

REQUEST FOR QUOTATION

	BHARAT HEAVY ELECTRICALS LIMITED Electronics Division PB No. 2606, Mysore Road Bangalore - 560026 INDIA	RFQ NUMBER: UPK0000976 RFQ DATE : 24.JAN.2017	Due Date 06.FEB.2017 Time: 13:00 HRS VENUE : NEW ENGG. BLDG
MMI:PU:RF:003			

PURCHASE FILE COPY

(for all correspondence)

Purchase Executive : UPENDER KUMAR
 Phone : 2698 9572
 Fax : 00918026742498
 E-mail: upender@bheledn.co.in

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

Sl No.	Description	Qty	Unit	Delivery qty	Delivery Date
1	PS0679065407 Porta cabin As per BHEL spec clause 5.1 Test Certificate	1	NO	1	17.MAR.2017
2	PS0679065415 Security cabin As per BHEL spec clause 5.1 a Test Certificate	1	NO	1	17.MAR.2017
3	PS0679065423 Submersible pump 3-phase Submersible pump 3-phase, 3HP for bore wells with 5cx4 mm2 cable As per BHEL spec clause 5.4 Test Certificate	3	NO	3	17.MAR.2017
4	PS0679065440 HDPE DWC pipe HDPE DWC pipe for underground laying of 6mm2 cables as per BHEL spec clause 5.9 Test Certificate	8,500	M	8,500	17.MAR.2017
5	PS0679065458 Cable trays in control room: Normal typ Cable trays in control room: Normal type (750mm x 40mm x3mm thick) as per BHEL spec clause 5.14 c Test Certificate	300	M	300	17.MAR.2017
6	PS0679065466 Cable trays in control room: Corner ben Cable trays in control room: Corner bends As per BHEL spec clause 5.14 d Test Certificate	24	NO	24	17.MAR.2017
7	PS0679065474 Cable support structure Cable support structure(inclined) for 1-C 630mm2 cables As per BHEL spec clause 5.18 Test Certificate	4	NO	4	17.MAR.2017
8	PS0679065482 Cable support structure (normal) Cable support structure (normal) for 1-C 630mm2 cables As per BHEL spec clause 5.18	4	NO	4	17.MAR.2017

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Sl No.	Description	Qty	Unit	Delivery qty	Delivery Date
	Test Certificate				
9	PS0679065490 Hardware for grouting control room panel Hardware for grouting control room panels as per BHEL spec clause 5.15 (2) Test Certificate	1	ST	1	17.MAR.2017
10	PS0679065504 Hardware requirements Hardware requirements for foundation positioning / anchoring of transformers as per bhel spec clause 5.19 (4) Test Certificate	4	ST	4	17.MAR.2017
11	PS0679065512 Cable 3.5-cx95mm2, copper conductor Cable 3.5-cx95mm2, copper conductor, XLPE ins, PVC sheathed, armoured cable as per BHEL spec clause 5.31 d Test Certificate	100	M	100	17.MAR.2017
12	PS0679065520 Cable 3.5-cx25mm2, copper conductor Cable 3.5-cx25mm2, copper conductor, XLPE ins, PVC sheathed, armoured cable as per BHEL spec clause 5.31 c Test Certificate	1,500	M	1,500	17.MAR.2017
13	PS0679065539 Termination kits, INDOOR TYPE Termination kits, INDOOR TYPE, 36kV Indoor type for 3-cx300mm2 cable with cable lugs, hardware As per BHEL spec clause 5.23 Test Certificate	7	NO	7	17.MAR.2017
14	PS0679065547 Termination kits, OUTOOR TYPE, Termination kits, OUTOOR TYPE, 36kV outdoor type for 3-Cx300mm2 cable with cable lugs, hardware As per BHEL spec clause 5.23 Test Certificate	11	NO	11	17.MAR.2017
15	PS0679065555 RSJ Poles 185x75x6mm, 7m length As per BHEL spec clause 5.24 Test Certificate	30	NO	30	17.MAR.2017
16	PS0679065563 GOS switches GOS switches 400A, 33kV without earth switch	10	NO	10	17.MAR.2017

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Sl No.	Description	Qty	Unit	Delivery qty	Delivery Date
	As per BHEL spec clause 5.25 Test Certificate				
17	PS0679065571 GOS air break switches GOS air break switches 400A, 33kV with earth switch As per BHEL spec clause 5.25 Test Certificate	2	NO	2	17.MAR.2017
18	PS0679065580 Lightning arrestors Lightning arrestors for switchyard 42kV, 10kA class-3 As per BHEL spec clause 5.26 Test Certificate	12	NO	12	17.MAR.2017
19	PS0679065598 Supporting BOQ items of four pole Supporting BOQ items of four pole structure such as disc insulators, cross-arms / base channels, connectors, CPVC pipe, hardware for both Inv room-1 and Inv room-2 switchyards as per BHEL spec clause 5.27 Test Certificate	2	ST	2	17.MAR.2017
20	PS0679065601 Supporting BOQ items of Six pole Supporting BOQ items of Six pole structure such as disc insulators, cross-arms / base channels, connectors, CPVC pipe, hardware for control room switchyard as per BHEL spec clause 5.29 Test Certificate	1	ST	1	17.MAR.2017
21	PS0679065628 33 kV Outdoor CT 33 kV Outdoor CT 250/1A-1A, core-1 & -2: cl 0.2s, 5VA as per bhel spec clause 5.30 Test Certificate	1	ST	1	17.MAR.2017
22	PS0679065636 33 kV Outdoor PT 33 kV Outdoor PT 33/0.11kV-0.11kV, core-1&-2: cl-0.2, 30VA as per bhel spec clause 5.30 Test Certificate	1	ST	1	17.MAR.2017
	PS0679065644 Metering panel	1	ST	1	17.MAR.2017

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Sl No.	Description	Qty	Unit	Delivery qty	Delivery Date
23	Metering panel with two nos each of ER300P meter as per BHEL spec 5.30 Test Certificate				
24	PS0679065652 License with MRI instrument License with MRI instrument, optical probes as per bhel spec clause 5.30 Test Certificate	2	ST	2	17.MAR.2017
25	PS0679065660 Cable 1 pair x 4 sq-mm, copper Cable 2 pair x 4 sq-mm, copper, PVC with flexible corrugated electrical conduit for CT, PT connection to metering panel with necessary length. as per BHEL spec clause 5.39 a Test Certificate	3,000	M	3,000	17.MAR.2017
26	PS0679065679 Auxiliary transformer 100kVA Auxiliary transformer 100kVA, 33kV/415V ONAN As per BHEL spec clause 5.32 Test Certificate	1	NO	1	17.MAR.2017
27	PS0679065687 Drop out fuse Drop out fuse set on HV side of 100kVA transformer 1set =3no. as per bhel spec clause 5.32 Test Certificate	1	ST	1	17.MAR.2017
28	PS0679065695 ACDB panel ACDB panel As per BHEL spec clause 5.31 Test Certificate	1	NO	1	17.MAR.2017
29	PS0679065709 DB Switchboards DB Switchboards As per BHEL spec clause 5.31 Test Certificate	2	NO	2	17.MAR.2017
30	PS0679065717 ACSR conductor DOG type, 7/4.09 ACSR conductor DOG type, 7/4.09	1,000	M	1,000	17.MAR.2017

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Sl No.	Description	Qty	Unit	Delivery qty	Delivery Date
	as per BHEL spec clause 5.27 a Test Certificate				
31	PS0679065725 Cable glands, cable lugs and hardware Cable glands, cable lugs and hardware for ACDB panel as per bhel spec clause 5.31 Test Certificate	1	ST	1	17.MAR.2017
32	PS0679065733 Cross-linked GI 0x50x4mm 1 set= 1 square meter Cross-linked GI 50x50x4mm of height 1.5m fencing for Inverter room-1 yard, Inverter room-2 yard and control room switchyard as per bhel spec clause 5.28 Test Certificate	375	ST	375	17.MAR.2017
33	PS0679065741 Steel angles, strips, hardware Steel angles, strips, hardware etc for switchyard fencing as per bhel spec clause 5.28 Test Certificate	1	ST	1	17.MAR.2017
34	PS0679065750 MS gate 3.5m wide x 3m tall MS gate 3.5m wide x 3m tall for switchyard As per BHEL spec clause 5.28 Test Certificate	9	NO	9	17.MAR.2017
35	PS0679065768 Stone jelly 20mm for Inv rooms Stone jelly 20mm for Inv room-1 and Inv room-2 switchyard: Area 310 sq- m x 100 mm layer thickness(1st=1 cube meter) as per bhel spec clause 5.27 Test Certificate	60	ST	60	17.MAR.2017
36	PS0679065776 Stone jelly 20mm for Control room Stone jelly 20mm for Control room switchyard: Area 340 sq-m x 100 mm layer thickness (1 st = 1 cube meter) as per bhel spec clause 5.29 Test Certificate	40	ST	40	17.MAR.2017
	PS0679065784 Data cable 10 pair x 0.5 mm2	750	M	750	17.MAR.2017

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37	Data cable 12 pair x 1.5 mm2 as per BHEL spec clause 5.39 a Test Certificate				
38	PS0679065792 Miscellaneous item for bos supply Miscellaneous item for bos supply as per bhel spec clause 5.68 Test Certificate	1	ST	1	17.MAR.2017
39	PS0679065806 Battery bank Battery bank 110 V, 125 AH, Plante type as per bhel spec clause 5.40 Test Certificate	1	ST	1	17.MAR.2017
40	PS0679065814 Battery charger, 135 volts, 25 Amps Battery charger, 135 volts, 25 Amps As per BHEL spec clause 5.40 Test Certificate	1	NO	1	17.MAR.2017
41	PS0679065822 UPS 5 kVA with battery bank UPS 5 kVA with battery bank As per BHEL spec clause 5.31 d Test Certificate	3	NO	3	17.MAR.2017
42	PS0679065830 hardware for 6 mm2 cable earthing DCDB for inverter rooms(1 ST= 2 nos) as per bhel spec clause 5.31 Test Certificate	1	ST	1	17.MAR.2017
43	PS0679065849 Cable 1Cx 25 mm2 copper conductor Cable 1Cx 25 mm2 copper conductor, PVC cable as per BHEL spec clause 5.51 Test Certificate	1,000	M	1,000	17.MAR.2017
44	PS0679065857 paste control pest control as per bhel spec clause 5.67 Test Certificate	1	ST	1	17.MAR.2017
	PS0679065865 Expansion bolts	100	NO	100	17.MAR.2017

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45	Expansion bolts, hardware for insulation bush supports As per BHEL spec clause 5.43 (7) Test Certificate				
46	PS0679065873 Lightning rod with earthing set Lightning rod with earthing set for Control room, Inverter rooms As per BHEL spec clause 5.47 Test Certificate	3	NO	3	17.MAR.2017
47	PS0679065881 LED lights LSTO-25 W LED lights LSTO-25 W As per BHEL spec clause 5.48 & 5.49 Test Certificate	300	NO	300	17.MAR.2017
48	PS0679065890 Lighting hardwares for solar array Balance of Lighting hardwares / fixtures for solar array lights with 25NB bend pipes, 80NB pipes, junction boxes, 1-inch, 1.5-inch CPVC pipe, glands, sockets, cable lugs, hardware, etc. As per BHEL spec clause 5.48 & 5.49 Test Certificate	250	NO	250	17.MAR.2017
49	PS0679065903 Lighting hardwares for Yard lights Balance of Lighting hardwares / fixtures for Yard lights for Inv -1 & -2 transformer yards and Control room with fittings for with 25NB bend pipes, junction boxes, 1-inch, 1.5-inch CPVC pipe, glands, sockets, cable lugs, hardware, etc. As per BHEL spec	50	NO	50	17.MAR.2017

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Sl No.	Description	Qty	Unit	Delivery qty	Delivery Date
	Test Certificate				
50	PS0679065911 Cable 3.5cx 2.5 mm2 Cable 3.5cx 2.5 mm2 copper, PVC arm cable for yard light system as per BHEL spec clause 5.51 Test Certificate	7,500	M	7,500	17.MAR.2017
51	PS0679065920 Cable 2Cx 1.5 mm2 copper Cable 2Cx 1.5 mm2 copper, PVC unarm cable for yard light system as per BHEL spec clause 5.51 Test Certificate	2,000	M	2,000	17.MAR.2017
52	PS0679065938 Cable 1Cx 1.5 mm2 Cable 1Cx 1.5 mm2 copper, PVC unarm cable for yard light system as per BHEL spec clause 5.51 Test Certificate	1,200	M	1,200	17.MAR.2017
53	PS0679065946 CPVC pipe, 2-inch, for module cleaning CPVC pipe, 2-inch, for module cleaning system as per BHEL spec clause 5.52 & 5.53 Test Certificate	1,500	M	1,500	17.MAR.2017
54	PS0679065954 CPVC pipe, 1 inch, for module cleaning CPVC pipe, 1 inch, for module cleaning system as per BHEL spec clause 5.53 Test Certificate	3,600	M	3,600	17.MAR.2017
55	PS0679065962 Booster Pump Booster Pump, Model CMB 3-5 of Grundfos-make or approved equivalent DP switch, cables, hardware etc As per BHEL spec clause 5.53 Test Certificate	3	NO	3	17.MAR.2017

