditions, on the system including those due to short circuits.

3.2 VIBRATION & NOISE

The Noise level at rated voltage and frequency shall not be more than the specified level as per NEMA publication.

3.3 SUPPRESSION OF HARMONICS

The Transformer shall be designed with particular attention for the suppression of harmonic voltages.

3.4 FREQUENCY & VOLTAGE VARIATION

The Transformer shall be suitable for continuous operation with the frequency variation of +3% or -5% from normal 50Hz without exceeding the specified temperature rise. Further, the Transformer shall be capable of operating without

injurious heating at rated KVA on any particular tapping provided that the voltage does not vary by more than +/-10% of the voltage corresponding to the tapping.

3.5 GENERAL DESIGN AND OPERATING CONSIDERATIONS

i. Duty under Fault Conditions

Transformer shall be capable of withstanding short circuit currents without damage according to IS: 2026. Unbalanced loading from the transformers is anticipated and the transformers shall be designed for operation at unbalanced loading conditions. Transformers shall be free from partial discharges over the range of operating voltages.

ii. Over Fluxing

The transformers shall be suitable for over fluxing up to 12.5% without injurious heating. The maximum flux density in any part of the core and yoke of the transformers at normal voltage and frequency shall be such that the flux density under the over voltage conditions of 110% continuously of the rated voltage of any tapping shall not exceed 1.7 Tesla.

3.6 CONSTRUCTION AND MATERIALS

3.6.1 Core

i) The core shall be constructed from high-grade, cold rolled, non-ageing, low loss and high permeability grain oriented silicon steel laminations. The material shall conform to the latest edition of relevant IEC / IS.

ii) The core laminations shall be annealed after removing all sharp projections and each lamination shall be coated with durable baked enamel / glass insulation. The complete core shall be coated with special resin as a protection against corrosion.

iii) The core shall be rigidly clamped and bolted to ensure adequate mechanical strength and to prevent vibration/noise during operation. The bolts used in the assembly of the core shall be so constructed that eddy current flow is minimum.

iv) The design of the magnetic circuit shall be such as to avoid static discharges, development of short circuit paths within itself or to the earthed clamping structure and the production of the flux components at right angles to the plane of the laminations which may cause local heating.

v) The insulation of core to bolts and core to clamp plates shall be able to withstand a voltage of 2kV rms for one minute.

vi) The core shall be provided with lugs suitable for lifting the complete core and coil assembly of the transformers.

3.6.2 Windings

i) All windings shall be fully insulated. Neutral points shall be insulated for voltages specified in IS: 2026. The windings shall be designed to reduce the out-of balance forces to minimum in the transformer at all voltage ratios.

ii) The insulation at transformer windings and connections shall be free from insulating composition liable to soften, core out, shrink or collapse. The stacks and winding shall receive adequate shrinkage treatment before final assembly.

iii) The high and low voltage windings shall be of copper conductors. The entire coil shall be epoxy resin encapsulated, cast under vacuum. The insulation system shall be of uniform glass-fibre epoxy laminated of highest electrical and mechanical quality into which the windings are voidlessly embedded. Both the HV & LV windings of one phase shall be separately cast as one rigid tubular coil having no link between their coaxial arrangement i.e. no creepage path can be formed even under dusty and corroding ambient conditions. The insulation laminates shall correspond to class F as per IS: 2026. Precautions shall be taken that the thermal stresses do not prove detrimental to the insulation of winding.

iv) The winding shall not absorb any moisture and shall be suitable for tropical climate and 95% air humidity. The coils shall be hardly inflammable and shall be self-extinguishing in case of transformer catching fire.

v) The windings shall be clamped securely in place so that they will not be displaced or deformed during short circuits. The assembled core shall be vacuum dried.

vi) Thermal control of coils shall be effected via two separate signal systems for alarm and tripping. RTD sensors (two Nos. per phase) shall be provided for measurement of winding temperature. The temperature protection equipment shall be suitable for use with 110V DC voltage. All contacts shall be rated to make at 5A (min).

3.6.3 Terminal Connections

i) The HV terminals shall be connected to the 11 kV Bus. Removable links shall be provided.

ii) Cable box suitable for PVC / XLPE cables of adequate size shall be provided on LV side.

iii) Additional LV neutral bushing shall be provided for neutral earthing at transformer end.

