



ಭಾರತ್ ಹೆವಿ ಎಲೆಕ್ಟ್ರಿಕಲ್ಸ್ ಲಿಮಿಟೆಡ್
भारत हेवी इलेक्ट्रिकल्स लिमिटेड

PHONE : 080 - 26998377
Fax : 080 -26989217
E-MAIL pragadeeshtg@bhel.in

Bharat Heavy Electricals Limited
(A Government of India Undertaking)
ELECTRONICS DIVISION

P.O. Box No. 2606, Mysuru Road, Bengaluru - 560 026

An ISO 9001, ISO 14001, OHSAS 18001 & ISO/IEC 27001:2005 Company

E-Tender

The Quotations are invited under two part bid system for supply, installation and commissioning of fire alarm system in 129 MW solar PV plants, Telangana

RFQ NO and date	TGPBOS0030 dated 10.07.2019 (e-tender)
RFQ due date & time	22.07.2019 up to 13.00 hrs (IST)
Date, Time & Venue of Part-I Bid Opening	22.07.2019 after 13.30 hrs (IST)
Date, Time & Venue of Price Bid opening	Will be intimated later for technically accepted vendors
Address for Commercial Communication & Contact Person in BHEL (MM dept)	Mr. T.G.Pragadeesh (09742576787) Manager Mr. Ramachandra (09980958476), SDGM SC&PV MM Department, BHEL Electronics Division, PB NO 2606, Mysuru road, Bengaluru-560 026. INDIA Email: pragadeeshtg@bhel.in ramachandra@bhel.in Telephone number: +91 80 26998377, +91 80 26998476
Address for Technical Communication & Contact Person in BHEL with CC to MM dept	Mr. Vipindas C P (9686938636) Dy.Manager Mr. Sreenath M (9845605037), AGM SC&PV ENGINEERING Department, BHEL Electronics Division, PB NO 2606, Mysuru road, Bengaluru-560 026. INDIA Email: vipindas.cp@bhel.in sreenath@bhel.in Telephone number: +91 80 26998389, +91 80 26998489

Any Deviations from or additions to the "General Conditions of Contract" or "Special Conditions of Contract" require BHEL's express written consent. The General Terms of Business or Sale of the Bidder shall not apply to this tender.

PREQUALIFICATION CRITERIA

- 1) Vendor should have executed contracts of electrical installations of 33KV minimum in power plants or sub-stations in India with scope including both supply and erection for a cumulative value of Rs. 2.0 Crores with such individual contract values not less than Rs. 0.5 Crores within last 5 years from date of tender opening. As evidence for this, vendor shall submit copies of purchase order along with dispatch documents.
- 2) Vendor should have achieved annual average financial turnover of Rs. 2 Crores in three financial years (2015-16, 16-17 and 17-18). Vendor shall submit the audited balance sheets for all the 3 years.
- 3) During technical evaluation, credentials of vendor will be submitted to end customer for approval. Only the price bids of those vendors, **who are technically qualified and Approved by end customer** before price bid opening, will be considered for further procurement processing.
- 4) Any vendors, against whom, action due to non-performance has been initiated by BHEL are not eligible for participation. Such offers will not be considered.

REQUEST FOR QUOTATION

 MMI:PU:RF:003	BHARAT HEAVY ELECTRICALS LIMITED Electronics Division PB No. 2606, Mysore Road Bangalore - 560026 INDIA	RFQ NUMBER: TGPBOS0030 RFQ DATE : 10.JUL.2019	Due Date 22.JUL.2019 Time: 13:00 HRS VENUE : NEW ENGG. BLDG
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PURCHASE FILE COPY	(for all correspondence) Purchase Executive : TG Pragadeesh Phone : 080 26998377 Fax : E-mail: pragadeeshtg@bhel.in
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Please submit your lowest quotation subject to our terms and conditions attached for the material mentioned below. The quotation must be enclosed in a sealed envelope / Fax superscribed with RFQ no.and due date, should reach us on or before the due date by **13.00** hours IST and will be opened on the same day at **13.30** hours at the venue mentioned above. **PLEASE DROP THE OFFER IN THE BOX PROVIDED AT RECEPTION.**

SI No.	Description	Qty	Unit	Delivery qty	Delivery Date
1	PS0679080171 Supply of cable ties, HDPE DWC pipe with couplers, joints, bends etc for 6 sq.mm cable routing from row end to SMB As per PS-439-1262 Test Certificate	1	ST	1	21.OCT.2019
2	PS0679080180 Supply of pin type copper lugs For string termination at SMB As per PS-439-1262 Test Certificate	2,000	NO	2,000	21.OCT.2019
3	PS0679080198 Supply of al cable lugs for 300 sq.mm As per PS-439-1262 Test Certificate	300	NO	300	21.OCT.2019
4	PS0679080201 Supply of SMB support structure suitable for mounting on HDPE floating pontoons As per PS-439-1262 Test Certificate	36	NO	36	21.OCT.2019
5	PS0679080210 Supply of Hume pipes for DC cable crossing over the bund As per PS-439-1262 Test Certificate	1	ST	1	21.OCT.2019
6	PS0679080228 Supply of cable glands for 300 sq.mm Supply of double compression weatherproof metallic cable gland, bi-metallic strip or washer, SS304 hardware for 300 sq.mm cable- PCU DC side As per PS-439-1262 Test Certificate	110	ST	110	21.OCT.2019
7	PS0679080236 Supply of cable glands for 630 sq.mm Supply of double compression weatherproof metallic cable gland, aluminium cable lug, bi-metallic strip washer, SS304 hardware for 630 sq.mm cable- PCU AC side and TRF LV side As per PS-439-1262 Test Certificate	100	ST	100	21.OCT.2019
8	PS0679080244 1.1KV, 3.5CX70 sq.mm XLPE al armd cable # For Aux Transformer LV side to LT SWITCHGEAR As per PS-439-1262 Test Certificate	100	M	100	21.OCT.2019
	PS0679080252 cable gland for 3.5CX70 sq.mm cable	2	ST	2	21.OCT.2019

For and On behalf of BHEL.

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SI No.	Description	Qty	Unit	Delivery qty	Delivery Date
9	Supply of double compression weatherproof metallic cable gland, aluminium cable lug, bi-metallic strip washer, SS304 hardware for 3.5CX70 sq.mm cable- Aux TRF & LT SWITCHGEAR As per PS-439-1262 Test Certificate				
10	PS0679080260 33KV/415V, 100KVA, ONAN auxiliary TRF As per PS-439-1262 Test Certificate	1	NO	1	21.OCT.2019
11	PS0679080279 Supply of LT SWITCHGEAR PANEL As per PS-439-1262 Test Certificate	1	NO	1	21.OCT.2019
12	PS0679080287 220V FCBC, DCDB, Plante type Battery bank FOR Main Control Room As per PS-439-1262 Test Certificate	1	ST	1	21.OCT.2019
13	PS0679080295 UPS, UPSDB and Ni-Cd type battery bank As per PS-439-1262 Test Certificate	1	ST	1	21.OCT.2019
14	PS0679080309 Supply of 33KV outdoor S/Y equipments CTs, PTs, LAs, SF6 breaker, isolators with earth switch, ABT meter, Moose ACSR conductor, Control and Relay panel, DC system etc. As per PS-439-1262 Test Certificate	1	ST	1	21.OCT.2019
15	PS0679080317 Supply of earthing system, fencing, gate and lattice support structure for switchyard equipment As per PS-439-1262 Test Certificate	1	ST	1	21.OCT.2019
16	PS0679080325 Supply of C-channel support for equipmen and cable tray support for main control room As per PS-439-1262 Test Certificate	1	ST	1	21.OCT.2019
17	PS0679080333 Supply of 8mm Thk chequered plate As per PS-439-1262 Test Certificate	1	ST	1	21.OCT.2019
18	PS0679080341 Supply of cable tray- 3 tier As per PS-439-1262 Test Certificate	1	ST	1	21.OCT.2019
	PS0679080350 Ladder type cable support for 630 sq.mm	2	ST	2	21.OCT.2019

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SI No.	Description	Qty	Unit	Delivery qty	Delivery Date
19	cable upto TRF LV side As per PS-439-1262 Test Certificate				
20	PS0679080368 cable gland for 33KV(UE), 3CX240 sq.mm Supply of double compression weatherproof metallic cable gland for 33KV (UE), 3CX240 sq.mm cable As per PS-439-1262 Test Certificate	8	NO	8	21.OCT.2019
21	PS0679080376 Indoor cable termination kit for 33KV Supply of indoor cable termination kit for 33KV(UE),3CX240 sq.mm As per PS-439-1262 Test Certificate	8	NO	8	21.OCT.2019
22	PS0679080384 outdoor cable termination kit for 33KV Supply of outdoor cable termination kit for 33KV(UE), 3CX240 sq.mm As per PS-439-1262 Test Certificate	2	NO	2	21.OCT.2019
23	PS0679080392 straight through joint kits for 33KV(UE) Supply of straight through joint kits for 33KV(UE), 3CX240 sq.mm cable As per PS-439-1262 Test Certificate	4	NO	4	21.OCT.2019
24	PS0679080406 Supply of earthing system for array & CR Supply of earthing electrodes with chemical compound, earthing strips/flats, earthing cable(70 sq.mm for PCU, 16 sq.mm for SCADA, min 2.5 sq.mm for SPV modules) i.e. unarmoured copper cables, termination hardware, brick masonry earth chamber with inspection lids for solar array and main control room As per PS-439-1262 Test Certificate	1	ST	1	21.OCT.2019
25	PS0679080414 Supply of module washing system Battery/diesel/petrol operated hand held pump system with pressure nozzle for cleaning 16860 Nos of SPV modules As per PS-439-1262 Test Certificate	1	ST	1	21.OCT.2019

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SI No.	Description	Qty	Unit	Delivery qty	Delivery Date
26	PS0679080422 control and instrumentation Cable for connecting PCU, HT panel, LT SWITCHGEAR, FCBC, DCDB, UPS, fire alarm system, inverter transformer, auxiliary transformer, WMS, CCTV, Wireless receiver mounted on top of building etc to SCADA panel As per PS-439-1262 Test Certificate	1	ST	1	21.OCT.2019
27	PS0679080430 Supply of peripheral lighting- Supply of items for LED based peripheral lighting system covering Inverter TRF yard, security cabin, watch tower, access road, across the embankment (maximum 15 m between two adjacent lamps) As per PS-439-1262 Test Certificate	1	ST	1	21.OCT.2019
28	PS0679080449 Supply of weather monitoring system(WMS) As per PS-439-1262 Test Certificate	1	ST	1	21.OCT.2019
29	PS0679080457 Supply of safety related items including fire alarm systems for building, fire extinguishers, sand buckets, safety gadgets etc As per PS-439-1262 Test Certificate	1	ST	1	21.OCT.2019
30	PS0679080465 Supply of ESE type lightning arrester including 7 meter pole, counter, earthing materials, earthing strip etc. (4 sets on water and 1 set on main control room) As per PS-439-1262 Test Certificate	6	ST	6	21.OCT.2019
31	PS0679080473 Supply of Pre-fabricated watchman cabin Dimensions 1.2mX1.8mX2.4m(H)-minimum As per PS-439-1262 Test Certificate	1	NO	1	21.OCT.2019
32	PS0679080481 Supply of Pre-fabricated security cabin near main entrance # Dimensions 3mX3mX2.4m(H)-minimum As per PS-439-1262 Test Certificate	1	NO	1	21.OCT.2019
33	PS0679080490 Supply of watchtower to be installed on top of RCC control room	1	NO	1	21.OCT.2019

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SI No.	Description	Qty	Unit	Delivery qty	Delivery Date
	As per PS-439-1262 Test Certificate				
34	PS0679080503 Supply of air conditioners for MCR Supply of air conditioners for main control building SCADA room- Capacity 2 Ton As per PS-439-1262 Test Certificate	2	NO	2	21.OCT.2019
35	PS0679080511 Supply of complete CCTV system including min 42# display (with controller#) As per PS-439-1262 Test Certificate	1	ST	1	21.OCT.2019
36	PS0679080520 Supply of paddle boat with 4 persons cap As per PS-439-1262 Test Certificate	1	NO	1	21.OCT.2019
37	PS0679080538 Supply of 20HP flattered boat As per PS-439-1262 Test Certificate	1	NO	1	21.OCT.2019
38	PS0679080546 Hydraulic manual pallet truck As per PS-439-1262 Test Certificate	1	NO	1	21.OCT.2019
39	PS0679080554 25L commercial RO+UV water purifier As per PS-439-1262 Test Certificate	1	NO	1	21.OCT.2019
40	PS0679080562 Supply of water pump and UPVC pipe line for taking the water from a point 150m away from control room to the OH tank on top of control room As per PS-439-1262 Test Certificate	1	ST	1	21.OCT.2019
41	PS0679080570 Supply of miscellaneous items such as cable tags, cable ties, cable ferrules, cable route markers, hoarding board, sign boards, danger boards, display boards, plant Layout boards, electrical insulation mat, tool kits, measuring instruments, office furniture, items for remote connectivity of SCADA, etc. As per PS-439-1262 Test Certificate	1	ST	1	21.OCT.2019
42	PS0679080589 Supply of spare items As per PS-439-1262	1	ST	1	21.OCT.2019

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SI No.	Description	Qty	Unit	Delivery qty	Delivery Date
	Test Certificate				
43	PS0679080597 I&C : Containerized office room for 4 mo As per PS-439-1262	1	AU	1	18.NOV.2019
44	PS0679080600 I&C: Installation of floating pontoons a as per the instructions and on-site hands-on training by the OEM of pontoons. Supply of pontoons, modules and hardware for installation is in BHEL scope. Anchoring and mooring of the floating island is also in BHEL scope. As per OEM, approximate labour required shall be 3 modules/hour/person. Total number of modules to be installed is 16,860 Nos. As per PS-439-1262	1	AU	1	18.NOV.2019
45	PS0679080619 I&C: Interconnection of SPV modules, ins 36 Nos of SMBs(wireless communication), laying/ termination/ ferruling of solar array 1Cx6sqmm cable including related conduit works. As per PS-439-1262	1	AU	1	18.NOV.2019
46	PS0679080627 I&C: Laying and termination of 1Cx300sq DC power cable from SMB to PCU As per PS-439-1262	1	AU	1	18.NOV.2019
47	PS0679080635 I&C: Earthing of 16860 nos modules and 3 Earthing of 16860 nos modules and 36 nos of SMBs using combination of earthing cables of adequate size and earthing strip/flats. Total number of chemical earth pits for array earthing shall be 4 Nos. SMB-SPD earthing cables shall be connected to array earthing grid. As per PS-439-1262	1	AU	1	18.NOV.2019
48	PS0679080643 I&C: Installation of 5 Nos of ESE type L Installation of 4 Nos of ESE type LA on separate floating platform and 1 No on main control room. LAs on pond shall be placed as per tentative layout. Approximate distance from LA to embankment will be 5 to 10	6	AU	6	18.NOV.2019

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SI No.	Description	Qty	Unit	Delivery qty	Delivery Date
	meters. The earth pits for LA shall be suitably placed on the ground near embankment. As per PS-439-1262				
49	PS0679080651 I&C: Erection of indoor electrical panel (PCUs, VCB panels, DB boards of all types, UPS/ FCBC/ battery bank, SCADA panels etc) in the control room including grouting of panels, laying/fixing of cable trays, routing/terminations of cables at the electrical panels and up to LV side of transformers in the switchyard. As per PS-439-1262	1	AU	1	18.NOV.2019
50	PS0679080660 I&C: Erection of 33kV transformer yard Erection of 2 Nos. of 2.7MVA inverter transformer and 1 No. 100KVA aux. transformer, cable trays, drain pipes etc As per PS-439-1262	1	AU	1	18.NOV.2019
51	PS0679080678 I&C: Transformer yard with 3 Transformer with 3 Transformer foundations, jelly spreading, fencing and gate. As per PS-439-1262	1	AU	1	18.NOV.2019
52	PS0679080694 I&C: Installation and commissioning of S by integrating the data cables from all the electrical and weather monitoring system equipments (WMS) of the power plant at the data logger/ PLC panel / HMI computer control desk at main control room etc As per PS-439-1262	1	AU	1	18.NOV.2019
53	PS0679080708 I&C: Earthing system for main control room including laying of underground earth mat grids, earth chambers with lids, laying/termination of earthing strips from all electrical equipment to earth mat grid etc As per PS-439-1262	1	AU	1	18.NOV.2019
54	PS0679080716 I&C: Preparation of foundation and installation of 33KV switchyard CT, PT, SF6 breaker, isolator with earth switch, LA, ABT meter etc. As per PS-439-1262	1	AU	1	18.NOV.2019

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55	PS0679080724 I&C: Peripheral lighting system / plant lighting system including outdoor cable laying, cable terminations at poles / lights as well as DB boards of main control room As per PS-439-1262	1	AU	1	18.NOV.2019
56	PS0679080732 I&C: CCTV system as per specification As per PS-439-1262	1	AU	1	18.NOV.2019
57	PS0679080740 I&C: Miscellaneous and safety items such as cable tags, cable markers, hoarding board, sign boards, danger boards, display boards, electrical insulation mat, checkered plates, air conditioners, office furniture, fire extinguishers, fire alarm system, weather monitoring system, items for remote connectivity of SCADA, connection from sump tank/water point to OH tank identification markings using painting etc As per PS-439-1262	1	AU	1	18.NOV.2019
58	PS0679080759 I&C: Pre-commissioning inspections/ check checks/tests, MRT tests, coordination/liaison with state /central departments/CEIG etc for necessary approvals/clearances for commissioning, synchronization with grid/ plant commissioning As per PS-439-1262	1	AU	1	18.NOV.2019

Total Number of Items - 58


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


For and On behalf of BHEL.

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vii). All Prices should be written in words and numbers.			
viii). Excise Chapter Heading should be mentioned for all items where VAT is applicable .			
Vendors list to whom RFQ has been sent:			
1. BHEL, Electronics Division (X563699) - 6400127299			

For and On behalf of BHEL.

	PURCHASE SPECIFICATION: SUPPLY OF BOS ITEMS AND I&C OF 5MW(AC) FLOATING SOLAR PV POWER PLANT FOR WBPDCCL AT SAGARDIGHI TPP, WEST BENGAL	PS-439-1262
		Rev No: 00
		PAGE : 1 OF 32

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**Technical specification
for
Supply of Balance of System items, Installation & Commissioning
of
5MW (AC) Floating Solar Photovoltaic Grid-connected Power plant for The
West Bengal Power Development Corporation (WBPDCCL) at
Sagardighi Thermal Power Plant, West Bengal**

Revision details: Rev:00	Prepared Vipindas C P	Approved: M Sreenath	Date: 24.06.2019
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**PURCHASE SPECIFICATION:
SUPPLY OF BOS ITEMS AND I&C OF 5MW(AC)
FLOATING SOLAR PV POWER PLANT FOR WBPDC AT
SAGARDIGHI TPP, WEST BENGAL**

PS-439-1262

Rev No: 00

PAGE : 2 OF 32

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1.1	Overall project outline of 5MW (AC) Floating solar photovoltaic power plant
1.2	Scope of this tender specification
1.3	Enclosures to this tender specification (Tender purpose only)
1.4	Location / address of power plant
2.0	Scope of work
2.1	Bidder scope –Supply and I&C
3.0	3.0 BHEL scope of Supplies (I&C in bidder scope)
4.0	List of documents to be submitted along with the technical bid
5.0	Technical specification for supply , installation and commissioning
5.1	Temporary site office for BHEL use
5.2	Electrical power / water for construction
5.3	Construction of temporary yards for safe storage of BHEL & bidder supplied item
5.4	Unloading, safe storage and movement of items received at site
5.5	Installation of floating pontoons with module mounting mechanism
5.6	Series interconnection of SPV modules to form strings
5.7	Installation of SMBs including erection of SMB mounting structures
5.8	Interconnection of SPV module strings to 1Cx6sq.mm. cable
5.9	Ferruling for 1Cx6sq.mm cable
5.10	Routing of 1Cx 6sq.mm cable up to SMB
5.11	Termination of 1Cx6sq.mm. Copper cables on input side of SMBs
5.12	
5.13	Laying of 2run/4runs of 1Cx300sq.mm Al cable upto main control room and terminations at PCU
5.14	Termination of 2 run/4 run 1Cx300 DC power cables at SMBs
5.15	Laying and Termination of 1Cx630sq.mm LT AC power cables at PCU and Inverter Transformer
5.16	Laying and termination of 33KV(UE), 3CX240 sq.mm XLPE Al cable from Inverter transformer and Aux transformer to HT panel
5.17	Laying and termination of 33KV(UE), 2 runs of 3CX240 sq.mm XLPE Al cable from HT panel to outdoor switchyard
5.18	Identification marking of cables using cable tags
5.19	Installation of electrical panels in main control room
5.20	Installation of electrical panels in outdoor switchyard small control room
5.21	Installation of cable trays, cable laying/dressing etc. in main control room
5.22	Design, Supply, Laying, termination of aux supply cables in main control room
5.23	Design, Supply, Laying and installation of Control / data / instrumentation cables
5.24	Erection of 33kv transformer yards attached to main control room
5.25	Specification of auxiliary transformer 100kVA, 33kv/415V, Dyn11, Outdoor, ONAN
5.26	Specification for Float Cum Boost Charger
5.27	Specification of Plante type battery bank for FCBC
5.28	Specification of UPS with battery bank




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	5.29	Specification of LT SWITCHGEAR
	5.30	Specification of CCTV
	5.31	Specification of chemical earthing electrodes
	5.32	Specification of ESE type LAs
	5.33	Specification of 33KV outdoor switchyard with metering
	5.34	Specification of illumination system
	5.35	Auxiliary AC/DC power supply system
	5.36	Design, supply, installation of Watchman and security room with electrical fittings
	5.37	Supply and installation of Weather monitoring system
	5.38	Broadband Connection with Static IP
	5.39	Installation and commissioning of SCADA integration systems
	5.40	Earthing of solar PV modules and SMBs
	5.41	Earthing system for main control room and 33kV transformer yard
	5.42	Water washing system for SPV modules (Module cleaning system)
	5.43	Connection of water point to Overhead water tank
	5.44	Firefighting systems and Fire Alarm System
	5.45	Identification marking of electrical items using painting
	5.46	Cable markers and cables tags
	5.47	Display boards and sign boards
	5.48	Electrical insulation mat
	5.49	Chequered plates
	5.50	Supply and Installation Miscellaneous Items for Control Room
	5.51	Tool kits and instruments
	5.52	Cable installation Methodology
	5.53	Pre-commissioning inspections/ checks/tests, MRT tests, coordination/liason with state /central departments/CEIG etc. for necessary approvals/clearances for commissioning, synchronization with grid/ plant commissioning
	5.54	Spares required to be supplied along with main consignment
6.0		General conditions applicable during supply, installation and commissioning phase
7.0		Documents to be submitted for BHEL/WBPDC approval during detailed engineering

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1.0 Introduction

1.1 Overall project outline of 5MW (AC) Floating solar photovoltaic power plant

Bharat Heavy Electricals Limited (BHEL), Electronics Division, Bangalore is setting up a 5MW (AC) Floating solar photovoltaic (SPV) power plant for WBPDCCL at Thermal Pond-3 of Sagardighi Thermal Power Plant at West Bengal.

The supply of all floatation devices including hardware for forming floating islands shall be in scope of BHEL. However assembly of floatation devices as per OEM manual shall be in bidder's scope. All necessary on site hands on training for assembly of floatation devices will be given to the bidder's labours by OEM of floatation devices and BHEL. Design, Anchoring and mooring of the floating island is in the scope of BHEL.

After forming floating island, the installation of BHEL supplied solar PV modules on the floating island using BHEL supplied hardware shall be in the scope of bidder. The floating solar array shall be formed as per the BHEL drawings. Solar PV modules employed at the plant, generates DC electricity that in turn shall be inverted to AC in the range 300-400V. The output voltage from inverter/PCU stepped upto 33KV level. The combined 5MW output at 33KV level shall be terminated in the WBPDCCL/WBSEDCL switchyard which is approximately 1500 meters away. Laying of 2 runs of 33KV(UE), 3CX240 sq.mm cable shall be in the scope of bidder.

The plant is envisaged to have several other infrastructural support systems such as module cleaning system for SPV modules, CCTV, plant illumination system, fire alarm system etc.

1.2 Scope of this tender specification

Bidder scope includes supply, installation, testing and commissioning of identified activities of the solar photovoltaic power plant.

This scope includes activities but not limited to obtaining approval from BHEL / WBPDCCL for the datasheets / drawings / MQP, manufacture / testing / inspection at manufacturer's works, packing, supply, transportation, transit insurance, delivery to site, unloading, storage, installation and commissioning of AC and DC side activities of power plant identified under this specification.

Note: The above is only a broad outline of bidder scope for the sake of introduction. The detailed bidder scope is elaborated under various other sections of this specification.

1.3 Enclosures to this tender specification (Tender purpose only)

1	AC single line diagram of overall Solar PV power plant
2	Tentative array layout with SMB locations
3	SPV module drawing
4	Tentative layout of main control room
5	Auxiliary transformer specification
6	Battery-FCBC-DCDB specification
7	UPS-Battery specification
8	LT Switchgear specification
9	33KV outdoor switchyard specification
10	CCTV system specification
11	Earthing system specification
12	ESE Lightning Arrester specification

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13	Illumination system specification
14	WBPDCCL approved vendor list
15	Floater installation manual
16	Site key plan with CCTV camera and ESE LA locations

1.4 Location/ address of power plant:


5MW (AC) Floating Solar Photovoltaic Power Plant,
The West Bengal Power Development Corporation Limited (WBPDCCL),
Sagardighi Thermal Power plant,
Murshidabad,
West Bengal.

2.0 Scope of Work


2.1 Bidder scope of supply, Installation and Commissioning

The table below briefly indicates the scope of work for the bidder, as briefly outlined.


#	Bidder scope of work (as briefly outlined)	Qty
1	Supply of cable ties, HDPE DWC pipe with couplers, joints, bends etc for 6 sq.mm cable routing from row end to SMB	1 set (as required basis)
2	Supply of pin type copper lugs- For string termination at SMB	2000 Nos
3	Supply of aluminium cable lugs for 300 sq.mm cable	300 Nos
4	Supply of SMB support structure suitable for mounting on HDPE floating pontoons	36 Nos
5	Supply of Hume pipes for DC cable crossing over the bund	1 set
6	Supply of double compression weatherproof metallic cable gland, bi-metallic strip or washer, SS304 hardware for 300 sq.mm cable- PCU DC side	110 set
7	Supply of double compression weatherproof metallic cable gland, aluminium cable lug, bi-metallic strip washer, SS304 hardware for 630 sq.mm cable- PCU AC side and TRF LV side	100 set
8	Supply of 1.1KV, 3.5CX70 sq.mm XLPE aluminium armoured cable – For Aux Transformer LV side to LT SWITCHGEAR	100 meter
9	Supply of double compression weatherproof metallic cable gland, aluminium cable lug, bi-metallic strip washer, SS304 hardware for 3.5CX70 sq.mm cable- Aux TRF & LT SWITCHGEAR	2 sets
10	Supply of 33KV/415V, 100kVA, ONAN auxiliary transformer	1 No
11	Supply of LT SWITCHGEAR	1 No
12	Supply of 220V FCBC, DCDB, fuse box and Plante type battery bank for main control room	1 set
13	Supply of UPS, UPSDB and Ni-Cd type battery bank	1 set
14	Supply of 33KV outdoor switchyard equipment as per specification- CTs, PTs, LAs, SF6 breaker, isolators with earth switch, ABT meter, Moose ACSR conductor, Control and Relay panel, DC system etc.	1 set

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15	Supply of earthing system, fencing, gate and lattice support structure for switchyard equipment	1 set
16	Supply of C-channel support for equipment and cable tray support for main control room	1 set
17	Supply of 8mm Thk chequered plate	1 set
18	Supply of cable tray- 3 tier	1 set
19	Supply of ladder type cable support for 630 sq.mm cable upto TRF LV side	2 sets
20	Supply of double compression weatherproof metallic cable gland for 33KV(UE), 3CX240 sq.mm cable	8 Nos
21	Supply of indoor cable termination kit for 33KV(UE),3CX240 sq.mm	8 Nos
22	Supply of outdoor cable termination kit for 33KV(UE), 3CX240 sq.mm	2 Nos
23	Supply of straight through joint kits for 33KV(UE), 3CX240 sq.mm cable	4 Nos
24	Supply of earthing electrodes with chemical compound, earthing strips/flats, earthing cable(70 sq.mm for PCU, 16 sq.mm for SCADA, min 2.5 sq.mm for SPV modules) i.e. unarmoured copper cables, termination hardware, brick masonry earth chamber with inspection lids for solar array and main control room	1 set (as required basis)
25	Supply of module washing system- Battery/diesel/petrol operated hand held pump system with pressure nozzle for cleaning 16860 Nos of SPV modules	1 set
26	Supply of control and instrumentation cable for connecting PCU, HT panel, LT SWITCHGEAR, FCBC, DCDB, UPS, fire alarm system, inverter transformer, auxiliary transformer, WMS, CCTV, Wireless receiver mounted on top of building etc to SCADA panel	1 set (as required)
27	Supply of items for LED based peripheral lighting system covering Inverter TRF yard, security cabin, watch tower, access road, across the embankment (maximum 15 m between two adjacent lamps)	1 set (as required)
28	Supply of weather monitoring system (WMS)	1 set
29	Supply of safety related items including fire alarm systems for building, fire extinguishers, sand buckets, safety gadgets etc as per clauses 5.38	1 set
30	Supply of ESE type lightning arrester including 7 meter pole, counter, earthing materials, earthing strip etc. (5 sets on water and 1 set on main control room)	6 sets
31	Supply of Pre-fabricated watchman cabin – Dimensions 1.2mX1.8mX2.4m(H)-minimum	1 No
32	Supply of Pre-fabricated security cabin near main entrance – Dimensions 3mX3mX2.4m(H)-minimum	1 No
33	Supply of watchtower to be installed on top of RCC control room	1 No
34	Supply of air conditioners for main control building SCADA room- Capacity 2 Ton	2 Nos
35	Supply of complete CCTV system including min 42” display (with controller)	1 set
36	Supply of paddle boat with 4 persons capacity	1 No
37	Supply of 20HP flattered boat	1 No
38	Hydraulic manual pallet truck for control room electrical panel placement- Capacity 5 Ton (Min)	1 No
39	Supply of 25L commercial RO+UV water purifier	1 No

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40	Supply of water pump and UPVC pipe line for taking the water from a point 150m away from control room to the OH tank on top of control room	1 set
41	Supply of miscellaneous items such as cable tags, cable ties, cable ferrules, cable route markers, hoarding board, sign boards, danger boards, display boards, plant Layout boards, electrical insulation mat, tool kits, measuring instruments, office furniture, items for remote connectivity of SCADA, etc.	1 set (as required)
42	Supply of spare items	1 set
43	I&C : Containerized office room for 6 months	1 AU
44	I&C: Installation of floating pontoons and modules as per the instructions and on-site hands-on training by the OEM of pontoons. Supply of pontoons, modules and hardware for installation is in BHEL scope. Anchoring and mooring of the floating island is also in BHEL scope. As per OEM, approximate labour required shall be 3 modules/hour/person. Total number of modules to be installed is 16,860 Nos.	1 AU
45	I&C: Interconnection of SPV modules, installation of 36 Nos of SMBs(wireless communication), laying/ termination/ ferruling of solar array 1Cx6sqmm cable including related conduit works.	1 AU
46	I&C: Laying and termination of 1Cx300sqmm DC power cable from SMB to PCU	1 AU
47	I&C: Earthing of 16860 nos modules and 36 nos of SMBs using combination of earthing cables of adequate size and earthing strip/flats. Total number of chemical earth pits for array earthing shall be 4 Nos. SMB-SPD earthing cables shall be connected to array earthing grid.	1 AU
48	I&C: Installation of 5 Nos of ESE type LA on separate floating platform and 1 No on main control room. LAs on pond shall be placed as per tentative layout. Approximate distance from LA to embankment will be 5 to 10 meters. The earth pits for LA shall be suitably placed on the ground near embankment.	6 AU
49	I&C: Erection of indoor electrical panels (PCUs, VCB panels, DB boards of all types, UPS/ FCBC/ battery bank, SCADA panels etc) in the control room including grouting of panels, laying/fixing of cable trays, routing/terminations of cables at the electrical panels and up to LV side of transformers in the switchyard.	1 AU
50	I&C: Erection of 33kV transformer yard - Erection of 2 Nos. of 2.7MVA inverter transformer and 1 No. 100KVA aux. transformer, cable trays, drain pipes etc	1 AU
51	I&C: Transformer yard with 3 Transformer foundations, jelly spreading, fencing and gate.	1 AU
52	I&C: Erection of indoor electrical panels (VCB panels, AC/DC DB boards/panels, UPS system, FCBC/ battery banks, SCADA panels etc) in the main control room including grouting of panels, laying/fixing of cable trays, routing/terminations of LT/HT power/control cables to the electrical panels and upto 33kV connecting point at 66KV metering yard etc.	1 AU
53	I&C: Installation and commissioning of SCADA system by integrating the data cables from all the electrical and weather monitoring system equipments (WMS) of the power plant at the data logger/ PLC panel / HMI computer control desk at main control room etc	1 AU
54	I&C: Earthing system for main control room and 33kV transformer yard including laying of underground earth mat grids, earth chambers with lids, laying/termination of earthing strips from all electrical equipment to earth mat grid etc	1 AU

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55	I&C: Preparation of foundation and installation of 33KV switchyard CT, PT, SF6 breaker, isolator with earth switch, LA, ABT meter etc.	1 AU
56	I&C: Peripheral lighting system / plant lighting system including outdoor cable laying, cable terminations at poles / lights as well as DB boards of main control room	1 AU
57	I&C: CCTV system as per specification	1 AU
58	I&C: Miscellaneous and safety items such as cable tags, cable markers, hoarding board, sign boards, danger boards, display boards, electrical insulation mat, checkered plates, air conditioners, office furniture, fire extinguishers, fire alarm system, weather monitoring system, items for remote connectivity of SCADA, connection from sump tank/water point to OH tank, identification markings using painting etc	1 AU
59	I&C: Pre-commissioning inspections/ checks/tests, MRT tests, coordination/liaison with state /central departments/CEIG etc for necessary approvals/clearances for commissioning, synchronization with grid/ plant commissioning as per clauses 5.47	1 AU


3.0 BHEL scope of supplies (I&C in bidder scope)

For clarity to the bidder, other items and activities within BHEL scope of solar PV plant end of the project are listed below:

1	Supply of solar PV modules	16860 Nos
2	Supply of MC4 connectors	1500 pair
3	Supply of floating pontoons for modules, SMB and LA	1 set
4	Supply of 1C x 6 sqmm Solar Cable	~68KM
5	Supply of DC cable, 1C x 300sq mm, Al, XLPE, armoured as per IS: 7098 (from SMB to PCU)	~40KM
6	Supply of 1.1KV, 1CX630 sq.mm XLPE armoured Aluminium cable	~1.2KM
7	Supply of 33kV(UE) HT cable, 3C x 240 sq.mm, Al, XLPE, armoured as per IS: 7098	~4KM
8	Supply of power conditioning units (PCUs) of 1250 kW with ducts	4 Sets
9	Supply of String Monitoring Box (SMB) with wireless communication	36 Nos
10	Supply of inverter transformer 2.7MVA, 33kV/350-350 V, ONAN	2 Nos
11	Supply of 33kV HT panels	1 Set
12	Supply of SCADA system including PLC panels, computers, software systems and related peripherals & accessories.	1 Set
13	Construction of RCC main control room	1 Room


4.0 List of documents to be submitted along with the technical bid:

1. All supporting documents to meet Pre-Qualification Criteria (PQC) as mentioned in the RFQ.
2. Bidder has to enclose the deviation sheet clause wise separately, in case any deviations are sought by the bidder. Absence of any deviation sheet shall be taken as compliance of BHEL technical specification in total without any deviation.

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5.0 Technical specification for supply, installation and commissioning

#	BHEL purchase specification
5.1	<p>Temporary site office for BHEL use</p> <p>Bidder shall make necessary office arrangements such as porta cabin (Min 20 ft long) , furniture, electrical points/ fittings etc. for a period of 6 months for BHEL's use at site during the period of project execution. Drinking water, tea/coffee shall be made available for BHEL/WBPDC's representatives.</p>
5.2	<p>Electrical power / water for construction</p> <p>Power for construction will be made available near control room on chargeable basis by WBPDC. For construction and cleaning of module the pond water can be used.</p>
5.3	<p>Construction of temporary yards for safe storage of BHEL & bidder supplied items</p> <p>(a) Bidder shall, at a suitable location at the site, as decided based on discussions with BHEL site engineer, construct temporary yards for safe storage of BHEL & bidder supplied items.</p> <p>(b) Area of all storage yards/sheds shall be selected based on sizes of items. Bidder shall, at the time of starting their activities at site, submit drawings/ sketches/ dimensions etc to obtain approval from BHEL.</p> <p>(c) Safety and security of all the items shall be within bidder scope. Accordingly, bidder shall ensure adequate security watch and ward for these items round the clock.</p>
5.4	<p>Unloading, safe storage and movement of items received at site:</p> <p>(1) Bidder shall organize all necessary resources such as labour, machinery and tools (cranes, hydra, forklifts, transportation trucks/ trolleys, lifting accessories etc.) for unloading the items (supplied by both BHEL & bidder) received at site and subsequent movement to storage yards.</p> <p>(2) Similar arrangements shall also be made by bidder for movement of the stored items from storage yards to the exact construction locations within the project site.</p> <p>(3) Bidder shall maintain proper documentation / compilation of all the records related to shipping (invoices, LRs, delivery challans, material receipt certificates etc.) and shall take approval from BHEL site engineer for every consignment. The documents shall be suitably preserved for further handing over to BHEL.</p> <p>(4) Registers shall be maintained for the yard to keep track of incoming/outgoing items.</p> <p>(5) Safety of items shall be in bidder scope. Accordingly, suitable watch and ward shall be deployed on round-the-clock basis.</p>
5.5	<p>Installation of floating pontoons with module mounting mechanism:</p> <p>Bidder shall be imparted necessary training to carry out the work of assembly of floatation platform and surrounding pathway using the HDPE floaters and HDPE hardware and for mounting of the PV modules on the floaters. The bidder has to arrange work men who shall be trained by the OEM of floater platform to carry out the work and to further ensure and supervise the proper assembly and quality of the platform and module mounting.</p> <p>The vendor shall arrange the following essential tools/accessories to enable the work:</p> <ol style="list-style-type: none"> 1. Supply Life saving vests for all workers working on water body 2. Provide Inflatable / other small boats for work over water and towing floaters 3. Supply and lay carpet of Rubber/HDPE/Canvas sheets on land next to water body for enabling assembly of floaters without damage due to friction/rubbing on concrete/ground and sliding into water 4. Provide temporary nylon ropes for tying floaters to shore before assembly and for towing upto work point and for cordoning safe areas of working

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	<p>5. Provide sheets for holding hardware and cabling accessories for assembly without accidental dropping into water</p> <p>For more details please refer the attached installation manual of floater manufacturer (OEM).</p>
5.6	<p>Series interconnection of SPV modules to form strings Type of module and rating: (320 / 325Wp). Total quantity = 16860 Nos. (BHEL scope of supply) Bidder shall interconnect the SPV 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 next module. The cables have MC4 type of connectors. One polarity cable has male type connector, while the other has female type connector. (c) This way, 20 modules shall be connected in series. Each set of connections is called as a series string. (d) Thus, a total of 843 strings shall be connected to achieve 5.4MWp.</p>
5.7	<p>Installation of SMBs including erection of SMB mounting structures (1) Supply of string monitoring boxes (SMB), 36 sets, is in BHEL scope. These are 24-in/1- out type. (2) Bidder shall install the SMBs on the floating pontoon using suitable fixing mechanism supplied by bidder. Provision will be provided in the pontoon to mount the SMB structure. However, necessary hardware like nuts, bolts, washers etc. shall be in the bidder scope of supply. (3) All necessary labour, tools, machinery etc. for erection work shall be in bidder scope.</p>
5.8	<p>Interconnection of SPV module strings to 1Cx6sq.mm. cable (1)SPV module is provided with positive and negative cables 1Cx4sqmm having male and female parts of MC4 type connectors. (2) Required tools and tackles for crimping of cable etc. shall be arranged by bidder. 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 1Cx4 and 1Cx6 (of both pliers).</p>
5.9	<p>Ferruling for 1Cx6sq.mm cable 1) For 1Cx6 sqmm DC solar array cable, bidder shall provide UV resistant ferrules printed with source/destination identification of cable. Printing details shall be submitted for BHEL/WBPDC approval during detailed engineering. Printing shall be of appropriate size to ensure readability. 2) Supply of ferrule shall be in bidder scope. 3) Ferrules shall be provided on both the termination ends: module end and SMB end.</p>
5.10	<p>Routing of 1Cx 6sq.mm cable up to SMB (1) Cable from the farther end of the string shall be routed below the module till other end. From that point both positive and negative cables shall be neatly routed through HDPE pipe using necessary water tight joints till SMB input side. The HDPE pipes for routing cables are only required in pathways where SMBs are mounted. Each rows HDPE pipes are not envisaged. After completing the cabling and terminations at both sides, bidder shall seal the HDPE pipes with non-inflammable foam filling or any other reputed methods for water sealing. The HDPE pipes shall be tied neatly to the pontoon lips at regular intervals. (2) HDPE DWC pipe together with necessary HDPE couplers/ joints (T-joints, elbows, bends etc) shall be within scope of bidder supply. Specification: As per relevant IS; ID shall be selected to accommodate the number of 1Cx6sq.mm cables to be guided. ID shall be minimum 63mm. However, exact ID shall be selected to ensure that only a maximum of 60% of the ID space is occupied by the cables. Make,</p>



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	<p>part number, sizes/ dimensions shall be submitted for BHEL/WBPDC approval during detailed engineering.</p> <p>(3) Cable ties shall be in bidder scope of supply. Width of the cable ties shall be minimum 4.5 mm.</p> <p>(4) Cable ties, nylon polyamide 6.6 UV stabilized black, UL94 flammability rating V2, operating temperature up to 85 deg C, shall be used to arrest any possibility of movement or sagging. Cable ties shall be of make: 3M, Phoenix contact, Weidmuller, Hellermannntyton, Panduit or other reputed equivalent subject to BHEL/WBPDC. Width and Length shall be so appropriate as to ensure that the bunched cables are held firmly to the mounting structure. During detailed engineering, BHEL/WBPDC approval shall be obtained for the selected brand and sizes of cable tie.</p> <p>(5) Spacing between two adjacent cable ties shall be so appropriate as to ensure that there is no loose hanging of cables.</p>
<p>5.11</p>	<p>Termination of 1Cx6sq.mm. Copper cables on input side of SMBs</p> <p>(1) 1Cx6sq.mm cables of positive and negative polarities originating from SPV module strings shall be terminated at the input side of SMBs using suitable lugs.</p> <p>(2) Bidder 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 terminal block (connector) within the SMB. Cables shall enter the SMB through the cable glands that are provided as part of the SMBs supplied by BHEL.</p> <p>(3) Cable lug shall be in bidder scope of supply</p> <p>(4) Any other hardware, if necessary for fulfilling the connection, such as bolts, nuts, screws, washers etc. shall be in bidder scope of supply. All hardware shall be of SS304.</p> <p>(5) All necessary tools such as pliers, strippers, MC4 crimping tools etc. shall be within bidder scope.</p> <p>(6) After cable termination, all the cable entry points shall be sealed from outside using non inflammable foam or any other reputed proven weather resistant water sealing mechanisms to avoid water ingress.</p>
<p>5.12</p>	<p>FRP/HDPE/Treated Wood slotted supports to be provided from Float end to the entry of Hume pipe on Pond embankment. This shall be provided such that Cables can be guided on either side of the Final walk-way from the floating platform upto embankment and such that walking space is available along the centre of the walkway.</p>
<p>5.13</p>	<p>Laying of 2run/4runs of 1Cx300sq.mm Al cable upto main control room and terminations at PCU</p> <p>(1) 2 runs/4runs of 1Cx300sq.mm cables (Al conductor, XLPE insulation, armoured: BHEL scope of supply) running from SMBs shall be routed into the control room and laid on the cable trays therein. To maintain the contractual allowable voltage drop, 2 runs each for positive and negative 1CX300 sq.mm cables are required for SMBs placed more than 370 meters from PCU. Other SMBs shall be having 1 run each for positive and negative outputs.</p> <p>(2) The cables shall be neatly routed above floating pontoons without touching water and has to be taken to the embankment through the walkways/cableways. The cables shall be drawn over the embankment through hume pipes (2 crossings) fixed on embankment of 3 meter wide and necessary sloping on either sides with Concrete work has to be given for vehicle movement over the dyke road.</p> <p>(3) Supply and laying of cable trays within the room shall be in bidder scope. Bidder shall route/lay/dress the cables neatly on the trays. Cable ties shall be in bidder scope of supply, shall be of 4.5mm minimum thickness and with adequate length of tying.</p>