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56	PS0679065970 Sintex tank Sintex-make tank of 6000 litres As per BHEL spec clause 5.52 & 5.53 Test Certificate	3	NO	3	17.MAR.2017
57	PS0679065989 Ball valves 2-inch Ball valves, forged steel type, 2-inch for the main header line As per BHEL spec clause 5.53 Test Certificate	5	NO	5	17.MAR.2017
58	PS0679065997 Ball valves 1-inch Ball valves, forged steel type, 1-inch with nipples As per BHEL spec clause 5.53 Test Certificate	100	NO	100	17.MAR.2017
59	PS0679066004 Hose pipes ribbed, flexible (50 m) Hose pipes ribbed, flexible (50 m) as per bhel spec clause 5.53 Test Certificate	3	ST	3	17.MAR.2017
60	PS0679066012 High pressure gun High pressure gun as per bhel spec clause 5.53 Test Certificate	3	ST	3	17.MAR.2017
61	PS0679066020 Cable tags Cable tags, aluminium plate for all SMBs, electrical panels as per bhel spec clause 5.54 Test Certificate	1	ST	1	17.MAR.2017
62	PS0679066039 Danger boards Danger boards for SMBs, electrical panels, transformers as per bhel spec clause 5.57 Test Certificate	1	ST	1	17.MAR.2017
63	PS0679066047 Cable markers Cable markers for cable trenches of 300 mm2 in solar array (125 Nos),	460	NO	460	17.MAR.2017

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	data cable in solar array (125 Nos), bore well cable (10 Nos), 33kV cable (30 Nos), yard lights cable (100 Nos), Aux transformer LV cable (20 Nos), CPVC water pipeline (50 Nos). As per BHEL spec clause 5.55 Test Certificate				
64	PS0679066055 Hoarding plate Hoarding plate at the plant entrance with mounting items as per bhel spec clause 5.56 Test Certificate	1	ST	1	17.MAR.2017
65	PS0679066063 Display boards and Sign boards Display boards and Sign boards as per bhel spec clause 5.57 Test Certificate	1	ST	1	17.MAR.2017
66	PS0679066071 insulation mat Electrical insulation mat 1m width x 2.5 mm thick As per BHEL spec clause 5.58 Test Certificate	60	NO	60	17.MAR.2017
67	PS0679066080 Air conditioner Air conditioner, 3-star, split type, 1.5 T As per BHEL spec clause 5.59 Test Certificate	2	NO	2	17.MAR.2017
68	PS0679066101 Tool kits and instruments Tool kits and instruments as per bhel spec clause 5.62 Test Certificate	1	ST	1	17.MAR.2017
69	PS0679066110 Office furniture Office furniture as per bhel spec clause 5.63 Test Certificate	1	ST	1	17.MAR.2017
70	PS0679066128 Fire alarm system with spares Fire alarm system with spares as per bhel spec clause 5.64 Test Certificate	1	ST	1	17.MAR.2017
	PS0679066136 Safety gadgets	1	ST	1	17.MAR.2017

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71	Safety gadgets as per bhel spec clause 5.66 Test Certificate				
72	PS0679066144 Fire extinguishers Fire extinguishers as per bhel spec clause 5.66 Test Certificate	1	ST	1	17.MAR.2017
73	PS0679066152 Grass cutting machine Grass cutting machine with blade spares As per BHEL spec clause 5.62 Test Certificate	2	NO	2	17.MAR.2017
74	PS0679066160 I&C1 Receipt of site materials in Stores area and maintenance of Stores as per spec ps-439-1083	1	AU	1	27.FEB.2017
75	PS0679066179 I&C2 Bore wells including tank connection as per spec ps-439-1083	3	AU	3	27.FEB.2017
76	PS0679066187 I&C3 Interconnection of SPV modules, installation of string monitoring boxes including separate grounding / earthing connection of structures / SMBs and cable terminations and inspection connected with each PCU (1.25 MW) as per spec ps-439-1083	8	AU	8	27.FEB.2017
77	PS0679066195 I&C4 Laying of 1cx300 sq mm Al armoured cables with Data cables from SMBs, closing of trenches per Inverter room basis as per spec ps-439-1083	2	AU	2	27.FEB.2017
78	PS0679066209 I&C5 Positioning & Erection of electrical panels of PCUs, UPS, DB panels including grouting, erection of GI cable trays and cable supports in	2	AU	2	27.FEB.2017

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	both Inverter rooms, routing and terminations of DC and AC cables up to LV side of transformers in switchyard including erection of Cable tray between PCUs / Transformer per Inverter room as per spec ps-439-1083				
79	PS0679066217 I&C6 Laying of 33 kV earth mat at 1 m depth in each of (i) Inverter room-1 switchyard (ii) Inverter room-2 switchyard and (iii)Control room switchyard as per spec ps-439-1083	3	AU	3	27.FEB.2017
80	PS0679066225 I&C7 (i) Erection & installation of 2800 KVA transformers on its pedestal and oil filtration activity (ii) Erection of 3 nos of PC-VCBs on structure with spring charge motor mechanism(iii) Erection of CTs, PTs, Isolators (iv)Termination of ACSR DOG conductor at Transformer end, at CT end, at PT end (v) Installation and wiring of C&R panels per Inverter room (totally Inv room-1 & -2) as per spec ps-439-1083	2	AU	2	27.FEB.2017
81	PS0679066233 6&C8 For both Inverter room switchyards (i) Spreading of stone jelly (ii) Fencing for switchyard (iii) Provision of gate per Inverter room switchyard as per spec ps-439-1083	2	AU	2	27.FEB.2017
82	PS0679066241 I&C9 Cable trench formation and laying of 33kV, 3 -c x 300 sq mm HT cable from corresponding 33 kV PC-VCBs in Inverter room yard to the HT Outdoor PC-VCB Panel in the control room including termination of cables as per cable trench drawing / description as per spec ps-439-1083	2	AU	2	27.FEB.2017

For and On behalf of BHEL.

REQUEST FOR QUOTATION

	BHARAT HEAVY ELECTRICALS LIMITED Electronics Division PB No. 2606, Mysore Road Bangalore - 560026 INDIA	RFQ NUMBER: UPK0000976 RFQ DATE : 24.JAN.2017	Due Date 06.FEB.2017 Time: 13:00 HRS VENUE : NEW ENGG. BLDG		
MMI:PU:RF:003	PURCHASE FILE COPY		(for all correspondence) Purchase Executive : UPENDER KUMAR Phone : 2698 9572 Fax : 00918026742498 E-mail: upender@bheledn.co.in		
Please submit your lowest quotation subject to our terms and conditions attached for the material mentioned below. The quotation must be enclosed in a sealed envelope / Fax superscribed with RFQ no.and due date, should reach us on or before the due date by 13.00 hours IST and will be opened on the same day at 13.30 hours at the venue mentioned above. PLEASE DROP THE OFFER IN THE BOX PROVIDED AT RECEPTION.					
Sl No.	Description	Qty	Unit	Delivery qty	Delivery Date
83	PS0679066250 I&C10 Control room switchyard works of (i) Erection of RSJ poles for various equipments including fabrication works for mounting of CTs, PTs, GOS, LAs (ii) Erection of PC-VCBs (ii) Erection of CTs, PTs, Isolators (iii) Termination of ACSR DOG conductor at Transformer end, at CT end, at PT end (iv) Erection of CTs, PTs, Isolators (v) Erection of LAs, 33 kV GOS (Isolators) (vi)Termination of ACSR DOG conductor at Transformer end, at CT end, at PT end (vii) Erection of Metering CT, PT and Metering cubicle in Control room as per spec ps-439-1083	1	AU	1	27.FEB.2017
84	PS0679066268 I&C11 Switchyard leveling, jelly spreading, fencing including gates for 33 KV switchyard associated with Control room as per spec ps-439-1083	1	AU	1	27.FEB.2017
85	PS0679066276 I&C12 Cable laying, cable terminations for control and optic fibre cables related to remote C&R panel and SCADA as per spec ps-439-1083	1	AU	1	27.FEB.2017
86	PS0679066284 I&C13 (i) Earthing for solar array field (ii)Earthing of Inverter room / control room panels including laying of GI strips (iii) Two independent earthings of 2800 KVA transformers # Body earth and Neutral earth, equipment including installation of Chemical electrodes, construction & electrical interconnection of earth chambers as per clauses 5.44, 5.45, 5.46 (iv) Two independent earthing of CTs, PTs, LAs, Metering box as per spec ps-439-1083	1	AU	1	27.FEB.2017
87	PS0679066292 I&C14 I & C of cells to form Battery bank, I & C of Battery charger,	1	AU	1	27.FEB.2017

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Sl No.	Description	Qty	Unit	Delivery qty	Delivery Date
	initial charging of battery bank as per spec ps-439-1083				
88	PS0679066306 I&C15 I&C of yard lights for solar array field, switchyard and including cable trenches, cable laying and cable terminations at the yard lighting poles as well as Main ACDB panel in Control room or Inv rooms as per spec ps-439-1083	1	AU	1	27.FEB.2017
89	PS0679066314 I&C16 Supply, installation and communication system between Main control room and the two Inverter rooms as per clause 5.64 as per spec ps-439-1083	1	AU	1	27.FEB.2017
90	PS0679066322 I&C17 I&C of module cleaning system including trenches for pipelines, laying of pipelines from bore wells to solar array field through overhead tanks, erection of pumps, ball valves, non-returnable valves etc., as per spec ps-439-1083	1	AU	1	27.FEB.2017
91	PS0679066330 I&C18 I & C of LA (ESE) lightning protection system for solar array field as per spec ps-439-1083	10	AU	10	27.FEB.2017
92	PS0679066357 I&C19 I&C of miscellaneous and safety items such as cable tags, danger boards, cable markers for 33 kV HT cables, hoarding board, sign boards, display boards, electrical insulation mat, air conditioners, office furniture, fire extinguishers, fire alarm system, etc., as per spec ps-439-1083	1	AU	1	27.FEB.2017
93	PS0679066365 I&C20 Pre-commissioning inspections / checks / tests, MRT tests and coordination with state departments CEA/CEIG etc., for necessary approvals / clearances for commissioning, synchronization with grid and	1	AU	1	27.FEB.2017

For and On behalf of BHEL.

REQUEST FOR QUOTATION

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Sl No.	Description	Qty	Unit	Delivery qty	Delivery Date
	post-commissioning operation of the plant as per spec ps-439-1083				
94	PS0679066373 O&M -1A Solar modules cleaning for one time every month as per spec ps-439-1083	4	AU	4	27.FEB.2017
95	PS0679066381 6&M -1B Grass cutting maintenance works as per spec ps-439-1083	4	AU	4	27.FEB.2017
96	PS0679066390 O&M -1C Monitoring of plant operations monthly, Submission of reports of Daily and monthly generation / export, Materials stock list, String currents, Earth resistance measurements and reports as per spec ps-439-1083	4	AU	4	27.FEB.2017
97	PS0679066403 O&M -1D Regular O &M works as per spec ps-439-1083	4	AU	4	27.FEB.2017
98	PS0679066411 O&M -1E Miscellaneous works including Maintenance of vendor-supplied items as per spec ps-439-1083	4	AU	4	27.FEB.2017
99	PS0679066420 O&M -1F Fire extinguishers checking and re-filling (after every one year) as per spec ps-439-1083	1	AU	1	27.FEB.2017
100	PS0679066438 O&M -1G Security works as per spec ps-439-1083	4	AU	4	27.FEB.2017
101	PS0679066446 O&M -2A Solar modules cleaning for one time every month as per spec ps-439-1083	4	AU	4	27.FEB.2017
102	PS0679066454 O&M -2B Grass cutting maintenance works as per spec ps-439-1083	4	AU	4	27.FEB.2017
103	PS0679066462 6&M -2C Monitoring of plant operations monthly, Submission of reports of Daily and monthly generation / export, Materials stock list, String currents, Earth resistance measurements and reports	4	AU	4	27.FEB.2017

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Sl No.	Description	Qty	Unit	Delivery qty	Delivery Date
	as per BHEL spec clauses 8.1 to 8.10				
104	PS0679066470 O&M -2D Regular O &M works as per BHEL spec clauses 8.1 to 8.10	4	AU	4	26.FEB.2017
105	PS0679066489 O&M -2E Miscellaneous works including Maintenance of vendor-supplied items as per spec ps-439-1083	4	AU	4	03.MAR.2017
106	PS0679066497 O&M -2F Fire extinguishers checking and re-filling (after every one year) as per BHEL spec clauses 8.1 to 8.10	1	AU	1	03.MAR.2017
107	PS0679066500 O&M -2G Security works as per spec ps-439-1083	4	AU	4	03.MAR.2017
108	PS0679066519 O&M -3A Solar modules cleaning for one time every month as per BHEL spec clauses 8.1 to 8.10	4	AU	4	03.MAR.2017
109	PS0679066527 O&M -3B Grass cutting maintenance works. as per BHEL spec clauses 8.1 to 8.10	4	AU	4	03.MAR.2017
110	PS0679066535 O&M -3C Monitoring of plant operations monthly, Submission of reports of Daily and monthly generation / export, Materials stock list, String currents, Earth resistance measurements and reports as per BHEL spec clauses 8.1 to 8.10	4	AU	4	03.MAR.2017
111	PS0679066543 O&M -3D Regular O&M works as per BHEL spec clauses 8.1 to 8.10	4	AU	4	03.MAR.2017
112	PS0679066551 O&M -3E Miscellaneous works including Maintenance of vendor-supplied items as per BHEL spec clauses 8.1 to 8.10	4	AU	4	03.MAR.2017
113	PS0679066560 O&M -3F Fire extinguishers checking and re-filling (after every one	1	AU	1	03.MAR.2017

For and On behalf of BHEL.