3.6.4 Disconnecting switches:

There shall also be one off-load disconnecting switches on 415V side housed in separate chamber. This disconnect shall be suitable for operation by means of handle broughtout of the switch cubicle mounted on side of the transformer

housing. Rating in ampere of disconnecting switches shall be as decided during detailed engineering. The necessary locks shall be provided for locking up the handle either in OFF or ON position.

3.6.5 Earthing Terminals

Two earthing terminals each capable of carrying short circuit current of the transformers for two seconds shall be provided at bottom at two corners of the transformer enclosure. The earthing terminals shall be suitable for bolted connections to the grounding.

3.6.6 Bushings

The bushings used in the transformers shall comply with latest edition of IS: 2099, IS: 3347, IEC 60237 or any other equivalent International Standard. The bushing shall be of solid porcelain / epoxy case resin type. The bushing shall have high factor of safety against leakage to ground and shall be located so as to provide adequate electrical clearance between bushings and between bushing and ground parts. Bushings of identical voltage shall be interchangeable. All bushings shall be equipped with suitable terminals of approved type and size and all external current carrying contact surfaces shall be silver-plated.

3.6.7 Tappings

i) Tappings will be provided for voltage adjustment on the HV winding with adjustment of high voltage of + 5% to …5% in steps of 2.5% for all the transformers.

ii) Off circuit tap changer shall have bolted link type arrangement and the links shall be completely shrouded and no live parts shall be exposed.

3.6.8 Transformer Enclosures:

The Transformers shall be provided with enclosures of IP: 33 protection class as per IS: 13947 for indoor installations (IP: 43 for outdoor installations) and shall be fabricated from sheet steel of minimum 2.5mm thick. Double leaf access door shall be provided with concealed hinge and neoprene gaskets for easy access to HV

links and also for withdrawal of core and coil assembly if required. The enclosure door shall have provision of padlocking in closed position.

3.6.9 Marshaling box:

Suitable cubicle for housing the temperature sensing relay and winding temperature indicator shall be provided.

3.6.10 Cooling:

All transformers shall be suitable for working outdoor and shall conform to IS: 11171 with AN cooling type.

3.6.11 Painting

The internal and external surfaces of enclosure and structural steel work to be painted shall be shot or sand blasted type to remove all rust, scale, foreign adhering matters, etc. All steel surfaces exposed to weather shall be given a primary coat of zinc chromate, second coat of weather resistant varnish of a color distinct from primary and final two coats of weather resisting color paint to be finalised during detailed engineering.

3.6.12 Galvanizing

All galvanizing shall be done after fabrication by the hot dip method.

3.6.13 Marking of Parts

Each part of the equipment shall be properly marked to ensure easy identification and to facilitate correct assembly and erection in the field.

3.7 FITTINGS AND ACCESSORIES

The following fittings and accessories shall be provided on each transformer together with such other fittings and accessories which are necessary for satisfactory installation, operation and maintenance of the transformers. The fittings and accessories shall conform to relevant IS/IEC wherever exists.

i) Rating plates bearing data such as Type, applicable standard, Manufacturer•s serial number, Year of manufacture, No. of phases, Rated power, Rated frequency, Rated voltage, Rated current, Percentage impedance voltage at rated current at principal & extreme taps, Type of cooling, Connection diagram, Total weight and dimensions, core + coil wt., Temperature class of insulation, etc.

ii) A diagram plate showing the internal connections and also the vector relationship of the windings in accordance with requirements of standards and in addition to the plan view of the transformers, giving the correct principal relationship of transformer.

iii) Suitable HV & LV terminals to suit the terminal arrangements.

iv) Dial type winding temperature indicator /Digital Temperature Scanner fitted with maximum set of contacts.

v) Under carriage with four nos. plain bi-directional rollers with locking and bolting devices.

vi) Jacking lugs.

vii) Transformer clamping / fixing devices against earthquakes.

viii) 2 Nos. earthing terminals.

ix) Enclosure lifting eyes, transformer-lifting lugs, core and winding lifting lugs, skids and pulling eye on both sides.

x) Temperature sensors suitable for giving alarm and trip commands.

xi) Indicating alarm shall have contacts suitable for operation with 110V D.C. supply.

xii) Any other accessories or appliances recommended by the manufacturer for the satisfactory operation of the transformer together with their prices shall be supplied.

xiii) Off circuit tap changing equipment

3.8 Requirements to meet the SCADA and Metering.

Contractors shall study and provide all the necessary outputs for connecting to SCADA. Details in this regard shall be furnished during detailed engineering for approval by the purchaser. Arrangements may be made to measure the energy consumed.