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	<p>(4) Bidder shall carry out drilling of holes in cable gland plates of the PCUs for the positive and negative DC inputs of 1Cx300 cable for 4 nos of PCUs. Gas cutting method is strictly not allowed. Bidder shall organize hole-saw cutters of appropriate size for this purpose. All necessary drilling machines / tools etc. shall be made available at site.</p> <p>(5) Prior to termination, each cable shall be checked for continuity and meggered. In case any cable found defective, bidder shall implement suitable corrective action such as cable jointing, replacement/re-laying of cable etc. as applicable.</p> <p>(6) Bidder shall carry out glanding of the cables following which the glands shall be fitted to the respective holes of gland plates.</p> <p>(7) Bidder shall carry out the cable terminations for positive and negative inputs that include tasks such as unsleeving, crimping, connecting to the tinned copper bus bars, tightening using torque wrench etc. Proper labelling/tagging is to be planned and fixed on cables.</p> <p>(8) Bidder shall arrange torque wrench of appropriate range. Torque setting shall be as per the bolt size and property class. For the setting, approval shall be obtained from BHEL site engineer.</p> <p>(10) Bidder shall submit details of cable glands/lugs/ties/hardware (Make, part number, size, quantity etc.) Glands shall be of COMET or 3D make. Other than these makes shall not be accepted.</p> <p>(11) Cable lugs shall be of Dowell or COMET or 3D make. Other than these makes shall not be accepted.</p> <p>(12) All tools/accessories such as crimping tools etc. required to carry out the termination shall be within scope of bidder.</p>
5.14	<p>Termination of 2 run/4 run 1Cx300 DC power cables at SMBs</p> <p>(1) Cables of 2run/4run, 1Cx300 (Al conductor, XLPE insulation, armoured) shall be terminated at the output side of SMBs (positive, negative terminals).</p> <p>(2) Bidder 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 tinned copper bus bar within the SMB. Cables shall enter the SMB through the cable glands that are also supplied by BHEL along with SMBs.</p> <p>(3) Cable lug with bimetallic washers shall be in bidder scope of supply. Make shall be Dowell or COMET or 3D make. Other than these makes shall not be accepted.</p> <p>(4) SS304 bolts/ nuts/ plain washers and Zinc/epoxy coated spring washers shall be in bidder scope of supply.</p> <p>(5) All necessary tools such as pliers, strippers, crimping tool etc shall be within bidder scope.</p>
5.15	<p>Laying and Termination of 1Cx630sq.mm LT AC power cables at PCU and Inverter Transformer</p> <p>(1) LT Cables 4 runs of 1C x 630 sqmm per phase shall be laid between AC side of the PCU and the LT side of the Inverter transformer as per “Cable installation methodology” defined in this specification.</p> <p>(2) Bidder 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 tinned copper bus bar within the PCU and Transformer. Cables shall enter the PCU and Transformer through the metallic cable glands.</p> <p>(3) Cable lug make shall be Dowell, COMET or 3D. Other than these makes shall not be accepted.</p> <p>(4) Cable gland metallic type shall be of COMET or 3D make. Other than these makes shall not be accepted.</p> <p>(5) Quantity of lug and hardware shall also include contingency requirements arising out of shortage due to various reasons (damage, theft etc.) during installation.</p> <p>(6) All necessary tools such as pliers, strippers, crimping tool etc. shall be within bidder scope.</p>

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5.16	<p>Laying and termination of 33KV(UE), 3CX240 sq.mm XLPE Al cable from Inverter transformer and Aux transformer to HT panel</p> <p>1) Laying and termination of 1 run 33KV(UE),3CX240 sq.mm XLPE Al armoured cable from HV side of the inverter transformer and Auxiliary transformer to HT panel inside the main control room shall be in vendor scope.</p> <p>(2) Cable glands, cable lugs, 33kV HT cable termination kits (indoor/ outdoor types as applicable), bolts, nuts, washers etc. shall be in bidder scope of supply. Cable glands make shall be COMET or 3D. Cable lugs make shall be Dowell or COMET or 3D. Other than these makes shall not be accepted.</p> <p>(3) HT termination kits (indoor/ outdoor as applicable) shall be Raychem or 3M make. HT termination shall be carried out by certified jointers. Credentials / certification of experience from Raychem or 3M for the proposed jointers shall be submitted for BHEL/WBPDC approval during detailed engineering.</p>
5.17	<p>Laying and termination of 33KV(UE), 2 runs of 3CX240 sq.mm XLPE Al cable from HT panel to outdoor switchyard</p> <p>1) Laying and termination of 2 runs 33KV(UE),3CX240 sq.mm XLPE Al armoured cable from HT panel outgoer to outdoor switchyard nearly 1.5Km away through underground cable trench as per standards, shall be in vendor scope.</p> <p>(2) Cable glands, 33kV HT cable termination kits (indoor/ outdoor types as applicable), Cable jointing kits, bolts, nuts, washers etc. shall be in bidder scope of supply. Cable glands make shall be COMET or 3D. Cable lugs make shall be Dowell or COMET or 3D. Other than these makes shall not be accepted.</p> <p>(3) HT termination kits (indoor/ outdoor as applicable) shall be Raychem or 3M make. HT termination shall be carried out by certified jointers. Credentials / certification of experience from Raychem or 3M for the proposed jointers shall be submitted for BHEL/WBPDC approval during detailed engineering.</p> <p>(4) Proper HT cable route marker shall be used in regular intervals as approved by BHEL/WBPDC.</p>
5.18	<p>Identification marking of cables using cable tags</p> <p>1) Cable tags shall be provided on all power cables at both ends just before entering the equipment enclosure.</p> <p>2) Cable tags shall be of rectangular shape.</p> <p>3) Cable tag shall be of 2mm thick aluminum with number punched (embossed) on it and securely attached to the cable by not less than two turns of 20 SWG GI wire conforming to IS:280.</p> <p>4) Bidder shall submit the technical details of cable tags, ID numbering scheme for BHEL/WBPDC approval during detailed engineering.</p>



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5.19 Installation of electrical panels in main control room

Bidder shall organize necessary resources such as labour, cranes, hydra, forklifts, transportation trucks / trolleys and other accessories for movements and positioning of the panels as below

- (a) PCU : 4 Nos
- (b) 33kV HT panel: 1 set (2 incomers +1 outgoer+1 Aux TRF+1 Bus coupler+2 Bus PT+1 spare)
- (c) LT SWITCHGEAR main panel: 1 No
- (d) Distribution boards : DCDB, UPS DB, CR DB (room utilities), FCBCDB, PLDB (plant lighting), PDB (power DB): 1 No. each + any extra boards as required
- (e) SCADA panel: 1 No
- (f) HMI SCADA control desk with PCs and accessories: 1 set
- (g) UPS with battery bank – 2 Set.
- (h) FCBC battery charger – 2 Set.
- (i) Battery bank – 2 Set.
- (j) CCTV system- 1 Set

- (1) Panels shall be moved to the respective positions and placed over the cable trenches in control room, in the exact sequence and locations as per drawings approved by BHEL/WBPDC.
- (2) PCUs, VCB panels shall be placed on cable trench of main control room, with cable entry openings to match cable trench on bottom side.
- (3) Panels shall be suitably grouted using welding / bolting methods as per relevant standards. BHEL approval shall be obtained for the grouting arrangement. All necessary hardware for the same shall be within bidder scope of supply. Each panel shall be double earthed to the earth mat grid of the room.

5.20 Installation of electrical panels in outdoor switchyard small control room:

- (1) Design, supply and installation of electrical equipment required for outdoor switchyard is in bidder's scope.
- (2) 1 No control and relay(C&RP) panel and DC system for C&RP, SF6 breaker shall be installed inside small control room near to outdoor switchyard.
- (3) Construction of small control room is in BHEL scope.



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5.21	<p>Installation of cable trays, cable laying/dressing etc. in main control room</p> <p>A. Installation of cable trays</p> <ol style="list-style-type: none">(1) Bidder shall supply and install cable trays, fittings and accessories within control room for laying 33kV HT, DC/AC LT, control, communication cables etc as per “Cable installation methodology” section of this specification. Cables trays shall be ladder type with horizontal corner bend pieces. 750mm minimum width, 2mm minimum thickness and appropriate height. Drawings/ make/ part number of these shall be submitted for BHEL/WBPDC approval.(2) Bidder shall place and fit these cable trays over steel support structure (angles, sections etc.)(3) Cable trays shall be in three vertical layer arrangements: bottom for 33kV cables, middle for LT AC/DC cables and top for control/data/ communication cables.(4) Suitable cut outs, wherever applicable, shall be made in the cable trays to provide path for the cable to reach the panel.(5) Adjacent cable trays shall be interconnected using suitable hardware items that shall be in bidder scope of supply.(6) Cable trays shall be double earthed to the earth mat grid of the room. <p>B. Cable routing, laying, dressing</p> <ol style="list-style-type: none">(1) Cables entering into the main control room from outside (solar array/ transformer yards) shall be bunched appropriately DC/ LT/ HT/ control/ communication category wise. The multiple bunches shall be routed through PVC conduit pipes of appropriate type, diameter and length that shall be fixed below the plinth beam of room.(2) Cables (DC/ HT, LT, communication, control etc.) shall be laid on cable trays in separate tiers with appropriate spacing as per IS: 1255.(3) Control/ data/ instrumentation cables that run from inverter rooms to marshalling box of inverter transformers shall be routed through HDPE DWC conduit pipes of appropriate size. These pipes shall in turn be routed below plinth level.(4) Cables shall be dressed using appropriate cable ties at appropriate intervals to ensure firmness of their position over the trays.(5) Trefoil clamps shall be used wherever single core cables are used for three phase system. These clamps shall be at appropriate intervals to ensure firmness of bunching of cables.(6) All cable entry openings of conduit pipes, after laying/ termination of the cables, shall be sealed using appropriate sealant to ensure water proof tightness.(7) All cable accessories such as cable conduits/pipes, ties, trefoil clamps, sealants etc for the above purpose shall be in bidder scope of supply.(8) All the supply and installation works as mentioned above shall be as per “Cable installation methodology” section of this specification and as per drawings approved by BHEL/ WBPDC during detailed engineering.
5.22	<p>Design, Supply, Laying, termination of aux supply cables in main control room</p> <ol style="list-style-type: none">(1) All aux. cables shall be in bidder scope of supply. Selection of cable type and its sizing shall be as per applicable standards and design calculations. Aux. cables shall be KEC/ LAPP/ KEI/ Havells/ Universal/Gemscab/Polycab make.(2) Cable glands, cable lugs, bolts, nuts, washers etc. shall be in bidder scope of supply. Cable glands make shall be COMET or 3D. Cable lugs make shall be Dowell or COMET or 3D. Other than these makes shall not be accepted.(3) For marshalling box of transformer/ UPS/ SCADA/ DB boards, single compression nickel plated brass glands shall be provided by bidder. Make shall be COMET or 3D.(4) All cables other than those listed under section “BHEL scope” of this specification shall be in bidder scope of supply.



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	(5) Lengths of all aux. cables shall be assessed by bidder based on indicative layouts of main control room enclosed with the tender.
5.23	<p>Design, Supply, Laying and installation of Control / data / instrumentation cables</p> <p>(1) All the cable installation accessories such as cable trays, cable conduits, cable glands, cable lugs, ferrules, cable ties, bolts, nuts, washers etc. shall be in bidder scope of supply. Cable laying and cable terminations shall be in bidder scope. All necessary resources such as labour, tools and accessories required to carry out laying and termination works etc. shall be in bidder scope.</p> <p>(2) All the other cables such as (i) control cables from inverter transformer marshalling boxes to relay circuits in VCB panels (transformer trip signals), (ii) control cables from inverter transformer marshalling boxes to SCADA (transformer alarm signals), (iii) control cables from SCADA panels to relay circuits in VCB panels (VCB on/off status, VCB close/open command signals), (iv) instrumentation cables from inverter transformer marshalling boxes to SCADA panels (4-20mA signals, WTI/OTI values) shall be in bidder scope of supply.</p> <p>(3) Cable laying and cable terminations shall be in bidder scope. Make shall be shall be KEC/ LAPP/ KEI/ Havells/ Universal/Gemscab/ Polycab. Design calculations for cable selection together with GTP/datasheet particulars shall be submitted for BHEL/ WBPDC approval. Number of cores, length requirements shall be appropriately assessed by the bidder.</p> <p>(4) Bidder shall lay and terminate the RS485 cables to SCADA from (a) MFM meters of VCB panels, (b) MFM meters of LT SWITCHGEAR panel, (f) Weather monitoring station (g) Wireless receiver installed on top of building for SMB communication.</p> <p>(5) Bidder shall lay and terminate the Ethernet cables to SCADA from (a) PCUs, (b) numerical relays of VCB panels.</p> <p>(6) All necessary resources such as labour, tools and accessories required to carry out laying and termination works etc shall be within scope of bidder.</p> <p>(7) All applicable/ relevant clauses under “Cable installation methodology” sections of this specification shall be adopted for all aspects of these cables such as technical specifications (ratings, sizes, calculations etc), cable selection, tests on cables, cable installation, cable accessories etc.</p>
5.24	<p>Erection of 33kV transformer yards attached to main control room</p> <p>(1) Construction of RCC foundations for 2 Nos of 2.7MVA transformer, 1 No 100KVA transformer, 2 Nos of fire wall as per standards, fencing and gates for transformer yard are in the scope of bidder.</p> <p>(2) Bidder shall erect the transformers on RCC foundation as per transformer GA details. Bidder scope of I&C of transformers shall include:</p> <ol style="list-style-type: none">Movement of transformers and its accessory parts such as radiators, cable boxes, hardware etc from storage yard and placement on foundation pedestal.Assembly of transformer parts.Cable laying and terminations at LV/HV/Marshalling boxes of transformers.All activities applicable to oil filling and filtration including measurement of oil BDV and PPM in NABL accredited laboratory. Particularly for inverter transformers, filtration of oil shall be carried out to such an extent as to obtain the desired BDV (>60 kV) and PPM (< 15ppm) values.Testing of transformers as per “pre-commissioning checks” section of this section. <p>(3) After installation of transformers at the transformer yard, bidder shall level/ compact 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, bidder shall implement suitable civil works in and around the transformer yard. This shall include filling up the land (wherever necessary) with suitable soil and compact the filled-up portions</p>



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	<p>either manually or with rollers, as applicable, as per site conditions, to achieve required compaction/slope.</p> <p>(4) Bidder shall provide the 100 mm layer of stone gravels in transformer yards as per relevant IS standards / CBIP/ CEIG requirements etc. Also, PVC pipes shall be provided at appropriate locations along the periphery of transformer yard fencing for draining out of water from the yard. PVC of appropriate size shall be in bidder scope of supply.</p> <p>(5) Bidder shall provide applicable earthing connections to transformers, fencing / gates etc. in the yard as per relevant clauses under the “Earthing system” section of this specification.</p> <p>(6) All other items (if any, other than the above) that are required to meet the technical requirements of transformer yard as per applicable standards / electricity rules shall be incorporated by the bidder.</p>
5.25	<p>Specification of auxiliary transformer 100kVA, 33kV/415V, Dyn11, Outdoor, ONAN Make of aux. transformer shall be Sudhir/ Voltamp/CGL/Areva (Schneider) Detailed technical specification attached as Annexure.</p>
5.26	Specification for Float Cum Boost Charger
5.27	Specification of Plante type battery bank for FCBC
5.28	Specification of UPS with battery bank
5.29	Specification of LT SWITCHGEAR
5.30	Specification of CCTV
5.31	Specification of chemical earthing electrodes
5.32	Specification of ESE type LAs
5.33	Specification of 33KV outdoor switchyard with metering
5.34	Specification of illumination system
5.35	<p>Auxiliary AC/DC power supply system Bidder shall establish an auxiliary AC supply system for (a) various utility power consumption purposes such as main control room lights, ceiling fans, exhaust fans, plant lighting, air-conditioner, other electric appliances, auxiliary power supply to PCUs, VCB panels, transformers etc and also, for (b) powering the battery chargers that in-turn charge the battery banks for 220V DC supply.</p> <p>Bidder shall submit detailed SLD diagram of Aux AC/DC system with ELR/CBCT, MCCB, MCB types (TPN, DP, SP)/ Amp/kA ratings for incoming/ outgoing feeders for various electrical loads/ utilities for BHEL/WBPDCL approval during detailed engineering.</p> <p>i. Following DB boards for application in main control room shall be in bidder scope of supply, installation and commissioning:</p> <p style="padding-left: 40px;">LT SWITCHGEAR, UPS DB for 230V AC UPS supply to SCADA, PCUs (control circuits), VCB(control circuits), weather monitoring system, SMB wireless receiver installed on top of control room, fire alarm system, emergency loads, CCTV system, DCDB, CR DB (room utilities), FCBC DB, PLDB (plant lighting), PDB (power DB) - 1 Sets</p> <p>ii. Above DB boards shall also provide for any other feeders, if necessary, to meet functional requirements. In addition, at least two spare feeders shall be provided in each of the above DB boards. Further, any extra DB boards to meet functional requirements of Aux AC/DC system shall be provided by the bidder.</p>



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- iii. Above DBs shall be of reputed make such as Legrand, Siemens, Schneider or any other reputed make as approved by BHEL/WBPDCCL.
- iv. DB boards shall be provided with incoming/ outgoing MCB as applicable (based on rating requirements) with spare feeders as shall be approved by BHEL/WBPDCCL.
- v. Installation of all the above items including all necessary cables, cable terminations/ installation shall be in bidder scope.

The system shall comprise of following items:

- (a) An **auxiliary transformer (1 No) 100kVA**, 33kV/415V, Dyn11, Outdoor, Oil-immersion / ONAN type shall be installed at transformer yard attached to main control room. Supply and installation of aux transformer, erection of transformer, all necessary cable terminations, cable installation and cable interconnections with VCB panel (on HV side) and with LT SWITCHGEAR panel (on LV side) shall be in bidder scope. LV cables shall be in bidder scope of supply.
- (b) **LT SWITCHGEAR floor-mounted panel, 1 No** (fed by 2 nos of 3ph, 4-wire 415V auxiliary transformer supply) distributes the AC power to various utility applications in main control room. The panel shall be supplied, installed and commissioned in main control room by the bidder. It shall have 2 nos of incoming feeder supply with castle key arrangement to select one feeder at a time without disturbing the cabling. Presently 1 feeder shall be fed from auxiliary transformer. Second feeder shall be kept as spare for future purpose.

Constructional features of the panel shall be as per specification “**LT switchgear**”

LT switchgear component of reputed make such as L&T, Siemens, ABB or Schneider. Other than these bidders shall not be accepted.

MFM meter with RS485 communication feature to facilitate SCADA connection shall be provided in LT SWITCHGEAR.

(c) **Battery banks, Dual Float-cum-boost charger, UPS in main control room:**

- 1. **Battery bank** shall be supplied by Bidder. Battery bank is for backing up the FCBC panel which is also supplied by Bidder.
- 2. **Dual Float-cum-boost-charger with boost current and boost voltage :**
Dual FCBC shall be supplied by bidder as per specification.
- 3. **UPS panel, 5kVA with 40Ah battery bank :** As per technical specification

5.36 Design, supply, installation of Watchman and security room with electrical fittings

Bidder shall provide prefabricated Watchman's portable cabin at strategic locations surrounding of the plant. The Minimum size of watchmen's cabin is 1.2 metre x 1.8 metre size and height of 2.4m with appropriate roof at the top. Location of the watch Cabin will be as directed by BHEL/WBPDCCL. The Prefabricated Security Cabin of size 3 metre x 3 metre at the main entrance gate shall be designed and constructed by the bidder keeping in view the safety and security of the power plant.



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5.37	Supply and installation of Weather monitoring system i) Weather Monitoring Station comprised of the following: a) Solar Irradiance: Two nos. of Pyranometer (Class II or better) shall be provided. One no. calibrated pyranometer to determine irradiance on the plane of array and other calibrated pyranometer to determine irradiance on horizontal plane (with a target measurement uncertainty of ± 2). Readout shall be integrated with data logging system. b) Wind Speed: An integrated wind speed measurement unit shall be provided. c) PV module temperature sensor, ambient temperature: Temperature probes for recording the PV Module temperature and ambient temperature shall be provided. ii) The components of the Weather Monitoring Station shall be matched with the BHEL SCADA system. iii) The data from the Weather Monitoring station shall be sent to the Web server through SCADA and shall be downloaded from the remote server from any where Approved make: M/s Kipp & Zonnen only since the performance is directly linked with PG test.
5.38	Broadband Connection with Static IP Bidder has to provide broadband connection with static IP for remote monitoring of solar PV power plant through BHEL SCADA. All charges incurred for establishing the connection shall be in bidder scope.
5.39	Installation and commissioning of SCADA integration systems (1) SCADA system, supply of which shall be in BHEL scope, comprises of data station panels and PC based control desks with software to collect, store, process and report the data parameters of power plant and also to control the operations of the power plant by integrating the various equipment at the segments as follows: (a) String monitoring boxes (36 Nos) in solar array field (b) Weather monitoring equipment: Pyranometers for solar irradiation (1 No), thermometer for ambient temperature (1 No), thermometer for module surface temperature (1 No), anemometer for wind speed and direction (1 No). (c) Power conditioning units (4 Nos): DC input / AC output parameters of inverters, grid data, fault status and events logged, etc. (d) Inverter transformers (2 Nos): Alarm/Trip signals, WTI/OTI temperature values. (e) 33kV VCB breaker panels (as per SLD): status of VCB breakers, status of protection relays of transformers, oil / winding temperatures, AC parameters at 5MW level of the plant. (f) LT SWITCHGEAR multifunction meters (1 No): AC auxiliary utility consumption parameters (g) Fire alarm system at main control room: status signals (h) FCBC (2) BHEL scope of SCADA:



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- (a) Data station panels with necessary data loggers / PLCs and other accessories such as power supply etc to integrate the data signals.
- (b) Desktop PCs (HMI control desks) provided with necessary software packages and remote monitoring features.
- (c) Supply of SCADA related communication/ data / LAN cables as brought out in other clauses of this specification.

(3) Bidder scope of supply and installation of SCADA system:

- (a) Bidder shall install the BHEL supplied SCADA system in the air-conditioned SCADA room in main control room.
- (b) Cable laying/ terminations of all SCADA cables at respective panels / equipments shall be in bidder scope of supply. BHEL will provide the necessary cabling schedule during detailed engineering.

5.40 Earthing of solar PV modules and SMBs

The solar PV modules, SMBs and various electrical equipments installed by the bidder shall be provided with appropriate earthing for protection against faults as guided by IEC 60364.

The earthing electrodes shall be as per the technical specification. For each electrode, earth chamber shall be constructed using brick masonry/precast material.

Bidder shall use min 2.5 sq.mm earthing copper cable (Yellow Green PVC sheathed) for connecting 20 modules in a row. Similar 843 Nos of rows shall be interconnected using suitable earthing Aluminium cables or GI strips. **Bidder shall submit for approval detailed earthing plan with earthing cable sizing and break proof methodology for linking solar PV modules and SMBs earthing.** The main earthing cables/strips shall be laid upto shore along with DC cables and shall be terminated at 4 Nos of chemical earthing electrodes at mutually agreed locations. 36 Nos of SMB earthing shall be connected in parallel to the main earthing grid. Proper tools and clamps shall be used for connecting the earthing branches to the main earthing grid.

Bidder has to provide the earth chamber precast/ prefab type for each earth electrode with following details.

- (a) Minimum Inner diameter shall be 300mm. Exact size shall be chosen to ensure ease of maintenance operation using spanners etc.
- (b) Projection of chamber above FGL = 150mm minimum
- (c) Top of electrode shall have minimum clearance of 100 mm below cover plate.
- (d) Cover plate with suitable lifting hooks and padlocking arrangement.

5.41 Earthing system for main control room and 33kV transformer yard

- (1) Bidder shall install and commission earthing system for protection against faults as guided by IEC 60364 for the control room and 33kV transformer yard.
- (2) Flats GI 65x8 shall be provided for double earthing of 33kV VCB panels, UPS/ FCBC/ Battery banks, C&R panel, ABT metering panels, cable trays. The earthing for PCU shall be done through 1Cx70sq.mm flexible copper cable and for SCADA through 1Cx 16 sqmm copper cable.
- (3) Earthing of inverter transformers and aux transformers in the transformer yards near main control room:
 - (a) Flats GI 65x8 minimum shall be provided for interconnecting various parts of the inverter transformer (for body earthing) viz tank, conservator, disconnecting chambers, cable boxes, marshaling box, radiators etc.
 - (b) Such interconnected local grid shall be double earthed to the main earth mat grid running underground through GI flats 65x8



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- (c) Flats shall be bolted on transformer side and overlap welded to earth mat grid. Two earth pits shall be located close to each transformer for body earthing.
- (d) Shield earthing of inverter transformers shall be separate and connected to two earth pits using GI flat 65x8.
- (e) Neutral of aux transformer shall be connected to two earth pits using GI flat.
- (5) Transformer yard fencing shall be earthed at two different locations using GI flats 65x8 minimum. Gate shall be looped to the fencing mesh by way of GI wire of suitable size.
- (6) Earth mat grid shall be buried underground up to a depth of 600mm minimum from FGL. Back filling soil to be placed over buried conductors shall be free from stones and harmful mixtures. Back filling shall be placed in layers of 150 mm. Backfilled surface shall be well compacted.
- (7) Bidder has to provide the earth chamber precast / prefab type for each earth electrode with following details
- Minimum Inner diameter shall be 300mm. Exact size shall be chosen to ensure ease of maintenance operation using spanners etc.
 - Projection of chamber above FGL = 150mm minimum
 - Top of electrode shall have minimum clearance of 100 mm below cover plate.
 - Cover plate with suitable lifting hook.
- (8) Supply and installation of all materials related to Earth chambers shall be in bidder scope.
- (9) Earth electrode shall be bolted to a horizontal GI flat 65x8 minimum that in turn bolted (M10 minimum) to two GI flat 65x8 minimum raisers on either side of horizontal flat. Raisers shall be connected to earth mat grid by way of overlap welding.

General points:

- All earthing electrodes, GI flats is in bidder scope of supply. Bidder to ensure GI strips which are easily bendable and not prone to cracks during bending and forming during connections.
- All hardware etc shall be in bidder scope of supply.
- GI bolts, nuts, plain washers shall be used. Spring washers shall be zinc/epoxy coated.
- Welding for GI flats shall be using electric arc welding. Both the flats shall be overlapped for the full width where they are in perpendicular direction in same plane. Where the connection is along same line, both flats shall be overlapped for a minimum of 50mm. L-bend with weld length of 50mm minimum shall be adopted wherever overlap length to be ensured.
- Resistance of welded joint shall not be more than that of GI flat.
- Welds shall be treated with red lead for rust protection and then coated with bitumen compound for corrosion protection.
- While laying earthing electrodes, adding/mixing of chemical compound and water around the electrode in the dug hole shall be as per instructions of OEM.

5.42 Water washing system for SPV modules (Module cleaning system)

- Vendor shall provide water washing system with Pressure pump (AC/DC motor) for drawig water from below the floater and providing water jet to clean the PV modules.
- The pump set shall be complete with nozzle and flexible hose of atleast 20 m length and with flexible power cable of sufficient length in case of AC motor.
- The pump shall be capable of providing water jet of atleast 2 kg/sqcm pressure to clean the PV modules in two to four adjacent rows at a time. Refer the PV array layout provided for view the Module arrangement.



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5.43 Connection of water point to Overhead water tank

Bidder shall make necessary arrangement to pump the water from a point which is 150 m away from control room to the overhead water tank placed above the control room.

5.44 Firefighting systems and Fire Alarm System

Firefighting systems: Fire extinguishers and sand buckets

Bidder shall provide fire extinguishers/ sand buckets as follows for fighting fire of oils, solvents, gases, paints, varnishes, electrical wiring, live machinery fires and flammable liquid/ gas as per recommendation by relevant fire safety authority and as per relevant standards IS: 2171 and IS: 10658 marked. Make shall be Safex/ Ceasefire/ Vintex/ Unicare fire safety or any other reputed equivalent subject to BHEL/WBPDC approval.

- DCP type (ABC) minimum 5 Kg designed/tested IS 15683 with safety release valve, NRV and CE approved valve. Dry powder IS 14609 with standard accessories.
- CO2 type Hand 9 Kg with wheel. Designed/tested IS 2878 complete with hose, screw valve, CO2 gas IS 1522, cylinder IS 7285, valve IS 3224. Tested at 250 Kgf/cm².
- Foam type hand 9Kg, squeeze grip CO2 cartridge type, throw period 35s, range of Jet 6m, designed/tested IS:15683, Gas cartridge IS:4947.
- Sand bucket should be wall mounted made from at least 24 SWG sheet with bracket fixing on wall conforming to IS 2546 at strategic locations.

Quantity requirements:

Type of extinguisher	DCP type (ABC) 5 Kg	CO2 type Hand 9 Kg	Foam type hand 9 Kg	Sand buckets
Main control room	1	1	1	4
Transformer yard	1	1	1	2
Outdoor switchyard	1	1	1	2

1.0 FIRE ALARM SYSTEM:

The following specification provides BHEL's requirement for supply, installation and commissioning of Fire Alarm System in Solar Photovoltaic (SPV) power plant. Independent / Stand Alone Fire alarm systems shall be installed in 1 No. Main Control room and. Fire alarm system shall be connected to SCADA panel via RS-485 Modbus protocol.

2.0 SCOPE OF SUPPLY AND INSTALLATION:

Sl.	Item Description	Quantity
1.	Supply of Fire Alarm system for Control Room	1 ST
2.	Installation and Commissioning of Fire Alarm system for Control Room	1 AU

3.0 TECHNICAL DETAILS:

Fire Alarm system at each room shall consist of following components:

3.1 Fire Alarm Panel: Integrated Fire Detection, Alarm and Control System with Voice Evacuation (EVAC) of UL listed Microprocessor based networkable analogue addressable Main Fire Alarm Control having required loop capacity. Panel capacity can be expanded to additional loops by addition of modules or integrating multiple panels. Panel costs to include power supply, 24VDC power supply automatic battery charger, 24 volts sealed lead acid batteries sufficient for



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24 hours normal working and then be capable of operating the system for 2 hours during emergency conditions. The system should be complete with user-friendly programming and configuration tools, front panel operating with a full QWERTY keypad and alphanumeric 640 character LCD display. The Panel as well as detectors and devices shall be UL 9th edition Approved/Listed and in conformance with international standards such as NFPA 72 2010 edition National Fire Alarm and Signalling Code for Human Life Safety. The complete system as a solution must be supplied from the same make/OEM manufacturer components conforming to these standards. The panel shall have the capability to integrate with SCADA on open protocol (MODBUS) and shall be communicable with SCADA. Provision for displaying Alarms in SCADA shall be available. In case of fire, exhaust fan operation to be controlled by Fire Alarm Panel as per NFPA & NBC guideline.

3.2 Smoke Detector: Analog Multi-Criteria Sensing Type Detector or Heat Detector as per application must be with mounting based LED, Switch inclusive of detector base and complete as required. All Detectors must be UL Listed & FM Approved.

3.3 Sounder: UL Listed Directional Sounders with 20 hz to 20 khz operating frequency with minimum 8 distinct sound patterns to indicate corridors, Exit doors, Move upward, move downward etc. to direct Occupants for fast & safe Evacuation as specified in NFPA 72 - 2007 edition complete as per all requirements of technical specifications & contracts works. Lighting strobe also to be provided.

3.4 Manual Call Point / Glass Break Device: UL listed, Flush or surface mounted Manual Call Point in manufacturers prescribed matching red enamel outlet box complete. All components must be of same manufacturing origin.

3.5 Monitor, Control Modules & Fault Isolators: UL listed, modules complete with mounting arrangement on North American junction box as per requirements of contract works.

3.6 Cables: All Cables required for operation of Fire alarm system shall be supplied and installed by bidder. This includes cable from Building auxiliary distribution panel to Fire alarm panel, cable between Fire alarm panel and detectors, manual call points, Hooter, Strobe etc. Specification of cable shall be as per relevant standards and as per recommendations of manufacturers. Details of Cables used for Fire system shall be indicated in layout. Conduit required for laying of cables shall also be supplied by bidder.

3.7 Installation requirements: The installation practices adopted for fire detection and alarm system shall comply with NFPA and NBC norms. Cabling shall be concealed in conduits for aesthetic view.

3.8 Commissioning: After completion of installation, bidder shall commission the system and demonstrate the operation of complete system to BHEL/ WBPDC representatives at site.

5.45 Identification marking of electrical items using painting

Following items shall be identified by way of artistic painting in black letters with yellow background. For danger symbol/text, white letters in red background. Identification number/text to be painted shall be submitted for BHEL/WBPDC approval during detailed engineering for the following.

- (1) String monitoring boxes: 36 Nos
- (2) Size/ source/ destination of DC cable 1Cx300 with arrow mark (power flow direction) to be painted on SMBs and PCUs
- (3) PCUs front side: PCU ID number (1 to 4) with rating 1250kW, AC chamber/ DC chamber, Danger text/symbol.
- (4) PCUs DC chamber back side: SMB ID numbers, cable size (1Cx300 +,-) with upward arrow mark, danger text/symbol
- (5) PCUs AC chamber back side: Inv Trnfmr ID, cable size (4Rx1Cx630 / ph) with downward




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	<p>arrow mark, danger text/symbol</p> <p>(6) Same way as above, the corresponding panel ID with rating, cable destination with arrow mark in power flow direction, danger text/symbol shall be painted for all VCB panels, Inverter transformers (HV and LV sides), Aux transformer (HV and LV sides), LT SWITCHGEAR panel.</p> <p>(7) For UPS/ FCBC/ SCADA/ ABT metering panels, C&R panel, all DB boards/ fire alarm panels, ID number shall be painted. Cable size/ destination/ arrow marks not required to be painted as cable tags shall be adequate.</p> <p>(8) For earth chambers of main control room ID number shall be painted.</p> <p>(9) All switchboards shall be painted with ID number.</p>																									
5.46	<p>Cable markers and cables tags</p> <p>(1) Cable markers and joint markers for underground cables shall be provided along the route of the cables as per section “Cable installation methodology” of this specification.</p> <p>(2) Cable tags shall be provided at either of the cable (at the entry point to the panel / equipment to which it is connected / terminated) shall be provided as per section “Cable installation methodology” of this specification.</p> <p>(3) Bidder shall submit the respective schemes of marking and tagging for BHEL/WBPDCCL approval during detailed engineering.</p>																									
5.47	<p>Display boards and sign boards</p> <table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="width: 10%;">Sl. No</th> <th style="width: 70%;">Description</th> <th style="width: 20%;">Qty for Control room</th> </tr> </thead> <tbody> <tr> <td>1</td> <td>Board displaying instruction chart for restoration from Electric Shock</td> <td>1 No</td> </tr> <tr> <td>2</td> <td>Board displaying instruction chart for artificial respiration</td> <td>1 No</td> </tr> <tr> <td>3</td> <td>Board displaying dos and don'ts.</td> <td>1 No</td> </tr> <tr> <td>4</td> <td>Board displaying fire extinguishers details and operations</td> <td>1 No</td> </tr> <tr> <td>5</td> <td>“No smoking” board</td> <td>3 Nos</td> </tr> <tr> <td>6</td> <td>Danger boards: 33000V with danger symbol in Hindi, Bengali and English</td> <td>As required</td> </tr> <tr> <td>7</td> <td>Identification boards, of suitable sizes, within and outside control room such as Main control room, Executive lounge, Store room, Gents toilet, Ladies toilet, SCADA room, Battery room, conference room etc. BHEL will provide list.</td> <td>As required</td> </tr> </tbody> </table> <p>Note: In addition to the above, requirement of hoarding board as well as direction board for the overall power plant shall be fabricated in consultation with BHEL/WBPDCCL and installed at a suitable location near the main entrance gate of the plant.</p>		Sl. No	Description	Qty for Control room	1	Board displaying instruction chart for restoration from Electric Shock	1 No	2	Board displaying instruction chart for artificial respiration	1 No	3	Board displaying dos and don'ts.	1 No	4	Board displaying fire extinguishers details and operations	1 No	5	“No smoking” board	3 Nos	6	Danger boards: 33000V with danger symbol in Hindi, Bengali and English	As required	7	Identification boards, of suitable sizes, within and outside control room such as Main control room, Executive lounge, Store room, Gents toilet, Ladies toilet, SCADA room, Battery room, conference room etc. BHEL will provide list.	As required
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5.48	<p>Electrical insulation mat</p> <p>(1) Bidder shall supply electrical insulating mats as follows:</p> <ul style="list-style-type: none"> (a) Reputed make as shall be approved by BHEL/ WBPDCCL (b) As per IS: 15652:2006 (c) Class B (d) Thickness 2.5 mm minimum (e) Size = 2m x 1m minimum, exact size shall be as approved by BHEL/WBPDCCL during detailed engineering. (f) Colour: to be approved by BHEL/WBPDCCL (g) Max use voltage = 33 kV (h) Marking of IS standard on the mat 																									

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	<p>(2) Test certificate shall be provided by bidder</p> <p>(3) Bidder shall lay the mats in front of all the indoor electrical panels viz. PCUs, VCB panels, LT SWITCHGEAR panels, SCADA panels, UPS panels, FCBC battery charger, battery banks etc.</p>
5.49	<p>Chequered plates</p> <p>Bidder shall supply and install chequered plates made of MS for closing the cable trenches (a) behind/ in front, as applicable, of the panels such as PCUs, LT panels, LT SWITCHGEAR panels etc in main control room to cover up the cable trench and also (b) all other open trench areas.</p> <p>(1) MS plates shall have a suitable handle (welded to the plate) to facilitate ease of lifting and movements.</p> <p>(2) Plate thickness = 8 mm minimum</p> <p>(3) Width and length of checkered plates shall be selected so that the cable trenches are neatly sealed without any gaps.</p> <p>(4) Plates shall be red oxide coated followed by black painting.</p> <p>(5) BHEL/WBPDC approval shall be obtained for overall arrangement of chequered plate.</p>
5.50	<p>Supply and Installation Miscellaneous Items for Control Room</p> <p>(1) Split Air conditioner of 2 tonne (2 Nos) of split type for SCADA room, conference room of Voltas/ Hitachi/ Samsung/LG make.</p> <p>(2) Furniture for SCADA room as below</p> <ul style="list-style-type: none"> • Table with drawer for desktop PC – 1 No • Executive table complete with draws/ side racks: 1 Set • Chair, industry standard, revolving type, with wheels, arm rest, provisions for adjustment of height (hydraulic/ gas lift): 4 Nos • Storage almirah: 1 No • Filing cabinet: 1 No • Printer table: 1 No • Storing rack (slotted metal frame) 1 no. in store room <p>(3) Furniture for Conference Room</p> <ul style="list-style-type: none"> • 1 no of conference table for 10 persons and equipped with 5 x 16 A power sockets and 10 nos. chairs, revolving type with wheels. <p>Note : Make of the above mentioned furniture shall be Godrej/Durain/Zuari/Usha/Lexus. Other than these makes shall not be accepted.</p>
5.51	<p>Tool kits and instruments :</p> <p>The bidder shall keep ready stock of tools, tackles and essential spares that will be needed for the day-to-day maintenance of the solar PV system. This shall include but not be limited to the following:</p> <ul style="list-style-type: none"> • Screw driver and / or Allen key suitable for the connectors, power distribution blocks, Circuit breaker terminals and surge arrestor terminals. • Spanners / box spanners suitable for the removal of solar PV modules from the solar PV module support structure. • Cleaning tools for the cleaning of the solar PV modules. • Spare fuses. • Panel efficiency measurement tools • Digital multimeter- 2 Nos • AC/DC clamp meter – 2 Nos



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- Meggering kit (5 KV) – 1 No.
- Cable crimping tool – 1 no. 4/6/10 sq.mm and 1 no. 240-630 sq.mm (hydraulic type)
- Rechargeable LED type water proof Flash lights – 10 nos.

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

5.52 Cable installation Methodology

Directly Buried Cables

- a) Cable trenches shall be constructed for directly buried cables. Construction of cable trench for cables shall include excavation, preparation of sieved sand bedding, riddled soil cover, supply and installation of brick or concrete protective covers, back filling and compacting, supply and installation of route markers and joint markers. Laying of cables and providing protective covering shall be as per IS: 1255. Reference drawing for buried cables is included as a tender drawing and enclosed with this specification.
- b) RCC cable route and RCC joint markers shall be provided wherever required. The voltage grade of the higher voltage cables in route shall be engraved on the marker. Location of underground cable joints shall be indicated with cable marker with an additional inscription "Cable Joint". The marker shall project 150 mm above ground and shall be spaced at an interval of 30 meters and at every change in direction. They shall be located on both sides of road crossings and drain crossings. Top of cable marker/joint marker shall be sloped to avoid accumulation of water/dust on marker.
- c) Cable tags shall be provided on all cables at each end (just before entering the equipment enclosure), on both sides of a wall or floor crossing, on each duct/conduit entry, and at every 20 meters in cable tray/trench runs. Cable tags shall also be provided inside the switchgear, motor control centers, control and relay panels etc. where a number of cables enter together through a gland plate. Cable tag shall be of rectangular shape for power cables and control cables. Cable tag shall be of 2 mm thick aluminum with number punched on it and securely attached to the cable by not less than two turns of 20 SWG GI wire conforming to IS:280. Alternatively, the Contractor may also provide cable tags made of nylon, cable marking ties with cable number heat stamped on the cable tags.
- d) While crossing the floors, unarmoured cables shall be protected in conduits upto a height of 500 mm from floor level if not laid in tray.