REQUEST FOR QUOTATION

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Sl No.	Description	Qty	Unit	Delivery qty	Delivery Date
	year) as per BHEL spec clauses 8.1 to 8.10				
114	PS0679066578 O&M -3G Security works as per BHEL spec clauses 8.1 to 8.10	4	AU	4	03.MAR.2017
115	PS0679066586 O&M -4A Solar modules cleaning for one time every month as per BHEL spec clauses 8.1 to 8.10	4	AU	4	03.MAR.2017
116	PS0679066594 O&M -4B Grass cutting maintenance works. as per BHEL spec clauses 8.1 to 8.10	4	AU	4	03.MAR.2017
117	PS0679066608 O&M -4C Monitoring of plant operations monthly, Submission of reports of Daily and monthly generation / export, Materials stock list, String currents, Earth resistance measurements and reports as per BHEL spec clauses 8.1 to 8.10	4	AU	4	03.MAR.2017
118	PS0679066616 O&M -4D Regular O &M works as per BHEL spec clauses 8.1 to 8.10	4	AU	4	03.MAR.2017
119	PS0679066624 O&M -4E Miscellaneous works including Maintenance of vendor-supplied items as per BHEL spec clauses 8.1 to 8.10	4	AU	4	03.MAR.2017
120	PS0679066632 O&M -4F Fire extinguishers checking and re-filling (after every one year) as per BHEL spec clauses 8.1 to 8.10	1	AU	1	03.MAR.2017
121	PS0679066640 O&M -4G Security works as per BHEL spec clauses 8.1 to 8.10	4	AU	4	03.MAR.2017
122	PS0679066659 O&M -5A Solar modules cleaning for one time every month as per BHEL spec clauses 8.1 to 8.10	4	AU	4	03.MAR.2017
123	PS0679066667 O&M -5B Grass cutting maintenance works. as per BHEL spec clauses 8.1 to 8.10	4	AU	4	03.MAR.2017
124	PS0679066675 O&M -5C Monitoring of plant operations monthly, Submission of reports	4	AU	4	03.MAR.2017

For and On behalf of BHEL.

REQUEST FOR QUOTATION

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Sl No.	Description	Qty	Unit	Delivery qty	Delivery Date
	of Daily and monthly generation / export, Materials stock list, String currents, Earth resistance measurements and reports as per BHEL spec clauses 8.1 to 8.10				
125	PS0679066683 O&M -5D Regular O &M works as per BHEL spec clauses 8.1 to 8.10	4	AU	4	03.MAR.2017
126	PS0679066691 O&M -5E Miscellaneous works including Maintenance of vendor-supplied items as per BHEL spec clauses 8.1 to 8.10	4	AU	4	03.MAR.2017
127	PS0679066705 O&M -5F Fire extinguishers checking and re-filling (after every one year) as per BHEL spec clauses 8.1 to 8.10	1	AU	1	03.MAR.2017
128	PS0679066713 O&M -5G Security works as per BHEL spec clauses 8.1 to 8.10	4	AU	4	03.MAR.2017

Total Number of Items - 128

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

Vendors list to whom RFQ has been sent:

1. BHEL, Electronics Division (X563699) - 6400075727

For and On behalf of BHEL.

PRE-QUALIFICATION CRITERIA	
1.	Vendor should have executed at least one contract of indoor / outdoor electrical installation of 33kV minimum in power plants or sub-stations in India with scope including both supply and erection for total value, not less than Rs. 2 Crores. As evidence for this, the vendor should submit (a) Certification from clients for completion of supply and erection (b) Copies of Purchase orders from the clients.
2.	Vendor should furnish the solvency certificate issued by Nationalised I Scheduled works for minimum worth Rs. 1 Crore with date of issue not before three months from the tender opening date.
3.	Vendor should be registered company for a [period not less than one year from the date of tender opening. As evidence to this, vendor should submit certificate of registration.

	PURCHASE SPECIFICATION- GROUP: PHOTOVOLTAICS SUPPLY OF BOS ITEMS, I&C, O&M FOR 10 MW (AC) SPV POWER PLANT AT WBSEDCL MEJIA SITE, WEST BENGAL	PS-439-1082
		Rev No: 00
		PAGE : 1 OF 51

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Technical Specification for

Supply, installation and commissioning of Balance of System items and including

Operations & Maintenance of

10 MW(ac) Solar PV grid connected power plant at WBSEDCL Mejia site, West Bengal

Revision details : R 00	Prepared:	Approved:	Date:
	Sheetal / Phalguni	V Radhakrishnan	24-January 2017

	PURCHASE SPECIFICATION- GROUP: PHOTOVOLTAICS SUPPLY OF BOS ITEMS, I&C, O&M FOR 10 MW (AC) SPV POWER PLANT AT WBSEDCL MEJIA SITE, WEST BENGAL	PS-439-1082
		Rev No: 00
		PAGE : 2 OF 51

1.0 Introduction

Bharat Heavy Electricals Limited (BHEL), Electronics Division, Bangalore is setting up a 10 MW(AC) Grid connected Solar Photovoltaic power Plant at Chharrah site, West Bengal. Overall area of the plant is 40 acres. The site location is 300 Kms from Kolkata and the site is located **Mejia, Bankura District, West Bengal.**

This tender is for the procurement, supply, installation of Balance of system and for O & M of the solar power plant.

1.1 PLANT DESCRIPTION:

The plant will have fixed angle solar array field structures of solar modules. The solar modules rating for the entire 5 MW array will be of 300 to 315 Wp with interval of 5 watts and all solar modules shall be of same dimensions.

The entire solar array is therefore split into sub-arrays as below:

Sub-array	SMB	No of SMBs	Remarks
Sub array 1 to 8: 1260 KW	10 nos x 8	80 nos	Each SMB is a 24-input and 1-output type

The Inverter room houses the four nos of 1250 KW PCUs, DB panel, UPS and SCADA RTU panel. The 2800 KVA transformer is located outside the Inverter room. The output of the solar array (5000 KW) located close to the inverter room shall be inverted by four inverters (or PCUS). The AC output of the four PCUs in a single Inverter room shall be combined and stepped up to 33 KV voltage level through 2 nos **of 2800 KVA, two LV-winding transformers and combined by VCBs** to obtain 5 MW AC output at 33 KV level. The various cabling are as table below:

From	To	Cable	Approximate length
SMBs	PCUs in Inverter rooms	1cx300 sq mm Al cable, two runs for Positive and Negative	Laid underground in trenches – 2500m
1250 KW PCU of Inverter room	2800 KVA ONAF transformer	4-runs of 630 mm ² per phase aluminium XLPE insulated and PVC sheathed cable	Laid on steel cable trays to be fabricated by the vendor approximately 4 m in length
33 KV, 2800 KVA transformer	33 KV VCB panel	33 KV, DOG conductor	Laid overhead
33 KV VCB panel in Inverter room yards	33 KV HT panel in Main control room	33 KV, 1-core, 3x300 mm ² , aluminum cable, XLPE insulated and armoured HT cable	Laid in brick-walled cable trenches on steel angle at 1 m intervals for approximately total running length of 800m along with OFC, Battery cable and auxiliary cables – 800 m

	PURCHASE SPECIFICATION- GROUP: PHOTOVOLTAICS SUPPLY OF BOS ITEMS, I&C, O&M FOR 10 MW (AC) SPV POWER PLANT AT WBSEDCL MEJIA SITE, WEST BENGAL	PS-439-1082
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Likewise from Inverter room-2 switchyard, 5 MW AC output is produced from another set of solar array, four nos of 1250 KW PCUs and 5 MW AC output at 33kV level.

33 kV EVACUATION SWITCHYARD (at Control room):

The switchyard houses the outdoor 33 KV HT Panel which combines the 5 MW (AC) outputs at 33 kV level from the two Inverter rooms to form totally 10 MW of AC output at 33 KV level. HT breaker panels includes 2 incomer Outdoor PC-VCB panels, 1 outgoer PC-VCB panel and 33 kV Isolator for Station transformer and 1 Bus PT.

From	To	Cable	Remarks
Inverter room-1: 5MW (AC)	33 kV Common bus	1 run of 3-cx300 sq mm 33kV HT cable	Combined on a six-pole structure through a common bus of ACSR DOG conductor
Inverter room-2: 5MW (AC)	33 kV Common bus	1 run of 3-cx300 sq mm 33kV HT cable	
Outgoer VCB panel	CT & PT	ACSR DOG conductor	
CT & PT	Final 33 kV GOS isolator	ACSR DOG conductor	
CT & PT	Metering	4 mm ² copper	

The Control room also houses the SCADA system with the Weather monitoring instruments of Pyranometer, Anemometer and Thermometers (for solar module and ambient temperatures).

Scope of work of construction of Inverter rooms and control room is in BHELs scope.

No of Inverter rooms: Quantity 2 nos

No of Control rooms : Quantity 1 no

Construction of all rooms is in BHELs scope. Only the supply and I &C works of the following are in vendor's scope:

- (i) Fire detection system in Main control room and the four Inverter rooms.
- (ii) Firefighting equipment as fire cylinders in both Inverter rooms and control room
- (iii) Switchyards (Inverter room and also Control room)
- (iv) Supply and installation of Security cabin, Quantity 1 no

The plant also includes other infrastructural works as:

- (i) Solar modules water cleaning system with tanks, CPVC piping infrastructure, valves, pressure gun. This includes supply and installation of 3 nos of Submersible pumpsets with piping to the Inverter rooms and Control room tanks.
- (ii) Lighting system for the solar array field and for the switchyards

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

The vendor must also provide for Security services at the plant during the o & M period. The security services to be deployed after 6 months from BHEL purchase order date and up to completion of O & M period of 5-years.

	PURCHASE SPECIFICATION- GROUP: PHOTOVOLTAICS SUPPLY OF BOS ITEMS, I&C, O&M FOR 10 MW (AC) SPV POWER PLANT AT WBSEDCL MEJIA SITE, WEST BENGAL	PS-439-1082
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2.0 Documents enclosed with this specification

SI No	Description	Drawing reference
1	Solar array layout, SMB and DC cable layout	BH-WBSEDCL-MEJIA-DG-006R2
2	Trench layouts	BH-WBSEDCL-MEJIA-DG-007R2
2	Chain-link fencing all switchyards	3-679-05-00869
3	Solar array earthing scheme	BH-WBSEDCL-MEJIA-DG-004R1, Sh 1 & 2
4	Earth chamber	4-679-05-00064
5	Electrical schematic of Main ACDB panel and Inverter room Switchboards	3-679-05-05-00868
6	Equipment layout in switchyard of Inverter room	BH-WBSEDCL-MEJIA-DG-003R1
7	Equipment layout in switchyard of Control room	BH-WBSEDCL-MEJIA-DG-002R2
8	Peripheral Lighting layout in Solar array area	BH-WBSEDCL-MEJIA-DG-009 sh 1
9	Lighting pole arrangement for peripheral and array lights	BH-WBSEDCL-MEJIA-DG-009 sh 2
10	Foundation for 2800 kVA transformer	3-679-0-500868
11	Foundation for switchyard structures	3-679-0-500865
12	Foundation for SMB	3-679-0-500870

3.0 Scope of work

3.1 Vendor scope of work (as briefly outlined activities)

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

SUPPLY-related:

#	Scope of work (as briefly outlined)	Qty
1	Supply of porta cabin and furnishings for Porta cabin (cl no 5.1), Security cabin (cl no 5.1a)	1 set
2	Supply of cable ties(cl 5.8), HDPE conduits(cl 5.9), Submersible pumps sets (cl 5.4)	1 set
3	Supply of LT / HT power cables and 33 kV termination kits: (i) 3.5-cx95 mm ² Cu conductor, PVC arm cable (cl 5.31(d)), (ii) 3.5-cx25 mm ² Cu conductor, PVC arm cable (cl 5.31(c)) (iii) 3.5-cx2.5 mm ² Cu PVC ins and arm cable (Cl 5.51), (iv) 1cx25 mm ² Cu PVC unarm cable, cl no 5.51 (v) 2-c x 1.5 mm ² PVC ins and sheathed unarm cable (Cl 5.51), (v) 1-c x 1.5 mm ² PVC unarm cable (Cl 5.51), (vi) 2-pair 4 mm ² Cu cable, cl no 5.39(a) (vii) 12-core x 1.5 mm ² Cu instrumentation unarm cable, cl no 5.39(a) (viii) 33kV termination kits (cl 5.23), cl no 5.23	1 set
4	(i) Supply of Battery bank 110 volts, 125 AH capacity of PLANTE cells, Lead-acid type (ii) Battery charger 135 volts / 25 Amps capacity, (cl 5.40)	1 set 1 set
5	Supply of Main ACDB (1 no), Distribution Switchboards (2 nos) and DCDBs (cl 5.31)	1 set
6	Supply of items for Inverter room-1 switchyard, cl no 5.24 to 5.29 (i) RSJ joist 185 x 75 x 6, Length 7m Qty: 30 nos, (ii) 33 kV GOS / Isolator -10 sets) without ES (iii) Lightning arrestors/surge suppressors, Qty: 9 nos (Cl 5.24), (iv) ACSR DOG conductor (Qty: 1000 m), (v) 33 kV Disc insulators, Qty: 12 Nos (vi) ISMC channels 100x50x5mm, Qty: 1500 Kgs(vii) Paint of	2 sets