3.9 TESTS

The following tests will be carried out on the transformers as per IS/IEC :

3.9.1 Type tests

Temperature rise test shall be conducted on both the transformers at the Contractor•s works. Other type tests conducted on similar or higher rating transformer shall be furnished for our records.

3.9.2 Routine Tests

The following shall constitute the routine tests:

i) Measurement of winding resistance at all taps.
ii) Measurement of voltage ratio at all taps and check of voltage vector relationship and polarity.
iii) Measurement of insulation resistance.
iv) Induced over voltage withstand test.
v) Separate source voltage withstand test.
vi) Measurement of impedance voltage/short circuit impedance and load losses at principal and extreme tap.
vii) Measurement of no load losses and current at 90%, 100% & 110% rated voltage.
viii) Core isolation test.
ix) Capacitance and Tan delta measurement test.
x) Repeat measurement of no load loss & current after dielectric test.
xi) No load current at 415V.
xii) Magnetic balance test.
xiii) Partial discharge test.

3.9.3 Field Tests

The scope of tests during and after erection includes:

i) Checking of correctness and completeness
ii) Checking of quality of porcelain parts, seals and external surfaces
iii) Checking of connections with earthing system
iv) Checking of bolt connections with a spanner
v) Checking of correctness of phase alteration
vi) Checking of correctness of tap changer
vii) Measurement of insulation resistance
viii) Checking of control & protection
ix) Testing of insulation of all LV circuits

3.9.4 Vendor shall be responsible for getting permission from all authorities and for providing specific conditions of tests.

3.10 EFFICIENCY

The Transformer shall be so designed that the efficiency load characteristics shall be as flat as possible between 50% and 100% rated capacity. The efficiency figures shall be guaranteed as per IS: 2026 but without tolerances allowed therein.

3.11 GUARANTEE FOR LOSSES

The no-load loss in Kilowatts, the load loss in Kilowatts at rated output, rated voltage, rated frequency and at 75ºC temperature shall be specified and guaranteed without any tolerance.

3.12 REJECTION

3.12.1 BHEL will reject the transformer if during tests or service, any of the following conditions arise and the provision under the relevant clause of the general conditions of contract shall immediately become applicable.

i) No load loss exceeds the guaranteed value by +15%.
ii) Load loss exceeds the guaranteed value by +15%.
iii) Impedance value exceeds the guaranteed value by + or -7.5 %.
iv) No load current exceeds 30% of the declared value.

v) Transformer is proved to have been manufactured not in accordance with the agreed specification.

3.12.2 BHEL reserves the right to retain the rejected transformer and take it into service until the Contractor replaces, at no extra cost to BHEL the defective transformer by a new transformer. Alternately the Contractor shall repair or replace the transformer within a reasonable period to the satisfaction of BHEL at no extra cost to BHEL.

3.12.3 All commissioning checks shall be carried out and documented.

3.13 ACCEPTANCE

After successful completion of all the tests and commissioning of the equipments, BHEL will satisfy itself that the equipment is in full and satisfactory working condition and issue an acceptance certificate.

3.14 SPARES

List of mandatory spares to be supplied are as follows:

i. HV bushing complete with gaskets, etc. :1 set(3 Nos per set)

ii. LV bushing complete with gaskets, etc.(if provided separately) :1 set(3 Nos per set)

iii. 440 kV Terminal connector/box : 1 No

iv. Neutral bushing complete with gaskets, etc. : 1 No.

3.15 ENERGY METERS

1No. of 3phase, 4 wire 0.2 class energy meters for measuring auxiliary power consumption for each transformer. The meter shall have a communication port to communicate with the central PC system.