Cable Terminations & Connections

- a) The termination and connection of cables shall be done strictly in accordance with cable termination kit manufacturer" instructions, drawings and/or as directed by Project Manager. Cable jointer shall be qualified to carryout satisfactory cable jointing/termination. Contractor shall furnish for review documentary evidence/experience reports of the jointers to be deployed at site.
- b) Work shall include all clamps, fittings etc. and clamping, fitting, fixing, plumbing, soldering, drilling, cutting, taping, preparation of cable end, crimping of lug, insulated sleeving over control cable lugs, heat shrinking (where applicable), connecting to cable terminal, shorting and grounding as required to complete the job to the satisfaction of the Project Manager.
- c) The equipment will be generally provided with undrilled gland plates for cables/conduit entry. The Contractor shall be responsible for punching of gland plates, painting and touching up. Holes shall not be made by gas cutting. The holes shall be true in shape. All cable entry points shall be sealed and made vermin and dust proof. Unused openings shall be effectively



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- sealed by 2mm thick aluminium sheets.
- d) Control cable cores entering control panel/switchgear/MCC/miscellaneous panels shall be neatly bunched, clamped and tied with self-locking type nylon cable ties with de interlocking facility to keep them in position.
 - e) All the cores of the control cable to be terminated shall have identification by providing ferrules at either end of the core, each ferrule shall be indelible, printed single tube ferrule and shall include the complete wire number and TB number as per the drawings. The ferrule shall fit tightly on the core. Spare cores shall have similar ferrules with suffix sp1, sp2, -etc along with cable numbers and coiled up after end sealing.
 - f) All cable terminations shall be appropriately tightened to ensure secure and reliable connections.

5.53 Pre-commissioning inspections/ checks/tests, MRT tests, coordination/liaison with state /central departments/CEIG etc. for necessary approvals/clearances for commissioning, synchronization with grid/ plant commissioning:

#	Scope description
	Bidder shall be responsible for carrying out following activities for the Main Control Room
1	Pre-commissioning inspections / checks / tests, MRT tests and coordination / liaison activities with state / central departments / Transco/ DISCOM/ CEIG etc for necessary approvals / clearances for commissioning, synchronization with grid and post-commissioning operation of the plant. (Clearances shall include obtaining prior approvals for all applicable drawings/ documents etc from concerned state / central departments / Transco/ DISCOM/ CEIG etc.)
A	Basic checks
A1	Tightness checks:
	1) Terminations of AC/DC power cables at SMBs, PCUs, Inverter transformers, Aux transformer, LT SWITCHGEAR panel, UPS/ FCBC/ Battery banks, Aux AC/DC DB boards, ABT metering panel, 33kV VCB panels, 33kV LV side of Power transformer, SCADA panels etc. 2) Terminations of Control/ Instrumentation/ Data/ Communication cables wherever applicable. 3) Terminations of earthing at all electrical equipment/ panels of inverter rooms/ control room 4) Terminations of earthing of inverter transformers, aux transformer 5) Terminations of earth chambers of bidder scope. Note: For M10 and above, torque wrench settings shall be followed for reference.
A2	Electrical continuity checks
A3	Megger (5kV) checks for all HT (33kV) cables
A4	Hi-pot testing for all HT (33kV) cables prior to connection to the panels/ transformers.
A5	Megger (1kV) checks for all 1.1kV grade cables
A6	AC/DC supply checks at TBs of all electrical panels/ DBs/ Transformers.
B	Pre-commissioning electrical tests:



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	B1	Power conditioning units (with the support of PCU service engineer at site)	
		<ol style="list-style-type: none"> 1) DC side open circuit voltage and verification with SMB side measurements 2) Bidder to provide technician support to PCU service engineer for all other pre-commissioning tests as per OEM checklist 3) Functioning of duct fans (operation, direction of rotation) 	
	B2	Inverter transformers and Aux transformer	
		<ol style="list-style-type: none"> 1) Oil filtration: Equipment of adequate evacuation/ heating/ oil circulation capacity shall be deployed at site for this purpose. Filtration shall be carried out adequately in order to achieve the BDV, ppm, tan delta values within the limits as per relevant standards and as measured by NABL accredited laboratory. The machine shall have built-in BDV measuring set up for in-situ checking of BDV during filtration process. DG if required for oil filtration shall be arranged by bidder. 2) IR tests LV-HV, HV-E, LV-E 3) Vector group 4) Voltage ratio 5) Magnetizing current 6) Magnetic balance 7) Winding resistance at all taps 8) Fault simulation checks (at VCB breaker panels): Buchholz, OTI, WTI, PRV, LOLA etc 9) Alarm, trip settings (S1, S2) for WTI, OTI 10) Oil level at conservator (to be topped up, if required) 	
	B3	Indoor CTs 33kV	
		<ol style="list-style-type: none"> 1) IR tests (all cores): Pri-Sec, Sec-Sec, Pri-E, Sec-E 2) Ratio tests / primary injection 	
	B4	Indoor PTs 33kV including Bus PTs	
		<ol style="list-style-type: none"> 1) IR tests (all cores): Pri-Sec, Sec-Sec, Pri-E, Sec-E 2) Voltage ratio test 3) Polarity test 	
	B5	Indoor VCB breakers 33kV	
		IR tests Contact resistance measurement (CRM) Timing test: close/ open/ close-open Functional checks: breaker open/close, spring-charged motor Remote operation from SCADA panels: open/close, command/status, lamp indications	
	B6	Numerical relays at VCB breaker panels	
		<ol style="list-style-type: none"> 1) Relay calibration using applicable kit/ software 2) IDMT, DT curves with timing/pickup settings in all relays based on gradation across from downstream to upstream taking into account settings at STU substation 3) Overcurrent/ earth fault pickup/ tripping time tests 	
	B7	CT ratio / PT ratio to be set in meters/relays	
		<ol style="list-style-type: none"> i. All MFM meters ii. ABT meters iii. Protection relays 	




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		B8	ACB breaker settings (with the help of PCU service engineer)	
			1) Over load, Short time fault, ground fault	
		B9	Earth resistance measurements for all chambers of bidder scope	
			1) With electrode connected to grid 2) Without connecting electrode to grid	
		B10	UPS/ FCBC charger/ Battery banks	
			1) All functional checks: battery charging/ discharging, FCBC/ battery output parameters etc. as per OEM checklists	
		C	Testing agency	
			Credentials of testing agency shall be submitted to BHEL for approval prior to awarding of work.	
		D	Coordination and Liaison activities to be carried out by bidder:	
			1) Liaison responsibility for getting the approvals rests with the bidder. 2) Following are the areas of approval, as applicable, for the SPV-side portions including solar array and up to and including 33kV switchyard . (a) GTP/ datasheets/ GA drawings/ Bill of materials, MQP etc of supply items. (b) Site test reports of transformers, transformer oil, VCB breakers, CTs, PTs, resistance of earth mat grids etc (c) Interaction with supervising/ inspection agency such as MRT departments, Transco, CEIG, CEA etc, as applicable, for applying to them/ inviting them for supervision/ inspection at site. (d) Interaction/ coordination with customer (WBPDC) in the above process as and when required. (e) All necessary testing kits/ instruments shall be arranged as per the requirements of inspection agency. Basic instruments such as digital multimeter, 5kV digital megger with PI feature, earth resistance meter, VCB open/close timing test kit, clamp meters etc shall be organized at site at the time of inspection. Competent electrical technician shall also be made available at the site. (f) Subsequent to site inspection by the concerned agency, bidder shall obtain the clearance for grid synchronization of their respective.	
		E	Commissioning of power plant	
			1) Bidder shall organize all necessary tools/ measuring instruments required to operate the various electrical equipment at the time of commissioning: Digital megger 5KV with PI feature, Earth resistance tester, Phase sequence meter, Clamp meters etc., discharge rods, PPE safety gadgets (helmets, shoes etc.). 2) Bidder shall participate actively in the commissioning until it is established that there is successful export of power from all the PCUs and through the 33kV transmission line/ switchyards of power plant.	
5.54	Spares required to be supplied along with main consignment:			
5.54.	Spares on DC side			
1	1) Fuses of all types: 1 % of total population of respective items 2) MCB of all types: 1% of total population of respective items 3) Indicating lamp set of all types: 1% of total population of respective items 4) Surge protection devices/ MOV: 1% of total population of respective items 5) Lighting LED lamps: 5% each type.			

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	6) Indicating lamp set of all types: 1% of total population of respective items 7) Straight-through jointing kit for 1.1kV 1Cx300 cable (Al, XLPE, armoured, PVC): 4 kits for DC side.
5.54. 2	Spares on AC side 8) Spares of aux transformers: a) HV bushings with metal parts and gaskets: 1 set of 3phases b) LV bushings with metal parts and gaskets: 1 set of 3phases c) Neutral bushing with met metal parts an gaskets: 1 set of 3phases d) Gaskets : 2 sets e) Silica gel breather with charge: 2 set f) Diaphragm of explosion vent: 1 set g) Prismatic oil level gauge: 1 set h) Valves: 1 set 9) 33kV(UE) termination kit for 3Cx240 cable: 2 Nos 10) 33kV(UE) straight through jointing kit for 3Cx240 cable: 2 Nos 11) Fuses of all types: 10% of total population of respective items 17) MCCB, MCB of all types: 10% of total population of respective items 18) Indicating lamp set of all types: 10% of total population of respective items 19) Surge protection devices/ MOV: 10% of total population of respective items 20) Plant lighting LED lamps: 5% each type. 21)Current transformer each type used 1 no. 22)Coils for tripping and closing 1no. 23)Breaker Position Switch each type and rating 1 no. 24)Contactor of each type used 1no.s of each type. 25)Relay of each type used 1no.s of each type. 26)Circuit Breaker of each type 1no.s of each type Notes: (a) 1 set refers to total quantity of the item used in one transformer. (b) In case quantity arrived based on percentage is a decimal figure, it shall be rounded off to next higher integer. (c) Bidders shall supply the above mentioned item as applicable in their scope.

6.0 General conditions applicable during supply, installation and commissioning phase

6.1	Bidder shall arrange sufficient water safety equipments for floater installation like, safety vests, nylon ropes, buoys, inflatable rafts etc.
6.2	Bidder to source items as per WBPDC approved vendor list as applicable.
6.3	All machinery such as cranes, hydra, JCBs, forklifts, transport trucks, trolleys etc necessary for movement and installation of materials / panels / equipment etc shall be organized by the bidder.
6.4	All necessary tools and tackles such as crimping tool (including heavy duty tools for crimping copper/ aluminium cables up to 630 sq-mm), screw driver set, power screw drivers, 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/ shuttering materials for RCC works, spade, shovel, hammer etc shall be organized by the bidder.
6.5	All necessary measuring instruments such as digital multimeters, measuring tapes, vernier calipers, electrical testers, digital meggers (1kV, 2.5kV, 5kV), earth resistance meters, clamp meters, transformer oil BDV kit, relay testing kit (secondary injection), primary injection kit,

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	infrared thermal imaging handheld temperature meter etc. All these instruments shall possess valid calibration certificate issued from approved NABL laboratory.
6.6	Bidder 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 bidder.
6.7	Bidder 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.
6.8	Bidder shall maintain updated labour register, with name, age, qualification, salary, attendance details etc. at the site.
6.9	Bidder shall use danger boards, wherever required, to ensure safety of the persons during the work at site.
6.10	Bidder 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 bidder in all respect to prevent accidents at the site and safeguard their labour from accidents.
6.11	Bidder 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, bidder shall finish the land neatly with necessary leveling, rolling etc.
6.12	Bidder shall carry out the work without causing inconvenience to other contract groups at the site. In case of conflicts with other groups, bidder shall ensure that the matter is resolved at once amicably so that the progress of work is not affected.
6.13	Any damages on the building, structures etc. attributable to the acts of labour / employees of bidder shall be rectified and made good by the bidder at their own cost.
6.14	No child labour shall be employed for execution of the present contract.
6.15	Any miscellaneous materials, which are found essential for technical completion of the contract but not mentioned explicitly in this specification, shall be deemed to be included in the specification. Accordingly, such materials shall be included by the bidder as part of the offer.
6.16	Special instruction for earthing: In compliance with Rule 33 and 61 of Indian Electricity Rules, 1956 (as amended up to date), all non-current carrying metal parts shall be earthed with two separate and distinct earth continuity conductors to an efficient earth electrode. Accordingly, all cases such as cable support structures, cable ladders, cable trays (control room) etc. shall be earthed.
6.17	BHEL/WBPDCCL shall witness routine/ acceptance/ type tests performed at manufacturer works for the items supplied by bidder. Bidder shall accordingly provide inspection call to BHEL with submission of quality assurance plan in advance. For the items 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/WBPDCCL for procurement of the item from dealers.
6.18	Field Quality Plan / Quality control system (if applicable) Bidder shall set up a field quality control laboratory with full set up to facilitate testing of all construction materials in accordance with FQP (Field quality control plan) as approved by BHEL/WBPDCCL. Bidder shall deploy a well experienced quality control engineer to monitor all QC activities at site as per approved FQP. Specifically with reference to civil works, bidder shall submit all concrete mix designs and bituminous mix designs for BHEL/WBPDCCL approval before starting of the work. All the third party testing should be conducted in NABL approved laboratories only. Bidder shall submit the FQP for the civil construction works before starting of the works for approval of BHEL/WBPDCCL.
6.19	Any deviations shall be discussed with BHEL/WBPDCCL site engineers and implementation shall be taken up only after approval from BHEL /WBPDCCL.

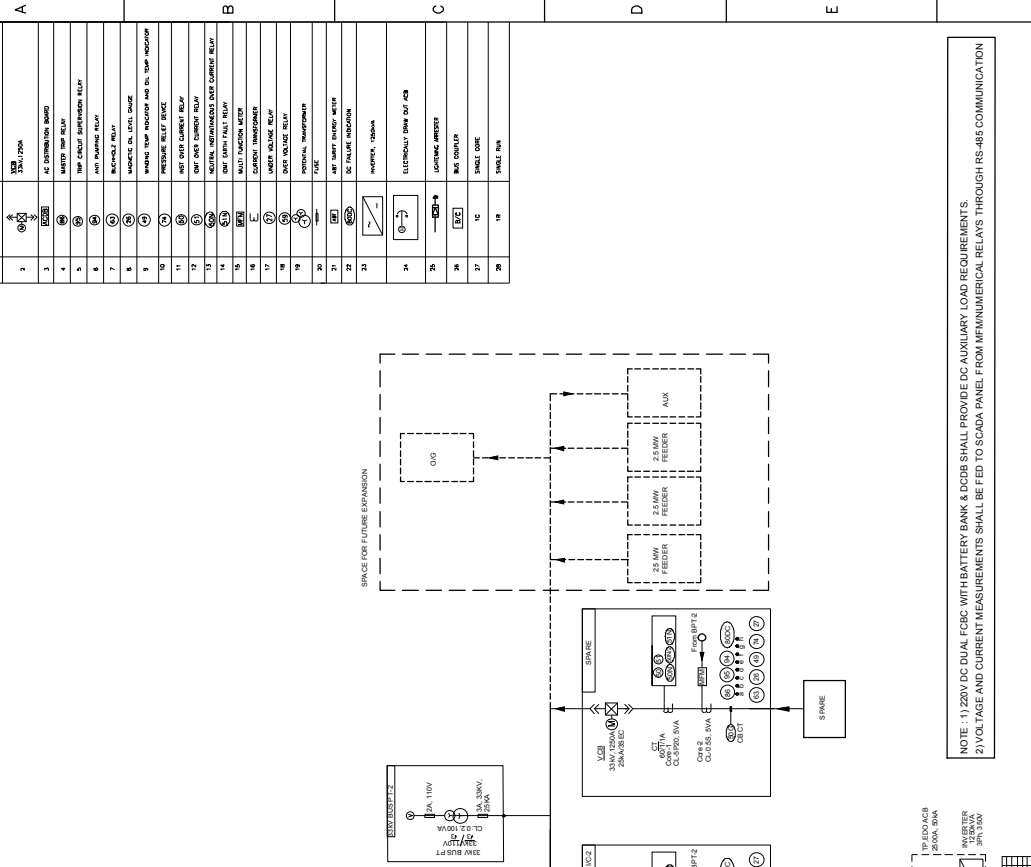
	PURCHASE SPECIFICATION:	PS-439-1262
	SUPPLY OF BOS ITEMS AND I&C OF 5MW(AC)	Rev No: 00
	FLOATING SOLAR PV POWER PLANT FOR WBPDCCL AT SAGARDIGHI TPP, WEST BENGAL	PAGE : 32 OF 32

6.20	Bidder shall submit periodic status report, on daily as well as weekly consolidated basis, to BHEL on the progress of the contract.
6.21	Bidder shall, as and when required by BHEL/WBPDCCL, participate in the review meetings conducted by BHEL/WBPDCCL at project site, BHEL-EDN (Bangalore), BHEL-Corporate office (New Delhi), WBPDCCL office (Kolkata) etc.
6.22	<p>General Guidelines</p> <p>a) Any civil or electrical work which is not mentioned or included in this tender document but necessary for functional requirements of the plant shall be carried out by bidder.</p> <p>b) Bidder shall prepare all designs / drawings based on the specifications given in the tender and in light of relevant BIS/IS/ equivalent standard.</p> <p>c) Bidder shall provide type test reports and datasheet/ GTP for all equipments covered under bidder scope of supply.</p> <p>d) BHEL reserves right to modify the design at any stage to meet local site conditions / project requirements.</p> <p>e) All work shall be carried out in accordance with the latest edition of the Indian Electricity Act and rules formed thereunder and as amended from time to time.</p>

7.0 Documents to be submitted for BHEL/WBPDCCL approval during detailed engineering

7.1	BHEL / WBPDCCL approval shall be obtained for the following technical documents, which shall be submitted to BHEL in phased manner based on priority sequence of activities during detailed engineering (after receipt of purchase order from BHEL).
7.2	Name of bidder/ make, model number/ part number, specification/ sizes/ dimensions/ drawings/ datasheets shall be submitted for approval to BHEL / WBPDCCL for the items which cases bidders name is not mentioned.
7.3	<p>Design calculations/ general arrangement drawings/ single line diagrams/ GTP particulars/ datasheets/ schemes/ layouts/ bill of materials etc., as applicable, shall be submitted for the following:</p> <p>(1) GI cable trays for internal cable trench, cable ties, HDPE DWC conduits, 33kV termination kits, 33kV straight through jointing kits, cable glands, cable lugs,</p> <p>(2) Earth chambers of solar array / main control rooms: GA, cross section, BoM with GTP/ datasheets etc.</p> <p>(3) Lighting system: lux calculations, lighting layouts, GA drawings of these, SLD, BoM with GTP/ datasheets etc.</p> <p>(4) Fire extinguisher datasheets</p> <p>(5) Weather Monitoring system BoM with GTP/ datasheets etc.</p> <p>(6) LT straight through jointing kits, 33kV termination kits, 33kV straight through jointing kits.</p> <p>(7) CCTV, FCBC with battery bank, LT Switchgear, UPS with battery bank etc.</p> <p>(8) Fire detection/ alarm system:Layouts in main control room, overall layout with zones/ sensor/ hooter/ control panel locations, BoM with GTP/ datasheets etc.</p> <p>(10) Any other designs/ schemes/ layouts etc as applicable as per BHEL / WBPDCCL requirements that will be discussed during detailed engineering.</p>
7.4	Manufacturing Quality Plans for all the bidder supplied items
7.5	Field quality plan for the field work: civil works, electrical works
7.6	Detailed activity-time chart for project implementation
7.7	Detailed manpower deployment schedule
7.8	Operation and maintenance manuals of bidder supplied items.

S. No.	SYMBOL	DESCRIPTION
1		INDIRECT TRANSFORMER / AIR TRANSFORMER
2		33kV / 120kV
3		42 DISTRIBUTION BUS
4		25kV BUS
5		MAIN BUS RELAY
6		TRIP CIRCUIT SUPERVISION RELAY
7		AUTO RECLOSE RELAY
8		SYNCHRONIZING RELAY
9		VOLTAGE LEVEL CHANGE
10		PRESSURE RELAY DEVICE
11		HOT OVER CURRENT RELAY
12		OVER OVER CURRENT RELAY
13		NEUTRAL POINT EARTH FAULT RELAY
14		BUS FAULT RELAY
15		BUS FAULT RELAY
16		BUS FAULT RELAY
17		BUS FAULT RELAY
18		BUS FAULT RELAY
19		BUS FAULT RELAY
20		BUS FAULT RELAY
21		BUS FAULT RELAY
22		BUS FAULT RELAY
23		BUS FAULT RELAY
24		ELECTRICALLY DRAWN OUT BUS
25		LOCKING ARRESTER
26		BUS COUPLER
27		PANEL DOOR
28		PANEL DOOR
29		PANEL DOOR
30		PANEL DOOR



PROJECT : 5MW FLOATING SOLAR POWER PLANT
CUSTOMER : WEST BENGAL POWER DEVELOPMENT CORPORATION LIMITED (WBPDCL)

BHARAT HEAVY ELECTRICALS LIMITED.
ELECTRONICS DIVISION, BANGALORE

TITLE: PLANT AC SINGLE LINE DIAGRAM

DRG. No. **BHEL-WBPDCL-ELEC-ACSLD-006**

REV. 04	DATE 08.06.19	APPROVED	ALTERED	DATE 06.06.19	CHECKED	DATE 03.04.19	SIGN VCP	NAME VCP
1) O/G, B/C, OUTDOOR S/Y CT RATIO CHANGED								
2) AUX TRF RATING WILL BE PROVIDED SEPARATELY AS PER CALCULATIONS								
3) OUTDOOR S/Y DETAILS ADDED								
1) HT PANEL CT POSITIONS CHANGED.								
2) AUX TRF RATING WILL BE PROVIDED SEPARATELY AS PER CALCULATIONS								
3) OUTDOOR S/Y DETAILS ADDED								

REV. 03	DATE 03.04.19	APPROVED	ALTERED	DATE 03.04.19	CHECKED MS	DATE 03.04.19	SIGN MS	NAME MS
DISTRIBUTION OF PRINTS								
DEPT. SC&PV								
CODE 439								

DRAWN APPROVED			CHECKED APPROVED			DATE 03.04.19		SIGN MS	
DISTRIBUTION OF PRINTS								CODE 439	
DEPT. SC&PV								SIGN MS	

REV. 04	DATE 08.06.19	APPROVED	ALTERED	DATE 06.06.19	CHECKED	DATE 03.04.19	SIGN VCP	NAME VCP
1) O/G, B/C, OUTDOOR S/Y CT RATIO CHANGED								
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3) OUTDOOR S/Y DETAILS ADDED								
1) HT PANEL CT POSITIONS CHANGED.								
2) AUX TRF RATING WILL BE PROVIDED SEPARATELY AS PER CALCULATIONS								
3) OUTDOOR S/Y DETAILS ADDED								



WIN097_PRO_Technical Pack

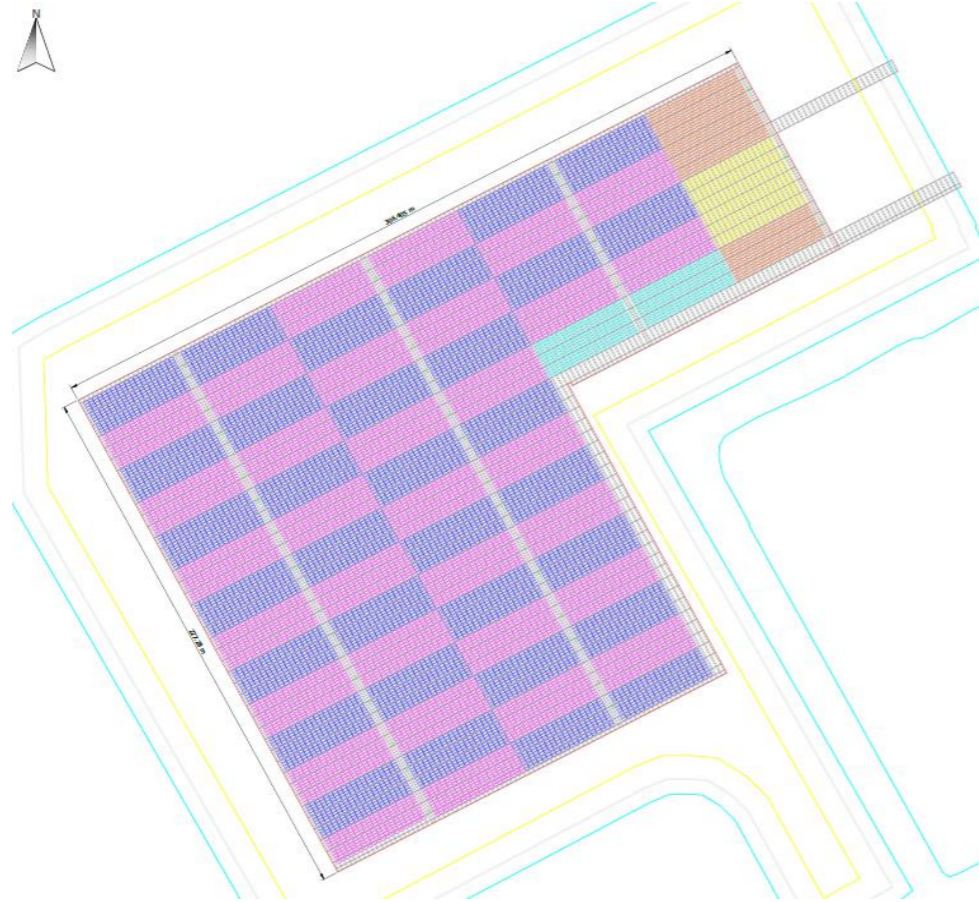
CONFIDENTIAL

Project Name: RAW WATER POND No.3 of SGTPP **Project capacity:** 5,403.60 kWp

Date of update: 03/06/2019

Updated by: TJ

Design version: VI lindA

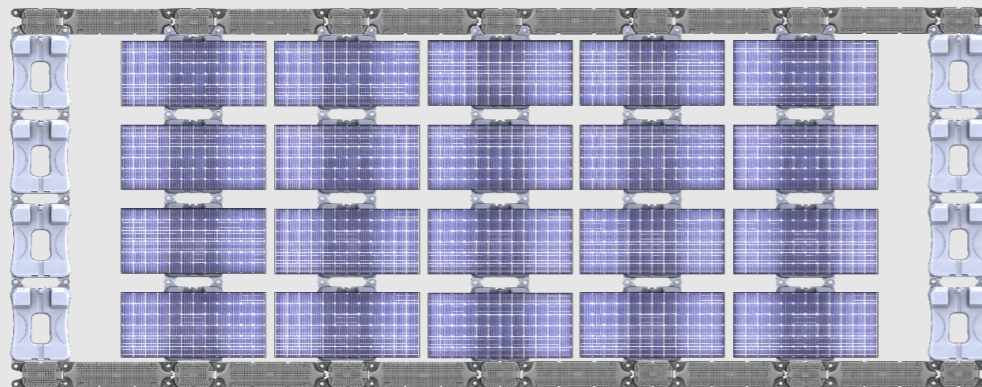


HYDRELIO CONFIGURATION

Side view Tilt: 5°



Top view 4-in-a-row



Number of solar arrays

1

SOLAR ARRAY

Solar Array characteristics

Solar Array capacity	5,403.60 kWp
Solar Array area	51,855 m ²
Effective Capacity ratio	104.21 Wp/m ²
Water Area	102,175 m ²
Usable Area	77,974 m ²
Coverage Ratio	50.75%

Hydrelio substructure

Main floats	19,149
Small Secondary floats	5,409
Long Secondary floats	5,106
Configuration*	Equato 4-in-a-row

* See Hydrelio configuration on the bottom-left corner

ELECTRICAL CONFIGURATION

Solar Panel specifications

Manufacturer	BHEL
Reference	BHEL-320
Number (per island)	16,880
Capacity	320, 325Wp
60 or 72 cells	72 cells

Inverter specifications

Manufacturer	BHEL
Reference	BHEL 1250
Number (per island)	4
Capacity	1,250 kVA
DC/AC ratio	1.08

YIELD ESTIMATION

Meteo Database	NASA
Azimuth*	-28°
Tilt	5°

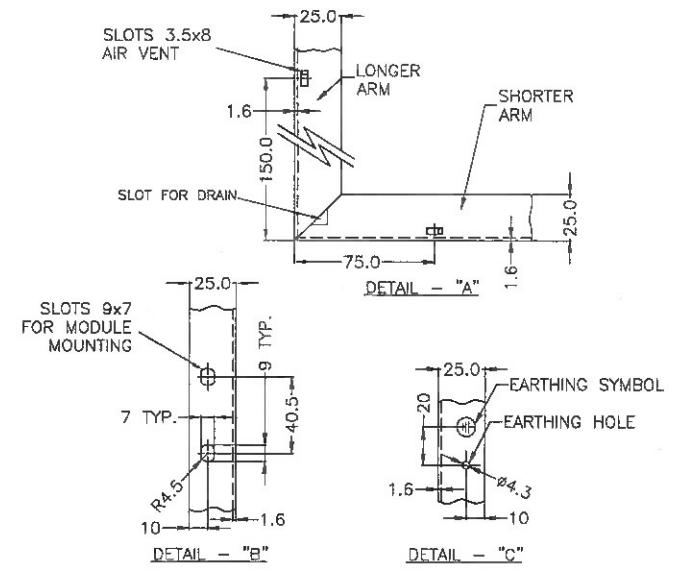
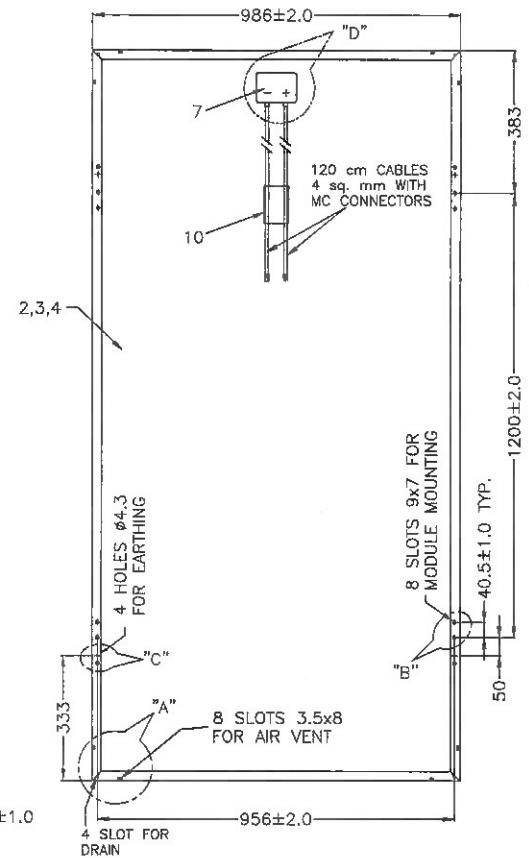
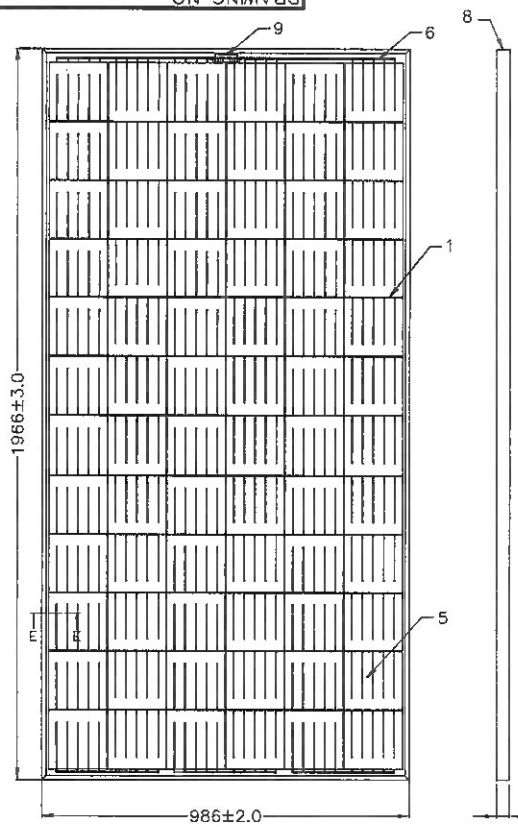
*- azimuth 0°= SOUTH when the project is located on the north hemisphere
 - azimuth 0°= NORTH when the project is located on the south hemisphere
 - clockwise

FIRST ANGLE PROJECTION

ALL DIMENSIONS ARE IN mm

DRAWING NO. 3-988-00-014-10

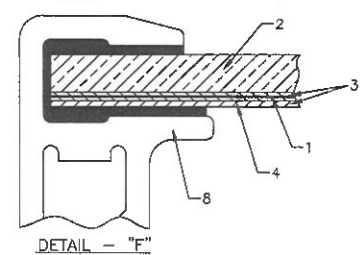
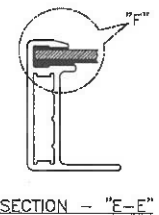
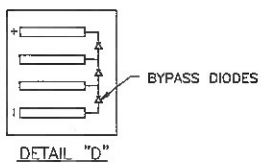
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WEIGHT OF SPV MODULE = 22.5 Kg (Typ.)

MASTER COPY
WHEN IN RED

PART	DESCRIPTION
10	MODULE RATING STICKER
9	PV MODULE SL. NO. STICKER WITH RFID
8	ANODISED ALUMINIUM FRAME (Coating Thk. - 18+/- 3 Microns)
7	JUNCTION BOX WITH CABLE & MC CONNECTOR
6	STRING INTERCONNECTS
5	CELL INTERCONNECTS
4	BACK SHEET
3	EVA SHEET
2	HIGH TRANSMISSION TEMPERED GLASS
1	72 Nos. OF 156.75 +/-0.5 mm / 157 +/-0.5 mm MULTI CRYSTALLINE SILICON SOLAR CELLS CONNECTED IN SERIES



REV.	DATE	ALTERED CHECKED	APPROVED	REV.	DATE	ALTERED CHECKED	APPROVED
00	25.04.18						

BHARAT HEAVY ELECTRICALS LIMITED. ELECTRIC & PHOTOVOLTAIC DIVISION, BANGALORE	DRN	RKP	SIGN.	[Signature]	DATE	25.05.19	No. OF VAR	
	CKD	AKS				25.05.19		
	APPD	SKG				25.05.19		
DEPT. SPV	FOR UNSPECIFIED-TOLERANCES REFER ED 0230499	SCALE	1 : 10	WEIGHT(Kg)	REF. TO ASSY. DRG.	JOB NO.	TT	ITEM NO.
CODE 901								
TITLE					DRAWING NO.		REV.	
SOLAR PHOTOVOLTAIC MODULE					3-988-00-014-10		00	
SPV MODULE - L24315P					SHEET NO. 01		NO. OF SHEETS 01	



**PURCHASE SPECIFICATION:
AUXILIARY TRANSFORMER**

PS-439-AUX

Rev No: 00

PAGE : 1 OF 7

Specification of auxiliary transformer 100kVA, 33kV/415V, Dyn11, Outdoor, ONAN

1.0 Technical parameters and specifications:

#	Technical parameter	Specification
1	Transformer type	Outdoor, oil-immersion type
2	IP class	Transformer, including cable box and marshalling box shall be of IP55
3	Type of cooling	ONAN
4	Governing Standard	IS: 1180
5	Rating in KVA	100 kVA
6	No. of phases	3
7	Frequency	50 Hz, +/- 3%
8	HV winding	33kV, 3-Ph, with Delta connection
9	LV windings	433V, 3-Ph, with Star connection
10	Winding material	Electrolytic grade copper for both HV and LV windings
11	Winding Insulation	Class A
12	Neutral on LV side	Neutral terminal shall be brought out separately to facilitate earthing connections.
13	Vector Group	Dyn11
14	Short circuit withstand time (thermal)	2 sec.
15	% Impedance	As per IS: 1180
16	Termination HV/LV/Orientation	Air insulated cable box with disconnecting chamber, for both HV and LV sides. Cable box / Cable box / 180°.
17	Cable entry on HV side	Bottom entry of cables. HV cable in BHEL scope.
18	Cable entry on LV side	Bottom entry of cables. Cable supply in bidder scope.
19	Cables and accessories	LV cable, Termination kits (for HV), cable lugs (Dowell/Comet/3D make) and connecting hardware shall be in bidder scope of supply. Bidder shall provide hole on the bottom-side gland-plate of HV & LV side cable box for cable entry as per the final outer diameter of cable provided by BHEL during detailed Engg.
20	Tapping on HV winding	Off circuit tap changer (OCTC) switch with five tap positions: +5%, +2.5%, 0, -2.5%, -5%.
21	Loading Capability	Continuous operation at rated KVA on any tap with voltage variation of +/-10%. Transformer shall be capable of being loaded in accordance with IS: 6600 / IEC 60076-7.
22	Ambient temperature	Max 50 deg C
23	Temperature rise	For top oil: Max. 50 deg C by thermometer method For winding: Max. 55 deg C by resistance method Both rises shall be over an ambient temperature of 50 deg C irrespective of tap position.



**PURCHASE SPECIFICATION:
AUXILIARY TRANSFORMER**

PS-439-AUX

Rev No: 00

PAGE : 2 OF 7

24	Flux density	Not to exceed 1.9 Wb/sq.m at any tap position with +/-10% voltage variation from voltage corresponding to the tap. Transformer shall also withstand following over-fluxing conditions due to combined voltage and frequency fluctuations: a) 110% for continuous rating b) 125% for at least one minute c) 140% for at least five seconds Bidder shall furnish over-fluxing characteristics up to 150%
25	Air Clearance	As per CBIP
26	Load loss principal tap at 75°C, with IS tolerance	This shall be provided by bidder.
27	No Load loss at rated voltage on principal tapping and at rated frequency, with IS tolerance	This shall be provided by bidder.
28	No load current at rated voltage and rated frequency	This shall be provided by bidder. To be indicated as percentage.
29	Efficiency at 75°C, UPF	As per IS 1180 and CBIP
30	Regulation at full load, 75 °C	< 2 % for UPF For 0.8 PF lagging, to be indicated by bidder.
31	Harmonics	Shall be designed to suppress harmonics especially 3 rd & 5 th .
32	Vibration & noise	Noise level shall be according to NEMA TR-1 standard
33	Highest system voltage	LV side: 1.1kV HV side: 36 kV
34	Insulation levels as per IS:2026 Rated Lightning Impulse withstand voltage / Short duration power frequency withstand voltage	LV side: -- kVp / 3 kV rms HV side: 170kVp / 70kV rms
35	Overall dimensions in mm Length x Breadth x Height	This shall be provided by bidder.
36	Oil capacity (in Litres)	This shall be provided by bidder.
37	Weight of transformer in Kg	This shall be provided by bidder.
38	Painting	Shade 631 of IS:5



**PURCHASE SPECIFICATION:
AUXILIARY TRANSFORMER**

PS-439-AUX

Rev No: 00

PAGE : 3 OF 7

39	Constructional features	As per relevant clause of this specification
40	Fittings and accessories	As per relevant clause of this specification
2.0 Tests on auxiliary transformer		
2.1	Routine Tests: As per IS: 1180 – MQP shall be submitted for approval.	
2.2	<p>Type Tests</p> <p>(a)Temperature rise test</p> <p>This test shall be performed as a type test on one sample of transformer. This is a mandatory test and shall be witnessed by BHEL/WBPDCL. Bidder shall include the price for this test in the price of auxiliary transformer.</p> <p>This temperature rise test shall be carried out at a tap corresponding to maximum losses as per IS: 1180. Test report shall be furnished to BHEL.</p> <p>(b) Valid type test report for all other type tests on similar rating transformers shall be submitted during detailed engineering.</p>	
3.0 Constructional features and details of transformer components		
3.0	<p>Transformer shall be constructed in accordance with IS: 2026 and IS: 3639 or equivalent international standard. All materials / components used shall be of best quality and class most suitable for working under the conditions specified.</p> <p>These shall withstand the variations of temperature and atmospheric conditions, overload, over-excitation, short-circuits as per specified standards without distortion or deterioration, without development of stresses in any part and also without affecting the strength and suitability of the various parts for the work that they have to perform.</p>	
3.1 Tank		
3.1.1	The transformer tank and cover shall be fabricated from high grade low carbon plate steel of tested quality. The tank and cover shall be of welded construction and there should be provision for lifting by crane.	
3.1.2	Suitable inspection hole(s) with welded flange(s) and bolted cover(s) shall be provided on the tank cover. The inspection hole(s) shall be sufficient size to afford easy access to the lower ends of the bushings, terminals etc.	



**PURCHASE SPECIFICATION:
AUXILIARY TRANSFORMER**

PS-439-AUX

Rev No: 00

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3.1.3	The exterior of tank and other steel surfaces exposed to the weather shall be thoroughly cleaned and have a priming coat of zinc chromate applied. The second coat shall be of an oil and weather-resistant nature, preferably of distinct colour from the prime and finish coats. The final coat shall be of a glossy, oil and weather resistant non-fading paint of specified shade.
3.1.4	The interior of the tank shall be cleaned by sand blasting and painted with two coats of heat resistant and oil insoluble paint.
3.1.5	Steel bolts and nuts exposed to atmosphere shall be galvanized. All bolted connections to the tank shall be fitted with suitable oil-tight gaskets that shall give satisfactory service under the operating conditions for complete life of the transformer, if not opened for maintenance at site.
3.1.6	The tank together with radiators, conservator, bushings and other fittings shall be designed to withstand the following conditions without permanent distortion: (i) Full vacuum of 760 mm of Hg, for filling with oil by vacuum. Internal gas pressure of 0.35 Kg/cm ² (5 lbs/sq.in) with oil as at operating level. (ii) The transformer shall have conservator tank of adequate capacity to accommodate oil preservation system and volumetric expansion of total transformer oil. The conservator shall be bolted into position so that it can be removed for cleaning purposes. (iii) The conservator shall be of single compartment type. The top of the conservator shall be connected to the atmosphere through a transparent type silica gel breather. (iv) The tank cover shall be suitably sloped so that it does not retain rain water. The material used for gaskets shall be cork, neoprene or approved equivalent.
3.2 Core	
3.2.1	The magnetic circuit shall be of core type. The core shall be constructed from non-ageing, cold rolled, super grain oriented silicon steel laminations (CRGOS) equivalent to M4 grade steels or better.
3.2.2	The insulation structure of the core to clamp plates shall be such that it withstands a voltage of 2kV (rms) for one minute in air.
3.2.3	Adequate lifting lugs will be provided to enable the core & windings to be lifted.
3.3 Windings	
3.3.1	Windings shall be of electrolytic grade copper free from scales and burrs.
3.3.2	Windings shall be subjected to a shrinking and seasoning process so that no further shrinkage occurs during service.



**PURCHASE SPECIFICATION:
AUXILIARY TRANSFORMER**

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3.3.3	Windings shall have uniform insulation.
3.3.4	Tapping shall be so arranged as to preserve the magnetic balance of the transformer at all voltage ratios.
3.3.5	The completed core and coil assembly shall be dried in vacuum and shall be immediately impregnated with oil after the drying process to ensure elimination of air and moisture within the insulation.
3.3.6	Windings shall be made in dust proof and conditioned atmosphere. Bidder shall indicate those details of facilities (as available at the winding works) that will ensure meeting this requirement.

3.4 Internal earthing

3.4.1	The frame work and clamping arrangements of core and coil shall be securely earthed inside the tank by copper strip connection to the tank.
-------	---

3.5 Bushings

3.5.1	Bushings shall be designed and tested to comply with the applicable standards. Bushings rated for 400A and above shall have non-ferrous flanges and hardware. Bushings shall be supplied with terminal connector clamp suitable for connecting the cables.
3.5.2	Neutral bushings of the star-connected LV winding shall be brought out to separate bushing terminals. The neutral bushings shall be provided on the tank at such a location that facilitates connecting earth conductor down to the ground level. Tank-mounted pin-type support insulators shall be provided for supporting the neutrlearthing bar of specified section, along its run from the neutral bushing to ground level.