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	red oxide and silver paint, Qty: As required (viii) Galvanised hardware, Qty & type: As required (ix) Cable lugs (x) Stay wire and sets including buckle, Qty: As required	
7	Supply of items for Inverter room-2 switchyard (i) RSJ joist 185 x 75 x 6, Length 7 m (Qty: incl in 6(i)), (ii) Lightning arrestors/surge suppressors, Qty: 3 nos (CI 5.24), (iii) ISMC channels 100x50x5mm, Qty: 1500 Kgs (iv) Paint of red oxide and silver paint, Qty: As required (v) Galvanised hardware, Qty & type: As required (vi) Cable lugs (vii) Stay wire and sets including buckle, Qty: As required	
8	Supply of items for Control room switchyard, 5.24 to 5.29, 5.32 (i) RSJ joist 185 x 75 x 6, Length 6.6m Qty: incl in 6(i), (ii) 33 kV GOS / Isolator (2 sets) with ES (1 set), (iii) Lightning arrestors/surge suppressors (CI 5.24), (iv) ACSR DOG conductor (1 Km), (v) 33 kV Disc insulators, Qty: As required (vi) ABT meter, Qty: 2 nos, cl no 5.30 (vii) Metering cubicle, Qty: 1 no (viii) ISMC channels 100x50x5mm, Qty: 1000 Kgs (ix) Paint of red oxide and silver paint, Qty: As required (x) Galvanised hardware, Qty & type: As required (xi) Cable lugs (xvi) Stay wire and sets including buckle – Qty as required (xii) Metering CT, Qty: 3 nos, cl no 5.30 (xiii) Metering PT, Qty: 3 nos, cl no 5.30	1 set
9	Supply of items of fencing, cl no 5.28 (i) Angles 75 x 5mm (Qty: As required (ii) GI Chain-linked fencing 75x75x4 mm dia of height (1.5m), Qty: As required	3 sets
10	Supply of miscellaneous items , cl no 5.68 (i) HDPE pipes, Qty: 7000 m (ii) PVC pipes, 1-inch, 6000m (iii) M-10 x45mm galvanised bolt with flat and spring washers (hardware sets) for SMB earthing, Qty: 100 sets (iv) PVC sleeves and Silicone sleeves, 1 set (v) PVC pipe 300 mm diameter, 40 Kgf, Qty: 20 metres (vi) RCC hume pipes, 300 mm diameter, length: 3 m, Qty: 60 nos (vii) Hardware, various types: 50 Kgs, (viii) GI wire SWG 12, Qty: 500 m, (ix) Sintex tanks 6000 Litres capacity, Qty: 3 nos	1 set
11	Supply of GI cable trays for Inverter rooms-1, -2 and Control room (cl no 5.18)	1 set
12	Supply of items of module cleaning system such as pumps, CPVC pipes with fittings, ball valves, nipples (CI 5.53)	1 set
13	Supply of items for yard lighting system such as pole pipes, 25 w lamps with fittings, junction boxes, cable lugs, related accessories, flexible PVC hose, hardware as per clauses 5.49 to 5.51.	1 set
14	Supply of miscellaneous items such as cable tags (CI 5.54) , danger boards, cable markers (CI 5.55), hoarding board (CI 5.56), sign boards and display boards (cl 5.57), electrical insulation mat (CI 5.58), Air conditioners (CI 5.59), Tool kits and Measuring instruments (CI no 5.62), Office furniture (CI 5.63), Grass cutting machine, cl no 5.62.	1 set
15	Supply of safety related items including fire alarm system for Main control room and four Inverter rooms, fire extinguishers for Inverter rooms and Main control room, Safety gadgets, EPABX communication system, as per clauses 5.64, 5.66,	1 set

CONSTRUCTION-related

16	Construction of earth pits as per drawing no. 4-679-05-006401	90 AU
17	Construction of foundations for SMBS	80 sets
18	Construction of pedestals and foundations for 2800 kVA transformers 4-679-05-00866	4 sets
19	Construction foundations, pedestals for RSJ joist poles in Inverter room switchyard 4-679-05-008664-679-05-00865	2 sets
20	Construction foundations and pedestals for RSJ joist poles in Control room switchyard 4-679-05-00865	1 set

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I & C-related

21	I&C: bore wells including tank connection, as per clauses 5.1, 5.2, 5.3	1 AU
22	I&C: Interconnection of SPV modules, installation of string monitoring boxes including separate grounding/ earthing connection and cable terminations and inspection thereof per MW as per clauses 5.6 to 5.11	1 AU
23	I&C: Formation of cable trenches and laying of 1cx300 mm ² Al armoured cables, per MW basis, as per clause 5.13 (1 AU = 1 MW) as per clause 5.13	10 AU
24	I&C: Erection of control room electrical panels including grouting, erection of cable trays and cable supports in both Inverter rooms, routing and terminations of DC and AC cables up to LV side of transformers in switchyard as per clauses 5.14 to 5.16	2 AU
25	I&C: Laying of 33 kV earth mat at 1 m depth in each of (i) Inverter room-1 switchyard (ii) Inverter room-2 switchyard and (iii)Control room switchyard	3 AU
26	I&C of Inverter rooms -1 & -2 Switchyard: (i) Erection & installation of 2800 KVA transformers on its pedestal and oil filtration activity (ii) Erection of 3 nos of PC-VCBs on structure with spring charge motor mechanism(iii) Erection of CTs, PTs, Isolators (iv)Termination of ACSR DOG conductor at Transformer end, at CT end, at PT end (v) Installation and wiring of C&R panels as per clauses 5.17, 5.18, 5.19	2 AU
27	I&C: (i) Spreading of stone jelly (ii) Fencing for switchyard (iii) Provision of gate for Inverter rooms -1 & -2	2 AU
28	I&C: Cable trench formation and laying of 33kV, 3-c x 300 sq mm HT cable from corresponding 33 kV PC-VCBs in Inverter room to the HT Outdoor PC-VCB Panel in the control room including termination of cables as per clause 5.20	2 AU
29	I&C of switchyard at Control room: (i) Erection of PC-VCBs (ii) Erection of CTs, PTs, Isolators (iii)Termination of ACSR DOG conductor at Transformer end, at CT end, at PT end (iv) Erection of CTs, PTs, Isolators (v) Erection of LAs, 33 kV GOS (Isolators) (vi)Termination of ACSR DOG conductor at Transformer end, at CT end, at PT end (vii) Erection of Metering CT, PT and Metering cubicle in Control room (viii)	
30	I&C: Switchyard leveling, jelly spreading, fencing including gates for 33 KV switchyard associated with Control room, as per clauses 5.35, 5.36, 5.37	1 AU
31	I&C: Cable trenches, cable laying, cable terminations for control and optic fibre cables related to remote C&R panel and SCADA as per clauses 5.36 to 5.38, 5.39, 5.40, 5.41, 5.42 and 5.42a.	1 AU
32	I&C of earthing system: (i) Earthing for solar array field (ii)Earthing of Inverter room / Main control room panels including laying of copper strips (iii)Installation of Earth mat for Inverter rooms -1 & -2 yards and control room switchyard (iv) Two independent earthing for 2800 KVA transformers – Body earth and Neutral earth, equipment including installation of Chemical electrodes, construction & electrical interconnection of earth chambers as per clauses 5.44, 5.45, 5.46 (v) Two independent earthing of CTs, PTs, LAs, Metering box	1 AU
33	I & C of cells to form Battery bank, I & C of Battery charger, initial charging of battery bank	1 AU
34	I&C of yard lights for solar array field, switchyard and including cable trenches, cable laying and cable terminations at the yard lighting poles as well as Main ACDB panel in Main control room etc., as per clauses 5.49 to 5.53	1 AU
35	Supply, installation and communication system between Main control room and the two Inverter rooms as per clause 5.64	1 AU
36	I&C of module cleaning system including trenches for pipelines, laying of pipelines from bore wells to solar array field through overhead tanks, erection of pumps, ball valves, non-returnable valves etc., as per clauses 5.55	1 AU

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37	I & C of LA (ESE) lightning protection system for solar array field	1 AU
39	I&C of miscellaneous and safety items such as cable tags, danger boards, cable markers for 33 kV HT cables, hoarding board, sign boards, display boards, electrical insulation mat, air conditioners, office furniture, fire extinguishers, fire alarm system, etc., as per clauses 5.51 to 5.62 and 5.66 to 5.68.	1 AU
40	I&C: Pre-commissioning inspections / checks / tests, MRT tests and coordination with state departments CEA/CEIG etc., for necessary approvals / clearances for commissioning, synchronization with grid and post-commissioning operation of the plant as per clause 5.69, 5.70	1 AU

41	Operations and Maintenance per month : First year	
(i)	Solar modules water washing on monthly basis / fortnightly	
(ii)	Monitoring of plant operations monthly, Submission of reports of Daily and monthly generation / export, Materials stock list, String currents, Earth resistance measurements and reports	
(iii)	BDV checking of transformer oil and oil filtration (after every one year)	
(iv)	Fire extinguishers checking (after every one year)	
(v)	Grass cutting maintenance works	
(vi)	Regular O &M works	
(vii)	Miscellaneous works including Maintenance of vendor-supplied items	
(viii)	Providing Security services for the plant	
42	Operations and Maintenance per month : Second year	12 Mon
43	Operations and Maintenance per month : Third year	12 Mon
44	Operations and Maintenance per month : Fourth year	12 Mon
45	Operations and Maintenance per month : Fifth year	12 Mon

3.2 BHEL scope of work

For the purpose of work clarity the items and activities listed below in BHEL's scope. However the receipt, storage, handling, erection of these items are within the scope of vendor. However, insurance for these items are within BHEL scope.

1	Solar PV Modules, 300 watts	36,000 nos approx
2	Solar array structures (20-modules per structure) with modules mounted on the Fixed tilt-type structures	1800 nos approx.
3	Cable, 1Cx 6 mm ² unarm (connection of PV modules to string monitoring boxes)	Approx: 35 + 35 Kms
4	Cable, 1C x 300 mm ² Al arm (for connection from SMBs up to PCUs in control room)	Approx: 7 + 7 Kms
5	Cable, 1c x 630 mm ² Al unarm (connection from PCUs to Inverter transformer)	-
6	Cable 3c x 300 mm ² AL 33kV HT cable (from Inverter rooms -1 and -2 to Control room switchyards)	-
5	String monitoring boxes with mounting fixtures	80 sets
6	Power conditioning units (PCUs) of 1250 KW	8 sets

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7	Transformers ONAF-type, 2800 kVA, 33kV/350V-350V (1 HV winding, 2 LV windings)	4 Nos.
8	33 kV PC-VCBs OUTDOOR type	9 nos
9	C&R panel	3 nos
10	Weather monitoring equipment for solar irradiation, wind velocity, ambient temperature, module temperature including supply	1 set
11	SCADA data station with PC, Data loggers, accessories and software	1 set
12	Data cable terminations at SMBs, SCADA data station panel and control desk (supply and laying of data cables except for weather monitoring equipment shall be in vendor scope)	-
13	Pathways, approach roads, drains within the solar array plant area	-
14	Supply of chemical earth electrodes, 25 x 3 GI strip, 50 x 6 GI strip, 50 x 8 GI strip, 50 x 6 Cu strip, Φ32 GI rods for earth mat	1 set
15	LA (ESE) terminals with all erection materials	10 sets

4.0 Instructions to vendors on bid submission

4.1	Offer shall be submitted in two-parts (Two part-bid). Both parts shall be in separate sealed envelopes as per instructions in tender. The individual envelopes shall be enclosed in a common bigger envelope with RFQ no., company name and other markings on the envelope as per instructions provided in tender.
4.2	First-part shall be techno-commercial bid. Following details shall be furnished: (i) Covering letter with Company details / brochure (ii) Filled-up enclosures as per BHEL formats (meant for first-part) provided in tender. (iii) Clause-wise compliance shall be filled-up in the column provided in this specification, with signature and seal on every page (iii) PROPOSED PROJECT IMPLEMENTATION – MONTHLY SCHEDULE IN EXCEL BAR CHART including confirmation to requirements of cl nos. 5.3, 5.32 and 5.33 (iv) Month-wise manpower deployment at site
4.3	Second-part shall be price bid with filled up enclosures as per BHEL formats provided in tender.
4.4	In addition to the above instructions, tender document provides detailed instructions for bid submission. Vendor shall submit the bid based on instructions in tender document.

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5.0 Technical specification for supply, installation and commissioning

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

#	BHEL specification	To indicate YES / NO, If "NO" to record comments
5.1	(i) Vendor shall supply and install site porta-cabin office for a period of six months. The porta cabin should be at site within 15 days of issue of Purchase order. Vendor shall provide furnishings with essential amenities such as two work tables, six chairs. (ii) Supply of Inverter 48V dc / 230 V AC, 1 KW (iii) Supply of SMF VRLA battery 12V x 150 AH, 8 Nos. (iv) Installation of Inverter / battery and connection to Porta cabin DB.	Vendor to confirm YES / No
5.1(a)	Supply of Security cabin: Dimensions of Security cabin to be minimum 3m x 3m, of Pre-engineered type. Cabin shall have provision of light, fan and electrical power, one table and two chairs. Drawing to be submitted for BHEL approval.	Vendor to confirm YES / No
5.2	Construction power & water: Vendor shall arrange Electrical power and water for his construction works.	Vendor to confirm YES / No
5.3	Receipt, unloading, safe storage and movement of BHEL and vendor supplied items: (i) Site storage space being arranged by BHEL, including unloading of site materials of BHEL-supplied materials. Vendor shall arrange for unloading of his own-supplied items. (ii) Vendor to allocate designated person for maintaining records of supply as Invoices, LR's, raise MRC, etc. on full time basis. (iii) Vendor to maintain register with list of items, box files for receipt details, LR copies, raise MRC, other paper works. Vendor shall maintain proper documentation / compilation of all the records related to shipping (invoices, delivery challans) and shall take verification and approval from BHEL site engineer for every consignment. The documents shall be suitably preserved for further handing over to BHEL. (iii) Maintenance a register for maintaining stock of all BHEL materials and also vendor-supplied materials. (iv) Deduct issuances of materials to site. (vi) Updated stock details to be mailed to BHEL Bangalore office on a fortnightly basis. With regard to storage of solar modules – they shall be stored in wattage ranges of 300-305 watts, 305-310 watts, 310-315 watts, >315 watts. (1) Vendor shall arrange for necessary insurance for his supplied items up to the time of commissioning. (2) BHEL will arrange insurance for all the BHEL supplied items. (3) Vendor shall make his own arrangements for movements of the items from storage yard to the point of construction.	Vendor to confirm YES / No
5.4	(i) Supply of 3 HP Submersible pump-sets with cable, Quantity: 3 sets	Vendor to confirm YES / No