Annexure-6

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.**

Annexure B

COMMERCIAL TERMS & CONDITIONS (to be enclosed with TECHNO-COMMERCIAL BID) (For Indigenous Purchase Orders)				
RFQ No.HBSBOS022 RFQ DATE : 24.09.2014 DUE DATE : 15.10.2014				
Sl No.	**Terms**	**BHEL Term**	**Confirmation**	**Deviation / Remarks**
1	**Bidding**	**(a)** Bid has to be submitted as Two Part – in two sealed covers-Techno Commercial Bid(Part-1) & Price Bid (Part-II)- clearly written on each cover both put in a single sealed envelope super-scribed with RFQ No. and Due date.	Acceptable / Not acceptable	
		(b) Documents as called in Pre-Qualification Criteria (Clause 1.0 of PS-439-895) 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 :Belakavadi,Mandya,Karnataka	Acceptable / Not acceptable	
4	**Delivery Period**	**(a)** Supply : Completion within ten (10) weeks from the date of Drawing Approval. Drawing Submission : Progressively from one 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

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Annexure B

COMMERCIAL TERMS & CONDITIONS (to be enclosed with TECHNO-COMMERCIAL BID) (For Indigenous Purchase Orders)				
RFQ No.HBSBOS022 RFQ DATE : 24.09.2014 DUE DATE : 15.10.2014				
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 5.4(5) of PS-439-895.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	
		The percentage of Supply, I&C and O&M values shall be in the range indicated below(approximately,with overall tallying to 100%) : (a) Supply : 51-53% (b) I&C : 36-38% (c) O&M : 10-12%	Acceptable / Not acceptable	
14	**Warranty / Guarantee**	(a) Supply : 42 months from the date of supply or 36 months from the date of I&C whichever is earlier. (b) Workmanship & I&C : 36 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	**Integrity Pact**	The bidder shall sign an "INTEGRITY PACT" in the format enclosed (total 7 sheets). Only those vendors / bidders who have entered into such an Integrity pact with BHEL would be competent to participate in the bidding. In other words, entering into this pact is a preliminary qualification. The Name & Address of Independent External Monitor (IEM) is given below: Shri D.R.S Chaudhary, IAS (Retd.) Flat No. L-202 & L-203 (1st Floor) Ansal Lake View Enclave Shamla Hills Bhopal- 462 013		
22	**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	
23	**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)	
24	**Bank Charges**	(a) All Bank charges to respective accounts	Acceptable / Not acceptable	
		(b) Deviation if any Please specify	(b)	
25	**Shipment**	Kindly indicate the state from where the shipment will take place.This is for the purpose of assessment of Tax.	State : ……	