3.6 Cables boxes and disconnecting chambers

3.6.1	Cable boxes shall be supplied with gland plates having holes to suit cables provided.
3.6.2	Cable boxes / disconnecting chambers shall be provided with body earth terminals.
3.6.3	LV cable boxes shall be provided with necessary LV bushings, bus bars, bus bar supports for making cable terminations.
3.6.4	HV cable boxes shall be provided with necessary HV bushings and terminals for making cable terminations.
3.6.5	Cable boxes shall be provided with suitable gaskets to ensure the specified protection class requirement (IP55).



**PURCHASE SPECIFICATION:
AUXILIARY TRANSFORMER**

PS-439-AUX

Rev No: 00

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3.6.6 Cable boxes / disconnecting chambers shall be provided with necessary arrangements to prevent entry of rain water into the same.

3.6.7 Disconnecting chambers:

- (1) Disconnecting chambers shall be provided to enable the transformer to be removed without unsealing the cables or draining oil from the main tank.
- (2) Disconnecting chamber shall be air insulated and complete with seal-off bushings, removable flexible connectors / links and removable covers.
- (3) Phase-to-phase and Phase-to-ground clearances within the chamber shall be such as to enable either the transformer or cable to be subject separately to HV tests. Clearances shall be subject to BHEL approval.

3.7 Transformer oil

3.7.1 Transformers shall be supplied complete with transformer oil. The new insulating oil before pouring into the transformer shall conform to the requirement of IS: 335. No inhibitors shall be used in the oil. The oil samples taken from the transformer at site shall conform to requirements of IS: 1866.

3.7.2 10% extra oil, in non-returnable sealed containers, shall be sent along with main consignment to avoid any shortage of oil at the time of topping up of oil at the site.

This oil quantity shall be over and above the specified mandatory spares requirement.

3.8 Fittings and accessories

Following fittings per transformer shall be provided. Bidder shall indicate compliance (Yes / No) for each line item. In case of non-compliance or deviation, bidder shall indicate and provide comments.

#	Nomenclature of fitting / accessory	Qty
1	Oil conservator with equalizer pipe and drain plug	1 set
2	HV cable box	1 set
4	LV cable box	1 set
6	Off circuit tap changing switch (OCTC) with operating knob, tap position marking and locking facility, with warning plate "Tap switch to be operated only with the transformer de-energized".	1 set
7	Neutral bushings for earthing of LV winding	1 No
8	Earthing terminals for cable boxes, tank etc.	2 Sets
9	Radiators (detachable type) with drain valve at the bottom, relief valve at the top, air plug, shut-off valves at every point of connection to the tank and lifting lugs.	4 sets



**PURCHASE SPECIFICATION:
AUXILIARY TRANSFORMER**

PS-439-AUX

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10	Silica gel dehydrating breather with oil cup	1 set
11	Prismatic / toughened glass oil level gauge for transformer and tap changer chamber with min and max markings.	1 set
12	Explosion vent (double diaphragm) with sight glasses and equalizing pipe connection to conservator	1 set
13	Inspection window with cover	1 set
14	Cover lifting lugs / eyes	2 Nos
15	Tank lifting lugs / eyes for the entire transformer	4 Nos
16	Bi-directional flat rollers	4 sets
17	Base channel with towing holes / lugs	2 sets
18	Air release hole with plug	1 No
19	Oil filling hole with cap	1 No
20	Top filter valve with threaded male adapter (blanking plug)	1 No
21	Drain cum sampling valve	1 No
22	Rating and diagram plates made of stainless steel or anodized aluminium.	1 No
23	Terminal marking plates	1 Set
24	Stem type thermometer mounted on top of tank	1 No

4.0 Inspection and testing of transformers at bidder works


4.0	Bidder shall provide inspection call to BHEL for the type and routine tests. Prior to the call, bidder shall submit the routine test results as per Manufacturing Quality Plan (MQP) for scrutiny of BHEL/WBPDCL.
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5.0 Documents to be submitted after receipt of purchase order

5.1	Following documents shall be submitted for BHEL approval within seven days from date of purchase order. (1) GA drawings including foundation details (2) GTP (3) MQP (4) Valid type test report as above
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6.0 Documents to be submitted along with consignment

6.1	Following documents shall be submitted to BHEL at the time of delivery of the consignment: (1) As built drawings of transformer (2) Routine test reports on transformer (3) Type test reports on transformer (4) Test certificate for transformer oil (5) Operations and maintenance manual of transformer
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	PURCHASE SPECIFICATION DC BATTERY, BATTERY CHARGING EQUIPMENT & DCDB	PS-439-DC SYSTEM
		REV NO: 00
		PAGE : 1 OF 5

1.0 Introduction

This technical specification provides BHEL requirements for supply of DC battery, battery charging equipment and DCDB system for the solar photovoltaic project.

2.0 Scope of supply

Sl. No	Item Description	Qty
1	Plante type battery bank – 220V/125Ah at C10 as per spec	2 Set
2	Dual Float Cum Boost Charger with selector switch as per spec	2 No
3	DCDB as per spec	1 No

3.0 Technical specification

The scope of work under this specification covers the design, manufacture, assembly, testing at manufacturer's works, transportation, transit insurance, delivery at site, storage, installation, testing, and commissioning of D.C equipment comprising of 220 V D.C Battery Bank Plante type of suitable designed capacity complete with battery charging equipment, D.C. Distribution Board and other auxiliary equipments.

The scope shall include all associated devices, components, relays, contactors, switches etc. required for satisfactory operation of the DC equipment as per the proposed logic control scheme.

The scope of supply shall also include necessary spares required for normal operation & maintenance of DC equipments for a period of 5 (five) years and special tools & plants required for erection & maintenance.


Corresponding parts of all the equipments & spares shall be of the same material & dimensions, workmanship & finish and shall be interchangeable. All the material & workmanship shall be of suitable commercial quality as have proven successful in their respective uses in similar services & under similar condition.

3.1 STANDARDS

The equipments covered under this chapter shall comply with the requirement of latest edition of following IS/BS/IEC specifications as amended up to date except where specified otherwise.

Sl. No.	Standards	Description
1	IS: 1651	Stationary cells & batteries, lead acid type (with tubular positive plates)
2	IS: 266	Battery grade Sulphuric Acid. (Battery electrolyte)
3	IS: 1069	Water for storage batteries
4	IS: 1146	Rubber & Plastic containers for lead Acid storage batteries
5	IS: 1248	Electrical Indicating Instruments
6	IS: 13947	Low voltage switchgear and control gear
7	IS: 3895	Mono-crystalline semi-conductor rectifier cells & stacks
8	IS: 8320	General requirement and methods of tests for lead acid storage batteries
9	IS : 6071	Synthetic separators for lead acid batteries
10	IS : 8623	Factory built assemblies of switchyard and control gear for voltage up to including 1000 V AC and 1200 V DC (Part 1 to 3)
11	IS : 4540	Non-crystalline semi-conductor rectifier assemblies &

Equipment meeting any other authoritative national or international standards that ensure equal or better quality than the standards mentioned above are also acceptable. Where the equipment


	PURCHASE SPECIFICATION	PS-439-DC SYSTEM
	DC BATTERY, BATTERY CHARGING EQUIPMENT & DCDB	REV NO: 00
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conforms to any other standards than those mentioned above, salient points of difference between the standards adopted and standards mentioned above shall be brought out in the tender.

3.2 GENERAL REQUIREMENTS

Minimum general requirements for the DC Battery, Battery charger and DC Distribution Board are mentioned below.

- Lead acid tubular type battery of required rating shall be provided at Main Control Room and each Local Control room. Battery Bank at Main Control Room shall be 220 V and Battery Bank at Local Control Rooms shall be selected based on the Control Voltage required for closing and tripping of 33 kV outdoor breaker. 10 hours continuous discharge shall be considered for sizing the battery.
- One float charger and one float cum boost chargers shall be provided to maintain constant voltage at D.C. bus bars while supplying the continuous load in addition to keeping the battery on float charge.
- In case of sudden D.C. requirements due to failure of A.C. supply or charger itself, the battery shall be capable of meeting the system load demand. In case of failure of float charger supplying the continuous DC load, the affected battery charger shall get disconnected automatically from the DCDB and the complete D.C. load requirements shall be met by the float charger of float cum boost charger unit.
- The charger shall be protected against overloads by having suitable characteristics so that all loads in excess of the capacity of the charger would be transferred to the battery.
- In the event of failure of A.C. supply, the battery shall meet the complete D.C. requirements. After the discharge of battery to a considerable extent, the boost charger on restoration of A.C. supply shall recharge the battery in a short period. During the period of boost charging, the D.C. load requirements of power station shall also continue to be met.
- The distribution board with necessary switch and interlock, if any, shall be provided for distributing the D.C. power for the control & protection circuits, emergency D.C. supply for essential lighting etc.
- The bidder may give his recommendation on the scheme of operation of battery, battery chargers as described in the specifications. However, the decision of the owner in this regard shall be final and bound to the bidder/contractor.
- The battery shall be capable of delivering the rated output at the minimum temperature of -3°C and maximum temperature of +40°C.
- The battery shall be mounted on the two tier wooden racks supplied along with the battery. Each cell as well as its locations shall be numbered for proper record of maintenance operations. Battery should be placed on the porcelain base kept on the wooden rack.
- The battery shall be connected to D.C. distribution board by single core cables laid above ground/ Cable trenches on trays. Suitable terminal arrangement with glands shall be provided for this purpose.

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	DC BATTERY, BATTERY CHARGING EQUIPMENT & DCDB	REV NO: 00
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- The ripple content in the D.C. current shall be less than 1%.
- The float charger unit shall be capable of supplying continuous D.C. load and trickle charge the battery.
- Necessary alarm and indication shall be provided with the DC System and also in the annunciation window of the Battery Charger.
- Necessary terminals with lugs for earthing the charger panels with two distinct separate earthing for each panel shall be provided. In addition, separate terminals for earthing of equipment shall be provided. The charger panels shall have space heaters.
- Compression type cable glands of suitable rating for PVC unarmoured cable, suitably mounted in the panel for cable entry from the bottom for A.C. & D.C. supplies shall be provided.
- Type of cell, cell terminal, containers and installation of battery, chargers, inverter, DC Distribution Board, cables etc. should conform to the latest edition of relevant Indian Standard.
- During installation of battery, charging & discharging and charging is to be done proper installation procedure.

3.3 TECHNICAL REQUIREMENTS

Minimum technical requirements for the DC Battery, Battery charger and DC Distribution Board are as following.

- The battery shall be made of lead-acid cells with tubular type plates conforming to latest issue of IS 1651. The battery cells shall be high discharge performance (HDP) type.
- The capacity of 220 V D.C. batteries based on 10 hours discharge rate shall be selected to fulfill the plant's requirement. The contractor shall propose the same to the owner and decision of the owner will be final and bound to the contractor.
- The battery shall normally remain under floating condition with the charger supplying the normal continuous load. However, the battery shall be capable of supplying the load without fall of terminal voltage per cell below 1.85V (92.5% of rated voltage).
- The number of cells of the 220 volt battery bank at Main Control Room and required voltage at Local Control Room shall be chosen to suit the following conditions.
 - Nominal floating voltage per cell shall be between 2.15 and 2.21 V.
 - The voltage of each cell under floating conditions shall be of optimum value for its performance and maintenance in a healthy condition.
 - The voltage of the battery after meeting the D.C. load cycle shall not be less than 90% of the rated voltage. The manufacturer shall ensure safe operation of the battery after the aforementioned end voltage.
 - The voltage across the load shall not exceed 110% of rated value under charging conditions of the battery. To achieve this condition under quick charging, a blocking diode may be incorporated by the supplier in the charging equipment.



PURCHASE SPECIFICATION


DC BATTERY, BATTERY CHARGING EQUIPMENT & DCDB

PS-439-DC SYSTEM

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- The bidder shall clearly justify the choice of number of cells in the tender on the above lines and furnish any clarifications required by the owner.
- All cell terminals shall have adequate current carrying capacity and shall be of lead-alloy or lead-alloy reinforced with copper core inserts. Cell terminal posts shall be equipped with acid resisting connector bolts and nuts.
- The electrolyte shall be of battery grade sulphuric acid. The battery shall be transported dry.
- The charging equipment shall preferably employ solid state full wave rectifier in a 3 phase full wave bridge circuit with suitable filter circuit of AC ripples, suitable for operation in conjunction with static voltage regulator. A.C. and D.C. Circuit breakers with thermal overload and instantaneous short circuit releases shall be provided on input and output sides of chargers respectively.
- Capacity of the float charger and the boost charger in the float cum boost charger shall be sufficient to meet the system requirement. Contractor shall submit the details to the owner.
- The charger shall be capable of providing the floating voltage between 2.15 V to 2.21 V per cell with the variation of not more than +1% irrespective of input supply voltage fluctuations within +/-10%, frequency fluctuation within +/-5 % throughout its ampere rating with ambient air temperature range of -3°C to 40°C.
- The DC Distribution Board (DCDB) shall be free standing, self-supporting and floor mounting type. It shall be totally enclosed and compartmentalized. DCDB shall be made as per relevant Indian Standard.
- One equivalent capacity of Incomer provision shall be there to connect with existing DC system with a castle key interlock
- The Emergency Lighting Board supplying the emergency lighting requirement of the power house at A.C shall have an arrangement so that automatic changeover to emergency lighting in case of A.C. failure, is achieved through an inverter of suitable capacity. Normally, the inverter shall run on AC. supply. In the event of failure of AC, the inverter shall automatically switch-over to DC supply and feed the selected emergency loads (lighting loads) at 230 V AC. On restoration of AC supply, the inverters load will automatically return to AC.
- The DC system shall have necessary control & protection arrangement which include but not limited to the following.
 - Auto/Manual selector switch
 - Digital D.C. voltmeter, ammeter
 - A.C. failure alarm
 - Ground fault relay and its annunciation
 - Double pole D.C. contactor of suitable capacity for annunciation
 - Triple pole A.C. contactor of suitable capacity for ON/OFF operation

	PURCHASE SPECIFICATION DC BATTERY, BATTERY CHARGING EQUIPMENT & DCDB	PS-439-DC SYSTEM
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- MCCB and DC contactor of suitable capacity in output circuit of each charger to suit the operation requirements.
- Indicating lamps, as required
- Triple pole, A.C. circuit breaker of sufficient capacity to meet system requirements & capacity with overload and short circuit release for incoming A.C. supply to charger panel
- MCB/MCCBs for A.C. supply to individual chargers
- A.C. under voltage relay
- A.C. voltmeter, ammeter etc.
- Nearest local control room from the main control room should be connected with 220 V DC from Battery Bank DCDB.
- 220 V AC/DC converter is to be provided in each isolated switchgear for operation of circuit breaker/isolator as and where required. Power required in

ACDB/DCDB for illumination, control system etc. for each control room should be collected from 415 V (3phase+N) transmission line with necessary cables and protection.

3.4 APPROVAL

The Detailed Design Report submitted by the contractor to BHEL/WBPDCL must contain but not limited to the following details of the DC system:

- Detailed specification of all the items.
- Necessary Drawings
- Test Certificates etc.

Prior to the delivery of the product, the contractor shall submit but not limited to the following documents:

- Guarantees
- Instructions for installation and operation, manual
- Detailed schematic, connection and control wiring diagrams etc.

The contractor can deliver the product to the site only after receiving such approval from BHEL/WBPDCL.



PURCHASE SPECIFICATION

UPS WITH Ni-Cd BATTERY BANK

PS-439-UPS

REV NO: 00

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1.0 Introduction

This technical specification provides BHEL requirements for supply of UPS with Ni-Cd battery bank for the solar photovoltaic project.

2.0 Scope of supply

Sl. No	Item Description	Qty
1	UPS 5KVA	2 set
2	Ni-Cd Battery bank- 120V, 40Ah	2 set

Note: WBPDCCL approved vendor for UPS system: 1) Emerson, Mumbai, 2) Hitachi-Hirel, Gandhi Nagar

WBPDCCL approved vendor for UPS Battery system: 1) HBL, Hyderabad

3.0 Technical specifications

UPS system shall have 2x100% configuration, normally both will run in parallel mode sharing 50% load. On failure of any UPS, its load shall automatically get transferred to the other healthy UPS. The UPS system shall meet the following minimum specifications.

1.0	Type	: IGBT based high frequency PWM technology of latest proven design.
2.0	Configuration	: 2 X 100% parallel redundant chargers and inverters, (2 X 100%) battery bank, bypass line transformers & voltage stabilizers, static switch, manual bypass switch and power distribution board.
3.0	Charger	: Solid state silicon controlled full wave rectifier designed for single and parallel operation with battery and shall have automatic voltage regulator, current limiter and filter circuits. Charger shall have provision for float, equalizing and boost charging.
4.0	Charger output Regulation	: $\pm 1\%$ from no load to full load with input power supply variation of 10 % to -15% in voltage and $\pm 5\%$ in frequency with output ripple content less than 2%.
5.0	Battery	: Ni-Cd vented type, pocket plate high discharge battery of adequate capacity to meet the requirement of UPS, generally conforming to IS-10918.
6.0	Backup time	: 1 hour in case of input power fail.
7.0	Inverter capacity	: To be decided by bidder. 25% extra capacity margin to be considered.
8.0	Overload capacity	: a) 125% for 10 minutes b) 150% for 60 seconds
9.0	Sizing	: a) Environmental temperature 0 to 50 degC. b) Power factor of load - 0.8



PURCHASE SPECIFICATION
UPS WITH Ni-Cd BATTERY BANK

PS-439-UPS

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		<p>c) Adequate I² t capability to clear fault in the maximum rated branch circuit.</p> <p>d) UPS shall be capable to operate without DC battery in circuit and under all conditions of load.</p> <p>e) In case of failure of a charger / input power, other charger whose input supply is healthy shall be capable to charge the battery and as well supply input power to inverter. No discharge of battery is allowed.</p> <p>f) Inrush current</p>
10.0	Inverter Output Regulation	<p>: a) Voltage- 240V ± 1%</p> <p>b) Frequency- ± 0.5%</p> <p>c) Power factor of load - 0.8</p> <p>d) Transient voltage regulation (on application /removal of 100%load) – better than ± 20 %.</p> <p>e) Recovery time from transient to normal – 50 msec.</p>
11.0	Harmonic	<p>: a) Sine wave output</p> <p>b) Total harmonic content- 5% (maximum)</p> <p>c) Content of single harmonic- 3% (maximum)</p>
12.0	Efficiency	<p>: a) 100% Full load- 85%</p> <p>b) 50% load-80%</p>
13.0	Synchronization limit	<p>: Between inverter & standby AC source shall be within 47 Hz to 53 Hz field adjustable.</p> <p>Inverter shall remain synchronized with the AC mains.</p>
14.0	Inverter protection	<p>: Overload, short circuit and 100% loss of load.</p>
15.0	Load sharing	<p>: 50% by each inverter in normal parallel operation. In case of failure of either inverter, 100% load shall automatically transfer to other inverter without any degradation of the UPS power quality.</p> <p>Power shall be transferred to the standby AC power without a break in synchronization if within limit in case of failure of both inverters.</p> <p>Asynchronous transfer to standby AC source in case inverters are being out of synchronism limit with AC mains.</p>
16.0	Static switch	<p>: Transfer UPS load to standby AC power in case of failure of both inverters.</p> <p>Transfer UPS load to standby AC power in case of failure of a inverter.</p>
17.0	Voltage stabilizer & Transformer	<p>: Solid state with regulation ± 1 % with efficiency greater than 95%.</p> <p>Overload capacity of transformer / stabilizer shall not be less than 300% of steady state for 200 msec.</p>
18.0	Diagnostic alarms	<p>: On panel & potential free contacts for interface to PLC</p>
19.0	Spare feeders	<p>: 25%</p>
20.0	Accessories	<p>: Power distribution board, Voltage & current meters, power factor meter, KVA, frequency, panel alarms, switches etc.</p>

4.0 APPROVAL

The Detailed Design Report submitted by the contractor to WBPDCCL must contain but not limited to the following details of the data acquisition and monitoring system:



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UPS WITH Ni-Cd BATTERY BANK

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- Detailed scheme
- Details of panels, metering system
- Necessary drawings for the scheme etc.

Drawings and scheme shall be submitted by the bidder for approval of BHEL/WBPDCL.



PURCHASE SPECIFICATION

LT SWITCHGEAR

PS-439-LT SWITCHGEAR

REV NO: 00

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1.0 Introduction

This technical specification provides BHEL requirements for LT Switchgear system for the solar photovoltaic project.

2.0 Scope of supply

Sl. No	Item Description	Qty
1	LT Switchgear	1 No

3.0 Technical specification

The scope of work under this specification covers the design, manufacture, assembly, testing at manufacturer's works, transportation, transit insurance, delivery at site, storage, installation, testing, and commissioning of indoor type following 415V LT Switchgear complete with all accessories and spares.

The Scope shall include supply of 415 V (3 phase, 1 neutral and single phase for lighting etc.) power distribution line for the entire area from the LT switchgear with necessary breaker, switch fuse unit as and when required, Boards as above along with gland plates for all power and control cables, base frames, special tools i.e. operating handles, trolley necessary for removing the circuit breakers for maintenance etc. Isolators should be provided in the line to connect or isolate the connection from both the station auxiliary transformer.

The scope shall include all associated devices, components, relays, contactors, switches etc. required for satisfactory operation of the switch boards as per the proposed logic control scheme. The scope of supply shall also include necessary spares required for operation & maintenance of switchgear equipments for a period of 5 (five) years & special tools & plants required for erection & maintenance. Corresponding parts of all the equipments & spares shall be of the same material & dimensions, workmanship & finish and shall be interchangeable. All the material & workmanship shall be of suitable commercial quality as have proven successful in their respective uses in similar services & under similar condition.

The switchgear to be designed in such way that it should capable to accommodate auxiliary load of another three equivalent 5MW solar power plants. Necessary equivalent space provision shall be kept physically for future extension of bus on both side of the switchgear

3.1 STANDARDS

The equipments covered under this chapter shall comply with the requirement of latest edition of following IS/BS/IEC specifications as amended up to date except where specified otherwise.

Sl. No.	Standards	Description
1	IS: 13947 (Part 1 to 5)	Specification for Low-Voltage Switchgear and Control gear.
2	IS: 10118 (Part 1 to 4)	Code of practice for selection, installation and maintenance of switchgear & control gear.
3	IS: 1248	Specifications for Electrical Indicating Instruments
4	IS: 2633	Hot dip Galvanizing
5	IS: 2705	Current Transformers
6	IS: 3156	Voltage Transformers
7	IS: 3231	Electrical Relays for Power System Protection
8	IS: 5082	Wrought Aluminium and Aluminium Alloy bars, tubes and sections for electrical purposes.
9	IS: 8623	General requirement for factory built assemblies up to 1000V.
10	IS: 8828	Circuit breakers for over current protection for household and similar installations



PURCHASE SPECIFICATION

LT SWITCHGEAR

PS-439-LT SWITCHGEAR

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11	IS: 13703	Low Voltage fuses for voltages not exceeding 1000V AC
12	IS: 11353	Guide for uniform system of marking and identification of conductors and apparatus terminals.

Equipment meeting any other authoritative national or international standards that ensure equal or better quality than the standards mentioned above are also acceptable. Where the equipment conforms to any other standards than those mentioned above, salient points of difference between the standards adopted and standards mentioned above shall be brought out in the tender.

The electrical installation shall meet the requirement of Indian Electricity rules and other statutory regulations as amended up to date and relevant BIS code of practice.

3.2 TECHNICAL REQUIREMENTS

- Main Incoming A.C. circuits on Station service Board shall be controlled through microprocessor based numerical relay with draw out type Air Circuit Breaker. Type and capacity of the breakers shall be proposed by the bidders in their bid considering the total auxiliary load of the plant.
- The LT switchgears shall be suitable for indoor installation in the control room.
- LT switchgears shall be placed in control room. LT switchgear at main control room shall be connected with Station Auxiliary Transformer 1. There shall be provision to connect another auxiliary transformer power with castle key arrangement to select one of them without removing the connected cables.
- The Station Service Board shall be sectionalized in two parts through sectionalizing breakers of equivalent capacity and protection of incomers on the bus to ensure continuity of supply to the auxiliaries in case of failure/fault on one section.
- For interconnection with various boards and all outgoing feeder circuits, 50 kA, 3 pole draw-out type MCCBs with adjustable current setting shall be provided.
- The Air Circuit Breakers, Boards etc. shall have at least the following ratings:
 - No. of phases : Three
 - Rated voltage : 1.1 kV
 - Service voltage : 415 V \pm 10%
 - Frequency : 50 Hz. \pm 5%
 - Rated short time current rating : 50 kA for 1 sec. for bus & switchgear
 - Normal control voltage : 220V DC
 - Degree of Protection : IP 42 or higher
- The following equipments at LT switchgear shall be monitored from SCADA/OWS PLC/.
 - 1) Circuit breaker - On/Off status & Control, test, service, spring charged, TCS healthy, 86 operated, DC fail etc.
 - 2) Auxiliary Transformer - Winding temperature Alarm status



PURCHASE SPECIFICATION

LT SWITCHGEAR

PS-439-LT SWITCHGEAR

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- 3) Energy meters
 - 4) Voltmeters-from transducer
 - 5) Ammeters-from transducer
 - 6) Numerical Relays should also be integrated with SCADA.
- The 415V switchboards shall be metal-enclosed draw out type, free standing, self-supporting, floor mounted, indoor type, totally enclosed and compartmentalized to house the switchgear. Circuit breakers and other switchgear components shall be arranged in compartments, vertically in a multi-tier formation. All metering and protection equipment associated with a particular circuit shall be housed in separate and independent compartment earmarked for particular circuit and in the fixed portion of the vertical panel in case of breaker panels.
 - Construction of all the switchboards and equipments shall conform to the latest edition of relevant IS codes.
 - All cable glands and aluminum crimping type cable lugs for all power and control cables shall be in the bidder's scope of supply. Panels shall be suitable for bottom entry of cable unless otherwise specified.
 - The bidder shall indicate clearly the de-rating factors, if any, employed for each component and furnish the basis for arriving at these de-rating factors duly considering the specified current ratings, ambient temperature etc.
 - The equipment shall comply with all safety requirements during erection and operation as per relevant standards.
 - The neutral of the incoming transformer secondary shall be connected to the neutral bus of the auxiliary boards. The neutral shall be connected to the common earthing system of the switchyard/control room.
 - All auxiliary devices for control, indication, measurement and protection such as push buttons, control and selector switches, indicating lamps, Power monitors, kWh meters and protective relays shall be mounted on the front side of the respective compartment. The design shall be such that unless required for maintenance / inspection purposes, all power ON/OFF or START / STOP and relay reset operations shall be performed without opening the panel door.
 - The switchboard panels shall be provided with thermostatically controlled space heaters to prevent moisture condensation.
 - Tube light / CFL / LED lamp fittings along with necessary isolating switches shall be provided for illumination inside the panels. Each panel shall be provided with an industrial grade power socket as well.
 - The 415V bus shall be of suitable cross-section so as to be able to carry the required continuous and short circuit currents within the limits of temperature rise for the site conditions.
 - Control and selector switches shall be rotary type with escutcheon plates clearly marked to show the function and positions. The switches shall be of sturdy construction suitable for mounting on panel front.
 - AC Distribution Board is to be provided in the main switchgear room.



PURCHASE SPECIFICATION

LT SWITCHGEAR

PS-439-LT SWITCHGEAR

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- Instrument transformers shall be provided and shall conform to the relevant standard.
- The relay for the switchgear units shall have all the features as specified somewhere else of the Technical Specification.
- All relays shown in the drawing and others required for operation of the system as per the specification shall be included in the scope of supply. The relays shall be of electromagnetic/ static/numerical type/ microprocessor based conforming to the requirements of IS: 8686 or IEC: 255.
- All instruments and meters shall be suitable for operation under the climatic conditions prevailing at site. The instrument cases shall be dust-proof, water tight, vermin proof, specially constructed to adequately protect the instruments against damage or deterioration due to high ambient temperature and humidity.
- The VA burden of instrument coils/elements shall be as low as possible, consistent with the best modern design.
- Watt hour meter shall be suitable for 3-Phase, 4-wire unbalanced system and shall comply generally with the requirements of relevant IS code and shall be of first grade for the purpose of accuracy classification. Watt hour meters shall be provided in each LT switchgears as well as each 33 kV switchgears.
- Panels shall be supplied completely wired internally to equipment and terminal blocks for connection to external cables entering the panel from the bottom. Terminal blocks shall be complete and provided with necessary terminal accessories for cable ends.
- Engraved PVC labels shall be provided on incoming and all outgoing breaker compartments, the exact details of legend to be engraved shall be furnished later to the contractor.
- All vertical cubicles shall be connected to earth bus bar running throughout the length of the switchboard. All doors and movable parts shall be connected to the earth-bus with flexible copper connections. Provision shall be made to connect the earthing bus bar to the main earthing grid at two ends. All non-current carrying metallic parts of the mounted equipment shall be earthed. Earthing bolts shall be provided to ground cable armours.
- Finishing work like painting etc. for switchgears should be as per relevant IS.

3.3 APPROVAL

The Detailed Design Report submitted by the bidder to BHEL/WBPDCL must contain but not limited to the following details of the LT Switchgear:

- Detailed specification of all the items.
- All necessary drawings
- All necessary test certificates and approvals etc.

Prior to the delivery of the product, the contractor shall submit but not limited to the following documents:

- Guarantees
- Instructions for installation and operation, manual



PURCHASE SPECIFICATION

LT SWITCHGEAR

PS-439-LT SWITCHGEAR

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- Electrical diagrams
- Safety precautions
- Detailed schematics of all power instrumentation and control equipment and subsystems along with their interconnection diagrams. Schematics shall indicate wiring diagrams, their numbers and quantities, type and ratings of all components and subsystems etc

The contractor can deliver the product to the site only after receiving such approval from BHEL/WBPDCL.



PURCHASE SPECIFICATION

OUTDOOR 33KV SWITCHYARD

PS-439-SWITCHYARD

REV NO: 00

PAGE : 1 OF 6

1.0 Introduction

This technical specification provides BHEL requirements for outdoor 33KV switchyard for the solar photovoltaic project.

2.0 Scope of supply

Sl. No	Item Description	Qty
1	Outdoor 33KV switchyard	1 Set

3.0 Technical specification

This specification covers the design, manufacture, testing at manufacturer's works before dispatch, supply, delivery at site, transit insurance, storage at site, erection, testing & commissioning of 36KV, 3 phase, 50 Hz SF6 type circuit breaker at switchyard for Power Evacuation of 5 MW Solar PV Power Plant in SgTPP, Sagardighi, Murshidabad, West Bengal.

The location of the outdoor switchyard shall be in the 33kV Solar Switchyard present in the Monigram substation of WBPDC. The following equipments to be envisaged for power evacuation of the solar plant.

i. Breaker-1(one)No:

33kV CB shall be of Sulphur Hexafluoride (SF6) type with motor mound spring charged mechanism. Breaker should be either gang or independent pole mounted. 33kV Breaker should be rated 36kV, 1250Amp. 25KA symmetrical interrupting with 3-cycle maximum tripping time and short time rating for 3 seconds.

ii. Disconnecter-2(two)Nos with earth switch

The rating of the disconnecter switch shall match with the corresponding breaker ratings. It shall be of centre rotating type with AC motor operated mechanism and manually operated earth switch

iii. Current & Potential transformer- 1(one) no each phase

The current and potential transformers shall be suitable for the fault MVA and BIL which is 170KV (peak). These shall be hermetically sealed, oil immersed type meant for separate mounting. Short time ratings of 33kV CT PT shall be 1 second. Electromagnetic dead tank type of CT shall be used in 33kV Switchyard.

iv. Lighting arrester-1(one)no or as per SLD

Gapless type of lighting arrester (Zno) with counter shall be used for 33kV system. LA should be heavy duty station class type.

v. Equipment inside control room:

A small local Control Room (Construction is in BHEL scope, if required) for Control Rely panel with DC System for Control, indication and protection and testing, metering shall be considered. Size of the control room will be as per the recommendations of OEM of supplier of Control Rely Panel and DC system with Battery.



PURCHASE SPECIFICATION

OUTDOOR 33KV SWITCHYARD

PS-439-SWITCHYARD

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vi. 3 phase whole current Export Import Energy Meter:

The Meter to be supplied must be tested. The export Import Energy meter shall be installed at the within the **Grid Interfacing Panel**. This Export- Import meter shall be installed to measure the total energy to be imported and exported from the PV power Plant. The meter shall be installed at the Control and Relay panel of the of outdoor 33kV breaker i.e. before the evacuation point. Please refer overall plant SLD for more details.

vii. All civil works for 33KV switchyard:

Bidder shall carry out all civil related works for installation of outdoor switchyard equipments at designated point. Fencing, gate and jelly spreading as per standards also in bidder scope.

viii. Chemical Earthing:

Sufficient number of chemical earthing electrodes for outdoor switchyard shall be in the scope of bidder.

ix. DC system with battery bank:

Bidder has to supply and install DC system with battery bank to backup the equipments at 33KV outdoor switchyard and Control Relay Panel.

4.0 OTHER REQUIREMENTS:

- i. 33kV buried cable from 5WM floating solar indoor switchgear shall be come above in a pole structure.
- ii. From the pole isolator 33kv outdoor switchyard bay shall be constructed.
- iii. All switchyard structure should be lattice mild steel structure hot dip galvanized.
- iv. All the buses should be adequately sized for fault and continuous current requirement.
- v. For 33kv bus, suitably supported single "Moose" conductor will be used in each phase.
- vi. The bus bar fittings, connectors etc will be of suitable aluminium alloy having desired mechanical strength and electrical properties.
- vii. The bidder shall be fully responsible for carrying out all co ordination and liaison work with electrical inspectors and other statutory bodies for implementation of the work, if required.
- viii. The relay for the switchgear units shall have all the features as specified under **Cl. no. 5.13.11** of, Sec-V of the Technical Specification.
- ix. The scopes which are mentioned above are only for indicative purpose only. The contractor to supply all equipments which are also required for successful completion of the work.



PURCHASE SPECIFICATION

OUTDOOR 33KV SWITCHYARD

PS-439-SWITCHYARD

REV NO: 00

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5.0 RELAYS

I. General- A

- a) All relays & timers in the protection circuit shall be flush mounted with connection from inside. They shall have transparent, dust tight covers, removable from the front. They shall have built-in testing facilities. Except small auxiliary relays and timers all relays shall be draw out type.
- b) Relays shall be rated for operation on 1A / 5A secondary current and 110V secondary voltage to be decided by the bidder. Number and rating of relay contacts shall suit the job requirements.
- c) The Bidder shall furnish, install & co-ordinate all relays to suit the requirements of protection, interlock. Application check shall be made on all protection relay. The result of such check shall be furnished for approval.
- d) It shall be the responsibility of the Bidder to fully co-ordinate the overload and short circuit tripping of the circuit breakers with the upstream and downstream circuit breakers to provide satisfactory discrimination.
- e) All setting devices shall be accessible after removing the front cover. No relay shall be mounted on the rear side of PCC / PMCC panel.
- f) All relay coils and their auxiliary contacts (including un-enabled relays in Composite Numerical Relays, if any), including spare contacts will be wired up to the terminal blocks of respective panels for wiring to remote panel / PLC and for future use.
- g) Parameterization and loading and downloading of data shall be possible from local HMI as well as from remote panel / PLC.
- h) All numerical relays shall have front communication port for parameterization, loading and downloading of data through Laptop.

II. General- B

- a) All protective relays shall be of numerical microprocessor based multifunctional type having communication facility.
- b) All relays shall conform to the requirements of IS: 3231 / IEC: 60255 standards. The Numerical relays shall have communication, Metering and monitoring facility.
- c) Bidder shall ensure availability of spare parts and maintenance support for the equipment for at least 15 years from the date of supply.
- d) Separate Master trip Lockout Relay shall be provided for SF6 operated HT system.
- e) Any foreign relay manufacturer through his Indian partner or subsidiary company in India shall provide application, testing, commissioning and other necessary support for minimum 15 years. They shall also maintain adequate inventory of each type of relay or spares to meet the requirement arising during project execution and plant operation.



PURCHASE SPECIFICATION

OUTDOOR 33KV SWITCHYARD

PS-439-SWITCHYARD

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III. Technical Requirement

a) Auxiliary Power Supply

Unless otherwise specified, relay shall be suitable to accept both AC / DC supplies with range 110V to 240V with tolerance of $\pm 20\%$. The auxiliary power supply shall preferably be site selectable requiring no additional hardware.

b) Basic Requirement and Constructional Requirement

i. Relays shall be suitable for flush mounting on the front with connections from the rear. The enclosure shall be dust tight having degree of protection minimum as IP: 52.

ii. Relay shall have draw out feature with plug in type PCB for easy replacement. In case of fixed type relay, the terminals shall be easily accessible for testing and commissioning.

iii. Relay shall have self-diagnostic feature with indication of relay failure on relay front. However, while diagnostic circuit runs, it must not interfere in the main protective relay circuit and allow working of main protective circuit continuously. Relay faults (self-diagnostic) shall be communicated and annunciated to HMI.

iv. Design of the relay shall be such that it must operate selectively and with proper discrimination. It must be immune to any kind of electromagnetic interference. Bidder to submit all related type test reports for the offered model along with the offer.

v. Necessary auxiliary relays, timers, trip relays, etc. required for complete scheme, interlocking, alarm, logging, etc. shall be provided. No control relay, which shall trip the circuit breaker when relay is de-energized, shall be employed in the circuits.

vi. Numerical Relays shall have appropriate setting ranges, accuracy, resetting ratio, transient overreach and other characteristics to provide required sensitivity to the satisfaction of the Owner.

vii. The internal clock of the system shall be synchronized through the GPS Time Synchronizing System.

c) Display & Indication

i. All numerical relays shall have keypad / keys to allow relay settings from relay front. In addition, relay shall have front port for downloading / uploading of relay settings from the PC / Laptop. All hand-reset relays shall have reset button on the relay front. Relay to be self or hand reset shall be software selectable.

ii. All relays shall have LED / LCD display for settings, status, faults and events. LCD display shall be backlit and temperature compensated up to 65°C for contrast and legibility.

iii. As a minimum, the relay shall have LED indicating lamps for fault trip, relay healthy / unhealthy and control supply on.

iv. The relay shall have at least 6 programmable LEDs on relay front.



PURCHASE SPECIFICATION

OUTDOOR 33KV SWITCHYARD

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d) Software Security

Relay shall be provided with password protection against unauthorized write access. However, viewing of metering data, settings, and status and event data as read only parameters should be without password protection. All software shall be user friendly and latest up to date version.

e) Disturbance, Event Recording & Data Storage

Status, disturbance data and events shall be stored in non-volatile memory or memory backed up by battery. It should be possible to store minimum 50 events with date and time stamp, last 5 fault records and last disturbance record. When auxiliary power fails, it should be possible to see the latest state of display when power is restored. Also, in case of power supply failure lock out status of the relay should be stored and kept in memory to allow the working of interlock logic properly on restoration of the supply.

f) Trip Circuit Supervision & Lock out function

i. Relay shall have built in lockout function. Lock out feature shall be self reset or hand reset and shall be software selectable.

ii. Relay shall have built in trip circuit supervision function.

g) Input / Output Interface, Filters and Galvanic Isolation

h) Relay shall have at least 4 NO contacts each shall separately be programmable for either hand reset or self-reset. The contact rating shall be minimum 5A at 250V AC / DC.

i. Relay shall be made immune to capacitance effect due to long length cables.

ii. All IOs shall have galvanic isolation. Analog inputs shall be protected against switching surges, harmonics etc.

i) Serial Communication


i. Relay shall have RS485 or FO (Fiber Optic) port for serial communication.

ii. All relays should be able to communicate with remote panel / PLC system. Data shall be available at the remote panel / PLC on request.

iii. Protocol adapted for communication to remote panel / PLC should facilitate easy interface with worldwide used open protocol like Modbus or IEC 103 protocols.

iv. It shall be also possible for Relay Parameterization as well Downloading of Disturbance Records from PC/ Laptop provided in Unit & Engineering Workstations located in Control Room of PWS. Necessary user friendly and latest software to be provided for this purpose. Communication protocol shall be selected from relay to PC to provide all information.

v. One (1) set of Laptop, loaded with common support software and which will allow easy settings of relays in addition to uploading of event, fault, disturbance records and measurement from relay front communication port. The Switchgear supplier shall furnish CD"s for the above relay parameterization as well as download of disturbance recorder for all relays of his supplied switchgear. Accessories like table/chair/desk/power socket etc. as required for all PC/Laptop should be supplied.

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6.0 Approval

Before starting manufacturing any equipment, the bidder shall have to take approval of relevant drawings and data from BHEL/WBPDCL.



PURCHASE SPECIFICATION

CCTV

PS-439-CCTV

REV NO: 00

PAGE: 1 OF 2

1.0 Introduction

This technical specification provides BHEL requirements for CCTV system for the solar photovoltaic project.

2.0 Scope of supply

Sl. No	Item Description	Qty
1	CCTV System with min 10 cameras	1 Set

3.0 Technical specification

- PTZ (Pan-Tilt-Zoom)/CCTV outdoor/indoor cameras covering the whole plant (nos of cameras requirement shall be as per design for well coverage of the plant) and total Control Room to be deployed with night vision and central monitoring through 42" LED monitor/TV at control room. CCTV system shall be powered from UPS ACDB.

Requirement of camera to be decided for full coverage of the plant however **minimum ten(10) nos. of camera** to be installed.

The outdoor Cameras covering Floating Solar PV array shall be suitable and safely mounted on steel painted poles with necessary civil works embedment on the pond embankment at required spots. Intercamera cabling shall be carried out through armoured Signal/Data cables laid along the embankment surface or floating platform with clamping arrangement and suitably marked for identification.

Technical Specification	
1/3 -inch, CCD / CMOS sensor IP Box/Bullet outdoor type HD 1080p True Day/Night Switching IP Camera UL listed with VF lens 3.3 to 12 mm, two way audio and audio alarm, WDR 65db or more, IP, Onvif profile	
Video compression	Two Simultaneous individual configurable H.264 Stream at 1080p 30fps.
Camera Must support 2 Regions of interest and Remote E-PTZ, Motion, tamper and audio detection.	
Image format	
Active Pixels	1920 x 1080 with aspect ratio 16: 9
Video Resolution (H x V)	1080p, 720p,
Sensitivity	Min. 0.3 lx, 0.0 lx (IR active)
Shutter	Automatic Electronic Shutter (AES) Fixed (1/30 [1/25] to 1/10000 or better
Lens	Varifocal 3.3 to 12 mm, DC Iris
Wide Dynamic Range	65db or more
Audio Communication	Two-way, full duplex
IR LED /Illuminator	LED high efficiency array, 850 nm
Night Vision distance	25m



PURCHASE SPECIFICATION

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Protocols	IPv4/ IPv6, UDP, TCP, HTTP, TTPS, RTP/RTCP, IGMP V2/V3, ICMP.
Ethernet	10/100 Base-T, auto-sensing, half/full duplex, RJ45
Connectivity-Onvif profile,	auto-MDIX
Operating Temperature	-10°C to +55°C with housing
Ingress and impact	Protection IP66
True Day/Night	Auto, Color Monochrome
Certifications	CE, FCC and UL
Video Management System Software (VMSS)	The Windows based video management system (VMS) specified shall be client/server based IP video security solution that provides seamless management of digital video and data across an IP network. System is designed to work with own CCTV cameras and Onvif profile compliant 3rd party products.
Display System	42" LED HD (1920 x 1080)
Data Storage Server	<ul style="list-style-type: none">i. Data Base Server – Designed as per system requirement for smooth operationii. OS - Windows Storage Server latest available,iii. Colour Monitor - 21" Flat Panel LED Monitoriv. RAM - 4GB DDR2, 667MHz SDRAM(minimum)v. Memory - 2 TB HDD(minimum)vi. Graphic Card - Integrated Intel Graphics Media Accelerator X3100vii. Two(2) PCI-X and Two(2) PCI-Express Expansion Slotsviii. 2/4 USB, 2 serial, and 2 VGA Adaptor,ix. CD/DVD ROM.; USB Keyboard and Mousex. Dual Channel Internal Ultra320 SCSIxi. Integrated RAID-I with hot-sparexii. Dual Integrated 10/100/1000 Ethernet NICxiii. I/O Expansion Optionxiv. Should be with Antivirus and Firewall complete in all respects as per specifications as required.