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	(ii) Construction of bore wells including hydro survey, water analysis, electrical cabling and plumbing works. (1) Vendor shall identify locations for three bore wells in consultation with BHEL. (2) Bore wells shall be of necessary depth based on water table at the identified locations. (3) Water analysis shall be carried out and report shall be submitted to BHEL. (4) Supply of Submersible AC centrifugal pump of 3HP (3 phase) with all necessary electrical cabling up to control room ACDB panel shall be provided. (5) Casing as required shall be provided for the pump. (6) Pump and the electrical cables shall be in vendor scope of supply. 5cx4 mm² cable (copper, armoured, PVC) shall be laid underground at a depth of ~600 mm, with sand layers below and above the cable (100 mm each). A brick layer, class-2, 75mm thick shall be laid over the sand layer. Trench shall, then, be closed with refill soil and neatly compacted. (7) Length of cable required ~ 600m (8) Pump make: CGL, Suguna, Kirloskar or any other reputed equivalent as shall be approved by BHEL.	
5.5	Interconnection of SPV modules to form strings: Supply of SPV modules is in BHEL scope, range 300 to 315 watts, approximate total quantity = 36,000 nos. Erection of mounting structures and fixing / mounting of the SPV modules on the structures is in BHEL scope. Vendor shall interconnect the modules as follows: (a) Each module is fitted integrally with a junction box having positive and negative polarity cables (4 mm²). (b) Positive cable of one module shall be connected to the negative cable of adjacent module. The cables have MC4 type of connectors. One polarity cable has male type connector, while the other has female type connector. (c) This way, 20 modules shall be connected in series. Each set of connections is called as a series string. Thus, 1800 strings shall be formed respectively. (d) After placing the purchase order on vendor, BHEL will provide layout drawings that will describe the exact way in which the series strings are formed. Vendor shall implement the interconnection as per these drawings. (e) Interconnected cables shall be neatly routed and dressed using UV resistant nylon cable ties of appropriate dimension. (f) These cable ties shall be in vendor scope of supply. Approved make: 3M, Phoenix contact, Weidmuller, Hellermannntyton, Panduit. (g) Vendor shall submit report for open circuit voltage. Specs: Nylon cable ties, polyamide 6.6 UV stabilized black, UL94 flammability rating V2, meant for outdoor use. Operating temperature up to 85°C. Width of cable tie shall be minimum 4.5 mm.	Vendor to confirm YES / No

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	BHEL approval shall be obtained for the selected brand and sizes of cable tie. (h) Cables shall not be loosely hanging.	
5.6	Installation of string monitoring boxes (1) The supply of string monitoring boxes (SMB), 80 sets, is in BHEL scope. These are 24-in and 1-out type. (2) Vendor shall install the SMBs in the solar array field. (3) All fixtures including stand, canopy, hardware required for installation of SMBs will be supplied by BHEL. (4) Drawings and details of SMBs and the fixtures will be provided to the vendor after placement of purchase order. (5) SMB foundation drawing is as per (6) SMBs shall be fixed on the stands using the hardware that are supplied by BHEL as part of SMB assembly kit. (7) All tools necessary for mounting shall be in vendor scope. (8) Power SPD and communication SPD shall be earthed to the SMB leg using 1cx25 sq mm cable. Two separate earthing connections through 25 x 3 GI strip to be made to the nearest MMS structure for each SMB. (9) Supply of GI strips is in BHEL scope, however vendor shall arrange to cut the same in required lengths and drill holes (holes provision in GI strip shall not be done by welding, only by drilling). M-10 bolts, washers and nuts, GI hardware to be galvanized and in vendor scope, Quantity: 100 sets.	Vendor to confirm YES / No
5.7	Interconnection of series-connected module strings to SMB using 6 mm² cable: (1) Each SPV module string is to be connected to SMB by extending the series string last solar modules cables with 1cx 6 mm² cable (copper, TUV cable) and MC4 straight connector, both items supplied by BHEL. (2) SPV module is provided with positive and negative cables (4 mm²) having male and female parts of MC4 type connectors. (3) BHEL shall supply plug connectors of straight connectors (MC4 type), each set having a pair of male and female parts, to join the 6 mm² cable with SPV module cable. (4) Cable numbering by ferrule numbers to be provided at both ends.(SMB termination end and 6 sq mm cable end).	
5.8	Routing of 1Cx 6 mm² cable: (1) 6 mm² cables connecting the SPV module strings to SMBs shall be neatly routed within purlin member of the structures. Cable ties shall be used for tying the cables together at maximum distances of 300 mm. (2) Cable ties, nylon polyamide 6.6 UV-stabilized black, UL94 flammability rating V2, operating temperature up to 85°C, shall be used to arrest any possibility of movement or sagging. Cable ties shall be of make: 3M, Phoenix contact, Weidmuller, Hellermannntyton, Panduit. (3) Width of the cable ties shall be a minimum of 4.5 mm. (4) Cable ties length 300mm-Qty: 10,000 nos (5) Cable ties length 100mm- Qty: 40,000 nos	

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5.9	Underground laying of 6 mm² cables between SOLAR ARRAY rows: (1) HDPE double walled corrugated (DWC) pipe shall be used to guide the 6 mm² cables underground from one row to the other. Quantity: 7000 metres (IN VENDOR'S SCOPE) to be supplied in lengths 7m. (2) Where 6 mm² cables run between two rows of structure, HDPE DWC pipe shall be within scope of vendor supply. (3) Specification of HDPE DWC pipe: As per IS 14930 (Part II), TEC GR No. GR/DWC-34/01 SEP 2007, RDSO specification no. RDSO/SPN/201/2011; ID shall be selected to accommodate the number of 6 mm² cables to be guided. However, ID shall be minimum 63mm. (4) Make: Jyoti Electricals or reputed make as shall be approved by BHEL. (5) Make, part number, sizes / dimensions shall be submitted to BHEL for approval. (6) This trench is in vendor's scope. Details of cable trench: (a) Trench depth = 450 mm minimum (b) Trench width = 300 mm minimum (c) Bottom layer shall be sand of IS: 383 with 100mm thick. (d) HDPE conduit shall be laid over the sand layer. (e) Another layer of sand of 100 mm thick. (f) Trench shall, then, be filled with refill soil and compacted.	
5.10	Connecting the 6 mm² cables on input side of SMBs: (1) 6 mm² cables of positive and negative polarities from individual SPV module strings shall be terminated at the input side of SMBs. (2) Vendor scope includes removal of sleeve at the cable end, crimping with 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 part of the SMBs supplied by BHEL. (3) Cable lug shall be supplied by BHEL. (4) PVC sleeve shall be used for covering the crimping connection and shall be in vendor's scope. All necessary tools such as pliers, strippers, crimping tool shall be in vendor's scope.	

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5.11	Connecting the 1-core 300 mm² Al cables on output side of SMBs: (1) BHEL-supplied cables of 1cx300 mm ² (aluminium conductor, XLPE insulation, PVC sheathed and armoured) cables of positive and negative polarities shall be terminated at the output side of SMBs. Positive and negative cables are identified by colour. (2) Overall diameter of cable ~ 32mm. (3) Vendor scope includes removal of sleeve at the cable end, crimping with suitable cable lug of appropriate type/size and connecting the lugged end to the bus bar within the SMB. Cables shall enter the SMB through the metallic cable glands. Cable glands and cable lugs shall be part of SMB supply arranged by BHEL. (4) Silicone heat shrinkable sleeve to be used to cover the crimped lug connection and shrunk using hot-air gun. Hardware such as bolts, nuts, plain washers and spring washers shall be in vendor scope of supply. The size and type of these shall be in accordance with termination arrangement on the bus bar. (5) All necessary tools such as pliers, strippers, crimping tool shall be within vendor scope.	
5.12	Construction and laying of underground Cable trenches for laying power cables from SMBs to Inverter rooms 1 & 2: (1) Excavation of trenches with JCB for laying of power cables from SMBs to Inverter room-1 and Inverter room-2 is in BHEL scope of work. However finer shaping and dressing / digging is in vendor's scope. (2) Vendor is required to lay 1cx300 sq mm Al cables from the respective SMBs to Inverter room-1 and Inverter room-2, RS-485 cable, OFC cable, (3) Cable : 1cx300 mm ² (aluminium, armoured, XLPE insulation, PVC sheath) of positive (red) and negative (black) (4) Cable trench drawing and layout as per drawing no. BH-WBSEDCL-CHHARRAH-DG-007 REV0 (5) No of SMBs: 80 nos (6) No of Cables: 160 nos; Two cables (+, -) from each of the 80 SMBs. (7) Minimum width of trench shall be 300 mm. (8) Near each SMB, the RS 485 cables shall be routed in flexible 1-inch PVC pipes. After routing the mouth of the conduit shall closed with silicone sealant to avoid entry of rodents. (9) APPROXIMATE CUMULATIVE TOTAL LENGTH OF DC Cable TRENCHES: 2500 METRES. (10) Quantity of 1-inch PVC pipes: 2000 metres	
5.13	Road crossing with hume pipes: (1) In the case of road crossing, hume pipes shall be provided for the routing of the cables. Civil works for the same shall be in vendor's scope. (2) Hume pipes shall be of minimum 300 mm diameter and 3 metres length and in the scope of the vendor. Quantity to be supplied: 25 nos.	

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5.14	Cable trays supply & installation in Inverter rooms-1 and -2: The Inverter rooms -1 and -2 will be of brick-wall superstructure type with suitable foundations, with RCC slab roofing. There is an internal cable trench of width 1.2m, depth 1m. Three ISMC angles ISMC 100 are embedded into the brick-walls of cable trench, the angles shall be at pitch of 1.5m all along the length of the cable trench. The angles are for three-tier cable trays. (1) Vendor shall supply and install cable trays within Inverter room trenches and the Main control room trench for laying DC and AC cables over the trays. Vendor shall supply cable trays as follows: (a) Perforated GI, Hot dip galvanized (b) Thickness = 3 mm, Depth = 40 mm, Width = 750 mm (c) Normal type trays: 300 m maximum (total length) (d) corner-bend trays, Qty: 24 nos (2) Vendor shall fix the cable trays on the projecting steel sections in cable trench of control room. (3) Suitable cut outs shall be made in the cable trays to provide path for the cable to reach the lower level trays. (4) Adjacent cable trays shall be interconnected using suitable hardware items that shall be in vendor scope of supply. (5) Cables shall be laid over the cable trays and neatly dressed using appropriate cable ties etc. (6) Similarly, cable ladders shall be provided for 1Cx 300 mm² cables to avoid sagging strain, near the single exit points, through which the cables approach transformer placed just outside. Cable ladders shall be made of MS, painted using red oxide and black paint. Drawing of ladder arrangement shall be submitted to BHEL for approval. (7) 1cx630mm² cables are routed from Inverter room to transformers in switchyard through foundations of the control room in which	
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5.15	(i) POSITIONING OF EQUIPMENTS IN INVERTER ROOMS -1 & -2: PCUs, ACDB panel, UPS panel, Cable trays in trenches, data stations (Loggers) of SCADA. Vendor shall organize necessary resources such as labour, cranes, hydra, forklifts, transportation trucks / trolleys and other accessories for movements and positioning of the items as below within the Inverter rooms 1&2: (a) 1250 kW PCU panels: 1 set (each ~2500 Kg) (b) ACDB panel: 1 set (~800 Kg) (c) Data loggers and station for SCADA: 1 set (~500 Kg) (d) C&R panel : 1 set Panels shall be placed over the cable trenches in control room, in the exact sequence and locations as shown in BHEL drawings that will be provided to vendor at an appropriate time during the period of execution. (ii) Panels shall be suitably grouted using welding / bolting methods as appropriate. BHEL approval shall be obtained for the grouting arrangement. All necessary hardware for the same shall be within vendor scope of supply. (iii) POSITIONING OF EQUIPMENTS IN CONTROL ROOM: Battery banks, UPS, FCBC battery charger panels, ACDB panel, data stations of SCADA, Cable trays in trench.	
5.16	Power cable terminations on DC side of PCUs in control room: (1) On DC side, for each PCU, vendor shall carry out the cable terminations for 11 positive and 11 negative inputs connections – unsleeving, crimping and connecting. (2) BHEL shall supply the cables (1Cx300 mm² aluminium, armoured, XLPE insulation, PVC sheath), cable glands, cable lugs, bolts, nuts and washers. (3) All tools and accessories required to carry out the termination shall be within scope of vendor.	
5.17	630 mm² Power cable terminations on AC (LT) side for PCUs and 2800 kVA transformers (1) On AC side, 3-phase 3-wire power cable interconnections shall be made between PCUs and 2800 kVA transformers using 4-runs per phase of 1cx630mm² aluminium, XLPE insulated, PVC sheathed, unarmoured, PVC cable. (2) For cable terminations at 2800 kVA transformer end. (3) For this 630 mm² cable terminations at PCU panels, BHEL shall supply the cables, cable glands, cable lugs, bolts, nuts, plain washers and spring washers. (4) Vendor shall make the measurements between the equipment, cut the cables to the required lengths, fix them with glands, remove sleeve at the ends, crimp them with the lugs and terminate them at the respective bus bar provisions within the panels.	