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Annexure B1

TECHNICAL BID ENCLOSURE FOR COMPLIANCE OF QUOTE : UNPRICED BID

RFQ No.HBSBOS022 RFQ DATE : 24.09.2014 DUE DATE : 15.10.2014

Sl No.	Material	Short Text	Quantity	Unit	Quoted	Taxes				Remarks
						**ED %	CST %	VAT %	Service Tax %	
A. SUPPLY										
1	PS0679043845	PV plant Consumables for 10 MW KPCL	1	ST	YES / NO	NA			NA	Taxes Included
2	PS0679043853	Auxiliary,HT & data cables for 10MW KPCL	1	ST	YES / NO	NA			NA	Taxes Included
3	PS0679043861	Switch yard equipment for 10 MW KPCL	1	ST	YES / NO	NA			NA	Taxes Included
4	PS0679043870	Earthing System for 10 MW KPCL	1	ST	YES / NO	NA			NA	Taxes Included
5	PS0679043888	Lightning Protection equip for 10 MWKPCL	1	ST	YES / NO	NA			NA	Taxes Included
6	PS0679043896	Peripheral lighting for 10 MW KPCL	1	ST	YES / NO	NA			NA	Taxes Included
7	PS0679043900	Module Cleaning System for 10 MW KPCL	1	ST	YES / NO	NA			NA	Taxes Included
8	PS0679043918	Miscellaneous items for 10 MW KPCL	1	ST	YES / NO	NA			NA	Taxes Included
9	PS0679043926	Fire protection System for 10 MW KPCL	1	ST	YES / NO	NA			NA	Taxes Included
10	PS0679043934	ACDB, FCBC etc. for 10 MW KPCL	1	ST	YES / NO	NA			NA	Taxes Included
11	PS0679043942	10KW PV system for 10 MW KPCL	1	ST	YES / NO	NA			NA	Taxes Included
12	PS0679043950	11KV Transmission line for 10 MW KPCL	1	ST	YES / NO	NA			NA	Taxes Included
13	PS0679043969	Pre-fab buildings for 10 MW KPCL	1	ST	YES / NO	NA			NA	Taxes Included
B.I&C										
1	PS0679043977	I&C Pre-Constrn activities at 10MW KPCL	1	AU	YES / NO	NA	NA	NA		Taxes Included
2	PS0679043985	I&C-Array cabling for 10 MW KPCL	1	AU	YES / NO	NA	NA	NA		Taxes Included
3	PS0679043993	I&C of control room equip for 10 MW KPCL	1	AU	YES / NO	NA	NA	NA		Taxes Included
4	PS0679044000	I&C of trfr yard equipment for 10MW KPCL	1	AU	YES / NO	NA	NA	NA		Taxes Included
5	PS0679044019	I&C of HTcable and trench for 10MW KPCL	1	AU	YES / NO	NA	NA	NA		Taxes Included
6	PS0679044027	I&C of control & data cable for 10MW KPC	1	AU	YES / NO	NA	NA	NA		Taxes Included
7	PS0679044035	I&C of Earthing Sytem for 10 MW KPCL	1	AU	YES / NO	NA	NA	NA		Taxes Included
8	PS0679044043	I&C of YardLighting System for 10MW KPCL	1	AU	YES / NO	NA	NA	NA		Taxes Included
9	PS0679044051	I&C of ModuleCleaning Sys for 10MW KPCL	1	AU	YES / NO	NA	NA	NA		Taxes Included
10	PS0679044060	I&C of Misc Works for 10MW KPCL	1	AU	YES / NO	NA	NA	NA		Taxes Included
11	PS0679044078	I&C of 10 KW PV system for 10MW KPCL	1	AU	YES / NO	NA	NA	NA		Taxes Included
12	PS0679044086	I&C of 11KV transmsn line for 10MW KPCL	1	AU	YES / NO	NA	NA	NA		Taxes Included
13	PS0679044094	I&C of pre-enginrd CntrlRoom for 10MW KP	1	AU	YES / NO	NA	NA	NA		Taxes Included
14	PS0679044108	Pre commissioning Insp for 10MW KPCL	1	AU	YES / NO	NA	NA	NA		Taxes Included
15	PS0679044116	Commissioning & Liasoning for 10MW KPCL	1	AU	YES / NO	NA	NA	NA		Taxes Included
C.O&M										
1	PS0679044124	O&M of 10 MW KPCL:1st Year	1	AU	YES / NO	NA	NA	NA		Taxes Included
2	PS0679044132	O&M of 10 MW KPCL:2nd Year	1	AU	YES / NO	NA	NA	NA		Taxes Included
3	PS0679044140	O&M of 10 MW KPCL:3rd Year	1	AU	YES / NO	NA	NA	NA		Taxes Included
E. Freight Charges including Service Tax @ 12.36% on 25% of Freight Value : Included in Unit rate										
F. 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.HBSBOS022 RFQ DATE : 24.09.2014 DUE DATE : 15.10.2014											
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	PS0679043845	PV plant Consumables for 10 MW KPCL	1	ST			NA			NA	Taxes Included
	Unit Rate in words :										
2	PS0679043853	Auxiliary,HT & data cables for 10MW KPCL	1	ST			NA			NA	Taxes Included
	Unit Rate in words :										
3	PS0679043861	Switch yard equipment for 10 MW KPCL	1	ST			NA			NA	Taxes Included
	Unit Rate in words :										
4	PS0679043870	Earthing System for 10 MW KPCL	1	ST			NA			NA	Taxes Included
	Unit Rate in words :										
5	PS0679043888	Lightning Protection equip for 10 MWKPCL	1	ST			NA			NA	Taxes Included
	Unit Rate in words :										
6	PS0679043896	Peripheral lighting for 10 MW KPCL	1	ST			NA			NA	Taxes Included
	Unit Rate in words :										
7	PS0679043900	Module Cleaning System for 10 MW KPCL	1	ST			NA			NA	Taxes Included
	Unit Rate in words :										
8	PS0679043918	Miscellaneous items for 10 MW KPCL	1	ST			NA			NA	Taxes Included
	Unit Rate in words :										
9	PS0679043926	Fire protection System for 10 MW KPCL	1	ST			NA			NA	Taxes Included
	Unit Rate in words :										
10	PS0679043934	ACDB, FCBC etc. for 10 MW KPCL	1	ST			NA			NA	Taxes Included
	Unit Rate in words :										
11	PS0679043942	10KW PV system for 10 MW KPCL	1	ST			NA			NA	Taxes Included
	Unit Rate in words :										
12	PS0679043950	11KV Transmission line for 10 MW KPCL	1	ST			NA			NA	Taxes Included
	Unit Rate in words :										
13	PS0679043969	Pre-fab buildings for 10 MW KPCL	1	ST			NA			NA	Taxes Included
	Unit Rate in words :										
B.I&C											
1	PS0679043977	I&C Pre-Constrn activities at10MW KPCL	1	AU			NA	NA	NA		Taxes Included
	Unit Rate in words :										
2	PS0679043985	I&C-Array cabling for 10 MW KPCL	1	AU			NA	NA	NA		Taxes Included
	Unit Rate in words :										
3	PS0679043993	I&C of control room equip for 10 MW KPCL	1	AU			NA	NA	NA		Taxes Included
	Unit Rate in words :										
4	PS0679044000	I&C of trfr yard equipment for 10MW KPCL	1	AU			NA	NA	NA		Taxes Included
	Unit Rate in words :										
5	PS0679044019	I&C of HTcable and trench for 10MW KPCL	1	AU			NA	NA	NA		Taxes Included
	Unit Rate in words :										