PURCHASE SPECIFICATION

EARTHING SYSTEM

PS-439-EARHING

REV NO: 00

PAGE : 1 OF 2

1.0 Introduction

This technical specification provides BHEL requirements for supply of plant earthing system for the solar photovoltaic project.

2.0 Scope of supply

Sl. No	Item Description	Qty
1	Supply of copper bonded MS Chemical Earth Electrode with earth enhancing compound as per clause 4.1	50 Set

3.0 Documents to be submitted along with offer

1. BHEL specification duly signed and sealed by vendor on each page
2. GA/GTP of each type chemical earthing electrodes offered
3. Type test certificates for chemical earth electrodes
4. Installation manual for chemical earth electrodes

4.0 Technical specification of plant earthing system

The vendor shall supply following type of chemical earth electrodes as per relevant Indian standards. The top terminals of all the electrodes shall have provision for connection to GI/ Cu strips using bolts and nuts. The size of holes shall be decided during detailed engg after placement of PO.

1. Supply of copper bonded MS rod Chemical Earth Electrode with earth enhancing compound

4.1 Copper bonded MS rod Chemical Earthing Electrode with earth enhancing compound

The copper bonded MS rod chemical electrode shall be supplied with suitable earth enhancing compound. The chemical electrode shall be of non-corrosive min 17 mm dia rod with 3m length. Minimum copper coating shall be 250 microns.

Earth enhancement material shall be type tested from NABL accredited lab. Earth enhancement material shall be superior conductive material so that it improves earthing effectiveness, especially in areas of poor conductivity (rocky ground, areas of moisture variation, sandy soils etc.).


The quantity of earth enhancing material required per earth electrode shall be indicated. In general, minimum 50Kg earth enhancing compound shall be supplied for each electrodes or as per OEM recommendation.

5.0 Documents to be submitted within 7 days after receipt of purchase order

1. Technical particulars of each type of chemical earth electrode
2. Installation manual for each type of chemical earth electrodes

6.0 Documents to be submitted along with consignment

1. Earth electrode installation manual

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2. Manufacturer test report for earth electrodes

7.0 Warranty

Vendor shall provide warranty for 12 months from the date of commissioning or 18 months from the date of supply, whichever is earlier.



PURCHASE SPECIFICATION

ESE LIGHTNING ARRESTOR SYSTEM

PS-439-ESE LA

REV NO: 00

PAGE : 1 OF 3

1.0 Introduction

This technical specification provides BHEL requirements for supply of ESE Lightning protection system for the solar photovoltaic project.

2.0 Scope of supply

Sl. No	Item Description	Qty
A	Supply of Lightning arrestor protection system	
a	Supply of ESE lightning arrestor terminal as per clause A 1.0	6 sets
b	Supply of 7m LA mounting pole & accessories for array as per clause A 2.0	5 sets
c	Supply of 3m LA mounting pole & accessories for control room as per clause A 2.0	1 set
d	Supply of Down Conductor as per clause A 3.0	6 sets
e	Supply of Lightning Event Counter as per clause A 4.0	6 sets
f	Supply of earthing set for LA as per clause A 5.0	6 sets
B	Installation of ESE lightning arrestor as per clause A 6.0 Note : 1 AU = Installation of 1 set of LA along with all accessories	6 AU

3.0 Documents to be submitted along with offer

1. BHEL specification duly signed and sealed by vendor on each page
2. Product catalogue of ESE-LA
3. Type test certificates for ESE-LA terminal with test reports complying to NF C 17 102(2011)
4. General arrangement and detailed drawings with bill of materials of the overall LA arrangement
5. Lightning arrestor protection coverage area calculations
6. Civil foundation pedestal drawing for lightning mast
7. Installation manual for ESE-LA

A) Supply and Installation of Lightning arrestor protection system

The vendor shall supply and install lightning protection system to protect the solar array (mounted 2m above ground level) and control rooms and inverter room buildings using ESE-type Lightning arrestors complying to NF C 17 102 (2011) standard. Vendor shall provide the lightning radius coverage with supporting calculations.

The complete lightning protection system will comprise the following key components:

1. ESE type Lightning Air Terminal
2. Mounting support Mast with guy kit and mast mounting accessories
3. Down conductor
4. Lightning Event Counter
5. Dedicated earthing system

1.0 ESE type Lightning Air Terminal

1.1 The lightning air terminal shall be an Early Streamer Emission type terminal which will respond dynamically upon downward leader activity in the near area.

1.2 The external shape of the advanced lightning rod shall be such that it will limit the development of sharp point corona discharge under static thunderstorm conditions and enhance leader initiation.



PURCHASE SPECIFICATION

ESE LIGHTNING ARRESTOR SYSTEM

PS-439-ESE LA

REV NO: 00

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1.3 The lightning air terminal shall have no moving parts and will have no dependence on an external power supply or batteries.

1.4 All components of the advanced lightning terminal shall be non-corroding.

1.5 The lightning air terminal should have been tested and certified in accordance with NF C 17-102:2011.

1.6 The radius of coverage of LA shall be as per protection Level 4 (minimum 107m protection radius).

1.6 Triggering gap shall be selected so that streamers are not launched until the electric field conditions are at an optimum magnitude for conversion to a stable, propagating upward leader.

2.0 LA mounting pole/ mast for Lightning Air Terminal

The mounting pole/ mast shall be used to support the lightning air terminal. It shall be either an insulating fibreglass tube or aluminium/ steel material.

Lightning protection system shall protect the solar array modules which are mounted at 2m height above ground level. The lightning pole height shall be minimum 7 m from ground level for PV array and minimum 10 m for control room and inverter room buildings.

Suitable provision for running the down conductors through the centre of the pole shall be provided.

The mounting pole shall be supported with minimum 3 set of Guy wires with suitable guy ring, clamps and hardware. The guy wire kit shall be supplied by vendor.

Mast shall have appropriate base plate for mounting on floating platform/RCC control room.

3.0 Down Conductor

Each lightning air terminal shall be connected to earth using down conductor.

The down conductors shall have a minimum size of 50 mm² each and shall be insulated round stranded copper conductor cable of reputed make. The down conductors shall be fixed securely every one metre along the length of mast wherever exposed.


The down conductors shall allow for direct connection to the lightning rod and to the earth electrode through the use of compression lug. The ESE lightning terminal shall have provision for the lug connection. Suitable lugs and hardware shall be supplied along with the down conductor.

4.0 Lightning Event Counter

Each ESE type lightning arrester shall be provided with individual lightning event counter to record lightning events arrested by particular ESE LA.

Lightning counters shall have IP65 or better rating enclosure and shall have provision for fixing of lightning mast pole using clamp, bolts and nuts.

Lightning counter shall have suitable lightning current withstand capacity according to the ESE LA rating. Test links shall be supplied along with each Lightning event counter to enable testing of LA and

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	ESE LIGHTNING ARRESTOR SYSTEM	REV NO: 00
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counter.

5.0 Earthing set for ESE LA

The earthing system shall incorporate minimum two dedicated chemical earth electrode for each ESE LA. The electrode shall be deep driven solid copper, copper bonded steel rod. Earth resistance enhancing compound shall be used in order to reduce the resistivity levels of the earthing system.

All components of the earthing system shall be electrically connected to the central injection rod which is securely connected to the lower end of the high voltage shielded cable. The earthing system shall be installed so that the enhanced earth resistance reading does not exceed 5 Ohms. The average soil resistivity at site is 10 ohm-m.

6.0 Installation of ESE LA

All the ESE type Lightning arresters for PV array, Control room and inverter rooms shall be installed on ground. Vendor shall construct the suitable RCC foundations and install the LA mast along with guy wires, down conductor, lightning event counters and test link. The earth pit installation and interconnection with associated LA is also in vendor scope.

B) Documents to be submitted within 7 days after receipt of purchase order

1. General arrangement and detailed drawings with bill of materials of the overall lightning arrester arrangement
2. Lightning arrester protection coverage area calculations
3. Civil foundation pedestal drawing for lightning mast
4. Installation manual for LA-ESE and earthing

C) Documents to be submitted along with consignment

1. ESE LA installation manual with GA drawings
2. Manufacturer test report for each LA

D) Warranty

Vendor shall provide warranty for 12 months from the date of commissioning or 18 months from the date of supply, whichever is earlier.



PURCHASE SPECIFICATION

ILLUMINATION SYSTEM

PS-439-ILLUMINATION

REV NO: 00

PAGE : 1 OF 2

1.0 Introduction

This technical specification provides BHEL requirements for illumination system for the solar photovoltaic project.

2.0 Scope of supply

Sl. No	Item Description	Qty
1	Illumination system	1 set

3.0 Technical specification

Note: Illumination system required inside the control room excluding emergency lights shall be supplied and installed by BHEL. All other illumination requirement specified in this specification are in bidder scope.

The scope of work under this specification covers design, manufacture, assembly, shop testing, delivery, site erection, testing & commissioning of Illumination system comprising of main Illumination switchboards, distribution boards, sub distribution boards, switchboards, lighting fixtures, convenience and power outlets, conduits & fittings, cabling, outdoor lighting including mounting structures & poles, security cabin, watch tower, access road, across the embankment (maximum 15 m between two adjacent lamps).

The illumination system shall be designed as per relevant Indian Standard / Guideline for different location of the plant. The lighting arrangement should be LED Based.

The scope of supply shall also include necessary spares required for normal operation & maintenance of illumination equipment for a period of 5 (five) years & special tools & plants required for erection & maintenance. Corresponding parts of all the equipments & spares shall be of the same material & dimensions, workmanship & finish and shall be interchangeable.

5.13.20.2 STANDARDS

The material, equipment and its installation under the scope shall comply with all applicable provisions of the latest Indian standards and codes of practice. Some of the relevant standards are given below:

Sl. No.	Standards	Description
1	IS: 3646	Code of practice for interior Illumination (Part I, II, III)
2	IS: 6665	Code of Practice for Industrial Lighting
3	IS: 732	Code of Practice for Electrical wiring installations
4	IS: 9537	Conduits for Electric installations
5	IS: 2418	Tubular fluorescent lamps for general lighting service
6	EN 61347-2-13	Particular requirements for D.C. or A.C. supplied electronic control gear for LED modules
7	EN 62384	D.C. or A.C. supplied electronic control gear for LED modules
8	EN 61000-3-2	Electromagnetic compatibility (EMC). Limits for harmonic current emissions (Equipment input current < 16 A per phase)
9	EN 61000-3-3	Limitation of voltage fluctuation and flicker in low voltage supply systems for equipment with rated current <= 16 A

The installation shall generally be carried out in conformity with the requirements of Indian Electricity Act 1910 (latest Amendment) & Indian Electricity Rules.

5.13.20.3 REQUIREMENT



PURCHASE SPECIFICATION

ILLUMINATION SYSTEM

PS-439-ILLUMINATION

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The lighting system for outdoor and indoor areas of Solar Power Plant shall be designed in such a way that uniform illumination is achieved.

In outdoor yard equipment / bus bar areas and the peripheral wall are to be illuminated and luminaires shall be aimed for clear view.

5.13.20.4 LIGHTING LEVELS

The average LUX level to be maintained shall be as under:

SI No.	Area	LUX
1	PEB	150
2	Other areas including embankment	20
3	H – pole and metering point	20
4	Switchyard	100

5.13.20.5 EMERGENCY LIGHT POINTS

Light points using LED lamps at 220 V shall also be provided as per requirement of the following area:

- All emergency light shall be from 220 V DC Battery.
- Control room and equipment room, Battery room, Office, Corridor, Local Control Room or any other place where light is required for clear vision.
- These lights shall operate on AC/DC changeover supply from the DC distribution Board. Separate wiring and distribution board shall be provided from these lights.
- Battery room shall be corrosion proof type lamp and fixtures.

5.13.20.6 APPROVAL

The Detailed Design Report submitted by the bidder to BHEL/WBPDCL must contain but not limited to the following details of the illumination system:

- Detailed scheme and specification
- Illumination calculations for arriving at the number of lighting fixtures for different areas & rooms considering the required lux level as per relevant IS Code.
- Necessary drawings etc.

Drawings and scheme submitted by the bidder will be subjected to approval of BHEL/WBPDCL.

The contractor can deliver the product to the site only after receipt of approval from BHEL/WBPDCL.

Necessary civil work as required to construct / fixing the Kiosks (s) shall be done by the contractor. If any civil construction is required for installing the whole arrangement, as and where required, it will be within the cost of contract value.

5.13.28 TOOLS, TACKLES AND SPARES

The Installer shall keep ready stock of tools, tackles and essential spares that will be needed for the day-to-day maintenance of the solar PV system. This shall include but not be limited to the following:

- i. Screw driver suitable for the junction boxes and combiner boxes.
- ii. Screw driver and / or Allen key suitable for the connectors, power distribution blocks, Circuit breaker terminals and surge arrestor terminals.
- iii. Spanners / box spanners suitable for the removal of solar PV modules from the solar PV module support structure.
- iv. Solar panel mounting clamps.
- v. Cleaning tools for the cleaning of the solar PV modules.
- vi. Spare fuses.
- vii. Panel efficiency measurement tools
- viii. One 20HP flattered Boat

5.13.29 OTHER CONDITIONS

The work includes necessary excavation, concreting, flooring, platform, necessary finishing, painting, back filling, shoring & shuttering, cable laying, location of installation of different component of PV Power Plant etc. if any , required for completion of the project in all respect shall be as per direction of Engineer-in-Charge.

NOTE:

Any item/equipment not mentioned in the Technical Specification, but required for successful completion of the project shall be deemed to be a part of the scope of the work and the same shall be included by the bidder in their Billing Break Up (BBU).

D. APPROVED VENDOR LIST FOR BOIS:

Equipment	List of Vendor for various BOIs
SOLAR PANELS	Any Solar PV Manufacturer in India having

	MNRE Certification
INVERTERS	ABB/ HITACHI/SMA/ DELTA
TRANSFORMER	SUDHIR/VOLTAMP/CGL/BHEL/AREVA
POWER CABLES	KEI/ FINOLEX /POLYCAB
CONTROL CABLES	KEI / DELTON/ FINOLEX /POLYCAB
LT SWITCHGEAR	L&T / SIEMENS / SCHNEIDER/ABB
STEEL MEMBERS	TATA / VIZA STEEL/SAIL (GI coating done) or any equivalent ISI Mark
EARTHING/ LIGHTNING	CGL/ELPRO INT. LTD/OBLUM
WEATHER MONITORING STATION	KIPP & ZONNEN / EPPLEY / EKO INSTRUMENTS /SOLAR L /GREEN POWER Monitoring
POWER PANEL	L&T / SIEMENS / SCHNEIDER/GE POWER
JUNCTION BOX	L&T / PYROTECH / SCHNEIDER
ENERGY METER	SECURE METERS/IMP/BHEL/RISHABH(L&T)
SCADA System	ABB, GE, ROCKWELL



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Do not hesitate to contact us for more information:

EUROPE, AFRICA, MIDDLE EAST

Contact: **Antoine Scoliege**

Mail: ascaliege@cieletterre.net

Tel: **+33 (0)3 20 01 05 65**

THE AMERICAS

Contact: **Lucas Wojcik**

Mail: lwojcik@cieletterre.net

Tel: **+1 707 529-5890**

ASIA

Contact: **Ludovic Dehondt**

Mail: ldehondt@cieletterre.net

Tel: **+603 2726 9914**

JAPAN

Contact: **Hiroyuki Takehara**

Mail: htakehara@cieletterre.net

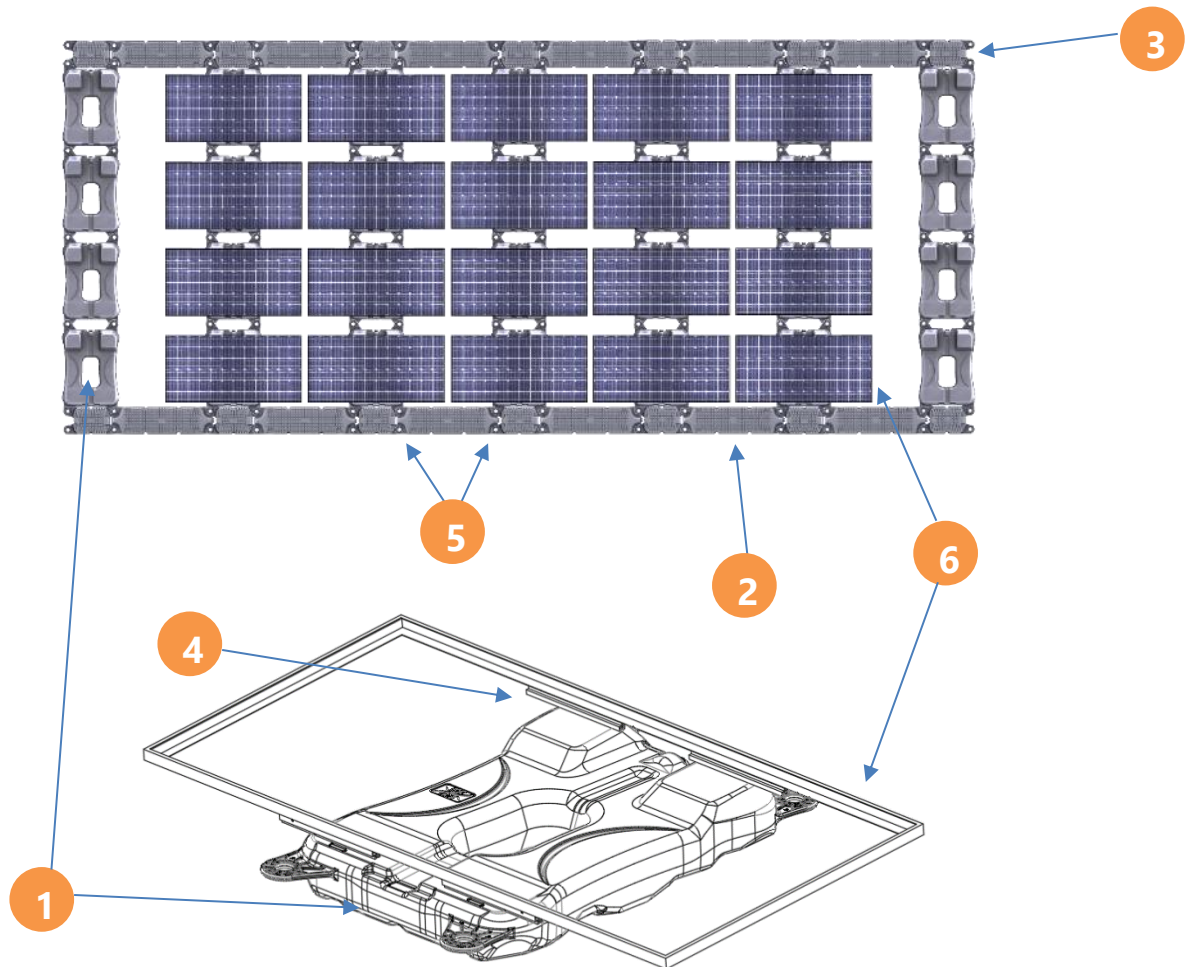
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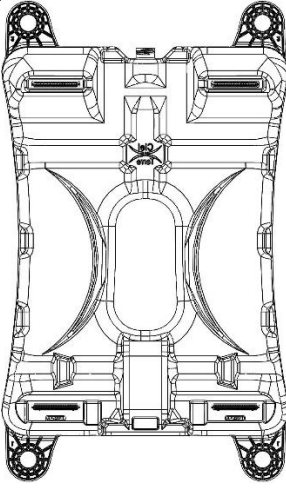
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A. HYDRELIO® DATASHEET



- | | |
|---|---|
| <p>1 Main float supporting the PV module
HDPE material
Inclination angle: 5°</p> | <p>4 Rail to attach the PV module to the float
Aluminium or fiberglass-reinforced PP plastic material
ISO 3302-1/1996 standard</p> |
| <p>2 Long Secondary float
HDPE material
Non-slipping surface</p> | <p>5 Connection pin
Fiberglass-reinforced PP plastic material
NFT 58 000 standard</p> |
| <p>3 Small Secondary float
HDPE material
Non-slipping surface</p> | <p>6 Standard framed 72-cell PV module
Length: max 1 975 mm (77.76 in)
Width: 991 ± 3 mm (39 ± 0.1 in)
Cable length: 1 200~1 300 mm (47~51 in)
Connector: Standard PV connectors</p> |

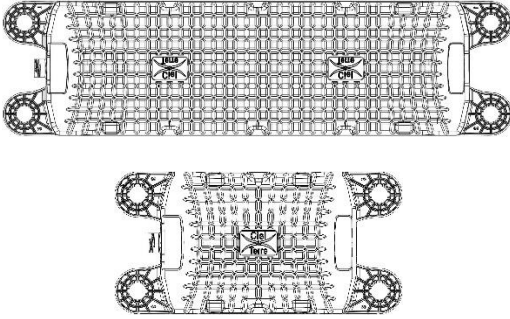
1. Main Float

	Raw material	High Density Polyethylene (HDPE), compliant with BS6920 water tests required in the UK, and containing UV stabilizer.
	Thickness	Average 3 mm (0.1")
	Weight	Average 7.50kg (15.5lbs)
	Dimensions	1410*840*252 (Overall max) 1132*840*241 (Blowed)
	Manufacturing process	Blow molding
	Function	<ul style="list-style-type: none"> Support the PV module Give an optimum 5° slope to the PV module

Additional information

The main floats are linked with the secondary floats thanks to the connection tabs where connection pins are inserted. A main float presents 4 "T" profiles to slide the fixing system onto. There is a vented cap (with 4 or 6 nocks) for each float which must be correctly locked before use on water.

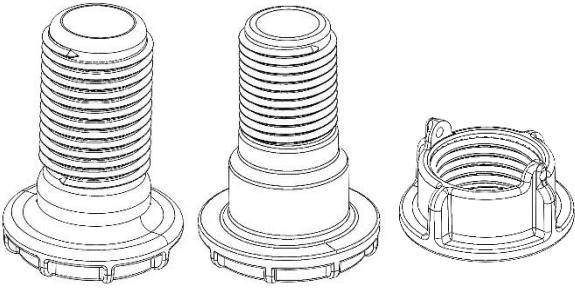
2. Secondary Floats (Small Secondary Float 'SSF' and Long Secondary Float 'LSF')

	Raw material	High Density Polyethylene (HDPE) compliant with BS6920 water tests required in the UK, and containing UV stabilizer.
	Thickness	Average 3 mm (0.1")
	Weight	SSF: average 2.85 kg (6.3 lbs) LSF 60 cells: average 4.20 kg (9.3 lbs) LSF 72 cells: average 5.50 kg (11 lbs)
	Dimensions	SSF: 400*813*150 LSF 60 cells: 400*1203*150 LSF 72 cells: 400*1528*150
	Manufacturing process	Blow molding
	Function	<ul style="list-style-type: none"> Ensure connection with the main and flat floats Limit the shading effect on the modules Create a maintenance walkway for the system

Additional information

The secondary floats are linked with the main and flat floats thanks to the connection tabs where connection pins are inserted. There is a cap (with 4 or 6 notches) for each float which must be correctly locked before use on water.

3. Connection Pins


 <p>Thin pin Large pin nut</p>	Raw material	Polypropylene reinforced with 40% fiberglass + UV stabilizer
	Weight (pin)	110 g (0.20 lbs) – Large pin 78 g (0.17 lbs) – Thin pin
	Weight (nut)	30 g (0.07 lbs)
	Manufacturing process	Injection
	Function	Ensure the connection between the secondary floats and main floats, through the connection tabs.

Additional information

The connection pins are inserted in the connection tabs, then the nuts are screwed tightly to secure the connection between the floats.

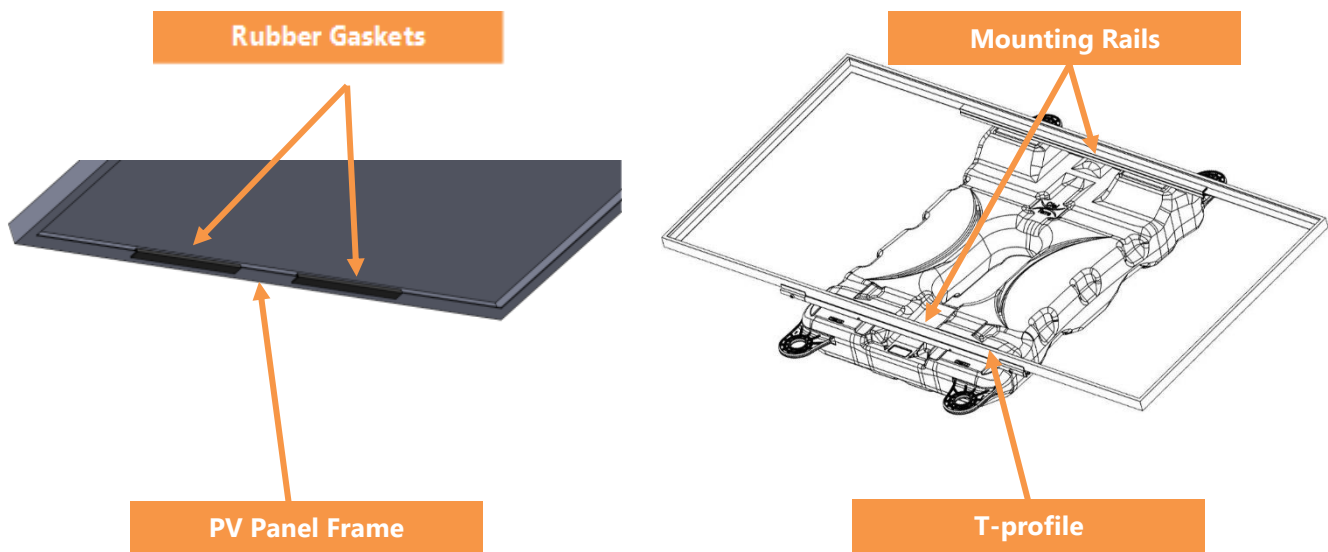
This connection pin is composed of 3 elements: the pin, the nut and a self-drilling screw (see below).

4. Self-Drilling Screw

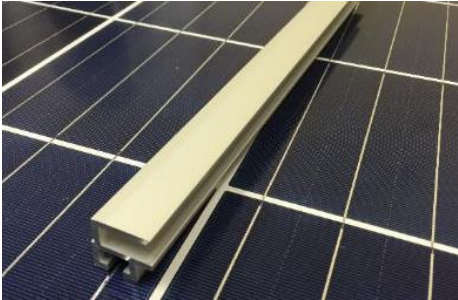
	Raw material	INOX A2/ SUS 304
	Dimension	Ø = 3.5 mm to 3.9 mm (1/8") L = 19 mm (3/4")
	Function	Block the connection pin in rotation, thus locking it.

5. Fixing System on the Upper Side


To ensure the fixation of the PV module on the upper part of the main float:



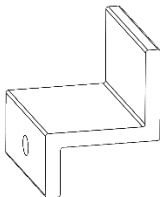
5.1. Top Mounting Rail

	Raw material	Aluminum 6060 or 6063
	Length	1010 mm (39.8") (depends on PV panel)
	Manufacturing process	Aluminum extrusion
	Function	Ensure the connection between the PV module and the "T" profile of the main float that supports the module.
<p>Additional information It is necessary to provide the PV module's characteristics to CIEL & TERRE® to guarantee its compliance. Each rail is manufactured with two (0.12") pre-drilled holes. A self-drilling screw must be inserted into each hole to avoid any translation of the rail along the "T" profile.</p>		


5.2. Mounting Gasket

	Raw material	Rubber
	Length	410 mm (16.14")
	Manufacturing process	Rubber extrusion
	Function	Avoid any vibration of the panel frame into the rail.
<p>Additional information It is necessary to provide the PV module's characteristics to CIEL & TERRE® to guarantee its compliance.</p>		

5.3. Z-bracket

	Raw material	INOX A2 / SUS 316
	Dimensions	Ø = 8 mm (0.31") (M8) L = 70 mm (2.76"), half threaded
	Manufacturing process	Aluminium extrusion
	Function	Prevent the PV panel from going out of the rail
<p>Additional information It is necessary to provide the PV module's characteristics to CIEL & TERRE® to guarantee its compliance.</p>		

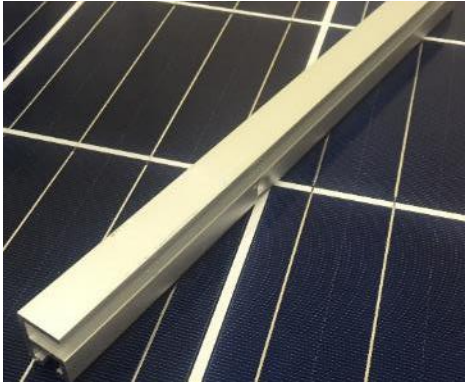
5.4. Self-Drilling Screw

	Raw material	INOX A2/ SUS 304
	Dimension	Ø = 3.5 to 3.9 mm (1/8") L = 19 mm (3/4")
	Function	Inserted in the pre-drilled hole of the rail, it secures the rail to the float.


6. Fixing System on the Lower Side

To ensure the fixation of the PV module on the lower part of the main float:

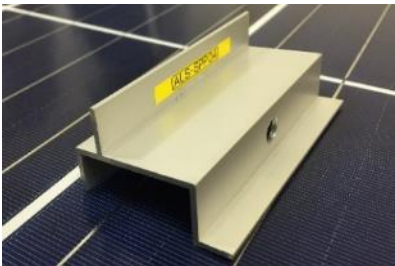
6.1. V5 Mounting Rails Bottom Left and Bottom Right

	Raw material	Aluminum 6060 or 6063
	Length	1010 mm (39.8")
	Manufacturing process	Aluminum extrusion
	Function	Ensure the connection between the PV module and the main float that supports the module.
<p>Additional information It is necessary to provide the PV module's characteristics to CIEL & TERRE® to guarantee its compliance. Each rail is manufactured with two (0.12") pre-drilled holes. A self-drilling screw must be inserted into each hole to avoid any translation of the rail along the "T" profile.</p>		

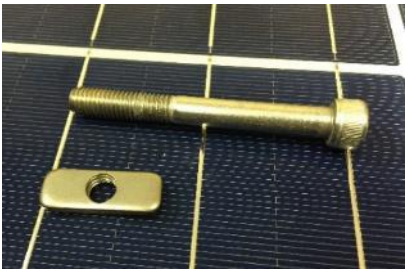
6.2. Bracket

	Raw material	Aluminum 6060 or 6063
	Technical features	Length = 100 mm (3.98") Thickness = 3 mm (0.12") Hole Ø = 9 mm (0.35")
	Manufacturing process	Aluminum extrusion
	Function	Tighten the panel frame against the rail and ensure that the panel cannot lift.

6.3. Aluminum Chair

	Raw material	Aluminum 6060 or 6063
	Technical feature	Length = 100 mm (3.94") Thickness = 3 mm (0.12") Hole Ø = 9 mm (0.35")
	Manufacturing process	Aluminum extrusion
	Function	Avoid any load on the frame of the panel.


6.4. Bolt

	Raw material	INOX A2 / SUS 316
	Screw	Ø = 8 mm (0.31") (M8) L = 70 mm (2.76"), half threaded
	Nut	Ø = 8 mm (0.31") (M8)
	Function	Attaches the rail, the chair and the bracket together and tightens the panel frame against the chair.

6.5. Self-Drilling Screw

	Raw material	INOX A2/ SUS 304
	Dimension	Ø = 3.5 mm to 3.9 mm (1/8") L = 19 mm (3/4")
	Function	Inserted in the pre-drilled hole of the rail, it secures the rail to the float.

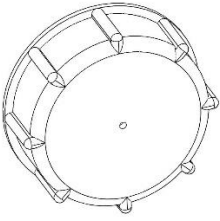
7. Spreaders Bars

	Raw Material	Aluminium 7075
	Resistance	The safe working load acceptable per spreader bar is 1 600 daN (3 600 lbf).
	Function	Enables the connection of the mooring cables with the solar island and spread the load on two connection ears of the floats.

Additional information

Two different sizes of spreaders bars are used, according to their location on the solar island. Each spreader bar is fixed on the 2 ears of a float by using connection pins.

8. Cap (bung)

	Raw material	Polypropylene (PP) Copolymer
	Dimensions	External Ø = 70.4mm (2.77") Height = 23 mm (0.9")
	Function	Used to ensure small and flat float waterproofing.

B. TESTS AND CERTIFICATIONS

- ✓ Wind tunnel tests carried out, updated and validated by the French aerospace lab – ONERA.
- ✓ Flow water resistance test witnessed by the independent audit and the inspection company: BUREAU VERITAS.
- ✓ Connection pins' shear stress tests carried out by IPC (Centre Technique Industriel de la Plasturgie et des Composites).
- ✓ Ongoing HDPE UV resistance test by the masterbatch supplier.

C. CONDITIONS AND LIMITS OF USE

The HYDRELIO® SYSTEM is designed to resist the following conditions:

- ✓ **Water velocity:** max speed **1 m/s (2.2 mph)** (can be discussed depending on the project specifications).
- ✓ **Waves:** up to **1 m (3.3')** (can be discussed depending on the project specifications).
- ✓ **Ambient Temperature:** between **-10°C (14°F)** and **50°C (122°F)**.
- ✓ **Wind velocity:** **a specific anchoring study must be done for each floating PV plant project to determine the maximum acceptable wind speed.**

WARNING: If the HYDRELIO® System is not properly constructed, it may not withstand the conditions listed above and the entire floating solar plant may be damaged!

D. MOUNTING INSTRUCTIONS

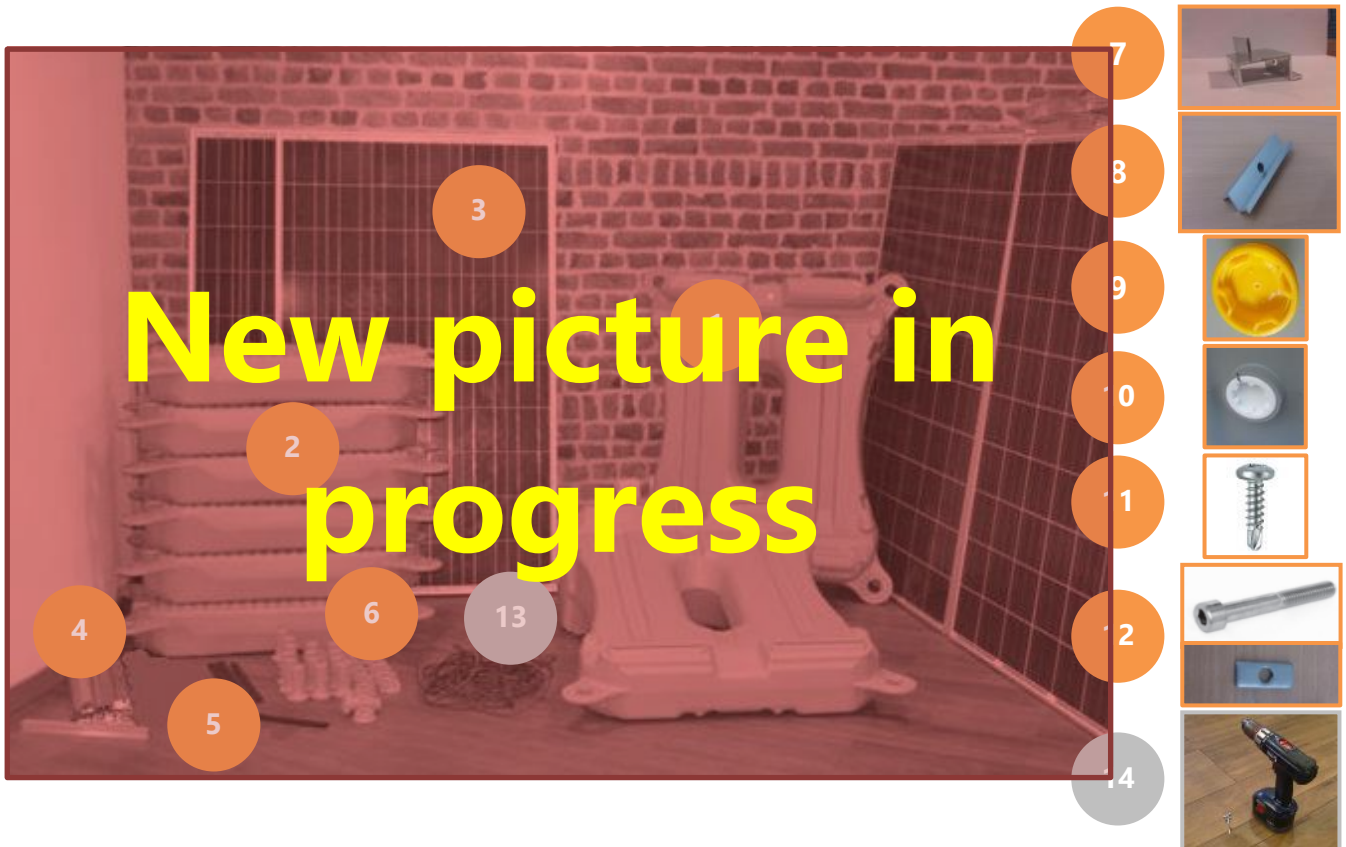
1. Key Points for a Compliant Installation

- ✓ **The solar island shall be built following CIEL & TERRE® designs and specifications**
- ✓ **Comply with the Connection Tabs/Ears order of alignment**
- ✓ **Check that PV panels have not shifted and are correctly fixed**
- ✓ **Check that all the float caps are correctly installed and tightened**

2. Equipment Presentation

The PV panels, **previously selected under the instructions of CIEL & TERRE®**, have to be installed in the 'landscape' frame, due to the main floats' specifications. PV panels will be connected in series.

Mounting the HYDRELIO® structure involves having received the working drawings and layouts of the solar island and the following equipment (orange = included – grey = not included):



1.	Main float	8.	Flat angle bracket
2.	Long and Small Secondary float	9.	Vented cap
3.	PV panel	10.	Cap
4.	Aluminum rails	11.	Self-drilling screw
5.	EPDM gasket (U profile)	12.	Rectangular nut + screw
6.	Connection pin	13.	String cable
7.	Aluminium chair	14.	Screw gun + PH2 or PZ2 and HEX 6 drill bits

3. Mounting description: PV Panels Mounting

3.1. PV Panel Fixing Concept

The PV panel fixing system is based on a concept of aluminum rails and accessories which can be fixed on four locations of the floats presenting a "T" profile. These "T" profiles are directly molded during the float manufacturing. On the PV panel side, the rail grips the aluminum frame (interior part of the frame, under the PV panel).

The attachment system ensures the connection between the floats and the PV panels. Due to this major role, it must be adapted to the PV panel frame profile, which varies depending on the chosen module. For this reason, it is essential for CIEL & TERRE® to know the selected PV panel before placing the orders. Per panel, the installation requires:

- One top rail;
- One bottom rail;
- Two aluminum chairs.
- Two Brackets;
- Two U EPDM gaskets;
- Two screws;

- Two rectangular nuts;
- Five self-drilling screws



CAUTION: This attachment system requires you to strictly follow the number of left/right rails per panel and their placement, otherwise it could not match the clamping zone, and would not qualify for the panel warranty.

This rail profile was designed to remove strips of plastic along the "T" profile's side. This way, once installed, the rail cannot be easily moved. **This does not affect the float's waterproofness.**



3.2. PV Panel Mounting on the Main Float

Recommendations:

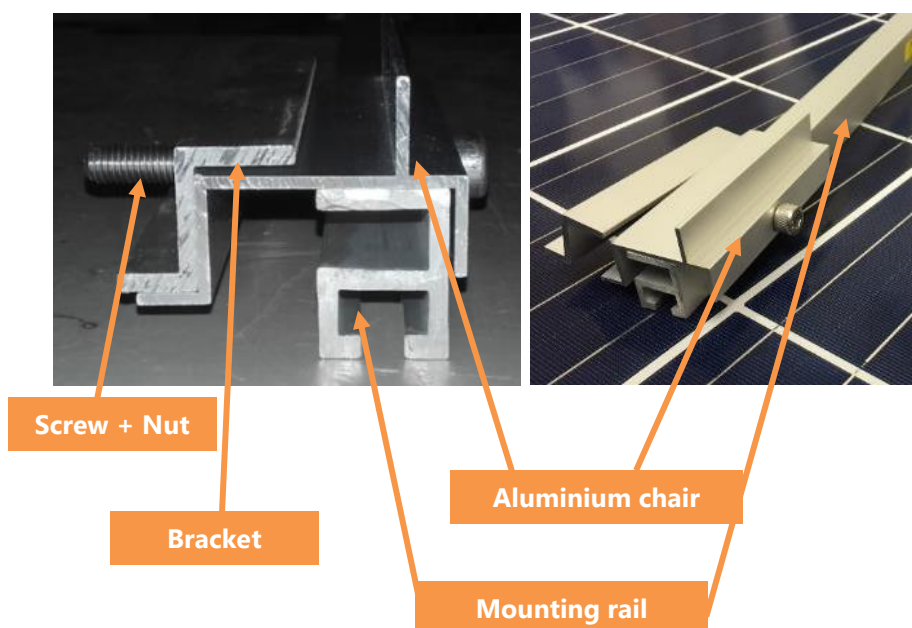
It is recommended to use a table to install the panels onto the floats. This method is easier and more ergonomic for the operators. Moreover, it is easier to check if the fixing system has been correctly installed, while on the ground it becomes more difficult to carry out a proper verification.

Make sure that the DC cables are loosened off before installing the panel on the float, and that the panel's DC boxes are all installed in the same direction.



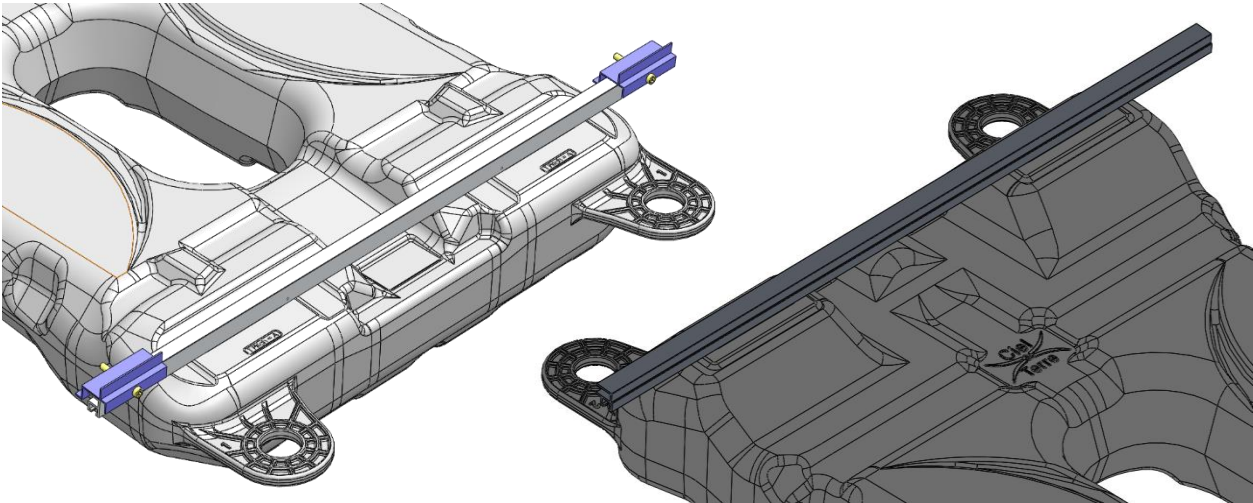
Step 1: Pre-assembly of the bottom rails

1. Install the aluminum chair on the rail,
2. Insert the screw in the holes of the chair and rail. The screw head shall face the flat side of the rail,
3. Insert the screw into the bracket's hole,
4. Loosely screw the rectangular nut onto the screw thread (only 1 pitch, the space between the bracket and the chair should as be wide as possible).