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	(5) There are 8 PCUs of 1250 kW with built-in Air Circuit Breakers, and 4 Transformers of 2800 kVA capacity. (6) All tools and accessories required to carry out the termination shall be within scope of vendor.	
5.18	Cable supporting structure: Cable supporting structure shall be installed between Inverter room wall and LV side of transformer using ISA angles of minimum 75x6mm arranged in vertical and horizontal orientations and joined using welding. The level of structure shall be at a minimum height of 400 mm above the ground level. Adequate number of horizontal angles shall be provided to minimize gap between two angles so that cable sagging is avoided. Vertical angles shall be grouted using concrete foundation with depth of minimum 400mm. PCC layer 1:3:6 of 100mm thick shall be used. Cross section of foundation shall be minimum 200x200mm. All items required for the structure shall be in vendor scope of supply. Structure shall be painted using red oxide and BHEL approved black paint. Suitable arrangement, such as fixing perforated cable trays in inverted position, shall be provided to cover the laid cables. Length of cable tray shall be maximum 4 metres. Vertical legs support shall be provided at maximum intervals of 1 metre. Quantity of cable support structure with cover = 4 sets.	
5.19	Outdoor installation of BHEL-supplied 2800kVA, 33kV/350V-350V ONAF transformers: (1) Construction of two nos of transformer foundations in Inverter room no. 1 and 2 as per drawing no. 3-679-05-00866. (2) Number of transformer foundations = 4 sets (3) Transformer and its accessory parts such as radiators, cable boxes, hardware as supplied by BHEL shall be moved from storage yard and positioned on foundation pedestal. All parts and hardware shall be assembled as per guidance at site provided by BHEL / transformer vendor. (4) Hardware for fixing position of transformers on foundation is in vendor's scope, Quantity: 4 sets. (5) Vendor has to arrange for BDV measurements and for OIL FILTRATION MACHINE. Vendor shall perform following works for each transformer: (a) Oil filling and oil filtration in all transformers. (b) Measurement of parameters: insulation resistance etc. (c) Connections to marshalling box (d) Measurement of BDV voltage of oil in Transformer tank and also in oil drums. (e) Vendor shall carry out oil filtration of oil in drums and also of oil in transformer tank. (f) Vendor shall check BDV voltage after filtration, it shall be minimum 60 kV.	
5.20	Solid copper grounding of four nos of 2800 kVA ONAF transformers: Vendor is required to provide solid grounding by copper strip by joining the bus-bar already provided in each of the four transformers. Copper bus-bar will be provided by BHEL.	

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5.21	Cable trench and laying of control cables and LT cables in switchyards of the two Inverter rooms-1 and -2: (1) Vendor shall construct underground RCC cable trench (rectangular cross section) with RCC slab for laying of the following cables: (i) Transformer data cables of OTI/WTI/others from the transformer marshalling box to the local SCADA panel (ii) Cables from the OUTDOOR PC-VCBs TO THE C & R panels in the Inverter rooms-1 & -2.	
5.22	Separate cable trenches between (i) Inverter room-1 and Control room & (ii) Inverter room-2 and Control room: Total approximate running length: 800 metres Brick-walled cable trench and RCC cover (75mm thick) as per BHEL drawing no: BH-WBSEDCL-CHHARRAH-DG-007 REV0. Cable trench shall be formed running between each of the Inverter room-1 and -2 and the Control room for following cables: (i) 3cx300 mm² 33 kV cables from Outdoor PC-VCB panel in Inverter room to Evacuation switchyard in Control room (ii) OFC cable from Inverter room SCADA panel to Main SCADA desk in Main control room (iii) 3.5-c x 25 mm² copper armoured LT cable for distribution of Auxiliary power from Main control room to Inverter rooms (iv) 6 sq mm DC cable from FCBC in Control room to Inverter rooms through CPVC conduit pipe of 1-inch diameter. (v) Telephone cable	
5.23	Supply and termination of 33 kV termination kits for Power cable terminations on AC HT side: 33 kV termination kits termination shall be arranged by vendor, to be done only by authorized representative of the manufacturer or personnel licensed by him. Vendor shall carry out the following terminations: (1) INVERTER ROOM PANELS: (a) 3cx300 sq mm 33 kV HT cable on HV side (33kV) in cable box of 2800 kVA transformers (4 sets) with 33 kV termination kits (b) ACSR DOG conductor terminations in CTs, PTs and GOS (d) Final outgoing from Inverter room switchyard to Evacuation yard in Control room shall through 33 kV, 3cx 300 mm² HT cable with 33 kV termination kit for which all cable lugs, 33 kV HT termination kits and all necessary hardware, all of which shall be within vendor scope of supply. No of terminations with HT kits in Inverter room-1 swyd: 5 Nos No of terminations with HT kits in Inverter room-2 swyd: 5 Nos (2) CONTROL ROOM PANELS: (a) For termination of the 3cx 300 mm² HT cable coming from the two nos of Inverter room to the incomers of PC-VCB panels (b) For termination of the ACSR DOG conductor PC-VCBs to the common bus of the Four-pole structure	

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	(c) For termination of ACSR DOG conductor from Four-pole structure to the Outgoing PC-VCB, CT, PT and Final GOS (Isolator) (c) For termination of the ACSR DOG conductor going to the 200 kVA station transformer (d) HT termination kits shall be of 36 kV, 3-core, Outdoor type. Make: Raychem, 3M or reputed equivalent to be approved by BHEL. (e) Quantity of termination kits: (i) Outdoor type 300 mm², 3-core, Inv room-1 & -2, Qty: 3 + 3 sets + 2 sets spares (ii) Indoor termination kits, Inv room-1, Inv room-2, Qty: 2 + 2 sets + 2 spare s (iii) Outdoor type 300 mm², 3-core, for Control room: 3 sets (iv) Indoor termination kits, Qty: 2 set Cable lugs and hardware shall be of Dowells / 3M or reputed equivalent as shall be approved by BHEL. (f) All tools and accessories required to carry out the termination shall be within the scope of vendor. (g) Since no cable glands are provided for these cases, vendor shall apply suitable grade of bitumen, RTV or any other sealant as shall be approved by BHEL, for sealing the gap around the cable at the cable entry of transformers and HT panels.	
5.24	Supply of RSJ poles 175x85xmin 7m, Qty: 30 nos (1) Vendor shall supply rolled steel joist beams (RSJ I-beams) of 175x 85mm and minimum length 7m as per IS: 2062-1992 (hot rolled steel) with dimensions as per IS: 808-1989 and tolerances as per IS: 1852-1985. Beams shall be hot-dip galvanized or suitably painted with red oxide and Aluminum paint. (2) The cross section dimensions of RSJ poles shall be as per WBSEDCL requirements meant for four pole / double pole structures. (3) Vendor shall submit the dimension details of RSJ poles. BHEL approval shall be obtained for the brand and supplier of the poles. (4) Test reports shall be submitted to BHEL. (5) Quantity of RSJ poles for Inverter room-1 yard: 6 nos (6) Quantity of RSJ poles for Inverter room-2 yard: 6 nos (7) Quantity of RSJ poles for Control room switchyard: 14 nos (8) Extra RSJ poles: 4 nos (9) Foundation details for RSJ poles shall be as per BHEL drawing no. 3-679-05-00865.	
5.25	Supply of 33 kV Gang operated switch (Air break switch), triple pole, double break, HORIZONTAL, DOUBLE-BREAK and centrally rotating type: (1) Rated voltage: 36 kV (2) Operating voltage: 33 kV (3) Impulse withstand voltage: 75 kV peak (4) Power frequency withstand voltage (1 min): 35 kV rms (5) Continuous current rating: 400 Amps Short-time current rating: 40 kA (7) Construction: Triple pole, Three insulators per pole, double break, centrally rotating type	

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	(8) Insulators: Porcelain type conforming to IS 2544 / IEC 273, made of homogeneous material with uniform glazing, free from cavities and other flaws, with high quality smooth finish. Fixed electrical contacts are supported by the insulators. (9) Mounting base: The three poles shall be mounted on a rigid base of MS channel of minimum size of 75x 40 x6 mm (hot dip galvanized), provided with suitable holes, clamps and bolts to enable firm mounting. (10) Electrical contacts: All current carrying parts shall be made of electrolytic copper (silver plated). The fixed contacts shall be of spring-loaded pressure type so as to ensure firm contact and proper alignment. (The springs shall not carry any current). Arcing contacts shall be provided with spring assisted operation. (11) Earthing terminals: Two terminals with adequate size to carry full short circuit current; shall be provided on the frame of each pole. (12) Coupling rod: 25mm nominal bore GI pipe medium gauge (13) Operating rod: 32 mm nominal bore GI pipe medium gauge single length 6m. (14) Standard: IS: 9921 part 1 to 4 / IEC 265 part 1 (15) Drawing / Catalogue shall be submitted by the vendor for BHEL approval. (16) Approved make: (i) Transpower Switchgear Industries, Mumbai (ii) Hightension Electrical Equipments Limited, Kolkata QUANTITY OF GOS SWITCHES REQUIRED: (a) 1 sets with Earth switch (manually operated) – 36 kV, 400 Amps at Evacuation point (b) 9 sets without Earth switch: One set each for Outgoing at each Inverter room (c) Spares 1 set each with and without Earth switch	
5.26	Supply of LIGHTNING ARRESTORS for switchyard (Surge suppressors): (1) Arrestor rating: 42kV, 10kA, Class-3 with IB (2) Type: Metal oxide Gapless lightning arrestor (3) Make: LAMCO (Hyderabad), ELECTROLITES (Jaipur) or any other reputed equivalent to be approved by BHEL. (4) Standard: IS 3070 (part-3) 1993 & IEC 60099-4 of 2004 (5) Test report to be furnished (6) These lightning arrestors / surge suppressors (9 Nos) shall be mounted on the four pole structures as shown in SLD diagram. Three each shall be mounted on the two outgoing lines from HT panel. And, the balance three shall be mounted on the second set of four pole structure. (7) Total quantity required = 12 nos DISTRIBUTION: 3 nos each at 33 KV Inv-1 and -2 room switchyard + 3 nos at Evacuation point + 3 extra for spares	
5.27	Inverter room-1 and -2 transformer yard installation works: The switchyard layout and foundation details for various switchgear as VCB, CT, PT, GOS isolator switch is shown in drawing no. BH-	

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	WBSEDCL-CHHARRAH-DG-0002. The installation requirements are as follows: CIVIL FOUNDATION WORKS: (1) Clearing of transformer yard area of grass and debris, if any (2) Compaction of soil (3) Installation of 33 kV Earth mat grid as per drawing (4) Construction of foundations for 2800 kVA transformer (2 nos), PC VCB (3 Nos), Four-pole structure (1 No), CT(1 No), PT, GOS (all separate), reference BHEL drawing no. 3-679-05-00865. (5) GOS switches (Air break switch), 3 pole, double break, horizontal, centrally operated, 33 kV, 400A as per IS:9921 part 1-4, without earth switch: 2 sets (6) Lightning arrestors (surge suppressors) of 42 kV, 10kA, class-3: - 3 Nos for the line1 from outgoing-1 HT VCB panel - 3 Nos for the line2 from outgoing-2 HT VCB panel (7) Angular frame made Base channels of 75x40x6 mm minimum shall be fabricated for mounting of lightning arrestors, GOS, CT & PT on the Two-pole structure. Assembly shall be by clamps only, no welding. (8) Insulators as per IS: 2544 / IEC 273 shall be used wherever required to maintain HV isolation from RSJ poles. (9) Angular channels shall be used to guide the XLPE HT cables (33kV, 3-Cx300 mm² cable) reaching the four pole structure from the two 33 kV PC VCB panels. These pipes shall be positioned vertically at the central location between adjacent RSJ poles. The pipes shall be fixed using a suitable arrangement of GI clamps, IS angles, hardware etc. The pipe as well as the clamping arrangement shall be approved by BHEL prior to procurement / fabrication. (10) All hardware fittings and accessories, which are essential to fulfill the functional requirements of the four pole structure in terms of mechanical stability, electrical insulation / connections, shall be provided by the vendor. This shall include items such as cross-arms, stay sets, disk insulators, insulation hardware (suspension string, tension string), forging fittings, yoke plates, clamps, connectors, corona control rings, arcing horns, earthing accessories, ACSR DOG conductor and its accessories, vibration dampers, spacers, as applicable to meet the WBSEDCL requirement shall be provided by the vendor. (11) Electrical interconnection between the switchyard equipment, including termination using 33 kV termination kits / ACSR conductor is to be done by the vendor. Note: All MS parts of RSJ poles, angular frames shall be suitably painted using red oxide and silver colour paint. (12) Switchyard fencing as per BHEL drawing no. BH (13) Stone jelly spreading for minimum 100mm above FGL.	
5.27(a)	Supply of ACSR DOG conductor, Qty: 1000 m	
5.28	Supply of fencing materials and erection of switchyard fencing with gate (for both Control room switchyard and Inverter room-1 and -2 transformer yards):	

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	Vendor shall provide all around chain-link fencing for all three yards with gate at one location as shall be decided by BHEL site engineer. (a) Fencing shall be as per BHEL drawing 3-679-0-500869. (b) GI Fence length ~ 80 m for Inverter room-1 yard (c) GI Fence length ~ 80 m for Inverter room-2 yard (d) GI Fence length ~ 60 m for Control room yard - Two gates with 3.5m width x 3m height, Frame of 50x50mm MS pipes with 4mm thick for each Inverter room-1 and -2 transformer yards - One gate with 3.5m width x 3m height, Frame of 50x50mm MS pipes with 4mm thick for Control room switchyard - Totally five gates. Details of gate: - Vertical grills of 16mm square bar at 120mm c/c - Other necessary details such as hinges, padlocks, wheels shall be considered. - Gate shall be finished with red oxide (two coats) and two coats paint of silver colour.	
5.29	Control room Switchyard installation works: The Control room switchyard layout is as per for various 33 kV switchgear as VCB, CT, PT, GOS isolator switch is shown in drawing no. BH-WBSEDCL-CHHARRAH-DG-003. The foundation details for the various components are separately. The installation requirements are as follows: CIVIL FOUNDATION WORKS, the works are then as follows: (1) Clearing of transformer yard area of grass and debris, if any (2) Compaction of soil (3) Installation of 33 kV Earth mat grid as per drawing. (4) Construction of foundations for 3 nos of PC VCB, Six-pole structure, CT, PT, GOS, Metering CT, Metering PT, Metering cubicle, (all separate) as per BHEL drawing no. 3-679-05-00865. (5) Angular frame made Base channels of 75x40x6 mm minimum shall be fabricated for mounting of lightning arrestors, GOS, CT & PT on the Two-pole structure. Assembly to RSJ poles shall be by clamps only, no welding. (6) Insulators as per IS: 2544 / IEC 273 shall be used wherever required to maintain HV isolation from RSJ poles. (7) Angular channels shall be used to guide the XLPE HT cables (33kV, 3-Cx300 mm² cable) reaching the four pole structure from the two 33 kV PC VCB panels. These pipes shall be positioned vertically at the central location between adjacent RSJ poles. The pipes shall be fixed using a suitable arrangement of GI clamps, IS angles, hardware etc. The pipe as well as the clamping arrangement shall be approved by BHEL prior to procurement / fabrication. (8) All hardware fittings and accessories, which are essential to fulfill the functional requirements of the four pole structure in terms of mechanical stability, electrical insulation / connections, shall be provided by the vendor. This shall include items such as cross-arms, stay sets, disk insulators, insulation hardware (suspension	