Authorized Signatory with seal

Annexure B2

PRICE BID											
RFQ No.HBSBOS022 RFQ DATE : 24.09.2014 DUE DATE : 15.10.2014											
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											
6	PS0679044027	I&C of control & data cable for 10MW KPC	1	AU			NA	NA	NA		Taxes Included
	Unit Rate in words :										
7	PS0679044035	I&C of Earthing Sytem for 10 MW KPCL	1	AU			NA	NA	NA		Taxes Included
	Unit Rate in words :										
8	PS0679044043	I&C of YardLighting System for 10MW KPCL	1	AU			NA	NA	NA		Taxes Included
	Unit Rate in words :										
9	PS0679044051	I&C of ModuleCleaning Sys for 10MW KPCL	1	AU			NA	NA	NA		Taxes Included
	Unit Rate in words :										
10	PS0679044060	I&C of Misc Works for 10MW KPCL	1	AU			NA	NA	NA		Taxes Included
	Unit Rate in words :										
11	PS0679044078	I&C of 10 KW PV system for 10MW KPCL	1	AU			NA	NA	NA		Taxes Included
	Unit Rate in words :										
12	PS0679044086	I&C of 11KV transmsn line for 10MW KPCL	1	AU			NA	NA	NA		Taxes Included
	Unit Rate in words :										
13	PS0679044094	I&C of pre-enginrd CntrlRoom for 10MW KP	1	AU			NA	NA	NA		Taxes Included
	Unit Rate in words :										
14	PS0679044108	Pre commissioning Insp for 10MW KPCL	1	AU			NA	NA	NA		Taxes Included
	Unit Rate in words :										
15	PS0679044116	Commissioning & Liasoning for 10MW KPCL	1	AU			NA	NA	NA		Taxes Included
	Unit Rate in words :										
C.O&M											
1	PS0679044124	O&M of 10 MW KPCL:1st Year	1	AU			NA	NA	NA		Taxes Included
	Unit Rate in words :										
2	PS0679044132	O&M of 10 MW KPCL:2nd Year	1	AU			NA	NA	NA		Taxes Included
	Unit Rate in words :										
3	PS0679044140	O&M of 10 MW KPCL:3rd 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 Tax assessment.

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

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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.

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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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INTEGRITY PACT

Between

Bharat Heavy Electricals Ltd. (BHEL), a company registered under the Companies Act 1956 and having its registered office at "BHEL House", Siri Fort, New Delhi – 110049 (India) hereinafter referred to as "The Principal", which expression unless repugnant to the context or meaning hereof shall include its successors or assigns of the ONE PART

and

_____, (description of the party along with address), hereinafter referred to as "The Bidder/ Contractor" which expression unless repugnant to the context or meaning hereof shall include its successors or assigns of the OTHER PART

Preamble

The Principal intends to award, under laid-down organizational procedures, contract/s for _____

_____

_____. The Principal values full compliance with all relevant laws of the land, rules and regulations, and the principles of economic use of resources, and of fairness and transparency in its relations with its Bidder(s)/ Contractor(s).