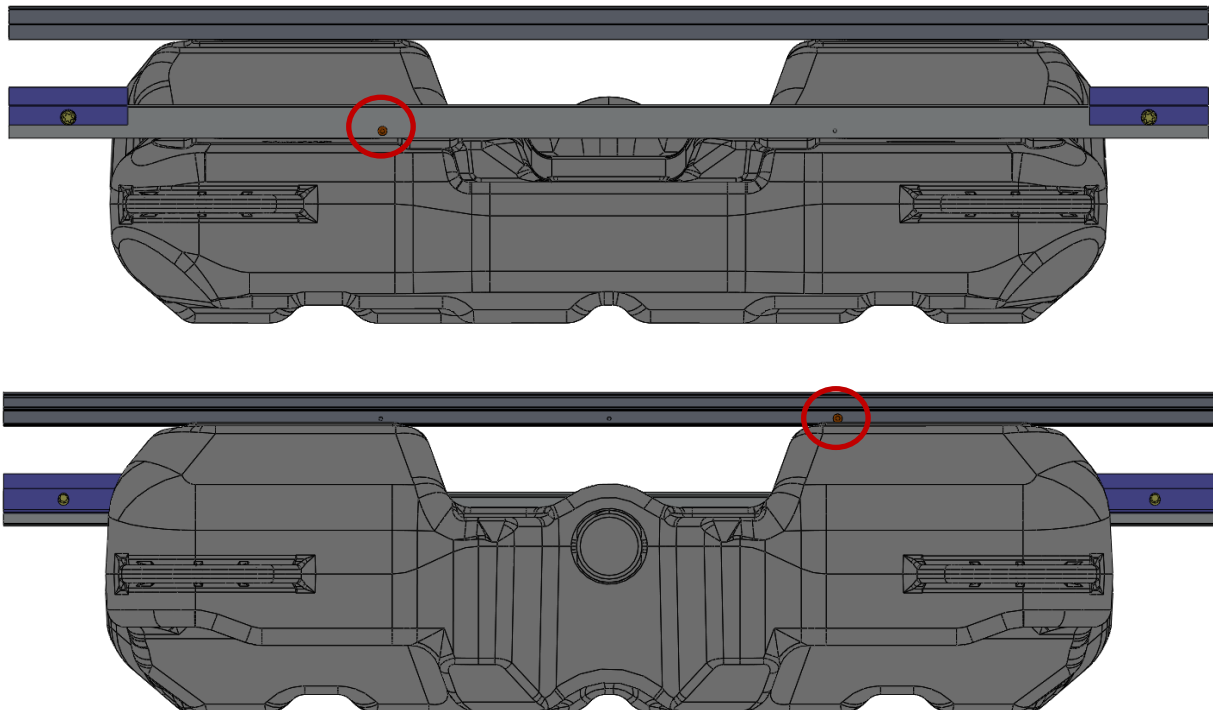


Step 2: Installation of the 2 rails (bottom and top)

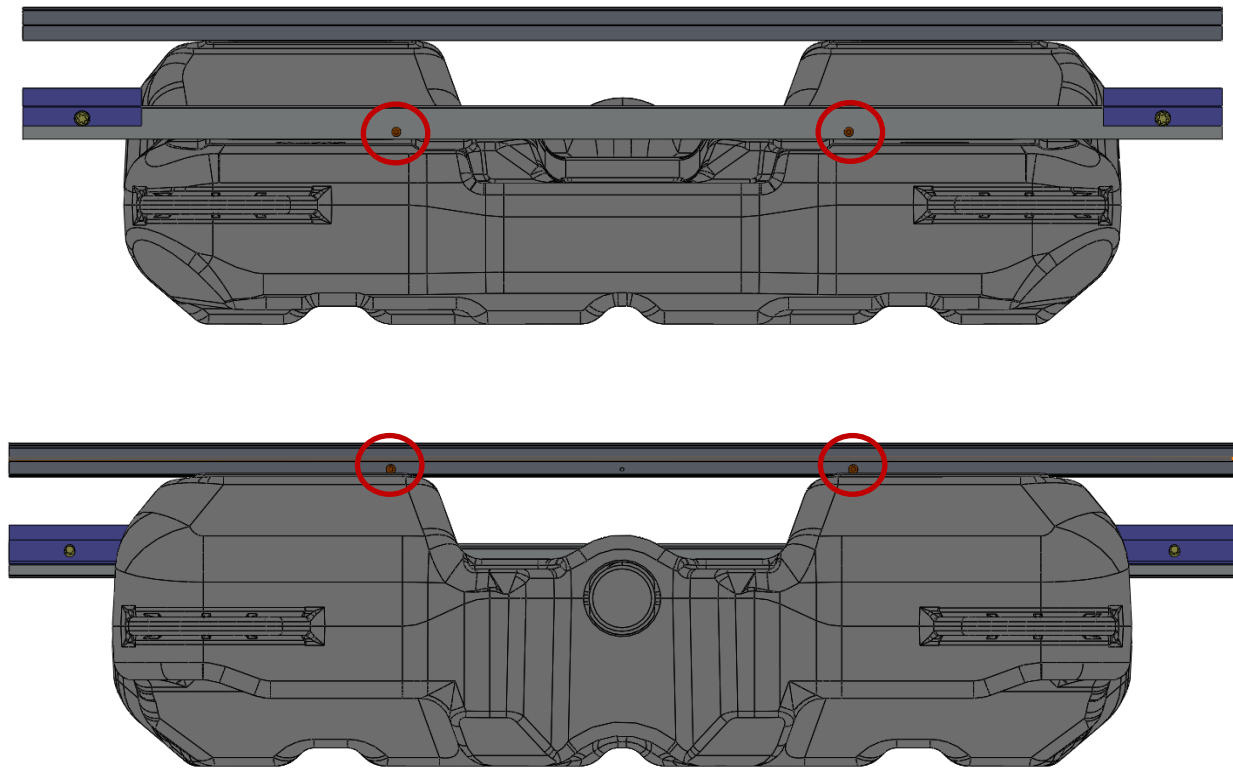
The open slot side of the rails shall always face the top of the float. The pre-assembled rail (with chairs and brackets) are installed at the bottom side whereas the single rail is installed at the top.



The rails have to be inserted until the second pre-drilled hole on the rail reaches inside the two "T" profiles. The first self-drilling screws can then be inserted, one on the bottom rail, one on the top rail

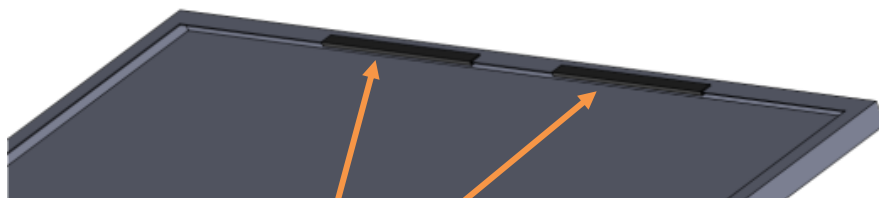


The rails must then be pushed until stopped by the "T" profile on the self-drilling screw. Then, the other self-drilling screws can be installed to completely stop translation of the rails.



Step 4: U EPDM gasket installation onto the PV panel frame

Before assembling the module onto the float, the U EPDM gasket shall be installed on the long side of the frame. This side shall be the one located on the top part of the float.



U EPDM Gaskets



Step 5: PV panel mounting onto the upper rails

The PV panel shall be slid into the upper rail openings until the 2 U EPDM gaskets reach the bottom of the rails and until the bottom of the module reaches the chairs (bottom side). The EPDM gaskets must be correctly aligned with the rails. **It is easier to do it with two people.**

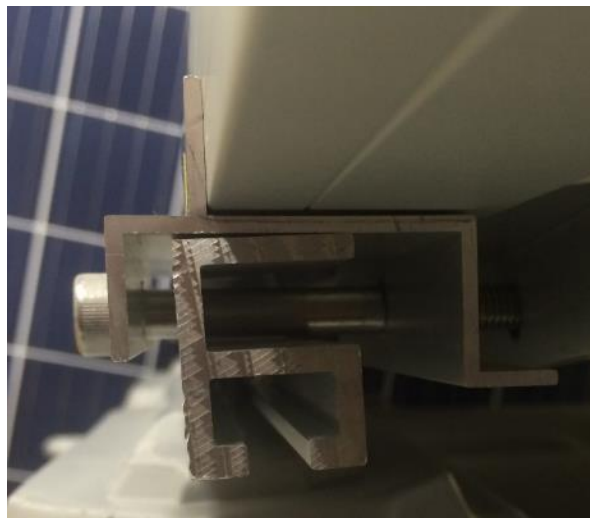
1. Insert the panel frame in the rails



2. Make sure the EPDM gaskets reach the bottom of the slot in the rails



3. Make sure the bottom of the module reaches the chairs



4. The EPDM gasket must be aligned with the rail



Current rails may differ slightly from those pictured here. (The rails that have to be installed on the top of the float are the ones presented in the datasheet).

Step 6: Tighten the PV panel with the aluminium chairs + brackets

1. Place the top of the bracket over the frame of the PV panel.



2. Make sure the rectangular nut is well positioned over the base of the bracket.



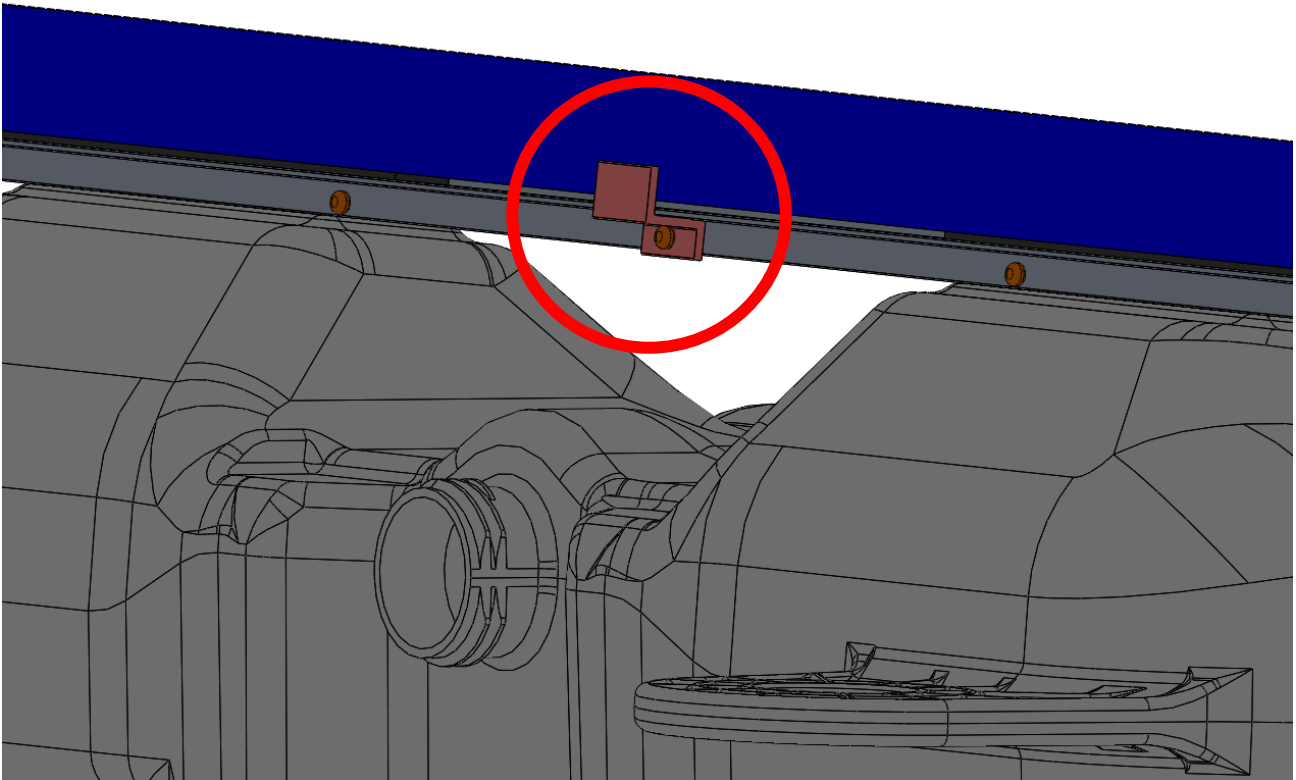
3. Tighten the screw using a screw gun.

N.B: We recommend tightening the screws with low speed, otherwise the thread pitch of the rectangular nut could be damaged. We recommend finishing by hand to ensure the screw's proper tightening.

Step 7: Install the 2-bracket

Using the pre-drilled holes in the middle of the top rail, screw the Z bracket using a self-drilling screw.

N.B. Be careful not to drill into the T profile with the cutter self-drilling screw.



4. Mounting of Floats in Columns

Recommendations:

- The Hydrelío® system should be installed on a flat mounting platform.
- We recommend dividing the power plant into smaller units in order to simplify the construction. The small units are assembled separately on the mounting platform and then linked together while on the water.
- The mounting platform and construction units must be sized accordingly to the PV plant design. **It is not possible to separate a string in several construction units** in the east-west direction as connection of the string on water is not feasible
- Make sure you don't assemble too many strings at once on the platform, it will be difficult to pull the island on the water.
- **We recommend building as much as possible on the bank and not on the water.**

4.1. Cap Installation

It is possible that some caps are not correctly tightened when delivered, it is important to double check the waterproofness of the floats.

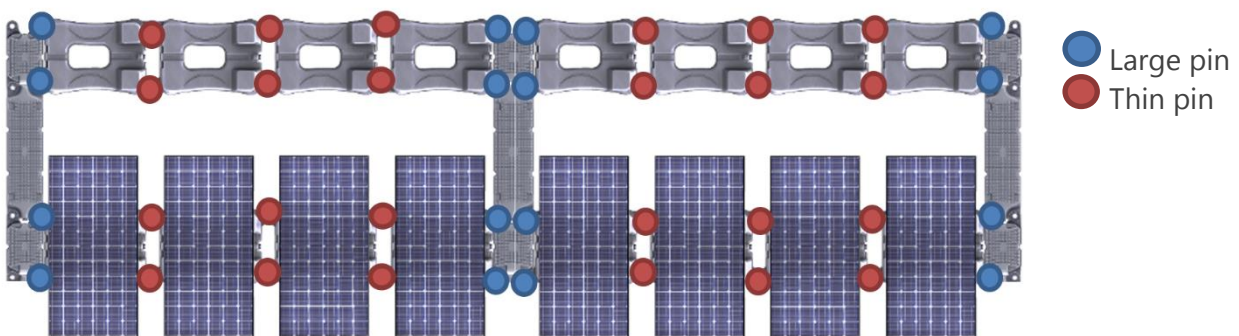
The floats caps have been tightened at the blow molding factory. A mark is left on both the cap and the float body to check the tightening. If these marks are not aligned, tighten the cap again using a torque wrench set to 10 N.m and a special tool adapted to the cap



4.2. Assembly of Floats with Connection Pins

To assemble two or three floats together, a connection pin is used. It consists of a big plastic screw, a plastic nut and a stainless-steel self-drilling screw (cutter pin).

Equatorial floats have two different connection pins: a thin pin and a large pin. The thin pin is used only when between two main floats. The large pin is used when connecting secondary floats.



When connecting this first row of secondary floats with main, there are two mounting options for connection pins:

- Three superimposed ears
- Only two superimposed ears

For both options, the mounting technique is the same. Before installing the pins, the order of the floats' ears shall be checked.

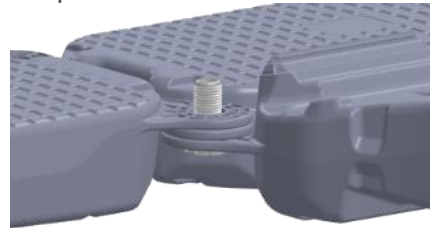
Step 1: Connection pin positioning

The pin is first placed under the ears, aligned with the holes.



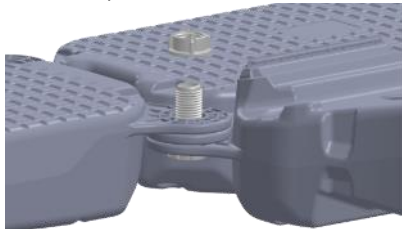
Step 2: Connection pin plugging

The pin is inserted into the hole until the pin head reaches the lower ear.



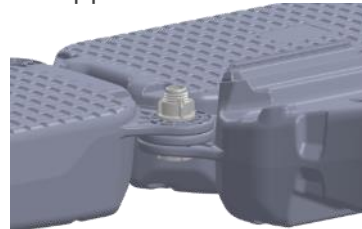
Step 3: Nut positioning

Once the pin is correctly plugged into the hole, the nut is screwed on top.



Step 4: Nut tightening

The nut is tightened until it reaches the upper ear.



Step 5: Pin locking

Once the connection pin is in place and correctly tightened, the pin can be locked using a self-drilling screw. It is inserted and screwed into one of the two existing holes present in the nut. This locking system prevents the bolt from loosening.



The connection pins shall be locked with self-drilling screws before the island is launched onto water, to avoid screws falling into water.

Be careful, you can damage the connection pin if you tighten the self-drilling screw too much. Use the drill's slow speed.

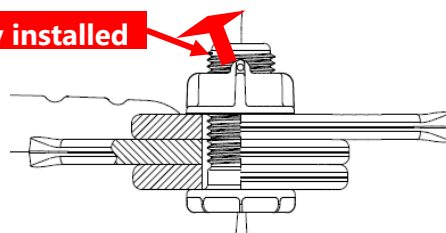


Pin damaged

Be careful, when you put a self-drilling screw directly in the nut, it might not penetrate the pin.



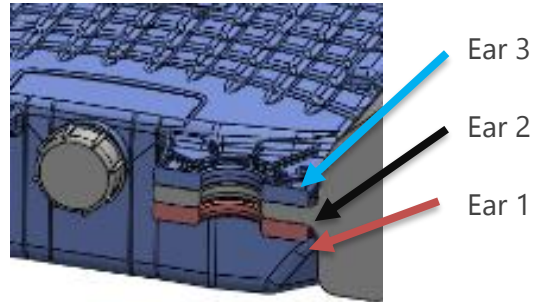
Self-drilling screw incorrectly installed



4.3. Step 2: Installation of the first line

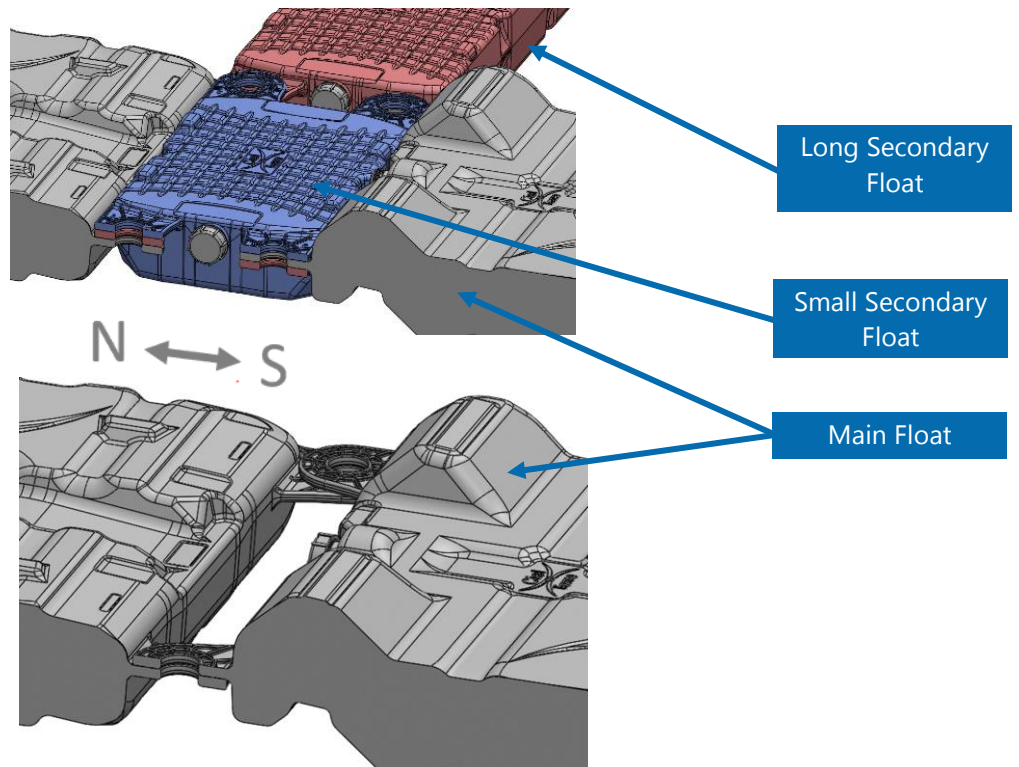
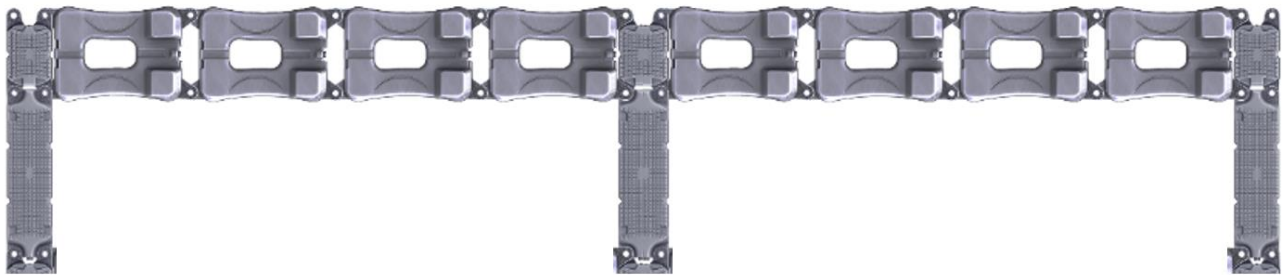
Depending on the size of the mounting area and following the construction drawings, install the first line of main floats (with or without panels) and small secondary floats. Make sure the caps of each different floats are oriented in the same direction (north or south for main floats, east or west for small secondary floats). Make sure the ears order is followed (ears 1 below the others, ears 2 in the middle, ears 3 above).

Connect the floats with large or thin connection pins where other floats won't be added in this construction unit or the closest ones.



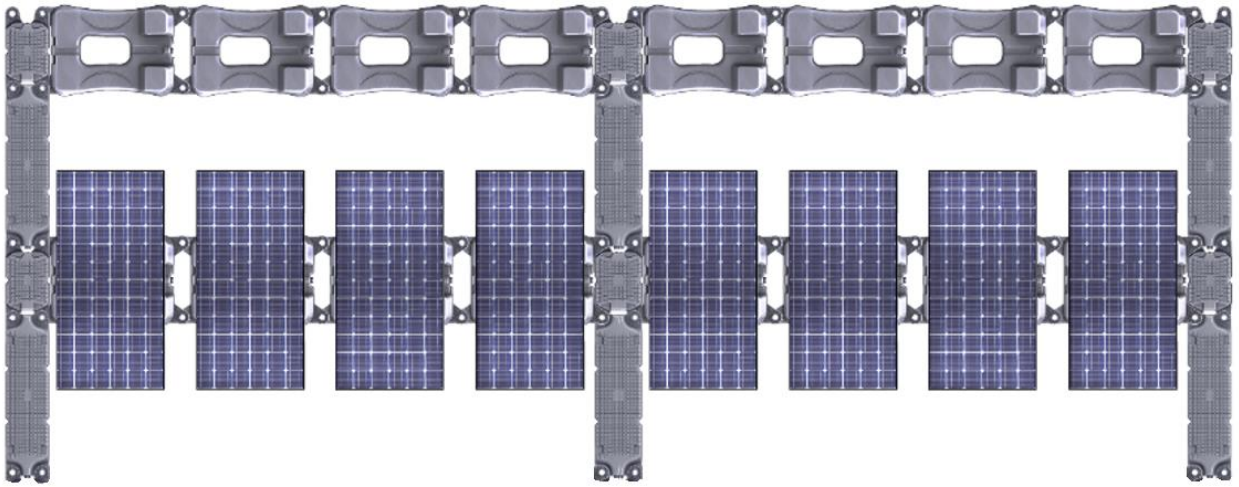
4.4. Step 3: Installation of the long secondary floats line

Add long secondary floats next to small secondary floats of the previous line. Connect them using large connection pins.



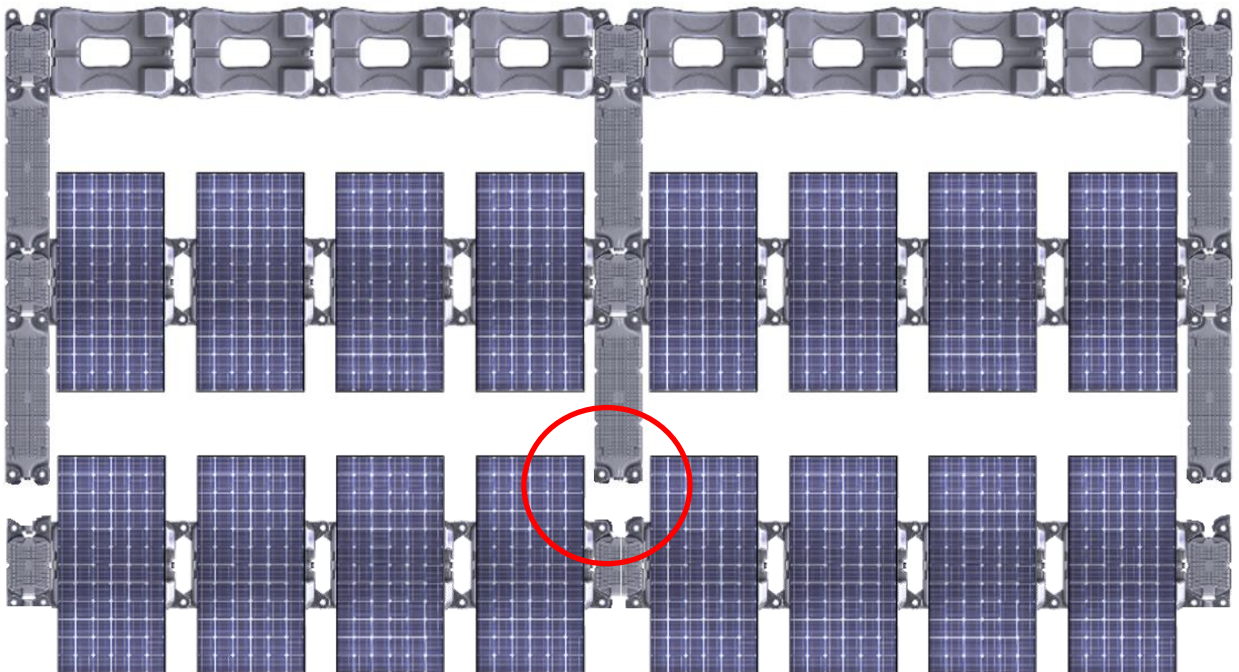
4.5. Step 4: Installation of the first PV line and long secondary floats

Add main floats with PV panels properly installed on them. Take care of removing the DC cables and preparing them for easy connection of the next panels. Follow closely the construction drawings and electrical design.

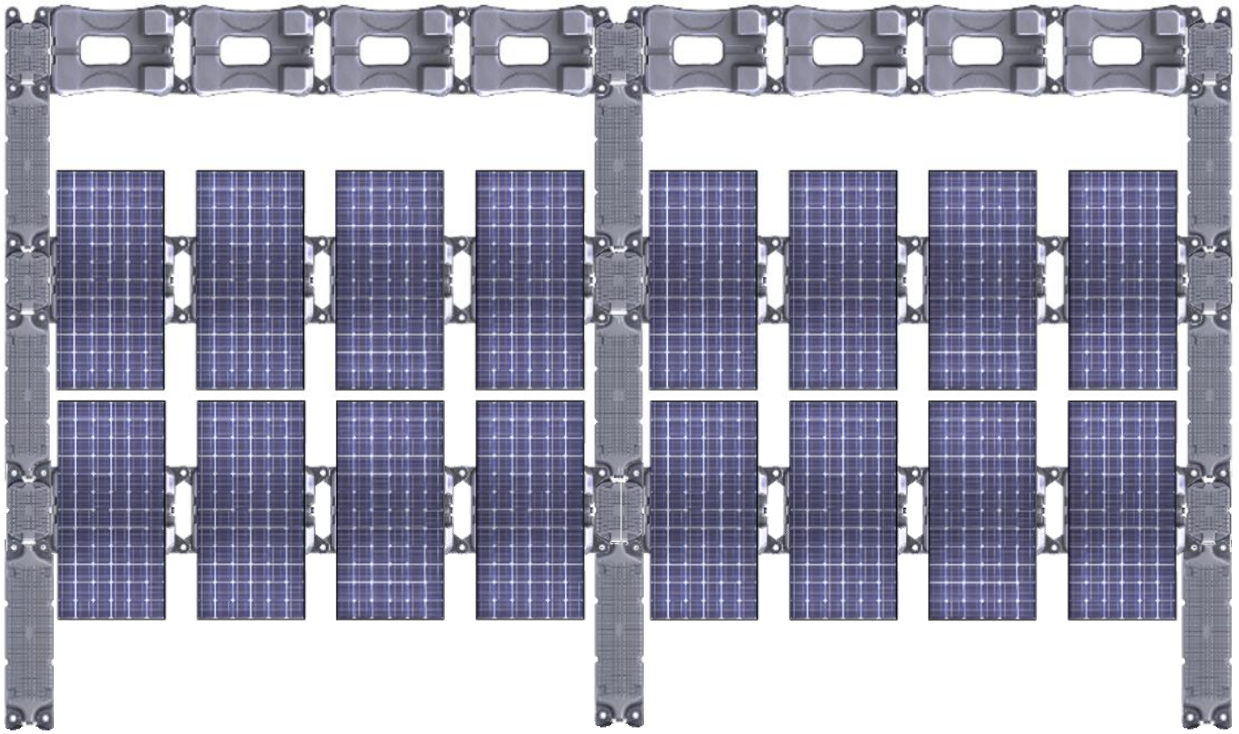


4.6. Step 5: Installation of the next PV line and long secondary floats

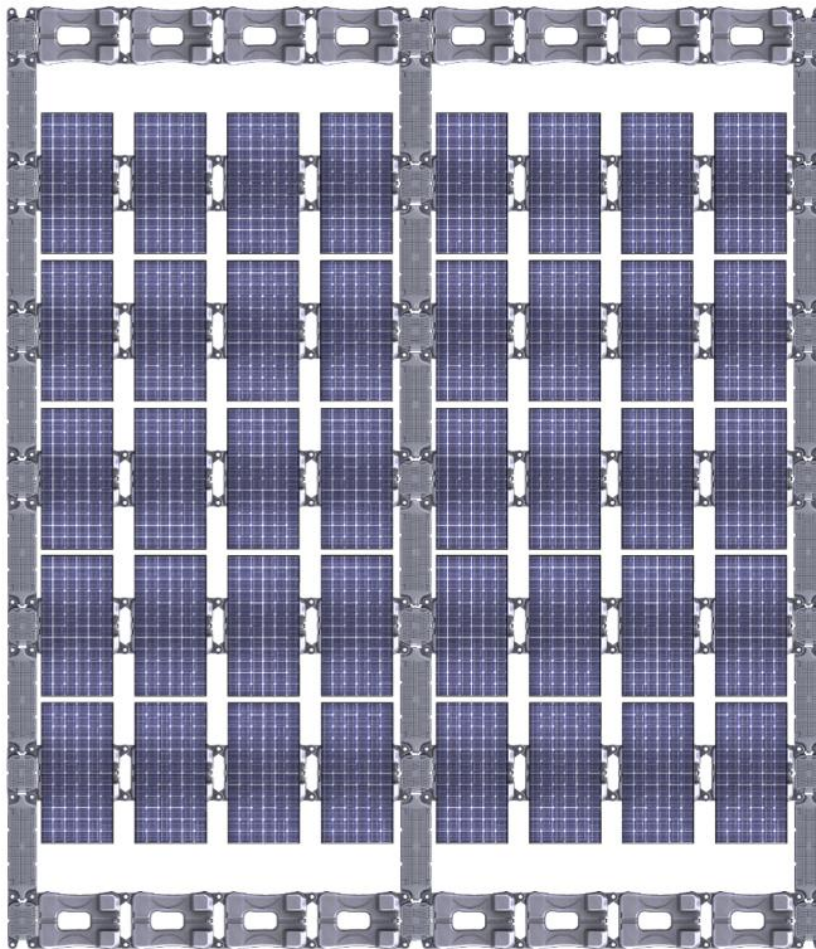
Prepare the next 4-in-a-row line of main floats with PV panels and small secondary floats. Assemble the line with connection pins and place it close the previous one while leaving approximately a 20cm gap. Following the electrical design, make the DC cable and earthing cable connection between the panels



Once the electrical connections (DC cables, earthing cables and cable management clips, ties...) are done, push the PV line and connect the long secondary floats to the small secondary floats with large connection pins. Then, add long secondary floats to the maintenance alley and repeat this step until the construction unit is finished.



The following picture represents an example of a construction unit of two 4-in-a-row with strings of 5 panels.



4.7. Push the Unit on to the Water

Every two or three rows, you will have to push the unit onto water to be able to build the next rows.



Once you have completed enough strings, the unit shall be pushed onto water and then towed from the mounting platform to its final location.

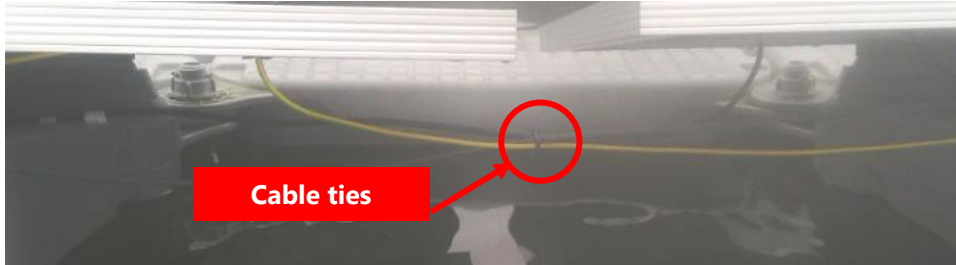
To do so, we recommend using a boat(s) and ropes. It can be difficult to tow a unit if you are against the wind. **The location of the mounting platform should be selected correctly in order to avoid this problem. As well, we do not recommend to tow a unit in case of extreme winds.**



5. Wiring and Grounding

Please refer to your country recommendations and standards for the cables sizing and grounding method.

We recommend using cables ties or wire management clips to secure the cables or to protect them to avoid any contact with the water.



The openings between the panels and main floats have been designed to allow of the good management of DC string and grounding cables.



The main DC cables shall be water resistant or be protected with cables conduits.

The cables can be installed on floating pontoon or float by themselves using plastic conduits.

Be careful with the weight of the cables, make sure that the island's buoyancy is sufficient.

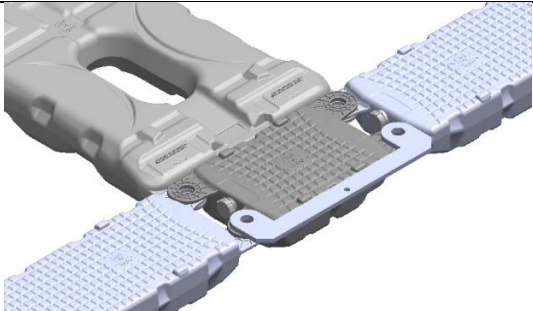
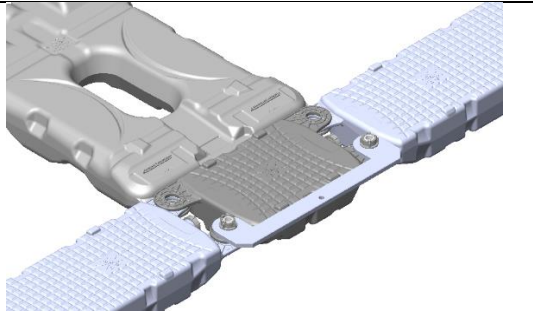
6. Spreader Bars Mounting

The spreader bars are necessary for the anchoring system. There are 4 possible places to install the spreader bars.

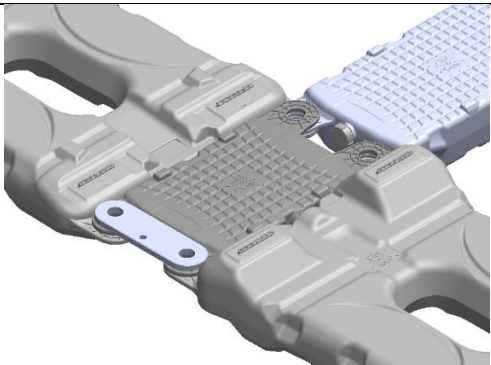
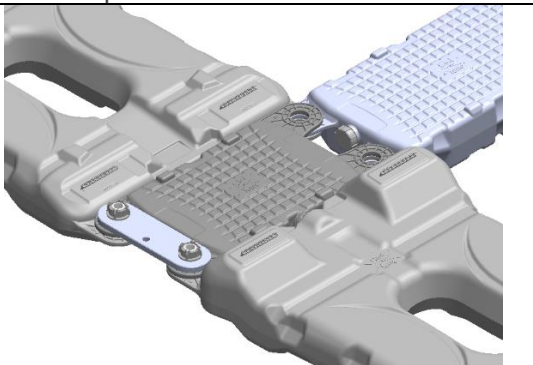
- Back / front side – On the periphery of the island = MEDIUM SPREADER BAR 987 mm (38.86") (797mm)
- Left / right side – On the periphery of the island = SMALL SPREADER BAR 522 mm (20.55") (384mm)

The location of spreader bars is defined by the anchorage layout (if an anchoring study is provided).

6.1. Back/Front Side – On the Outside of the Island

<p>Step 1: Place the spreader bar</p> <p>You can install the spreader bar at the same time as the floats. In order to do this, the secondary float shall be placed without connection pin on the outside. Then, the medium spreader bar is placed over the ears of each float.</p>	<p>Step 2: Pin's installation and locking</p> <p>Then the connection pin can be placed through the holes.</p> <p>The nut is tightened until it reaches the top of the spreader bar.</p> <p>At the end, the screw is locked using the same cutter pin system than for usual connection pins.</p>
	

6.2. Left/Right Side – On the Periphery of the Island

<p>Step 1: Place the spreader bar</p> <p>You can install the spreader bar at the same time as the floats. In order to do this, the secondary float shall be placed without connection pin on the outside. Then, the shortest spreader bar is placed over the ears of each float.</p>	<p>Step 2: Pin's installation and locking</p> <p>Then the connection pin can be placed through the holes.</p> <p>The nut is tightened until it reaches the top of the spreader bar.</p> <p>At the end, the screw is locked using the same self-drilling screw system as used for the connection pins.</p>
	

E. WEATHER CONDITIONS AND WORK

The contractor must consider the local codes regarding outside construction. In addition, some weather conditions are not suitable for the installation and maintenance of the floating PV plant.

1. Thunderstorms

Lightning makes it highly dangerous for the operator to connect electric cables during thunderstorms.

2. High Wind Speed and Waves

When the wind speed is higher than 40 km/h (25 mph), it will be difficult to carry and install the panels. The wind will also generate waves on the water surface; walking on the solar island near to the water becomes difficult, or even dangerous.

3. Temperature

When temperatures drop below -5°C (23°F), installation and maintenance have to be avoided. The lake could have a frozen layer of ice which will obstruct the construction site.

4. Snow and Hail

When there is snowfall or hail, it is not possible to carry out installation or maintenance activities.

F. STORAGE RECOMMENDATIONS

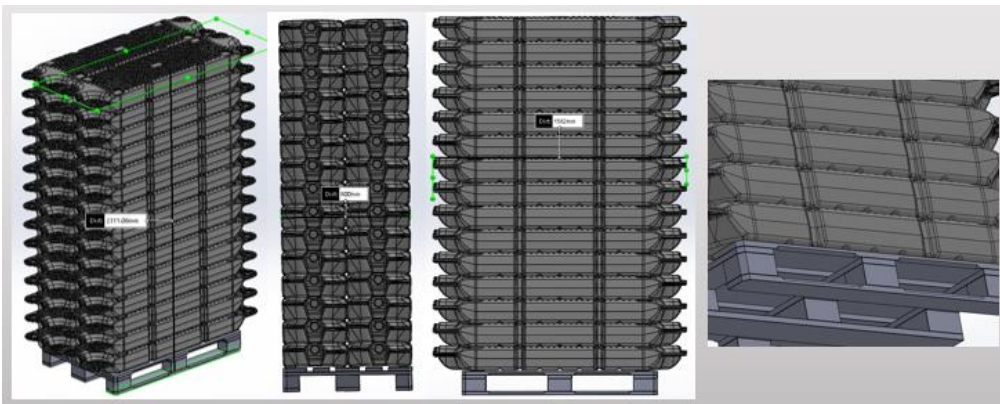
Container / Truck unloading:

- To unload a container or a truck, a forklift or a hand pallet truck shall be used.
- The main floats have been designed with slots for lifting forks, as shown on the picture below.

Main Floats:



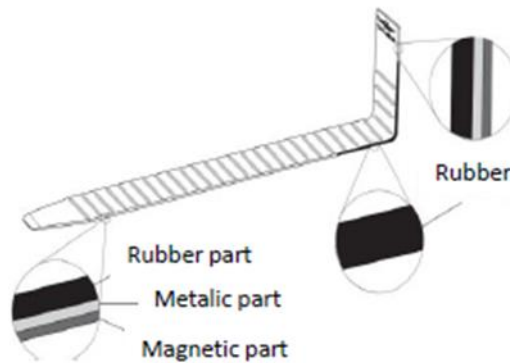
Long Secondary Floats:



Small Secondary Floats:



If a forklift is used it is preferable to install a rubber protection on the forks to avoid any damage of the floats.



Floats should not be dragged on the ground; this could damage them prematurely!

Cap Screwing:

It is possible that some caps are not correctly tightened when delivered, it is important to double check the waterproofness of the floats.

The floats caps have been tightened at the blow molding factory. A mark is left on both the cap and the float body to check the tightening. If these marks are not aligned, tighten the cap again using a torque wrench set to 10 N.m and a special tool adapted to the cap



Storage

1. On the ground

- As shown on the picture below, the storage area must be **flat**, and it is better if the floats are not laying directly on the ground.
- The storage place's temperature shall be kept between -5°C (23°F) and 30°C (86°F).
- The storage place shall not be close to a shelter with harsh chemical products which could have a negative effect on the float's material.