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	string, tension string), forging fittings, yoke plates, clamps, connectors, corona control rings, arcing horns, earthing accessories, ACSR DOG conductor and its accessories, vibration dampers, spacers, as applicable to meet the WBSEDCL requirement shall be provided by the vendor. Note: All MS parts of RSJ poles shall be suitably painted using red oxide and silver colour paint. (9) Stone jelly spreading for minimum 100mm above FGL.	
5.30	METERING CUBICLES: (1) Single or two independent cubicle panels housing two nos of ERP 300P Trivector meters (class 0.2s) with RS485 port, MODBUS RTU protocol, with downloading license shall be supplied and installed close in the Control room. Choice of single or two separate panels shall be made at time of submission of drawings by vendor. (2) The panel shall be wall-mounted type. Common Meter Reading Instrument as per IEC-62056, Sands make (CMRI-1006) or BHEL approved equivalent along with optical probes to be provided (2 sets). Scrolling of various parameters shall be provided in the Trivector Meter. (3) Supply of separate CT and PT , Quantity: 2 sets – one for each ABT-meter CT details: CT ratio – 250 / 1-1 Amps, CL:0.2s, 5 VA PT details: PT ratio- 33kV/V₃:110V/V₃: 110V/V₃ , CL:0.2, 30 VA Outdoor oil-immersed combined CT/PT set for metering purpose. The CTs and PTs shall each have two cores on their secondary side both meant for metering. CT and PT shall be manufactured in accordance with IS: 2705 / IEC 185 and IS: 3156 / IEC 186 respectively. Approved makes: LAMCO, ASCOT (4) Vendor shall arrange for downloading of software on assigned computer PC to enable downloading of data from the CMRI. PC shall be allocated at time of commissioning by BHEL or its customer. Vendor shall arrange for calibration and testing of the TVM meters, Metering CT and PT at WBSEDCL laboratory or at their nominated agency / laboratory. The costs associated with the same shall be in vendor scope.	
5.31	Auxiliary power or Station power: (1) The third GOS switch shall be for connected to the Station transformer that is mounted on a double pole structure. (2) From this it is connected to 100 kVA Station transformer to be stepped down to 415 volts to the Main ACDB panel through the change-over switch. (3) From the Main ACDB, the power is distributed to within the Main control unit and also to the four Inverter rooms. For this power distribution, 4 runs of 3.5cx25 mm² copper armoured PVC cable is to be used. (4) For this the following items are in the scope of the vendor:	

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	(a) Main ACDB - Quantity: 1 no (b) Switchboards - Quantity: 2 nos (c) DCDBs - Quantity: 2 nos (c) 3.5cx25 mm² copper armoured PVC cable – Quantity: 1500m (d) 3.5cx95 mm² copper armoured XLPE cable – Quantity: 100m MAIN ACDB specifications: (i) Mechanical details: Floor resting type ISMC 100 base frame Panel sheets of 2mm / 14 gauge CRCA sheet Hinged door: 2mm / 14 gauge CRCA sheet Removable door: 1.6mm / 16 gauge CRCA sheet Gland plate: 3mm / 10 gauge Lifting hooks (4 nos) of adequate capacity Locking provision with key, no door on rear side Paint colour: RAL 7032 of IS:5 Incomer cables: 3.5cx95 mm² cables Cable glands for 3.5cx95 mm² (Qty: 1 no) Cable glands for 3.5-c x 25 mm²(Qty: 4 nos) (a) Electrical details for MAIN ACDB PANEL, reference BHEL drawing no. 3-679-05-00868, sheet 1 Metering: Voltmeter, Ammeter, KWH meter (Model EM 6400 with MODBUS 485 output, Make: CONZERV) Main ACDB shall have common bus with coupler for TGBPP supply and for take of outputs to Sub ACDBs. The ACDB panel has have provision for correction and maintaining power factor to minimum 0.9 for a maximum inductive load of 25 KVA. (b) Electrical details for Switchboard distribution boards, reference BHEL drawing no. 3-679-05-00868, sheet 2 (c) DCDB will have following MCBs fitted: - 16 Amps (1 no) input - 6 Amps (4 nos) output DCDBS will have be a box walled mountable enclosure with cable gland, earthing provision. Detailed drawings to be submitted for approval prior to clearance for manufacturing. (d) Supply of 5 kVA UPS with battery bank, Quantity: 3 Nos	
5.32	Supply and Installation of Auxiliary transformer, RSJ structures, 33 kV GOS (Isolator) and drop out fuses on the HT side: Vendor shall supply and install a concrete structure that carries the following items: Supply of Auxiliary transformer: (1) Outdoor, Oil immersion type, ONAN, 3-phase, Dyn11, 100 kVA, 33kV/415V (+/-10%), 50Hz +/- 3% transformer, Class A insulation, percent impedance 4.5%, cable box with bottom side cable entry on	

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	both LV and HV side, as per IS: 2026 for auxiliary power consumption to internal utilities of the power plant. Cable glands, cable lugs, bolts, nuts, plain washers and spring washers for LV side should be supplied along with transformer suitable for 3.5cx95 mm², copper conductor, armoured, 1100V, XLPE insulation, PVC sheath cable as per IS: 1554 (part-1). Other parameters: - Winding material: Electrolytic grade copper for both primary and secondary windings - Off-circuit tap changer on HV side: +/- 5% in steps of 2.5% (-5%, -2.5%, 0, +2.5%, 5%) - Maximum Load loss @ 75°C : 1.235 KW - Maximum No load loss @ 75°C: 180 watts - Silica gel breather - HV side delta, LV side star with 4-wire, neutral terminal brought out separately and earthed through solid earthing. - Highest voltage for equipment: 36 kV rms for HV side, 1.1kV rms for LV side - Rated short duration power frequency withstand voltage: 28kV rms for HV side, 3kV rms for LV side - Rated lightning impulse withstand voltage: 75kV peak for HV side - Temperature rise: For max ambient of 40°C, the maximum allowable temperature rises in oil and winding by thermometer method shall be 45°C and 50°C respectively. - BHEL shall witness the temperature rise test and routine tests, for which vendor shall provide inspection call to BHEL in advance. (2) Transformer shall be mounted on concrete pedestal at a height 1.5 metres from the ground level. (3)The drawing for the concrete pedestal will be furnished by BHEL. Drop out fuse wires with 33kV fuse holders shall be mounted on a suitable mounting arrangement such as base channel of 75x40x6, etc. Rated voltage 36kV, copper fuse wire of AWG 30 (~10A melting). Reputed equivalent as shall be approved by BHEL. (1) Electrical interconnections up to the transformer bushings on HV side shall be made using ACSR conductors. (2) On LV side, suitable supporting arrangement shall be provided to route the cable, 3.5Cx 95 mm², copper conductor, armoured, XLPE insulation, PVC sheathed cable as per IS:1554. The arrangement shall provide for suitable clips, clamps to ensure neat dressing of the cable. Suitable nickel-plated cable glands to be used. (3) All hardware fittings and accessories, which are essential to fulfill the functional requirements of the double pole structure in terms of mechanical stability, electrical insulation / connections shall be provided by the vendor. This shall include items such as insulation hardware (suspension string, tension string), forging fittings, yoke plates, clamps, connectors, corona control rings, arcing horns, earthing accessories, ACSR conductor accessories, vibration	
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	dampers, spacers, stay sets, cross-arms as applicable to the context shall be provided by the vendor. (4) Vendor shall submit general arrangement and detailed drawings with bill of materials / quantities of the double pole structure with individual item description, quantity, make, specs / ratings for BHEL approval. Note: All MS parts of FP structure shall be suitably painted using red oxide and BHEL approved silver colour paint.	
5.33	Power cable terminations at 100 kVA transformer, Main ACDB and Distribution boards: (1) Vendor shall carry out termination on LT side of 100kVA auxiliary transformer (33kV/415V) using 3.5cx95 mm², copper conductor, armoured, 1100V, XLPE insulation, PVC sheath cable as per IS: 1554 (part-1), cable glands, cable lugs, bolts, nuts, plain washers and spring washers. All these items including cable shall be within vendor scope of supply. (2) Similar terminations shall be carried out on the other end of cable that gets terminated at Main ACDB panel in Main control room. Vendor shall supply the necessary cable glands, cable lugs and hardware for ACDB end as well. (3) Quantity of 3.5c x 95 arm cable ~ 100 m (4) All tools and accessories required to carry out the termination shall be within the scope of vendor. From the Main ACDB, 3.5cx25mm² copper, PVC insulated and arm cables are run independently to the Distribution boards of the four Inverter rooms. This cable is run in the same trench as the 33KV HT cables. QTY: Approx. length of 3.5-Cx95mm² XLPE arm cable: 100 metres QTY: Approx. length of 3.5-Cx25mm² PVC arm cable: 1000 metres.	
5.34	The construction of Inverter room-1, Inverter room-2 and Control room is in BHEL scope. The Inverter rooms -1 and -2 will be of brick-wall superstructure type with suitable foundations, with RCC slab roofing. There is an internal cable trench of width 1.2m, depth 1m. Three ISMC angles ISMC 100 are embedded into the brick-walls of cable trench, the angles shall be at pitch of 1.5m all along the length of the cable trench. The angles are for three-tier cable trays. Vendor shall supply and install cable trays within Inverter room trenches and the Main control room trench for laying DC and AC cables over the trays. Vendor shall supply cable trays as follows: - Perforated GI, Hot dip galvanized - Thickness = 3 mm, Depth = 40 mm, Width = 750 mm Normal type trays: 300 m maximum (total length) Corner-bend trays, Qty: 24 nos Vendor shall fix the cable trays on the projecting steel sections in cable trench of control room.	

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	d. Suitable cut outs shall be made in the cable trays to provide path for the cable to reach the lower level trays. e. Adjacent cable trays shall be interconnected using suitable hardware items that shall be in vendor scope of supply. f. Cables shall be laid over the cable trays and neatly dressed using appropriate cable ties etc. g. Similarly, cable ladders shall be provided for 1Cx 300 mm² cables to avoid sagging strain, near the single exit points, through which the cables approach transformer placed just outside. Cable ladders shall be made of MS, painted using red oxide and black paint. Drawing of ladder arrangement shall be submitted to BHEL for approval. 1Cx630mm² cables are routed from Inverter room to transformers in switchyard through an opening in the wall of control room. <u>These openings shall be closed using a suitable sheet made of steel / aluminium / fiber etc., to arrest entry of rodents.</u>	
5.35	Miscellaneous works of Control room works: The construction of Control room is in BHEL scope. However miscellaneous works are in vendor's scope: The Main control room shall be of brick-wall superstructure type and RCC slab roof. (i) Provision of Water tank of 6000 litres capacity (ii) Provision of cable tray for single trench for communication cables of length 20 m maximum. Chequered plate cover for trench of 6 mm thickness (Final Black colour painted) to cover cable trench after equipment installation. (iii) Supply of furniture for conference room and office	
5.36	Support and assistance for SCADA integration for the power plant Introduction to the SCADA of the Plant: SCADA for the power plant comprises of the following: (i) Data loggers located at the two Inverter rooms -1 and -2 for capturing the data from the various equipment and converting the digital / analog signals to optical signals for transmission by the optical fibre cable. (ii) Data station panel and PC based control desk with software located at the Control room to collect, store, process and report the following data parameters of power plant. a. String monitoring boxes in solar array field: string current, voltage, box temperature, module temperature, status of SPD and load break switch in SMBs b. Weather monitoring equipment: solar irradiation, ambient temperature, wind velocity and module temperature. c. At Inverter rooms: PCU data signals: DC input /AC output parameters of inverters, grid data, fault status and events logged, ACB status. d. At Inverter rooms: 33 KV VCB: Status, status of protection relays of transformers, oil / winding temperatures, LOLA, Fire alarm status	

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	e. At Control room: HT breaker panels: VCB breakers status, status of protection relays of transformers, oil / winding temperatures, AC parameters at 5MW levels, energy generation values. (1) Vendor shall provide support and assistance to BHEL in following activities: (a) Formation of underground cable trenches - Cable laying for data communication cables from 2800 KVA transformer to Data logger in Inverter room using 10-core, 0.5 mm², copper, screened cable in HDPE conduit, Qty: Approx. 25 m - Cable laying of Data cable from looped PCU, 33 KV VCB and ACDB panel to Data logger using 1-pair, twisted 0.5mm², copper screened cable in HDPE conduit - Metering cubicles to SCADA panel in Main control room using 10-core, 0.5 mm², copper, screened cable, Qty: 20m (b) Daisy looping of the two PCUs and connection to Data loggers in the respective Inverter room with 1-pair, twisted 0.5mm², copper screened cable (c) Data cable laying from PCUs, ACDB panels to Data loggers with 1-pair, twisted 0.5 mm², copper, screened cable (d) Data cable terminations at PCUs, ACDB panels, transformers and 33KV VCB panels and cable laying to the Data logger. Following materials shall in the vendor's scope: (i) Cable glands, 1-inch, polyamide, Quantity: 30 nos (ii) Lugs for termination and ferruling numbering.	
5.36(a)	Daisy-chain looping and Laying of RS 485 cable (Data communication cables) in trenches from SMBs to Inverter rooms -1 and -2. Reference drawing: BH-WBSEDCL-CHHARRAH-DG-007R2 The supply of Armoured cables RS 485 (2 pair, 0.5 sq mm) is in BHEL scope. The vendor is required to perform looping by laying in trenches (combined with the DC cable) of following: SMB1 to SMB10 (approx. length of trench 500m) & SMB11 to SMB20 (approx. length of trench 500m) SMB21 to SMB30 (approx. length 500m) & SMB31 to SMB40 (approx. length 500m) SMB41 to SMB50 (approx. length 500m) & SMB51 to SMB60 (approx. length 500m) SMB61 to SMB70 (approx. length 500m) & SMB71 to SMB80 (approx. length 500m) For the above looping the RS 485 cable shall be laid in the trenches. The RS 485 cable shall be laid in PVC conduit pipe. (1) This cable is meant for RS485 interfacing. The RS485 output of SMBs shall be daisy-chain looped using this cable. 10 SMBs shall be daisy-chained to form one cable connection running up to SCADA room. In such a case, the last SMB, OFC cable will run to the Inverter room. These data cables shall be laid underground in same cable trench along with power cables. A minimum distance	