In order to achieve these goals, the Principal will appoint Independent External Monitor(s), who will monitor the tender process and the execution of the contract for compliance with the principles mentioned above.

Section 1 – Commitments of the Principal

1.1 The Principal commits itself to take all measures necessary to prevent corruption and to observe the following principles:-

1.1.1 No employee of the Principal, personally or through family members, will in connection with the tender for, or the execution of a contract, demand, take a promise for or accept, for self or third person, any material or immaterial benefit which the person is not legally entitled to.

1.1.2 The Principal will, during the tender process treat all Bidder(s) with equity and reason. The Principal will in particular, before and during the tender process, provide to all Bidder(s) the same information and will not provide to any Bidder(s) confidential / additional information through which the Bidder(s) could obtain an advantage in relation to the tender process or the contract execution.

1.1.3 The Principal will exclude from the process all known prejudiced persons.

1.2 If the Principal obtains information on the conduct of any of its employees which is a penal offence under the Indian Penal Code 1860 and Prevention of Corruption Act 1988 or any other statutory penal enactment, or if there be a substantive suspicion in this regard, the Principal will inform its Vigilance Office and in addition can initiate disciplinary actions.

Section 2 – Commitments of the Bidder(s)/ Contractor(s)

2.1 The Bidder(s)/ Contractor(s) commit himself to take all measures necessary to prevent corruption. He commits himself to observe the following principles during his participation in the tender process and during the contract execution.

2.1.1 The Bidder(s)/ Contractor(s) will not, directly or through any other person or firm, offer, promise or give to the Principal or to any of the Principal's employees involved in the tender process or the execution of the contract or to any third person any material, immaterial or any other benefit which he / she is not legally entitled to, in

order to obtain in exchange any advantage of any kind whatsoever during the tender process or during the execution of the contract.

2.1.2 The Bidder(s)/ Contractor(s) will not enter with other Bidder(s) into any illegal or undisclosed agreement or understanding, whether formal or informal. This applies in particular to prices, specifications, certifications, subsidiary contracts, submission or non-submission of bids or any other actions to restrict competitiveness or to introduce cartelization in the bidding process.

2.1.3 The Bidder(s)/ Contractor(s) will not commit any penal offence under the relevant IPC/ PC Act; further the Bidder(s)/ Contractor(s) will not use improperly, for purposes of competition or personal gain, or pass on to others, any information or document provided by the Principal as part of the business relationship, regarding plans, technical proposals and business details, including information contained or transmitted electronically.

2.1.4 The Bidder(s)/ Contractor(s) will, when presenting his bid, disclose any and all payments he has made, and is committed to or intends to make to agents, brokers or any other intermediaries in connection with the award of the contract.

2.2 The Bidder(s)/ Contractor(s) will not instigate third persons to commit offences outlined above or be an accessory to such offences.

Section 3 – Disqualification from tender process and exclusion from future contracts

If the Bidder(s)/ Contractor(s), before award or during execution has committed a transgression through a violation of Section 2 above, or acts in any other manner such as to put his reliability or credibility in question, the Principal is entitled to disqualify the Bidders(s)/ Contractor(s) from the tender process or take action as per the separate "Guidelines for Suspension of Business Dealings with Suppliers/ Contractors" framed by the Principal.

Section 4 – Compensation for Damages

4.1 If the Principal has disqualified the Bidder(s) from the tender process prior to the award according to Section 3, the Principal is entitled to demand and recover the damages equivalent to Earnest Money Deposit/ Bid Security.

4.2 If the Principal has terminated the contract according to Section 3, or if the Principal is entitled to terminate the contract according to section 3, the Principal shall be entitled to demand and recover from the Contractor liquidated damages equivalent to 5% of the contract value or the amount equivalent to Security Deposit/Performance Bank Guarantee, whichever is higher.

Section 5 – Previous Transgression

5.1 The Bidder declares that no previous transgressions occurred in the last 3 years with any other company in any country conforming to the anti-corruption approach or with any other Public Sector Enterprise in India that could justify his exclusion from the tender process.

5.2 If the Bidder makes incorrect statement on this subject, he can be disqualified from the tender process or the contract, if already awarded, can be terminated for such reason.