G. PV PANEL SPECIFICATIONS RECOMMENDATIONS

Silicon crystalline (mono/poly) PV panels are proposed for floating PV power plants due to the consideration of water quality and potential impact of the PV panel on water.

We require the client to select panels complying with the following specifications for the floating solar PV plant.

Dimensions :

The dimensions of the module shall comply with the following data, with the admitted tolerance if needed:

Length = maximum 1 975 mm (77.76")

Width = 991 ± 3 mm (39" \pm 0.1)

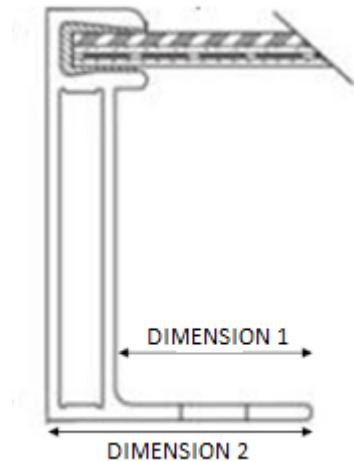
Height = minimum 20 mm (0.8")

Dimension 1 = minimum 15 mm (0.6")

Dimension 2 = 35 ± 3 mm (1.38" \pm 0.1)

Cable length = 1 200 to 1 300 mm (47" to 51"), the total length (sum of the 2 cables) shall be at least 2 400 mm (94").

The width of the frame is highly important, as the fixing system will be in contact with this frame.



Sketch of a PV panel showing the dimensions 1 & 2

Type of PV module:

Crystalline module with **72 cells** and **frame**. CIEL & TERRE[®] can also provide a solution for 60-cell framed panels. Please ask to your sales representative for the corresponding user manual.

Module origin:

CIEL & TERRE[®] does not have any preferences for the PV panel's origin as long as this origin does not have any influence on the compliance with local regulations.

Module capacity Wp:

CIEL & TERRE[®] does not have any requirement for the module power capacity. Nevertheless, CIEL & TERRE[®] usually installs 305 to 340 Wp Panels.

The PV module power capacity has to be reported to CIEL & TERRE[®] because of the electrical design of the PV plant, as electrical characteristics may vary. It also has an influence on the yield study provided by CIEL & TERRE[®] to the final client.

Connectors:

Standard PV connectors

Maximum Module Weight:

30 kg (66 lbs)

Module aluminum frame:

The drawings of PV panel's aluminum frame are indispensable for CIEL & TERRE[®] to supply the suitable fixing system for the PV panel's installation onto the floats. Be aware that module manufactures change frame heights and widths periodically.

Any change of PV panel brand/reference must be reported to CIEL & TERRE[®], as the aluminum frame profile may change, even if the PV panel manufacturer is the same.

Installation environment:

Due to the fact that the selected panels are going to be installed on a floating platform in contact with bodies of fresh water, the panels must comply with these specific environmental conditions:

- Salinity resistance for maximum water salinity : 25 mS/cm at 25°C (15 PSU).
- Water resistance for reservoirs with a maximum wave height of 1m from the crest to the trough of the wave.
- Minimum installation height of the panel : 15 cm (5.91") (meant as the height between the water surface and the lowest edge of the panel in usual conditions of operation).

Certifications and norms :

CE, TUV, MCS, IEC 61215 and IEC61730

PV panel warranty :

10-year product warranty + 25-year linear power output warranty.

H. SPECIFIC INSTRUCTIONS FOR FLOATING PV PLANTS

The list of instruction detailed below is not exhaustive and for informative purposes only. Local laws and standards shall always prevail and be followed. CIEL & TERRE® cannot assume any responsibility if the installation is not compliant with the local laws and standards.

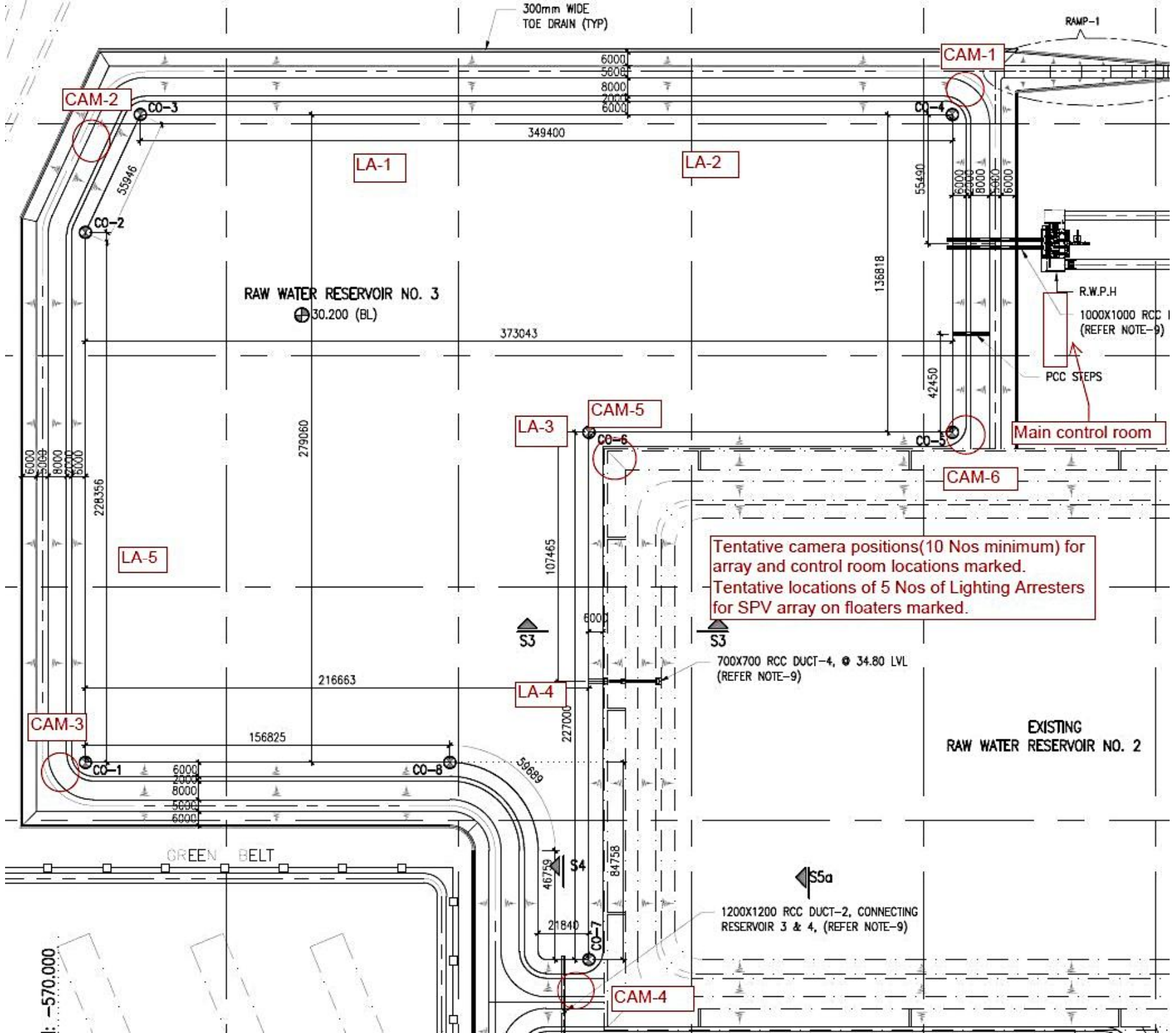
1. Installation

Due to the fact that the selected panels are going to be installed on a floating platform in contact with bodies of fresh water, the following installation instruction must be followed:

- All cables used for the installation must have a sufficient length and slack to prevent damage due to water level changes and wave motions.
- The lightning protection and grounding system used on the floating installation shall comply with the relevant local regulations
- The junction boxes must be installed following the instructions presented in this document. The minimum protection against waterproofness for the Junction box is: NEMA 4 or IP66.
- All cables must be protected from water splash or be manufactured with a sufficient waterproof protection, as contact with water cannot be totally avoided. However, this contact must be reduced as much as possible (cables can be fastened to stay well above the water surface, for instance).
- In areas attractive for birds, additional bird-repelling devices may be installed.

2. Safety

- Immediately disconnect the system if the solar island shows evidence of deviation from standard operating conditions.
- In the event of the solar island being submerged, immediately disconnect the DC cable at the inverter input. Do not attempt to save panels or solar island parts during daylight.





ಭಾರತ್ ಹವಿ ಎಲೆಕ್ಟ್ರಿಕಲ್ಸ್ ಲಿಮಿಟೆಡ್
 भारत हेवी इलेक्ट्रिकल्स लिमिटेड

Bharat Heavy Electricals Ltd.,
(A Government of India undertaking)
Electronics Division

PB 2606 , Mysore Road Bangalore , 560026 INDIA

SCPV: BOS: ITB - Rev 04

INSTRUCTIONS TO BIDDERS (ITB)

Bidders are requested to read the instructions carefully and submit their quotations covering all the points:

A. GENERAL INSTRUCTIONS:

1. Any Purchase Order resulting from this enquiry shall be governed by the Instructions to Bidders (document reference: SCPV: BOS: ITB – Rev 01), General Conditions of Contract (document reference: SCPV: BOS: GCC - Rev 01) and Special Conditions of Contract (document reference: SCPV: BOS: SCC: I - Rev 01/ SCPV: BOS: SCC: F - Rev 01), if any, of the enquiry.
2. Any deviations from or additions to the “General Conditions of Contract” or “Special Conditions of Contract” require BHEL’s express written consent. The general terms of business or sale of the bidder shall not apply to this tender.
3. Bidders (also includes the term suppliers / contractors wherever used in this document) are instructed to quote their most competitive price and best delivery, etc. in the offer. Prices should be indicated in both figures & words. **(Please also refer clause 11 under section B)**
4. Regret letter (either through post or by mail) indicating reasons for not quoting must be submitted without fail, in case of non-participation in this tender. If a bidder fails to respond against 3 consecutive tenders for the same item, he will be liable for removal as a registered vendor of BHEL.
5. Procurement directly from the manufacturers shall be preferred. However, if the OEM / Principal insist on engaging the services of an agent, such agent shall not be allowed to represent more than one manufacturer / supplier in the same tender. Moreover, either the agent could bid on behalf of the manufacturer / supplier or the manufacturer / supplier could bid directly but not both. In case bids are received from the manufacturer / supplier and his agent, bid received from the agent shall be ignored.
6. Consultant / firm (and any of its affiliates) shall not be eligible to participate in the tender/s for the related goods for the same project if they were engaged for consultancy services for the same project.
7. If an Indian representative / associate / liaison office quotes on behalf of a foreign based bidder, such representative shall furnish compulsorily the following documents:
 - a. Authorization letter to quote and negotiate on behalf of such foreign-based bidder.
 - b. Undertaking from such foreign based bidder that such contract will be honored and executed according to agreed scope of supply and commercial terms and conditions.
 - c. Undertaking shall be furnished by the Indian representative stating that the co-ordination and smooth execution of the contract and settlement of shortages / damages / replacement / repair of imported scope till system is commissioned and handed over to customer will be the sole responsibility of the Indian representative / associates / agent / liaison office.
8. In case of imported scope of supply, customs clearance & customs duty payment will be to BHEL account after the consignment is received at Indian Airport / Seaport. Bidders must provide all original documents required for completing the customs clearance along with the shipment. Warehousing charges due to incomplete or missing documentation will be recovered from the supplier’s bill. All offers for imported scope of supply must be made from any of the gateway ports (within the country) indicated. **(Refer Annexure I)**
9. The offers of the bidders who are on the banned list and also the offers of the bidders, who engage the services of the banned firms, shall be rejected. The list of the banned firms is available on BHEL website: **www.bhel.com**.

10. Business dealings with bidders will be suspended if they are found to have indulged in any malpractices / misconduct which are contrary to business ethics like bribery, corruption, fraud, pilferage, cartel formation, submission of fake/false/forged documents, poor quality, certificates, information to BHEL or if they tamper with tendering procedure affecting the ordering process or fail to execute a contract, or rejection of 3 consecutive supplies or if their firms / works are under strike / lockout for a long period.

B. GUIDELINES FOR PREPARATION OF OFFER:

1. Quotation shall be submitted in Single Part Bid, Two Part Bid or Three Part Bid, as called for in the tender:
 - **SINGLE PART BID:** Technical and Commercial Bid with prices along with price summary & filled in BHEL Standard Commercial terms and conditions in a single sealed envelope.
 - **TWO PART BID:** Unpriced offer i.e. "Techno-commercial Bid" with filled in BHEL Standard Commercial terms and conditions in a sealed envelope **along with the copy of the "Price Bid" without the prices** should be enclosed in one cover and the cover must be super scribed "**Techno-commercial offer** and Priced offer i.e. "Price Bid" containing price summary in a separate sealed envelope and must be super scribed "**Price Bid**". Both these envelopes shall be enclosed in a single sealed envelope super scribed with enquiry number, due date of tender and any other details as called for in the tender document.
 - **THREE PART BID:** Pre-qualification Bid (Part-I), Techno Commercial Bid with filled in BHEL Standard Commercial terms and conditions (Part-II), and Price Bid (Part-III). All three envelopes shall be enclosed in a single sealed envelope super scribed with enquiry number due date of tender and any other details as called for in the tender document.

If any of the offers (Part I, Part II or Part III) are not submitted before the due date and time of submission at the venue/place specified or if any part of the offer is incomplete the entire offer of the bidder is liable for rejection.

2. Supplier shall ensure to super scribe each envelope with RFQ number, RFQ Date, RFQ Due date and time, Item Description and Project clearly & boldly. Also mention on the envelope whether it is "Techno Commercial Bid" or "Price Bid" or "Pre-Qualification Bid". Please ensure complete address, department name and purchase executive name is mentioned on the envelope (before dropping in the tender box or handing over) so that the tender is available in time for bid opening.
3. BHEL standard Commercial Terms and Conditions shall be duly filled, signed & stamped and must accompany Technical-Commercial offer without fail and should be submitted in original only. Photocopy will not be accepted. All documents submitted along with the offer shall be signed and stamped in each page by authorized representative of the bidder.
4. Any of the terms and conditions not acceptable to supplier, shall be explicitly mentioned in the Techno-Commercial Bid. If no deviations are brought out in the offer it will be treated as if all terms and conditions of this enquiry are accepted by the supplier without any deviation.
5. Deviation to this specification / item description, if any, shall be brought out clearly indicating "DEVIATION TO BHEL SPECIFICATION" without fail, as a part of Techno-Commercial Bid. If no deviations are brought out in the offer it will be treated as if the entire specification of this enquiry is accepted without deviation.
6. Suppliers shall submit one set of original catalogue, datasheets, bill of materials, dimensional drawings, mounting details and / or any other relevant documents called in purchase specification as part of Technical Bid.
7. "Price Bid" shall be complete in all respects containing price break-up of all components along with all applicable taxes and duties, packing & forwarding charges (if applicable), freight charges (if applicable) etc. Once submitted no modification / addition / deletion will be allowed in the "Price Bid." Bidders are advised to thoroughly check the unit price, total price to avoid any discrepancy.
8. In addition, bidder shall also quote for erection & commissioning charges (I&C charges), documentation charges, service charges, testing charges (type & routine), training charges, service tax, etc. wherever applicable. The price summary must indicate all the elements clearly.
9. Vendors should indicate "lump sum" charges (including To & Fro Fare, Boarding, Lodging, Local Conveyance etc.) for Supervision of Erection, Commissioning and handing over to customer. The quotation shall clearly indicate scope of work, likely duration of commissioning, pre-commissioning checklist and service tax (if any).
10. Wherever bidders require PAC (Project Authority Certificate) for import of raw materials, components required for Mega

Power Projects, Export Projects, MNRE Concession or other similar projects wherein supplies are eligible for customs duty /Excise duty benefits, lists and quantities of such items and their values (CIF) has to be mentioned in the offer. Prices must be quoted taking into account of such benefits.

11. All quotations shall be free from corrections /overwriting. Corrections if any should be authenticated with signature and seal. Any typographical error, totalling mistakes, currency mistake, multiplication mistake, summing mistakes etc. observed in the price bids will be evaluated as per **Annexure VI** "Guidelines for dealing with Discrepancy in Words & Figures – quoted in price bid". BHEL decision will be final.

C. GUIDELINES FOR OFFER SUBMISSION:

1. Offers / Quotations must be dropped in tender box before 13.00 Hrs. on or before due date mentioned in RFQ. The offers are to be dropped in the proper slot of the Tender Box kept in our reception area with caption "CE, SC&PV, DEFENCE." Tenders are opened on 3 days in a week (Monday/Wednesday/Friday). Tender must be deposited in the slot corresponding to the day (Monday - Box no.4/Wednesday - Box no. 6 /Friday - Box no.8) while depositing the offer. **(This clause will not be applicable for e-tenders).**
2. E-Mail / Internet / EDI offers received in time shall be considered only when such offers are complete in all respects. In case of offers received through E-mail, please send the offer to the email IDs within time of submission of tender.
3. In cases where tender documents are bulky, or due to some reasons tender documents are required to be submitted by hand or through posts/couriers, the offers are to be handed over to purchase officers.
4. Tenders will be opened on due date, time and venue as indicated in the RFQ in the presence of bidders at the venue indicated in the RFQ. In case of e-procurement, bidders can see tender results till seven days after due date and time.
5. Vendor will be solely responsible:
 - a. For submission of offers before due date and time. Offers submitted after due date and time will be treated as "Late offers" and will be rejected.
 - b. For submission of offers in the correct compartment of the tender box based on the day of due date (Monday/Wednesday/Friday). Please check before dropping your offer in the correct tender box.
 - c. For depositing offers in proper sealed condition in the tender box. If the bidder drops the tender in the wrong tender box or if the tender document is handed over to the wrong person BHEL will not be responsible for any such delays.
 - d. For offers received through email/courier etc., suppliers are fully responsible for lack of secrecy on information and ensuring timely receipt of such offers in the tender box before due date & time.
 - e. In case of e-tender, all required documents should be uploaded before due date and time. Availability of power, internet connections, etc. will be the sole responsibility of the vendor. Wherever assistance is needed for submission of e-tenders, help line numbers and executives of service provider of BHEL may be contacted.
Service provider: e-Procurement Technologies Limited (abc Procure)
Website address: <https://bhel.abcprocure.com>
Helpline no.: +91-79-68136819/809/862/867/823/872/842 (9:30 am to 5:30 pm)
10:00 AM - 07:00 PM (Monday - Friday)
10:00 AM-04:00 PM (Saturday)

Purchase Executive / BHEL will not be responsible for any of the activities relating to submission of offer.

D. PROCESSING OFFERS RECEIVED:

1. Any discount / revised offer submitted by the supplier on its own shall be accepted provided it is received on or before the due date and time of offer submission (i.e. Part-I bid). The discount shall be applied on pro-rata basis to all items unless specified otherwise by the bidder.
2. Changes in offers or Revised offers given after Part-I bid opening shall not be considered as a part of the original offer unless such changes / revisions are requested by BHEL.
3. In case there is no change in the technical scope and / or specifications and / or commercial terms & conditions by BHEL, the supplier will not be allowed to change any of their bids after Technical bids are opened (after the due date and time of tender opening of Part-1 Bid).

4. In case of changes in scope and/ or technical specifications and/ or commercial terms & conditions by BHEL and it accounts for price implications from vendors, all techno-commercially acceptable bidders shall be asked by BHEL (after freezing the scope, technical specifications and commercial terms & conditions) to submit the impact of such changes on their price bid. Impact price will be applicable only for changes in technical specification / commercial conditions by BHEL. The impact price must be submitted on or before the cut-off date specified by BHEL and the original price bid and the price impact bid will be opened together at the time of price bid opening. Impact price means only for those items which have been impacted by addition / deletion / changes in the technical specifications or commercial conditions. The impact may be +/- incremental value of the currency in which originally quoted. The impact price bid to be submitted on the cut-off date, time & venue as specified by BHEL. The impact price bid shall be opened along with original price bid.
5. Un-opened bids (including price bids) will be returned to the respective bidders after release of PO and receipt of order acknowledgement from the successful bidder.
6. After receipt of Purchase Order, supplier should submit required documents like drawings, bill of materials, datasheets, catalogues, quality plan, test procedure, type test report , O & M Manuals and / or any other relevant documents as per Specification / Purchase Order, as and when required by BHEL / Customer.
7. Any deviation to the terms and conditions not mentioned in the quotation by supplier in response to this enquiry will not be considered, if put forth subsequently or after issue of Purchase Order, unless clarification is sought for by BHEL EDN and agreed upon in the Purchase Order.
8. Evaluation shall be on the basis of delivered cost (i.e. "Total Cost to BHEL"). As per RFQ terms. "Total Cost to BHEL" shall include total basic cost, packing & forwarding charges, taxes and duties, inspection charges, freight charges, test charges, insurance, service tax for services, any other cost indicated by vendor for execution of the contract and loading factors (for non-compliance to BHEL Standard Commercial Terms & Conditions). Benefits arising out of Nil Import Duty on Mega Projects, Physical Imports or such 100% exemptions & MNRE Exemptions (statutory benefits), customer reimbursements of statutory duties (like Excise Duty, CST, VAT) will also be taken into account at the time of tender evaluation. (Wherever applicable and as indicated in SCC document of tender)
9. For evaluation of offers in foreign currency, the exchange rate (TT selling rate of SBI) shall be taken as under:

Single part bids:	Date of tender opening
Two/three part bids:	Date of Part-I bid opening
Reverse Auction:	Date of Part-I bid opening

In case of Performance Bank Guarantee (PBG) also, exchange rate will be considered as mentioned above for converting foreign currency to Indian currency and vice versa.

If the relevant day happens to be a bank holiday, then the exchange rate as on the previous working day of the bank (SBI) shall be taken.
10. Ranking (L-1, L-2 etc.) shall be done only for the techno-commercially acceptable offers and on the basis or evaluation of Total Cost to BHEL.

E. INFORMATION ON PAYMENT TERMS:

1. All payments will be through Electronic Fund transfer (EFT). Vendor has to furnish necessary details as per BHEL standard format (**Refer Annexure IV**) for receiving all payments through NEFT. (Applicable for Indian vendors only)
2. Statutory deductions, if any, will be made and the deduction certificate shall be issued. In case vendor does not provide PAN details, the TDS deduction shall be at the maximum percentage stipulated as per the provisions of Income Tax Act. (Applicable for Indian vendors only). Foreign vendors shall submit relevant details of their bankers like Swift Code, Banker's Name & Address etc.
3. Vendors must submit bills & invoices along with required supporting documents in time. Incomplete documentation / delayed submission of invoice / documents will result in corresponding delay in payment.

F. STANDARD PAYMENT TERMS OF BHEL-EDN**Purchase Orders for indigenous procurement****(a) SUPPLY WITH I&C/SUPERVISION:****Supply:**

- 1) 80% of basic Supply value + 100% of taxes, duties and freight charges will be paid with 45 days credit from the receipt of material at site or 15 days credit from the date of submission of complete set of documentation whichever is later.
- 2) 10% of basic supply value will be paid on completion of I&C against submission of supplementary invoice along with proof of completion of I&C along with I&C charges (if any).
- 3) Balance 10% (retention money) against submission of supplementary invoice along with PBG valid for Warranty Period+3 months Claim Period from BHEL Consortium Bank.

I&C/Supervision: 100% on completion of I&C/Supervision and certification line item wise on pro-rata basis.

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

(b) SUPPLY ONLY:

- 1) 100% of Basic value with taxes, duties and freight will be paid with 45 days credit from the receipt of material at site or 15 days credit from the date of submission of complete set of documentation whichever is later)+ submission of PBG valid for Warranty Period+ 3 months Claim Period from BHEL Consortium Bank ,if applicable.

Purchase orders for import procurement:**(c) SUPPLY WITH I&C/SUPERVISION:****Supply:**

- 1) 80% of the basic value (excluding I&C charges) will be paid with 45 days credit, against Sight draft, from the date of AWB/BOL on submission of complete set of documents as in PO.
- 2) 10% of basic supply value will be paid on completion of I&C against submission of supplementary invoice along with proof of completion of I&C along with I&C charges (if any).
- 3) Balance 10% (retention money) against submission of supplementary invoice along with PBG valid for Warranty Period+3 months Claim Period from BHEL Consortium Bank.

I&C: 100% on completion of I&C/Supervision and certification line item wise on pro-rata basis.

(d) SUPPLY ONLY:

- 1) 100% of PO value will be paid against Sight draft with 45 days Credit from the date of dispatch or 15 days credit from the date of submission of complete set of documents whichever is later)+ submission of PBG valid for Warranty Period+3 months Claim Period from BHEL Consortium Bank ,if applicable.

Note for (a), (b), (c) and (d): In exceptional cases, if vendor fails to submit PBG after supplies, vendors can also accept for the final 10% payment, payable after the warranty period + 3 months of claim period against supplementary invoice subject to the completion of commissioning (if applicable) as PBG is linked to Warranty period.

G. LOADING FACTORS FOR PAYMENT TERMS & DELAYED DELIVERY:

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.

SI No	Deviation on	Nature of Deviation / Offered Terms	Loading %
1.	Payment Terms	For Purchase within India :-	
		1) Credit period less than 45 days	15
		* For Foreign Purchase :-	
		1) Payment through At Sight Letter of Credit	10
		2) Payment through Letter of Credit with usance credit of 45 days	5
2.	Penalty for Delayed Delivery	3) Sight Draft with credit period less than 45 days	5
		1) Non – Acceptance	10
		2) Partial Acceptance (X%)	(10 – X)

*** All bank charges shall be to seller's account. If bank charges of BHEL banker are to BHEL's account then additional loading of 2% on the quoted basic value is applicable.**

Offer/s with payment terms other than the standard payment terms indicated at Clause No. F or Deviated Payment Terms with loading indicated at Clause No. G above are liable for rejection.

NOTES:

1. ADVANCE PAYMENT/LC: Quotations with "Advance payment/Inland LC" shall be rejected.
2. Basic value of Purchase Order mentioned above will include all components of the purchase order and will exclude only taxes, duties, freight and I&C charges (wherever applicable).
3. Wherever the Purchase Order is split into import portion and indigenous portion of supply the retention money will be 10% (as applicable) of both purchase order values put together.
4. Non-Compliance of Warranty terms. Offers not complying with Warranty terms as per RFQ Terms is liable for rejection.
5. SALE IN TRANSIT/ LOCAL VAT: Sale in transit under section 6(2) of CST is allowed if movement of goods is interstate. In case intra state movement of goods, benefit of sale in transit is not available.
6. In case of intrastate movement i.e. supply within same state and VAT is applicable, the vendor shall furnish the respective BHEL's nodal agency TIN no. and address in their invoice. (Refer **Annexure IX**)

H. BANK GUARANTEE (BG) / PERFORMANCE BANK GUARANTEE (PBG):

1. Bank guarantee (BG) / Performance bank guarantee (PBG) will be applicable as called in the tender documents. Such PBG shall be valid for a period of Warranty Period + claim period of 3 months for a value equal to 10 % of the basic value of the purchase order. No deviation for the duration of PBG / BG will be permitted.
 - a. PBG shall be from any of the BHEL consortium of bankers (**refer Annexure V**).
 - b. PBGs from nationalized banks are also acceptable.

- c. PBG should be sent directly by the bank to the dealing executive mentioned in the purchase order located at the address mentioned in the purchase order. PBG should be in the format indicated. **(Refer Annexure III)**. No deviation to these formats will be allowed.
- d. Confirmation from any of the BHEL consortium of banks or any of the Indian Public Sector Banks is essential for the acceptance of PBGs issued by foreign banks (located outside India).
- e. Expired BGs / PBGs will be returned only after expiry of the claim period or on completion of the contractual obligation.
- f. In case vendor does not accept for submission of PBG, the vendor is liable for rejection on commercial grounds.

I. DOCUMENTS (TRIPLICATE COPIES) REQUIRED AT THE TIME OF DISPATCH FOR PROCESSING OF BILL:

1. FOR INDIGENOUS SCOPE OF SUPPLY:

For Supply: Invoice in Triplicate, Lorry receipt (LR) copy, Packing List, PSI Call Letter Copy, Proof of delivery such as MRC (Material Receipt Certificate)/ original acknowledged LR, Insurance intimation Letter and Warranty Certificate. Note that document pertaining to Proof of delivery shall clearly mention number of boxes/panels etc which shall be in line with the Packing list.

For I&C: Supplementary Invoice in Triplicate with copy of I&C Certificate (Proof of Completion of I&C).

For PBG: Supplementary Invoice in Triplicate with copy of PBG. However, PBG should reach concerned Purchase Officer directly from the Bank.

2. FOR IMPORTED SCOPE OF SUPPLY:

For Supply: Invoice in Triplicate, Air Way Bill/Bill of Lading, Packing List, PSI Call Letter Copy, and Warranty Certificate.

For I&C: Supplementary Invoice in Triplicate with copy of I&C Certificate (Proof of Completion of I&C).

For PBG: Supplementary Invoice in Triplicate with copy of PBG. Both PBG & supplementary invoice should reach concerned Purchase Officer directly from the Bank.

J. PROVISIONS APPLICABLE FOR MSE VENDORS (MICRO AND SMALL ENTERPRISES)

Vendors who qualify as MSE vendors are requested to submit applicable certificates (as specified by the Ministry of Micro, Small and Medium Enterprises) at the time of vendor registration. Vendors have to submit any of the following documents along with the tender documents in the Part I / Technical bid cover to avail the applicable benefits.

- a. Valid NSIC certificate or
- b. Entrepreneur's Memorandum part II (EM II) certificate (deemed valid for 2 years).
- c. EM II certificate with CA certificate **(in the prescribed format given in Annexure VIII)** applicable for the year certifying that the investment in plant and machinery of the vendor is within permissible limits as per the MSME Act 2006 for relevant status where the deemed validity is over.
- d. Documents submitted for establishing the credentials of MSE vendors must be valid as on the date of part I / technical bid opening for the vendors to be eligible for the benefits applicable for MSE vendors. Documents submitted after the Part I / Technical bid opening date will not be considered for this tender.

PURCHASE PREFERENCE FOR MSE VENDORS:

- e. MSE vendors quoting within a price band of L1 + 15% shall be allowed to supply up to 25% of the requirement against this tender provided. Minimum of 3% reservation for women owned MSEs within the above mentioned 25% reservation.
 1. The MSE vendor matches the L1 price.
 2. L1 price is from a non MSE vendor.
 3. L1 price will be offered to the nearest vendor nearest to L1 in terms of price ranking (L2 - nearest to L1). In case of non-acceptance by the MSE vendor (L2) next ranking MSE vendor will be offered who is within the L1 + 15% band (if L3 is also within 15% band).
 4. 25% of the 25% (i.e. 6.25% of the total enquired quantity) will be earmarked for SC/ST owned MSE firms provided conditions as mentioned in (1) and (2) are fulfilled.
 5. In case no vendor under SC / ST category firms are meeting the conditions mentioned in (1) and (2) or have not participated in the tender, in such cases the 6.25% quantity will be distributed among the other eligible MSE vendors who have participated in the tender.

6. Serial no. 1 to 5 will not be applicable wherever it is not possible to split the tendered quantity / items on account of customer contract requirement, or the items tendered are systems. Such information that tendered quantity will not be split will be indicated in the SCC.

K. INTEGRITY COMMITMENT IN THE TENDER PROCESS, AND EXECUTION OF CONTRACTS:

1. Commitment by BHEL:

BHEL commits to take all measures necessary to prevent corruption in connection with the Tender process and execution of the Contract. BHEL will, during the tender process, treat all bidder / suppliers in a transparent and fair manner, and with equity.

2. Commitment by Bidder(s)/ Contractor(s):

- a. The Bidder(s)/ Contractor(s) commit(s) to take all measures to prevent corruption and will not directly or indirectly try to influence any decision or benefit which he is not legally entitled to.
- b. The Bidder(s)/ Contractor(s) will not enter with other Bidder(s) into any undisclosed agreement or understanding or any actions to restrict competition.
- c. The Bidder(s)/ Contractor(s) will not commit any offence under the relevant Acts. 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 BHEL as part of business relationship.
- d. 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 and shall adhere to the relevant guidelines issued from time to time by Government of India/ BHEL.

If the Bidder(s) / Contractor(s), before award or during execution of the Contract commit(s) a transgression of the above or in any other manner such as to put his reliability or credibility in question, BHEL is entitled to disqualify the Bidder(s) / Contractor (s) from the tender process or terminate the contract and/ or take suitable action as deemed fit.

L. FRAUD PREVENTION POLICY:

The bidder along with its associate/collaborators/sub-contractors/sub-vendors/consultants/service providers shall strictly adhere to BHEL Fraud Prevention Policy displayed on BHEL website <http://www.bhel.com> and shall immediately bring to the notice of BHEL Management about any fraud or suspected fraud as soon as it comes to their notice. Fraud Prevention policy and List of Nodal Officers shall be hosted on BHEL website, vendor portals of Units/regions intranet.

PURCHASE EXECUTIVE



ಭಾರತ್ ಹೆವಿ ಎಲೆಕ್ಟ್ರಿಕಲ್ಸ್ ಲಿಮಿಟೆಡ್
भारत हेवी इलेक्ट्रिकल्स लिमिटेड

Bharat Heavy Electricals Ltd.,
(A Government of India undertaking)
Electronics Division

PB 2606 , Mysore Road Bangalore , 560026 INDIA

SCPV: BOS: GCC - Rev 03

GENERAL COMMERCIAL CONDITIONS FOR CONTRACT (GCC)

These 'General Commercial Conditions for Contract for Purchase' hereinafter referred to as GCC apply to all enquiries, tenders, requests for quotations, orders, contracts and agreements concerning the supply of goods and the rendering of related services (hereinafter referred to as "deliveries") to Bharat Heavy Electricals Limited and any of its units, regions or divisions (hereinafter referred to as "BHEL" or the Purchaser) or its projects / customers.

Any deviations from or additions to these GCC require BHEL's express written consent. The general terms of business or sale of the vendor shall not apply to BHEL. Acceptance, receipt of shipments or services or effecting payment shall not mean that the general terms of business or sale of the vendor have been accepted.

Orders, agreements and amendments thereto shall be binding if made or confirmed by BHEL in writing. Only the Purchasing department of BHEL is authorized to issue the Purchase Order or any amendment thereof.

Definitions: Throughout these conditions and in the specifications, the following terms shall have the meanings assigned to them, unless the subject matter or the context requires otherwise.

- 'The Purchaser' means Bharat Heavy Electricals Limited, Electronics division, Mysore road, Bangalore 560 026, a Unit of Bharat Heavy Electricals Limited (A Govt. of India Undertaking) incorporated under the Companies Act having its registered office at BHEL House, Siri Fort, New Delhi-110049, India and shall be deemed to include its successors and assigns. It may also be referred to as BHEL.
- 'The vendor' means the person, firm, company or organization on whom the Purchase Order is placed and shall be deemed to include the vendor's successors, representative heirs, executors and administrator as the case may be. It may also be referred to as Seller, Contractor or Supplier.
- 'Contract' shall mean and include the Purchase Order incorporating various agreements, viz. tender/ RFQ, offer, letter of intent / acceptance / award, the General Conditions of Contract and Special Conditions of Contract for Purchase, Specifications, Inspection / Quality Plan, Schedule of Prices and Quantities, Drawings, if any enclosed or to be provided by BHEL or his authorized nominee and the samples or patterns if any to be provided under the provisions of the contract.
- 'Parties to the Contract' shall mean the 'The Vendor' and the Purchaser as named in the main body of the Purchase Order.
- "Bidder" shall mean duly established reputed organisation, manufacturer etc. having requisite financial and technical capability and experience of participating in the bid invited by the purchaser for the tender.
- Bid- The term "bid" or "bidding" can also relate to the documented Offer submitted in response to a request for quotation (RFQ) /Tender.

Interpretation:

In the contract, except where the context requires otherwise:

- words indicating one gender include all genders;
- words indicating the singular also include the plural and words indicating the plural also include the singular;
- provisions including the word "agree", "agreed" or "agreement" require the agreement to be recorded in writing, and
- "Written" or "in writing" means hand-written, type-written, printed or electronically made, and resulting in a permanent record.

Applicable Conditions:

1. **Price Basis:** All prices shall be firm until the purchase order is executed / completed in all respects. No price variations / escalation shall be permitted unless otherwise such variations / escalations are provided for and agreed by BHEL in writing in the purchase order.
2. **Validity:** The offer will be valid for a period of 90 days from the date of technical bid opening date. Validity beyond 90 days, if required, will be specified in the SCC (special conditions of contract).
3. **Taxes & Duties:** Taxes as mentioned in the Contract Price or Price Schedule shall be paid to the Contractor subject to the Contractor complying with all the statutory requirements and furnishing the relevant documents including error free invoices containing detailed break-up of the taxes. Any duties, levies or taxes not mentioned in Contract Price or Price Schedule but applicable as per any statute(s) shall be deemed to be included in the Contract price and shall be to the account of the Contractor.
The Contractor shall bear and pay all the costs, liabilities, levies, interest, penalties in respect of non-compliances of any legal requirements as per various statutory provisions. The contractor shall keep the owner indemnified at all times from any tax liability, interest, penalties or assessments that may be imposed by the statutory authorities for non-compliances or non-observation of any statutory requirements by the Contractor.
4. **Ordering and confirmation of Order:** Vendor shall send the order acceptance on their company letter head within two weeks from the date of Purchase Order or such other period as specified / agreed by BHEL. BHEL reserves the right to revoke the order placed if the order confirmation differs from the original order placed. The acceptance of goods/services/supplies by BHEL as well as payments made in this regard shall not imply acceptance of any deviations.
The purchase order will be deemed to have been accepted if no communication to the contrary is received within two weeks (or the time limit as specified / agreed by BHEL) from the date of the purchase order.
5. **Documentation:** After receipt of Purchase Order, vendor should submit required documents like drawings, bill of materials, datasheets, catalogues, quality plan, test procedure, type test report , O & M Manuals and/or any other relevant documents as per Specification/Purchase Order, as and when required by BHEL/Customer.
At any stage within the contract period, the vendor shall notify of any error, fault or other defect found in BHEL's documents /specifications or any other items for reference. If and to the extent that (taking account of cost and time) any vendor exercising due care would have discovered the error, fault or other defect when examining the documents/specifications before submitting the tender, the time for completion shall not be extended. However if errors, omissions, ambiguities, inconsistencies, inadequacies or other defects are found in the vendor's documents, they shall be corrected at his cost, notwithstanding any consent or approval.
6. **TERMS OF DELIVERY:**
FOR IMPORTED PURCHASE:
Price offered shall be for goods packed and delivered CIF Seaport/ International Airport (FCA) 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. The consignment shall be handed over to BHEL approved freight forwarder as mentioned in PO.

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.

Deviation for the delivery term is liable for rejection.

7. Penalty:

For delay in delivery: In the event of delay in agreed contractual delivery as per Purchase Order, penalty @ 0.5 % (half percent) per week or part thereof but limited to a max of 10% (ten percent) value of undelivered portion (basic material cost) will be applicable. Delivery will commence from the date of document approval by customer / BHEL or date of issue of manufacturing clearance, whichever is later. The date for which Inspection call is issued by vendor along with test certificates / test reports / Certificate of Conformance / calibration reports, as proof of completion of manufacturing will be treated as date of deemed delivery for penalty calculation. In the absence of furnishing such document indicated above as proof of completion of manufacturing along with inspection call, actual date of inspection will be considered as date of deemed delivery and BHEL will not be responsible for delay in actual date of inspection.

Penalty for delayed delivery, if applicable, shall be deducted at the time of first payment. If penalty is applicable for duration of less than a week, penalty @ 0.5% (half percent) of the basic material value will be deducted.

8. **Contract variations (Increase or decrease in the scope of supply):** BHEL may vary the contracted scope as per requirements at site. If vendor is of the opinion that the variation has an effect on the agreed price or delivery period, BHEL shall be informed of this immediately in writing along with technical details. Where unit rates are available in the Contract, the same shall be applied to such additional work. Vendor shall not perform additional work before BHEL has issued written instructions / amendment to the Purchase Order to that effect. The work which the vendor should have or could have anticipated in terms of delivering the service(s) and functionality (i.e.) as described in this agreement, or which is considered to be the result of an attributable error on the vendor's part, shall not be considered additional work.
9. **Reverse Auction:** BHEL reserves the right to go for Reverse Auction (RA) (Guidelines as available on www.bhel.com) instead of opening the sealed envelope price bid, submitted by the bidder. This will be decided after techno-commercial evaluation. Bidders to give their acceptance with the offer 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.

Those bidders who have given their acceptance to participate in Reverse Auction will have to necessarily submit 'Process compliance form' (to the designated service provider) as well as 'Online sealed bid' in the Reverse Auction. Non-submission of 'Process compliance form' or 'Online sealed bid' by the agreed bidder(s) will be considered as tampering of the tender process and will invite action by BHEL as per extant guidelines for suspension of business dealings with suppliers/ contractors (as available on www.bhel.com).

The bidders have to necessarily submit online sealed bid less than or equal to their envelope sealed price bid already submitted to BHEL along with the offer. The envelope sealed price bid of successful L1 bidder in RA, if conducted, shall also be opened after RA and the order will be placed on lower of the two bids (RA closing price & envelope sealed price) thus obtained. The bidder having submitted this offer specifically agrees to this condition and undertakes to execute the contract on thus awarded rates.

If it is found that L1 bidder has quoted higher in online sealed bid in comparison to envelope sealed bid for any item(s), the bidder will be issued a warning letter to this effect. However, if the same bidder again defaults on this count in any subsequent tender in the unit, it will be considered as fraud and will invite action by BHEL as per extant guidelines for suspension of business dealings with suppliers/ contractors (as available on www.bhel.com).

10. **Pre Shipment Inspection:** Prior written notice of at least one week shall be given along with internal test certificates / COC and applicable test certificates. Materials will be inspected by BHEL-EDN-QS/CQS or BHEL nominated Third Party Inspection Agency (TPIA) or BHEL authorized Inspection Agency or Customer / Consultant or jointly by BHEL & Customer / consultant. All tests have to be conducted as applicable in line with approved Quality plan or QA Checklist or Purchase specification and original reports shall be furnished to BHEL-EDN, Bangalore for verification / acceptance for issue of dispatch clearance. All costs related to inspections & re-inspections shall be borne by vendor. Whether the Contract provides for tests on the premises of the vendor or any of his Sub-contractor/s, vendor shall be responsible to provide such assistance, labour, materials, electricity, fuels, stores, apparatus, instruments as may be required and as may be reasonably demanded to carry out such tests efficiently. Cost of any type test or such other special tests shall be borne by BHEL only if specifically agreed to in the purchase order.
11. **Transit Insurance:** Transit insurance coverage between vendor's works and project site shall be to the account of BHEL, unless specifically agreed otherwise. However, vendor shall send intimation directly to insurance agency through fax/courier/e-mail, immediately on dispatch of goods for covering insurance. A copy of such intimation sent by vendor to insurance agency shall be given to BHEL along with dispatch documents. Dispatch documents will be treated as incomplete without such intimation copy. BHEL shall not be responsible for sending intimations to insurance agency on behalf of the vendor.
12. **Packaging and dispatch:** The Seller shall package the goods safely and carefully and pack them suitably in all respects considering the peculiarity of the material for normal safe transport by Sea / Air / Rail / Road to its destination suitably protected against loss, damage, corrosion in transit and the effect of tropical salt laden atmosphere. The packages shall be provided with fixtures / hooks and sling marks as may be required for easy and safe handling. If any consignment needs special handling instruction, the same shall be clearly marked with standard symbols / instructions. Hazardous material should be notified as such and their packing, transportation and other protection must conform to relevant regulations. The packing, shipping, storage and processing of the goods must comply with the prevailing legislation and regulations concerning safety, the environment and working conditions. Any Imported/Physical Exports items packed with raw / solid wood packing material should be treated as per ISPM – 15 (fumigation) and accompanied by Phytosanitary / Fumigation certificate. If safety information sheets (MSDS – Material Safety Data Sheet) exist for an item or the packaging, vendor must provide this information without fail along with the consignment. Each package must be marked with Consignee name, Purchase order number, Package number, Gross weight and net weight, dimensions (L x B x H) and Seller's name. Packing list of goods inside each package with PO item number and quantity must also be fixed securely outside the box to indicate the contents of each box. Total number of packages in the consignment must also be indicated. Separate packing & identification of items should be as follows.
 1. Main Scope - All items must be tagged with part no. & item description.
 2. Commissioning spares - All items must be tagged with part no. & item description.
 3. Mandatory spares - All items must be tagged with part no. & item description.
13. **Assignment of Rights & Obligations; Subcontracting:** Vendor is not permitted to subcontract the delivery or any part thereof to third party or to assign the rights and obligations resulting from this agreement in whole or in part to third parties without prior written permission from BHEL. Any permission or approval given by the BHEL shall, however, not absolve the vendor of the responsibility of his obligations under the Contract.
14. **Progress report:** Vendor shall render such report as to the progress of work and in such form as may be called for by the concerned purchase officer from time to time. The submission and acceptance of such reports shall not prejudice the rights of BHEL in any manner.