Section 6 – Equal treatment of all Bidders/ Contractors/ Sub-contractors

6.1 The Bidder(s)/ Contractor(s) undertake(s) to demand from his sub-contractors a commitment consistent with this Integrity Pact. This commitment shall be taken only from those sub-contractors whose contract value is more than 20% of Bidder's/ Contractor's contract value with the Principal.

6.2 The Principal will enter into agreements with identical conditions as this one with all Bidders and Contractors.

6.3 The Principal will disqualify from the tender process all bidders who do not sign this pact or violate its provisions.

Section 7 – Criminal Charges against violating Bidders/ Contractors /Sub-contractors

If the Principal obtains knowledge of conduct of a Bidder, Contractor or Subcontractor, or of an employee or a representative or an associate of a Bidder, Contractor or Subcontractor which constitutes corruption, or if the Principal has substantive suspicion in this regard, the Principal will inform the Vigilance Office.

Section 8 –Independent External Monitor(s)

8.1 The Principal appoints competent and credible Independent External Monitor for this Pact. The task of the Monitor is to review independently and objectively, whether and to what extent the parties comply with the obligations under this agreement.

8.2 The Monitor is not subject to instructions by the representatives of the parties and performs his functions neutrally and independently. He reports to the CMD, BHEL.

8.3 The Bidder(s)/ Contractor(s) accepts that the Monitor has the right to access without restriction to all contract documentation of the Principal including that provided by the Bidder(s)/ Contractor(s). The Bidder(s)/ Contractor(s) will grant the monitor, upon his request and demonstration of a valid interest, unrestricted and unconditional access to his contract documentation. The same is applicable to Sub-contractor(s). The Monitor is under contractual obligation to treat the information and documents of the Bidder(s)/ Contractor(s) / Sub-contractor(s) with confidentiality.

8.4 The Principal will provide to the Monitor sufficient information about all meetings among the parties related to the contract provided such meetings could have an impact on the contractual relations between the Principal and the Contractor. The parties offer to the Monitor the option to participate in such meetings.

8.5 As soon as the Monitor notices, or believes to notice, a violation of this agreement, he will so inform the Management of the Principal and request the Management to discontinue or

take corrective action, or heal the situation, or to take other relevant action. The Monitor can in this regard submit non-binding recommendations. Beyond this, the Monitor has no right to demand from the parties that they act in a specific manner, refrain from action or tolerate action.

8.6 The Monitor will submit a written report to the CMD, BHEL within 8 to 10 weeks from the date of reference or intimation to him by the Principal and, should the occasion arise, submit proposals for correcting problematic situations.

8.7 The CMD, BHEL shall decide the compensation to be paid to the Monitor and its terms and conditions.

8.8 If the Monitor has reported to the CMD, BHEL, a substantiated suspicion of an offence under relevant IPC / PC Act, and the CMD, BHEL has not, within reasonable time, taken visible action to proceed against such offence or reported it to the Vigilance Office, the Monitor may also transmit this information directly to the Central Vigilance Commissioner, Government of India.

8.9 The number of Independent External Monitor(s) shall be decided by the CMD, BHEL.

8.10 The word 'Monitor' would include both singular and plural.

Section 9 – Pact Duration

9.1 This Pact begins when both parties have legally signed it. It expires for the Contractor 12 months after the last payment under the respective contract and for all other Bidders 6 months after the contract has been awarded.

9.2 If any claim is made / lodged during this time, the same shall be binding and continue to be valid despite the lapse of this pact as specified as above, unless it is discharged/ determined by the CMD, BHEL.

Section 10 – Other Provisions

10.1 This agreement is subject to Indian Laws and jurisdiction shall be registered office of the Principal, i.e. New Delhi.

10.2 Changes and supplements as well as termination notices need to be made in writing. Side agreements have not been made.

10.3 If the Contractor is a partnership or a consortium, this agreement must be signed by all partners or consortium members.

10.4 Should one or several provisions of this agreement turn out to be invalid, the remainder of this agreement remains valid. In this case, the parties will strive to come to an agreement to their original intentions.

10.5 Only those bidders/ contractors who have entered into this agreement with the Principal would be competent to participate in the bidding. In other words, entering into this agreement would be a preliminary qualification.

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For & On behalf of the Principal	For & On behalf of the Bidder/ Contractor
(Office Seal)	(Office Seal)

Place----------

Date----------

Witness: _____	Witness: _____
(Name & Address) _____	(Name & Address)_____
_____	_____