15. **Non-disclosure and Information Obligations: Vendor** shall provide with all necessary information pertaining to the goods as it could be of importance to BHEL. Vendor shall not reveal confidential information that may be divulged by BHEL to Vendor's employees not involved with the tender/ contract & its execution and delivery or to third parties, unless BHEL has agreed to this in writing beforehand. Vendor shall not be entitled to use the BHEL name in advertisements and other commercial publications without prior written permission from BHEL.
16. **Cancellation / Termination of contract:** BHEL shall have the right to completely or partially terminate the agreement by means of written notice to that effect. Termination of the Contract, for whatever reason, shall be without prejudice to the rights of the parties accrued under the Contract up to the time of termination.
BHEL shall have the right to cancel/foreclose the Order/ Contract, wholly or in part, in case it is constrained to do so, on account of any decline, diminution, curtailment or stoppage of the business.
17. **Risk Purchase Clause:** In case of failure of supplier, BHEL at its discretion may make purchase of the materials / services NOT supplied / rendered in time at the RISK & COST of the supplier. Under such situation, the supplier who fails to supply the goods in time shall be wholly liable to make good to BHEL any loss due to risk purchase.
In case of items demanding services at site like erection and commissioning, vendor should send his servicemen /representatives within 7 days from the service call. In case a vendor fails to attend to the service call, BHEL at its discretion may also make arrangements to attend such service by other parties at the **RISK & COST** of the supplier. Under such situation the supplier who fails to attend the service shall be wholly liable to make good to BHEL any loss due to risk purchase / service including additional handling charges due to the change.
18. **Shortages:** In the event of shortage on receipt of goods and/or on opening of packages at site, all such shortages shall be made good within a reasonable time that BHEL may allow from such intimation and free of cost.
Transit Damages: In the event of receipt of goods in damaged condition or having found them so upon opening of packages at site, Supplier shall make good of all such damages within a reasonable time from such intimation by BHEL.
19. **Remedial work:** Notwithstanding any previous test or certification, BHEL may instruct the vendor to remove and replace materials/goods or remove and re-execute works/services which are not in accordance with the purchase order. Similarly BHEL may ask the vendor to supply materials or to execute any services which are urgently required for any safety reasons, whether arising out of or because of an accident, unforeseeable event or otherwise. In such an event, Vendor shall provide such services within a reasonable time as specified by BHEL.
20. **Indemnity Clause:** Vendor shall comply with all applicable safety regulations and take care for the safety of all persons involved. Vendor is fully responsible for the safety of its personnel or that of his subcontractor's men / property, during execution of the Purchase Order and related services. All statutory payments including PF, ESI or other related charges have to be borne by the vendor. Vendor is fully responsible for ensuring that all legal compliances are followed in course of such employment.
21. **Product Information, Drawings and Documents:** Drawings, technical documents or other technical information received by Vendor from BHEL or vice versa shall not, without the consent of the other party, be used for any other purpose than that for which they were provided. They may not, without the consent of the Disclosing party, otherwise be used or copied, reproduced, transmitted or communicated to third parties. All information and data contained in general product documentation, whether in electronic or any other form, are binding only to the extent that they are by reference expressly included in the contract.
Vendor, as per agreed date/s but not later than the date of delivery, provide free of charge information and drawings which are necessary to permit and enable BHEL to erect, commission, operate and maintain the product. Such information and drawings shall be supplied in as many numbers of copies as may be agreed upon.
All intellectual properties, including designs, drawings and product information etc. exchanged during the

formation and execution of the Contract shall continue to be the property of the disclosing party.

22. **Intellectual Property Rights, Licenses:** If any Patent, design, Trade mark or any other intellectual property rights apply to the delivery (goods / related service) or accompanying documentation shall be the exclusive property of the Vendor and BHEL shall be entitled to the legal use thereof free of charge by means of a non-exclusive, worldwide, perpetual license. All intellectual property rights that arise during the execution of the Purchase Order/ contract for delivery by vendor and/or by its employees or third parties involved by the vendor for performance of the agreement shall belong to BHEL. Vendor shall perform everything necessary to obtain or establish the above mentioned rights. The Vendor guarantees that the delivery does not infringe on any of the intellectual property rights of third parties. The Vendor shall do everything necessary to obtain or establish the alternate acceptable arrangement pending resolution of any (alleged) claims by third parties. The Vendor shall indemnify BHEL against any (alleged) claims by third parties in this regard and shall reimburse BHEL for any damages suffered as a result thereof.
23. **Force Majeure:** Notwithstanding anything contained in the purchase order or any other document relevant thereto, neither party shall be liable for any failure or delay in performance to the extent said failures or delays are caused by the "Act of God" and occurring without its fault or negligence, provided that, force majeure will apply only if the failure to perform could not be avoided by the exercise of due care and vendor doing everything reasonably possible to resume its performance.
A party affected by an event of force majeure which may include fire, tempest, floods, earthquake, riot, war, damage by aircraft etc., shall give the other party written notice, with full details as soon as possible and in any event not later than seven (7) calendar days of the occurrence of the cause relied upon. If force majeure applies, dates by which performance obligations are scheduled to be met will be extended for a period of time equal to the time lost due to any delay so caused.
- Notwithstanding above provisions, in an event of Force Majeure, BHEL reserves for itself the right to cancel the order/ contract, wholly or partly, in order to meet the overall project schedule and make alternative arrangements for completion of deliveries and other schedules.
24. **Guarantee / Warranty:** Wherever required, and so provided in the specifications / Purchaser Order, the Seller shall guarantee that the stores supplied shall comply with the specifications laid down, for materials, workmanship and performance. The guarantee / warranty period as described shall apply afresh to replaced, repaired or re-executed parts of a delivery. If the vendor fails to take proper corrective action to repair/replace defects satisfactorily within a reasonable period, Purchaser shall be free to take corrective action as may be deemed necessary at vendor's risk and cost after giving notice to the vendor, including arranging supply of goods from elsewhere at the sole risk and cost of the vendor. Unless otherwise specifically provided in the Purchase Order, Vendor's liability shall be co terminus with the expiration of the applicable guarantee / warranty period.
25. **Limitation of Liability:** Vendor's liability towards this contract is limited to a maximum of 100% of the contract value and consequential damages are excluded. However the limits of liability will have no effect in cases of criminal negligence or wilful misconduct.
The total liability of Vendor for all claims arising out of or relating to the performance or breach of the Contract or use of any Products or Services or any order shall not exceed the total Contract price.
26. **Liability during guarantee / warranty:** Vendor shall arrange replacement / repair of all the defective materials / services under its obligation under the guarantee / warranty period. The rejected goods shall be taken away by vendor and replaced / repaired. In the event of the vendor's failure to comply, BHEL may take appropriate action including disposal of rejections and replenishment by any other sources at the cost and risk of the vendor.
In case, defects attributable to vendor are detected during first time commissioning or use, vendor shall be responsible for replacement / repair of the goods as required by BHEL at vendor's cost. In all such cases expiry of guarantee / warranty will not be applicable.
27. **Liability after guarantee / warranty period:** At the end of the guarantee / warranty, the Vendor's liability ceases except for latent defects (latent defects are defects / performance issues notices after the

guarantee / warranty has expired). The Contractor's liability for latent defects warranty for the plant and equipment including spares shall be limited to a period of six months from the end of the guarantee / as specified in RFQ.

28. **Compliance with Laws:** Vendor shall, in performing the contract, comply with all applicable laws. The vendor shall make all remittances, give all notices, pay all taxes, duties and fees, and obtain all permits, licences and approvals, as required by the laws in relation to the execution and completion of the contract and for remedying of any defects; and the Contractor shall indemnify and hold BHEL harmless against and from the consequences of any failure to do so.
29. **Settlement of Disputes:** Except as otherwise specifically provided in the Purchase Order, decision of BHEL shall be binding on the vendor with respect to all questions relating to the interpretation or meaning of the terms and conditions and instructions herein before mentioned and as to the completion of supplies/work/services, other questions, claim, right, matter or things whatsoever in any way arising out of or relating to the contract, instructions, orders or these conditions or otherwise concerning the supply or the execution or failure to execute the order, whether arising during the schedule of supply/work or after the completion or abandonment thereof. Any disputes or differences among the parties shall to the extent possible be settled amicably between the parties thereto, failing which the disputed issues shall be settled through arbitration. Vendor shall continue to perform the contract, pending settlement of dispute(s).
30. **Arbitration Clause:** In case amicable settlement is not reached in the event of any dispute or difference arising out of the execution of the Contract or the respective rights and liabilities of the parties or in relation to interpretation of any provision in any manner touching upon the Contract, such dispute or difference shall (except as to any matters, the decision of which is specifically provided for therein) be referred by either party to the sole arbitration of an Arbitrator appointed by the Executive Director/ General Manager of the purchasing unit/ region/ division of BHEL. Vendor shall have no objection even if the Arbitrator so appointed is an employee of BHEL or has ever dealt/ had to deal with any matter relating to this Contract.
- Subject as aforesaid the provisions of the Arbitration and Conciliation Act, 1996 of India or any statutory modification or re-enactment thereof and the rules made there under and for the time being in force shall apply to the arbitration proceedings under this clause. It is a term of contract that the party initiating arbitration shall specify the dispute or disputes to be referred to arbitration under this clause together with the amount or amounts claimed in respect of each such dispute. The venue for the arbitration shall be Bangalore, India. The award of the arbitrator shall be a speaking award and shall be final, conclusive and binding on all parties to this contract.
- The cost of arbitration shall be borne equally by the parties. Notwithstanding the existence of any dispute or difference or any reference for the arbitration, the vendor shall proceed with and continue without hindrance the performance of the work under the contract with due diligence and expedition in a professional manner.
31. **Applicable Laws and Jurisdiction of Courts:** Prevailing Indian laws both substantive and procedural, including modifications thereto, shall govern the Contract. Subject to the conditions as aforesaid, the competent courts in BANGALORE alone shall have jurisdiction to consider over any matters touching upon this contract.
32. **General Terms:** That any non-exercise, forbearance or omission of any of the powers conferred on BHEL and /or any of its authorities will not in any manner constitute waiver of the conditions hereto contained in these presents.
- That the headings used in this agreement are for convenience of reference only.
- That all notices etc., to be given under the Purchase order shall be in writing, type script or printed and if sent by registered post or by courier service to the address given in this document shall be deemed to have been served on the date when in the ordinary course, they would have been delivered to the addressee.
33. Vendors shall provide their state wise list of GSTIN number as per Govt of India Statute.

34. If the vendor is below the threshold limit, viz Rs.20. lacs as per existing provisions, then a declaration to be provided to that effect along with copy of accounts, failing which the supplier will be treated as an Unregistered dealer (URD) for which tax is payable on reverse charge (RCM) by BHEL.
35. If the vendor is above the threshold limit & is yet not registered, GST is payable by BHEL on reverse charge basis.
36. All supply items are linked to HSN code (Harmonised System Nomenclature). This goods list is mapped with HSN code which is released by Govt of India & available in public domain. All registered suppliers submitting the quote shall mandatorily mention HSN code relevant for the goods quoted.
37. Under GST, Govt of India has linked every service to a service accounting code called SAC. The list of services and the corresponding service accounting code (SAC) is released by Govt of India & available in public domain. All registered suppliers submitting the quote shall mandatorily mention SAC code relevant for the service quoted.
38. The rate of tax applicable for 35 services is also released by Government and rate for any service not falling in the list of 35 services is 18%.
39. Invoice should contain all particulars as per invoice Rules and should include the GST registration number (GSTIN), service accounting code (SAC) apart from all other details mentioned.
40. Invoice should contain all particulars as per invoice Rules and should include the GST registration number (GSTIN), HSN code apart from all other details mentioned.
41. In case GST is payable on reverse charge (RCM) invoice should mention that tax is payable on reverse charge
42. For a registered supplier, the supplier uploaded sales data for the month will be available to recipient on 11th of the subsequent month & details can be verified by BHEL. Credit availment can be confirmed based on this verified data
43. If the Supplier is not registered, then tax is payable on Reverse charge & will be to the account of the supplier
44. All services in the course of business or furtherance of business are eligible to credit subject to other compliances listed herein.
45. If service is eligible for credit, then the credit can be availed only if the invoice is as per the prescribed format, the supplier has uploaded the invoice in the GSTN portal, paid the taxes & uploaded the return, and matches with our inward data, failing which any availment of credit attracts interest.
46. Even in case of services where credit is not eligible,
 - (i) either the supplier should have registered (if above threshold limit) & comply with all above statutory provisions relating to invoice, tax remittance, return filing etc. This can be verified by BHEL from the GSTN portal OR
 - (ii) if not registered BHEL shall be liable to pay applicable taxes on reverse charge
47. For any deficiency in services, where a recovery is made / adjusted in supplier bills, the supplier has to raise a credit note on BHEL & upload in GSTN portal. All above rules applicable for invoice also apply for credit note.
48. All notifications and rules as per central board of excise and customs will be applicable.

ANNEXURE - I
LIST OF INTERNATIONAL GATEWAY AIRPORTS

SCHEDULE NO	COUNTRY	CURRENCY CODE	AIRPORT
D01	UK	GBP	LONDON (HEATHROW)
D02	UK	GBP	NEW CASTLE
D03	UK	GBP	OXFORD. CHETLAM
D04	UK	GBP	BRISTOL. WELLINGBOROUGH
D05	UK	GBP	BIRMINGHAM
DO6	UK	GBP	EAST MIDLANDS
D07	UK	GBP	MANCHESTER
D08	UK	GBP	LEEDS
D09	UK	GBP	GLASGOW
D10	FRANCE	EURO	PARIS (ROISSY) & LYON
D11	SWEDEN	EURO	STOCKHOLM
D12	SWEDEN	EURO	GOTHENBERG & MALMO
D13	ITALY	EURO	ROMA, MILAN
D14	ITALY	EURO	TURIN, BOLOGNA, FLORENCE
D15	NETHERLANDS	EURO	AMSTERDAM, ROTTERDAM
D16	AUSTRIA	EURO	VIENNA, LINZ, GRAZ
D17	BELGIUM	EURO	ANTWERP, BRUSSELS
D18	DENMARK	DKK	COPENHAGEN
D19	JAPAN	JPY	TOKYO, OSAKA
D20	SINGAPORE	SGD	SINGAPORE
D21	CANADA	CAD	TORONTO
D22	CANADA	CAD	MONTREAL
D23	USA	USD	NEW YORK, BOSTON
D24	USA	USD	CHICAGO
D25	USA	USD	SAN FRANCISCO, LOS ANGELES
D26	USA	USD	ALANTA, HOUSTON
D27	GERMANY	EURO	MUNICH, KOLN, DUSSELDORF, HANNOVER, HAMBURG, STUTTGART, DAMSTADT, MANIHIEM, NURUMBERG
D28	GERMANY	EURO	FRANKFURT
D29	GERMANY	EURO	BERLIN
D30	SWITZERLAND	SFR	BASLE, ZURICH, GENEVA
D31	SPAIN	EURO	BARCELONA
D32	AUSTRALIA	AUD	SYDNEY
D33	AUSTRALIA	AUD	MELBOURNE
D34	AUSTRALIA	AUD	PERTH
D35	CZECH	EURO	PRAGUE
D36	HONG KONG	HKD	HONG KONG
D37	NEW ZELAND	NZD	AUCKLAND
D38	RUSSIA	USD	MOSCOW
D39	SOUTH KOREA	USD	KIMPO INTERNATIONAL, INCHEON
D40	FINLAND	EURO	HELSINKI
D41	ROMANIA	EURO	BUCHAREST
D42	NORWAY	EURO	OSLO
D43	IRELAND	EURO	DUBLIN
D44	ISRAEL	USD	TEL AVIV
D45	UAE	USD	DUBAI
D46	OMAN	USD	MUSCAT
D47	EGYPT	USD	CAIRO
D48	TAIWAN	USD	TAIPEI
D49	UKRAINE	USD	KIEV
D50	CHINA	USD	SHANGHAI, SHENZHEN
D51	PHILIPINES	USD	MANILA
D52	MALAYSIA	USD	KUALALUMPUR, PE NANG
D53	CYPRUS	USD	LARNACA
D54	SOUTH AFRICA	USD	JOHANNESBERG, DURBAN
D55	SLOVAKIA	EURO	BARTISLOVA
D56	SAUDI ARABIA	SAR	RIYADH
D57	TURKEY	EURO	ISTANBUL
D58	THAILAND	USD	BANGKOK
D59	BRAZIL	USD	SAO PAULO, RIO DE JANEIRO

ANNEXURE - II
REQUEST FOR C FORM

NAME OF VENDOR :

VENDOR CODE ALLOTTED BY BHEL :

E mail id for c form correspondence :

BHEL PO NO	INVOICE NO	INVOICE DATE	INVOICE AMOUNT	SUPPLY FROM - STATE	SUPPLY TO - STATE	CST TIN NUMBER (SUPPLIER)	INVOICE AMOUNT EXCLUDING FREIGHT	C FORM QTR	YEAR	SUPPLY TO BHEL EDN / SITE
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Please note that one 'C' form will be issued for a quarter.

Any modification and cancellation of c form is not possible from our end since it is generated online therefore include all invoices pertaining to quarter in your request
Also check the data are correct in all respect

General Instruction:

1. C form request should be given only in this file.
2. Amount should be 100% of Invoice value but should Not include freight, Insurance etc.
3. PO No. should be numeric, starting with 4 and has 10 digits
4. For every quarter separate file to be provided
5. All Invoices pertaining to the relevant quarter to be included.
6. No corrections will be entertained once c-form is issued.

BANK GUARANTEE FOR PERFORMANCE SECURITY

Bank Guarantee No:

Date:

To
NAME
& ADDRESSES OF THE BENEFICIARY

Dear Sirs,

In consideration of Bharat Heavy Electricals Limited (hereinafter referred to as the 'Employer' which expression shall unless repugnant to the context or meaning thereof, include its successors and permitted assigns) incorporated under the Companies Act, 1956 and having its registered office at _____¹ through its Unit at _____ (name of the Unit) having awarded to (Name of the Vendor / Contractor / Supplier) with its registered office at _____² hereinafter referred to as the 'Vendor / Contractor / Supplier', which expression shall unless repugnant to the context or meaning thereof, include its successors and permitted assigns), a contract Ref No _____ dated _____³ valued at Rs _____⁴ (Rupees -----)/FC _____ (in words _____) for _____⁵ (hereinafter called the 'Contract') and the Vendor / Contractor / Supplier having agreed to provide a Contract Performance Bank Guarantee, equivalent to _____ % (_____ . Percent) of the said value of the Contract to the Employer for the faithful performance of the Contract,

we, _____, (hereinafter referred to as the Bank), having registered/Head office at _____ and inter alia a branch at _____ being the Guarantor under this Guarantee, hereby, irrevocably and unconditionally undertake to forthwith and immediately pay to the Employer any sum or sums upto a maximum amount of Rs -- _____⁶ (Rupees -----) without any demur, immediately on first demand from the Employer and without any reservation, protest, and recourse and without the Employer needing to prove or demonstrate reasons for its such demand.

Any such demand made on the Bank shall be conclusive as regards the amount due and payable by the Bank under this guarantee. However, our liability under this guarantee shall be restricted to an amount not exceeding Rs. _____.

We undertake to pay to the Employer any money so demanded notwithstanding any dispute or disputes raised by the Vendor / Contractor / Supplier in any suit or proceeding pending before any Court or Tribunal, Arbitrator or any other authority, our liability under this present being absolute and unequivocal.

The payment so made by us under this Guarantee shall be a valid discharge of our liability for payment thereunder and the Vendor / Contractor / Supplier shall have no claim against us for making such payment.

We the _____ bank further agree that the guarantee herein contained shall remain in full force and effect during the period that would be taken for the performance of the said Contract/satisfactory completion of the performance guarantee period as per the terms of the Contract and that it shall continue to be enforceable till

all the dues of the Employer under or by virtue of the said Contract have been fully paid and its claims satisfied or discharged.

We, _____ BANK further agree with the Employer that the Employer shall have the fullest liberty without our consent and without affecting in any manner our obligations hereunder to vary any of the terms and conditions of the said Contract or to extend time of performance by the said Vendor / Contractor / Supplier from time to time or to postpone for any time or from time to time any of the powers exercisable by the Employer against the said Vendor / Contractor / Supplier and to forbear or enforce any of the terms and conditions relating to the said Contract and we shall not be relieved from our liability by reason of any such variation, or extension being granted to the said Vendor / Contractor / Supplier or for any forbearance, act or omission on the part of the Employer or any indulgence by the Employer to the said Vendor / Contractor / Supplier or by any such matter or thing whatsoever which under the law relating to sureties would but for this provision have effect of so relieving us.

The Bank also agrees that the Employer at its option shall be entitled to enforce this Guarantee against the Bank as a principal debtor, in the first instance without proceeding against the Vendor / Contractor / Supplier and notwithstanding any security or other guarantee that the Employer may have in relation to the Vendor / Contractor / Supplier's liabilities.

This Guarantee shall remain in force upto and including _____⁷ and shall be extended from time to time for such period as may be desired by Employer.

This Guarantee shall not be determined or affected by liquidation or winding up, dissolution or change of constitution or insolvency of the Vendor / Contractor / Supplier but shall in all respects and for all purposes be binding and operative until payment of all money payable to the Employer in terms thereof.

Unless a demand or claim under this guarantee is made on us in writing on or before the _____⁸ we shall be discharged from all liabilities under this guarantee thereafter.

We, _____ BANK lastly undertake not to revoke this guarantee during its currency except with the previous consent of the Employer in writing.

Notwithstanding anything to the contrary contained hereinabove:

- a) The liability of the Bank under this Guarantee shall not exceed _____⁶
- b) This Guarantee shall be valid up to _____⁷
- c) Unless the Bank is served a written claim or demand on or before _____⁸ all rights under this guarantee shall be forfeited and the Bank shall be relieved and discharged from all liabilities under this guarantee irrespective of whether or not the original bank guarantee is returned to the Bank.

We, _____ Bank, have power to issue this Guarantee under law and the undersigned as a duly authorized person has full powers to sign this Guarantee on behalf of the Bank.

For and on behalf of
(Name of the Bank)

Dated _____ .

Place of Issue _____ .

¹ NAME AND ADDRESS OF EMPLOYER I.e Bharat Heavy Electricals Limited

² NAME AND ADDRESS OF THE VENDOR /CONTRACTOR / SUPPLIER.

³ DETAILS ABOUT THE NOTICE OF AWARD/CONTRACT REFERENCE

⁴ CONTRACT VALUE

⁵ PROJECT/SUPPLY DETAILS

⁶ BG AMOUNT IN FIGURES AND WORDS

⁷ VALIDITY DATE

⁸ DATE OF EXPIRY OF CLAIM PERIOD

Note:

1. Units are advised that expiry of claim period may be kept 3-6 months after validity date. It may be ensured that the same is in line with the agreement/ contract entered with the Vendor.
2. The BG should be on Non-Judicial Stamp paper/e-stamp paper of appropriate value as per Stamp Act prevailing in the State(s) where the BG is submitted or is to be acted upon or the rate prevailing in the State where the BG was executed, whichever is higher. The Stamp Paper/e-stamp paper shall be purchased in the name of Vendor/Contractor/Supplier /Bank issuing the guarantee.
3. In line with the GCC, SCC or contractual terms, Unit may carry out minor modifications in the Standard BG Formats. If required, such modifications may be carried out after taking up appropriately with the Unit/Region & Law Deptt.

4. In Case of Bank Guarantees submitted by Foreign Vendors-

- a. **From Nationalized/Public Sector / Private Sector/ Foreign Banks (BG issued by Branches in India)** can be accepted subject to the condition that the Bank Guarantee should be enforceable in the town/city or at nearest branch where the Unit is located i.e. Demand can be presented at the Branch located in the town/city or at nearest branch where the Unit is located.
- b. **From Foreign Banks (wherein Foreign Vendors intend to provide BG from local branch of the Vendor country's Bank)**
 - b.1 In such cases, in the Tender Enquiry/ Contract itself, it may be clearly specified that Bank Guarantee issued by **any of the Consortium Banks only** will be accepted by BHEL. As such, Foreign Vendor needs to make necessary arrangements for issuance of Counter- Guarantee by Foreign Bank in favour of the Indian Bank & (BHEL & Consortium Bank) branch in India. It is advisable that all charges for issuance of Bank Guarantee/ counter- Guarantee should be borne by the Foreign Vendor. The tender stipulation should clearly specify these requirements.
 - b.2 **In case, Foreign Vendors intend to provide BG from Overseas Branch of our Consortium Bank** (e.g. if a BG is to be issued by SBI Frankfurt), the same is acceptable. However, the procedure at **sl.no. b.1** will required to be followed.
 - b.3 The BG issued may preferably be subject to Uniform Rules for Demand Guarantees (URDG) 758 (as amended from time to time). The BG Format provided to them should clearly specify the same.

ANNEXURE - IV

Electronic Funds Transfer (EFT) OR Paylink Direct Credit Form

Please Fill up the form in **CAPITAL LETTERS** only.

TYPE OF REQUEST(Tick one): _____ CREATE _____ CHANGE

BHEL Vendor / Supplier Code:	
Company Name :	
Permanent Account Number(PAN):	
Address	

City: _____	PINCODE _____	STATE _____	
-------------	---------------	-------------	--

Contact Person(s)	
Telephone No:	
Fax No:	
e-mail id:	

1 Bank Name:	
2 Bank Address:	
3 Bank Telephone No:	
4 Bank Account No:	
5 Account Type: Savings/Cash Credit	
6 9 Digit Code Number of Bank and branch appearing on MICR cheque issued by Bank	
7 Bank swift Code(applicable for EFT only)	
8 Bank IFSC code(applicable for RTGS)	
9 Bank IFSC code(applicable for NEFT)	

- A I hereby certify that the particulars given above are true, correct and complete and that I, as a representative for the above named Company, hereby authorise BHEL, EDN, Bangalore to electronically deposit payments to the designated bank account.
- B If the transaction is delayed or not effected at all for reasons of incomplete or incorrect information, I would not hold BHEL / transferring Bank responsible.
- C This authority remains in full force until BHEL, EDN, Bangalore receives written notification requesting a change or cancellation.
- D I have read the contents of the covering letter and agree to discharge the responsibility expected of me as a participant under ECS / EFT.

Date:

Authorised Signatory:

Designation:

Telephone NO. with STD Code

Company Seal

Bank Certificate

We certify that _____ has an Account No _____ with us and we confirm that the bank details given above are correct as per our records.

Date:

(.....)

Place:

Signature

Please return completed form along with a blank cancelled cheque or photocopy thereof to:

Bharath Heavy Electricals Ltd,

Attn:

Electronics Division, Mysore Road,

BANGALORE - 560 026

In case of any Query, please call : 080-26998xxx / 2674xxxx or fax no. 080-2674xxxx

ANNEXURE-V
BHEL MEMBER BANKS (LIST OF CONSORTIUM BANKS)

BANK GUARANTEE (BG) SHALL BE ISSUED FROM THE FOLLOWING BANKS ONLY:

	Nationalised Banks		Nationalised Banks
1	Allahabad Bank	19	Vijaya Bank
2	Andhra Bank		Public Sector Banks
3	Bank of Baroda	20	IDBI
4	Canara Bank		Foreign Banks
5	Corporation Bank	21	CITI Bank N.A
6	Central Bank	22	Deutsche Bank AG
7	Indian Bank	23	The Hongkong and Shanghai Banking Corporation Ltd. (HSBC)
8	Indian Overseas Bank	24	Standard Chartered Bank
9	Oriental Bank of Commerce		
10	Punjab National Bank	26	J P Morgan
11	Punjab & Sindh Bank		Private Banks
12	State Bank of India	27	Axis Bank
13	State Bank of Hyderabad	28	The Federal Bank Limited
14	Syndicate Bank	29	HDFC Bank
15	State Bank of Travancore	30	Kotak Mahindra Bank Ltd
16	UCO Bank	31	ICICI Bank
17	Union Bank of India	32	IndusInd Bank
18	United Bank of India	33	Yes Bank

Note:

- All BGs must be issued from BHEL consortium banks listed above.
- BHEL may accept BG from other Nationalised Banks also which are not listed above.
- BG will not be accepted from Scheduled Banks and Co-operative Banks.
- In case BG is issued from a bank located outside Indian territory and is issued in foreign currency, the BG must be routed through and confirmed by any one of the above mentioned consortium banks or any of the Indian Public Sector Banks.
- This list is subject to changes. Hence vendors are requested to check this list every time before issuing BGs.

ANNEXURE - VI

DISCREPANCY IN WORDS & FIGURES – QUOTED IN PRICE BID

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

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

ANNEXURE - VII

BENEFITS FOR MSE SUPPLIERS AS PER MSMED ACT 2006 AND PUBLIC PROCUREMENT POLICY 2012

MSE suppliers can avail the intended benefits only if they submit along with the offer, attested copies of either EM II certificate having deemed validity (five years from the date of issue of Acknowledgement in EM II).

Or

Valid NSIC certificate or EM II certificate along with attested copy of CA certificate (Format enclosed: ANNEXURE VIII) where deemed validity of EM II certificate of five years has expired) applicable for the relevant financial year (latest audited).

Date to be reckoned for determining the deemed validity will be the date of bid opening (Part 1 in case of two part bid).

Non-submission of such documents will lead to consideration of their bid at par with other bidders.

No benefit shall be applicable for this enquiry if any deficiency in the above required documents are not submitted before price bid opening. If the tender is to be submitted through e-procurement portal, then the above required documents are to be uploaded on the portal. Documents should be notarized or attested by a Gazette officer.

ANNEXURE - VIII
CERTIFICATE BY CHARTERED ACCOUNTANT ON LETTER HEAD

This is to certify that M/s
.....(Hereinafter referred to as `Company`) having
its registered office at is registered under MSMED Act 2006, (Entrepreneur
Memorandum No ((Part-II) dtd Category:
(Micro/Small). (Copy enclosed).

Further verified from the Books of Accounts that the investment of the company as per the
latest audited financial year **as per MSMED Act 2006 is as follows:**

1. For Manufacturing Enterprises: Investment in plant and machinery (i.e., original cost excluding land
and building and the items specified by the Ministry of Small Industries vide its notification No.S.O.1722
(E) dated October 5, 2006:

Rs.Lacs.

2. For Service Enterprises: Investment in equipment (original cost excluding land and building
and furniture, fittings and other items not directly related to the service rendered or as may be
notified under the MSMED Act, 2006:

Rs.Lacs.

The above investment of Rs. Lacs in within permissible limit of Rs..... Lacs
for.....Micro / Small (Strike off which is not applicable) Category under MSMED
Act 2006.

(or)

The company has been graduated from its original category (Micro/Small) (Strike off which is not
applicable) and the date of graduation of such enterprise from its original category is
.....(dd/mm/yy) which is within the period of 3 years from the date of graduation of such enterprise
from its original category as notified vide S.O.No.3322(E) dated 01.11.2013 published in the gazette
notification dated 04.11.2013 by Ministry of MSME.

Date:

(Signature)

Name -

Membership Number -

Seal of Chartered Accountant

ANNEXURE - IX

In case of intrastate movement i.e. supply within same state and VAT is applicable, the vendor shall furnish the respective BHEL™s nodal agency TIN no. and address in their invoice.

List of Statewise Nodal Officers with Contact Details

Region	State	Nodal Unit responsible for all other units except those in column 4	Contact Details- Landline No.	E-mail	TIN No.	CST No.
1	2	3		7	8	9
Northern States	Jammu & Kashmir	PSNR	0120-2510488/2416452	rahulb@bhelpsnr.co.in / a.chadha@bhelpsnr.co.in	01291101313	
	Himachal Pradesh	PSNR			02011000622	
	Punjab	PSNR			03451148722	
	Haryana	PSNR			06962606884	
	Rajasthan	PSNR			08232903345	
	Uttar Pradesh	PSNR	0120-2416536	rahulb@bhelpsnr.co.in / smittal@bhelpsnr.co.in	09365800914	
	Uttarakhand	Hardwar	01334-285449	alok@bhelhwr.co.in	05001757277 Dated 30th Sep 2005	5000030 Dated 13/03/1965
	Delhi	TBG	0120-6748429	skjindal@bhel.in	07472001760	07472001760
Western States	Madhya Pradesh	Bhopal	0755-2503231	meeta@bhelbpl.co.in	23573600001 (HEL/05/01/0001/S dated 15/11/1979 under MPCT)	HEL/05/01/0004/C dated 15/11/1979
	Chattisgarh	PSWR	0712-3048609	m Gupta@bhelpswwr.co.in	22173202974	
	Gujarat	PSWR	0265-2370321	bhavin@bhelpswwr.co.in	24190101571	
	Maharashtra	ROD Mumbai	022-22126061/22187850	mahajani@bhel.in	27060300130V	27060300130C
	Daman & Diu	EDN	080-26998724 / 26998830	theerthagiri@bheledn.co.in	25000009902	
Southern States	Orissa	PSSR	044-28286773	sparida@bhelppsr.co.in / lakshmi@bhelppsr.co.in	21031301916	
	Tamil Nadu	Trichy	0431-2577757/ 2577229	mrsao@bheltry.co.in / bharaths@bheltry.co.in	33243560005	239383 dt.11.6.91
	Kerala	PSSR	044-28286773	lakshmi@bhelppsr.co.in	32072043622	
	Karnataka	EDN	080-26998724 / 26998830	theerthagiri@bheledn.co.in	29180069268	00850081
	Telangana	HPEP RC, Puram	040-23185406/ 040-23182238	chand@bhelhyd.co.in / sbsv@bhelhyd.co.in	36360151179	
	Andhra Pradesh	HPVP, Vizag	0891-6681298	sarmaass@bhypvl.com	37418632431	
	Puducherry	PSSR				
Eastern States	West Bengal	PSER	033-23216130-3238	amitavac@bhelppser.co.in	19200936019	19200936213
	Bihar	PSER	0612-2231275	rakesh@bhelppser.co.in	10010994046	10010994046
	Jharkhand	PSER	06549-266351 (Sh. Parmanand Swaroop)/06534-292179 (Sh. K.K. Ajeet)	pswaroop@bhelppser.co.in (Bokaro) kk.ajit@bhelppser.co.in (Koderma/Abhijeet/North Karanpura) manishk.jain@bhelppser.co.in (Chandrapura) kpsubbu@bhelppser.co.in	20352205642 (Bokaro) 20082005255 (Maithon) 20512405410 (Koderma) 20122200394 (Chandrapura) 20620905730 (Adhunik) 20650507026 (Abhijeet) 20452110016 (North Karanpura)	TG-729(C)
	Mizoram	PSER	033-23216130-3249	anindya@bhelppser.co.in	15501465017	
	Arunachal Pradesh	PSER	033-23216130-3249	anindya@bhelppser.co.in	12020122182	Not Applied
	Assam	PSER	033-23216130-3249	anindya@bhelppser.co.in	18790101415	18179903204
	Tripura	PSER	03821-265209	mkmahato@bhelppser.co.in	16060947071	16060947273
	Sikkim	PSER				
	Meghalaya	PSER				
	Manipur	PSER				
Nagaland	PSER					

Public Procurement (Preference to Make in India)

“For this procurement, Public Procurement (Preference to Make in India), Order 2017 dated 15.06.2017 & 28.05.2018 and subsequent orders issued by the respective Nodal Ministry shall be applicable even if issued after issue of this NIT but before finalization of contract/PO/WO against this NIT.

In the event of any Nodal Ministry prescribing higher or lower percentage of purchase preference and /or local content in respect of this procurement, same shall be applicable.”

Arbitration Clause in case of Contract with contractors/vendors /consultants other than Public Sector Enterprise (PSE) or a Government Department:

ARBITRATION & CONCILIATION

The parties shall attempt to settle any disputes or difference arising out of the formation, breach, termination, validity or execution of the Contract; or, the respective rights and liabilities of the parties; or, in relation to interpretation of any provision of the Contract; or, in any manner touching upon the Contract, or in connection with this contract through friendly discussions. In case no amicable settlement can be reached between the parties through such discussions, in respect of any dispute; then, either Party may, by a notice in writing to the other Party refer such dispute or difference to the sole arbitration of an arbitrator appointed by Head of the BHEL – EDN. Such Sole Arbitrator appointed, shall conduct the arbitration in English language.

The Arbitrator shall pass a reasoned award and the award of the Arbitration shall be final and binding upon the Parties.

Subject as aforesaid, the provisions of Arbitration and Conciliation Act 1996 (India) or statutory modifications or re-enactments thereof and the rules made thereunder and for the time being in force shall apply to the arbitration proceedings under this clause. The seat of arbitration shall be Bangalore.

The cost of arbitration shall be borne as decided by the Arbitrator upon him entering the reference.

Subject to the Arbitration Clause as above, the Courts at Bangalore alone shall have exclusive jurisdiction over any matter arising out of or in connection with this Contract.

Notwithstanding the existence or any dispute or differences and/or reference for the arbitration, the parties shall proceed with and continue without hindrance the performance of its obligations under this Contract with due diligence and efficiency in a professional manner except where the Contract has been terminated by either Party in terms of this Contract.

Arbitration Clause in case of Contract with contractors/vendors /consultants when they are a Public Sector Enterprise (PSE) or a Government Department:

In the event of any dispute or difference relating to the interpretation and application of the provisions of the Contract, such dispute or difference shall be referred by either party for Arbitration to the Sole Arbitrator in the Department of Public Enterprises to be nominated by the Secretary to the Government of India in-charge of the Department of Public Enterprises. The Arbitration and Conciliation Act, 1996 shall not be applicable to arbitration under this clause. The award of the Arbitrator shall be binding upon the parties to the dispute, provided, however, any Party aggrieved by such Award may make further reference for setting aside or revision of the Award to the Law Secretary, Department of Legal Affairs, Ministry of Law and Justice, Government of India. Upon such reference the dispute shall be decided by the Law Secretary or the Special Secretary or Additional Secretary when so authorized by the Law Secretary, whose decision shall bind the Parties hereto finally and conclusively. The Parties to the dispute will share equally the cost of arbitration as intimated by the Arbitrator.”

Format for Self Certification under preference to Make in India order

Certificate

In line with Government Public Procurement Order No. P-45021/2/2017-BE-II dt. 15.06.2017 & P-45021/2/2017-PP (BE-II) dated 28.05.2018, we hereby certify that we M/s _____ (supplier name) are local supplier meeting the requirement of minimum local content (50%) as defined in above orders for the material against Enquiry No. _____

Details of location at which local value addition will be made is as follows:

We also understand, false declarations will be in breach of the Code of Integrity under Rule 175(1)(i)(h) of the General Financial Rules for which a bidder or its successors can be debarred for up to two years as per Rule 151 (iii) of the General Financial Rules along with such other actions as may be permissible under law.

Seal and Signature of Supplier

ANNEXURE C

List of Documents to be submitted by Vendors/Subcontractors for SPV Contracts.		Confirmation on submission	DEVIATION OR REMARKS
IR Documents (Type - A): For all Civil & I&C & O&M			
Sl No.	Documents		
1	Wage Sheet (Form 17)	YES	
2	Attendance Register (w.r.t Sl No.1)	YES	
3	Workman Policy & Additional Insurance (Automotive Liability, Group Service Insurance Policy etc)	YES	
4	PF Challan	YES	
5	ESI (Employee State Insurance)	YES	
6	ECR (Electronic Challan Receipt)	YES	
7	Bank Statement for PF deposit	YES	
8	RCS (Remittance Confirmation Slip)	YES	
Quality Documents (Type - B): For all MMS Civil Works			
Sl No.	Documents		
1	FQA (Field Quality Assurance)	NA	
2	Field Content, Slump Test	NA	
3	Gradation of Aggregate (10mm, 20mm)	NA	
4	Fine Aggregate Test (for Sand)	NA	
5	Cube Test Registered	NA	
6	Material Test Certificate for Steel & Cement	NA	
7	Consumption Register for Steel & Invoice	NA	
8	Pour Card for Concreting purpose	NA	
9	Royalty Reports (10mm, 20mm, Sand)	NA	
10	Sand Soundness Test Reports	NA	
11	Slump Test Register	NA	
12	Sieve Analysis, Flakiness Index, Elongation Index - Register to be maintained	NA	
13	Moisture Content Coarse and Fine Aggregate - Register to be maintained	NA	
14	Water Test Report for Concrete	NA	
15	Design Mix Report for Concrete	NA	
Quality Documents (Type - B): For all Civil related Works			
Sl No	Documents		
1	FQA (Field Quality Assurance)	NA	
2	Field Content, Slump Test	NA	
3	Gradation of Aggregate (10mm, 20mm)	NA	
4	Fine Aggregate Test (for Sand)	NA	
5	Cube Test Registered	NA	
6	Material Test Certificate for Steel & Cement	NA	
7	Consumption Register for Steel & Invoice	NA	
8	Pour Card for Concreting purpose	NA	
9	Royalty Reports (10mm, 20mm, Sand)	NA	
10	Sand Soundness Test Reports	NA	
11	Warpage of Bricks Test Reports	NA	
12	Core Cutting (Compaction Test) - Roads & Pathways	NA	
13	Slump Test Register	NA	
14	Sieve Analysis, Flakiness Index, Elongation Index - Register to be maintained	NA	
15	Moisture Content Coarse and Fine Aggregate - Register to be maintained*	NA	
16	Brick Test Reports	NA	
17	Plastering profile and thickness	NA	
18	Compaction test beneath floor of all buildings. - Reports	NA	
19	Test Certificates for Paint, Glan, Glazing, etc.	NA	
20	Test Certificates Aluminium Section for doors and windows (Anodisation Certificates also)	NA	
21	BBS for Buildings	NA	
22	Water Test Report for Concrete	NA	
23	Design Mix Report for Concrete	NA	

Quality Documents: for Electrical & Mechanical Installation Works (BOS)			
Sl No	Documents		
1	FQA (Field Quality Assurance)	YES	
2	Inspection Reports	YES	
3	Guarantee Certificates	YES	
4	Factory Acceptance Test Reports	YES	
5	Commissioning Reports	YES	

NOTE:

* This list of documents is indicative and intended towards all Solar Projects.

* Apart from the above, any other document required by the Customer and which are mandatory for Billing by BHEL to the Customer, the same respective vendors.