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	of 500mm shall be maintained between the data cable trench and power cable trench to avoid EMI interference. (2) Underground laying shall be ensured even within the daisy-chain looping between adjacent SMBs. (3) Cable trench shall be as per details below: (a) Trench depth = 850mm minimum (b) Trench width shall be 200mm minimum (c) Bottom layer shall be sand as per IS: 383 with 100mm layer thickness. (d) Data cable shall be laid over the sand. (e) Another layer of sand, 100 mm thick, shall be laid. (f) A single layer of brick, class-2, 75mm thick, shall be laid over the sand. (g) Trench, then, shall be filled up with refill soil. (4) Total length of trench ~ 4000m	
5.37	(a)OFC cable laying in 33 kV HT cable trench, to be read in conjunction with cl no. 5.22: OFC cable is in BHEL scope. OFC cable is to be laid underground for the following: (i) Communication output last SMB in the daisy-chain loop; namely from each of the SMB10, SMB20, SMB30, SMB40, SMB50, SMB60, SMB70 and SMB80 to be laid in trenches to the RTU unit in the corresponding Inverter room. (ii) Connecting the Data loggers in the Inverter room-1 and Inverter room-2 to the Data station panel in Main control room. Drawing to be referred: BH-WBSEDCL-CHHARRAH-DG-007 and is for the OFC cable, 33 kV 3-cx300 sq mm HT cable, 6 sq mm battery cable and Auxiliary power cable (3cx25 sq mm cable). (b) OFC cable termination for SMBs, SCADA panels.	
5.38	Cable trench construction for laying of data communication cables from switchyard equipment to RTU in Inverter rooms -1 and -2 / Control room. These data cables (details under following section), which are within the vendor scope of supply, shall be laid in concrete / brick-walled trenches, of dimensions 450mm depth x 450 mm width. Cables required: 12-core, 1.5 mm² copper conductor, PVC insulated, shielded and armoured cable. In case 12-core is not readily vendor shall supply cable with greater number of cores. 1-pair x 4 sq mm cable (i) Data cables in Transformer yard in Inverter room: (a) From 2800 kVA transformers to 33kV C&R panel (of VCB panel) in each of Inverter room-1 and -2 using 12-core, 1.5 mm² instrumentation cable, (b) Inter-wiring between CT / PT in switchyard to C&R panel using 2-pair 4 sq mm copper cable.	

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	(ii) Data cables in switchyard in Control room: (a) 100 kVA transformer to C&R panel using 12-core 1.5 sq mm cable (b) Metering cubicles to SCADA panel, 2-c, 0.5 mm² copper, PVC insulated, shielded and armoured cables.	
5.39	Data cable terminations in Inverter rooms / Control room & switchyards: - Cables (12-c x 1.5 sq mm copper cable) required for the above terminations are in vendor scope. -Cable lugs and all hardware required for making the above terminations shall be in vendor scope of supply. (i) Inverter rooms and its switchyard: Vendor shall carry out data cable terminations at 2800 kVA transformers, Outdoor CB breaker panels, Metering panels, ACDB panels and PCUs. (a) Terminations at Marshalling box of the 2800 kVA transformer (b) 33kV Outdoor CB panel (Buchholz relay, pressure release valve, low oil level, WTI, OTI). (c) Terminations at 33kV VCB panel (Buchholz relay, pressure release valve, low oil level, WTI, OC/EF relay, EM6400 meters for SCADA connections. (d) Terminations at the 1250 kW PCU for capturing ON/OFF status of ACBs for SCADA purpose and also Modbus (e) Termination at the 1250 kW PCU for capturing the power, current RS485 MODBUS communication cable connections (ii) Data cable terminations in Control room and its switchyard (a) Termination at the Metering panels (b) Termination at the Marshalling box of the Aux transformer (c) Termination at the EM6400 in the 2 incomers and 1 outgoer for capturing the power, current (e) Terminations between 3 sets of HT panels: OC/EF relay, OV/UV relay etc. (f) Terminations at the PCU for capturing ON/OFF status of ACBs for SCADA purpose. (g) Terminations at two metering panels (a) Terminations at 1 ACDB panel. (b) All the cables required for the above terminations are in BHEL scope. (c) Cable lugs and all hardware required for making the above terminations shall be in vendor scope of supply. Note: Along with the above activities, DC / AC power supply cable laying and terminations shall be also be carried out for transformers and HT panels panel using 2Cx 2.5 sq-mm copper, armoured, PVC	

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	cables. Cable shall be laid from battery bank (for DC) and ACDB panel (for AC).	
5.39(a)	Supply of 2-pair 4 sq mm copper PVC cable, Qty: 3000 m Supply of Data cable 12-pair x 1.5 sq mm copper PVC cable, Qty: 750m	
5.40	Supply of Battery bank and chargers in Control room: (i) Vendor shall supply 110 volts / 125 AH battery bank with Float-cum-boost charger 135V / boost current 25 Amps, Qty: 1 set (ii) The cells shall be of PLANTE-type, YCP 11, lead-acid type, make: EXIDE (i) The supply shall include teak wood racks with acid-resistant paint, intercell connectors etc., required for installation of the battery banks. (iv) Operation in both boost and float modes, with maximum float current of 10 Amps. (v) Charger shall have DCDB terminal provision. (vi) Supply should include spares as Control card, fuses.	
5.41	I & C of Battery and charger: Erection of the battery bank, filling with electrolyte and initial charging shall be done by authorised representative of the manufacturer as initial charging is important for long life of the battery. If any problems arise with the charger, vendor shall arrange for Charger manufacturer to visit site for repair of charger.	
5.42	Earthing of solar array structures: The supply of GI strips 25x3mm, 50x5mm and Chemical earthing electrodes shall be completely in BHEL's scope of supply. I & C works are in the scope pf the vendor. (1) Buried Grid of 50x5mm GI strip at 400mm depth shall be formed in the solar array field and surrounding as per drawing no. BHE-WBSEDCL-CHHARRAH-DG-004. For joining of 50x5 mm strips welding with overlap of 150mm. (2) From this grid vendor shall interconnect solar array structures using bolting with 25x3 mm GI strips. The 25x3 mm GI strip to be connected to the outer 50x5mm GI strip by welding. (3) Chemical electrodes shall be used for earthing connection. Connection to the electrode to be made by bolting using M-10 x 45 mm hardware. The connection to the electrode to be made by a smaller a suitable bent GI strip bolted to the 25x3 mm GI strip. (4) Chemical earthing electrode of MS pipe 3000 mm long, Zn coated, hot dip galvanized, OD = 50 mm shall be supplied by vendor. (5) Quantity of chemical electrodes for solar array structures and SMBs earthing = 48 sets. (6) Earth pit shall be drilled and the chemical earth electrode shall be placed in the pit, filled with back filling chemical compound all around the electrode as per vendor datasheet instructions. (7) Procedure for installation of chemical electrodes as per the manufacturer's instructions should be followed. a) After finishing the pit work, pour a few buckets of water	

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	around the pit. (8) Earth chambers of brick masonry shall be constructed as per BHEL drawing 4-679-05-00064. All items of earth chambers, including lid, shall be in vendor scope of supply. (9) Earth chambers shall be interconnected for every 1MW of the solar array field, using 50x5 mm GI strip that shall be laid underground. (10) Terminations at the electrode end shall be made using bolting method. Welding shall not be applied at electrode end. For this purpose, a separate link with multiple mounting holes shall be used at the electrode end. This way, GI strips (25x6 mm) running from structure leg and the GI strips (50x5 mm) from adjacent electrodes shall be terminated at this link, which shall, in turn, be connected to the electrode. Joining of 50x5 mm GI strips at intermediate positions, wherever applicable, shall be made using either welding or bolting method. Either way, the overlapping of the two strips shall be for a minimum length of 150mm. Welding shall be for the entire overlapping length. In case of bolting, minimum three bolt joints shall be used per overlap length. (11) All hardware (nuts, bolts, washers) for jointing of earth strips shall be in vendor scope of supply. (12) BHEL will provide layout drawings showing earth chamber locations. NOTE: The resistance as measured at the individual electrodes measured in isolation from the remaining shall be less than 3 ohms.	
5.43	EARTHING FOR EQUIPMENTS IN INVERTER ROOMS and CONTROL ROOM(PCUs, ACDB panels, SCADA panels): 50mm x 5 mm GI strip lines shall be laid in the cable trenches of Inverter room-1 and -2. GI strips shall be anchored to the cable trench wall using insulation bush supports. Quantity of supports required ~ 30 Nos. (1) Expansion bolts of appropriate size (Minimum M8) shall be used to fix the insulation bush supports. (2) BHEL will provide the earthing line layout drawing. (3) Copper strips shall be interconnected to the earthing terminals of all the control room panels using 6 mm² copper, unarmoured, PVC cables that shall be supplied by BHEL. Cable lugs and hardware (bolts, nuts, washers) required for connecting the 6 mm² cable to the earth terminals of panels and also to the copper strip end shall be in vendor scope of supply. (4) Three sets of chemical earthing electrodes MS pipes 3000 mm long, Zn coated, hot dip galvanized, chemical electrodes Type: T-19, of M/s. Ashlok-make or equivalent, OD = 50 mm shall be supplied by vendor. Earth chambers of brick masonry shall be constructed as per BHEL drawing 4-679-05-00053. These chambers shall be located around the control room. Exact locations will be intimated by BHEL site engineer.	

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	(5) Connection between earth chamber and copper earthing strip in the control room shall be made using cable, 1cx25 mm², copper, unarmoured, 1100V, PVC cables as per IS:1554 (part-1) that shall be in vendor scope of supply. Quantity of cable required ~ 150m maximum. (6) Routing of 1Cx25 mm² cables to earth chambers shall be in 1-inch CPVC pipes, joints, bends and elbows that shall be in vendor scope of supply. Routing shall be underground outside the control room, at a depth of ~450mm below the ground level. Length of CPVC pipe required = 100m. Number of CPVC joints and elbows shall be as applicable. (7) Expansion bolts, cable lugs and all hardware required for this activity shall be within vendor scope of supply. (8) Chemical earth electrodes are required to be provided for the following: - Transformer body, 2 nos - Transformer neutral, 2 nos - Fencing, 1 no The resistance as measured at the individual electrodes measured in isolation from the remaining shall be less than 0.5 ohm. Total chemical electrodes per Inverter room: 8 nos Total chemical electrodes for four Inverter rooms: 32 nos	
5.44	Earthing of switchyard equipment in switchyard of Inverter room-1 and Inverter room-2: (i) Vendor install Earth mat for the entire switchyard area at 1 m below the ground level and all body earth shall be connected to the earth mat. (ii) Vendor shall construct Chemical safe earthing electrode, typically Zn coated, Hot dip galvanized, with brick masonry earth chamber for each case as per BHEL drawing 4-679-05-00064.	
5.45	Earthing of switchyard equipment in switchyard of Main control room: (i) Vendor install Earth mat for the entire switchyard area at 1 m below the ground level and all body earth shall be connected to the earth mat. (ii) Vendor shall construct Chemical safe earthing electrode, typically Zn coated, Hot dip galvanized, with brick masonry earth chamber for each case as per BHEL drawing 4-679-05-00064. (1) FP structure, GOS-1 switch body earth – 1 no (2) FP structure 2, GOS-2 switch body earth – 2 nos (3) Lightning arrestors – 2 nos (4) Metering CTs / PTs body earth – 2 nos (5) Metering panel 1 body earth – 2 nos (6) Metering panel 2 body earth – 2 nos (7) Aux transformer, body earth – 2 nos (8) Aux transformer, neutral earth – 2 nos (10) 1Cx300 mm² cables structure – 1 no	

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	(13) Switchyard fencing – 2 Nos Total number of chemical electrodes required for switchyard = 20 Nos + 5 nos(for equipment earths), Totally: 25 nos GI strips of 50x5 mm shall be used for this purpose. Length of GI string required ~ 300 m. GI strips shall be laid underground at a depth of ~ 500 mm. Chemical electrodes with chemicals, GI strips, all hardware required for making the connections shall be within vendor scope of supply. Vendor shall carry out all the necessary GI laying and interconnections. Vendor shall pour water in the earth pits DAILY for the first 15 DAYS after installation of chemical electrodes. Vendor shall carry out measurement of earth resistance in all the cases that shall be witnessed, verified and certified by BHEL site engineer.	
5.46	Installation of Lightning protection for site using Lightning arrestors (ESE) type BHEL shall supply all the 10 nos of Lightning arrestors (ESE) type along with auxiliary items as pole, HT cable, guy wires, chemical electrodes. The vendor shall install the LA (ESE) including civil foundations in solar array field. (1) Quantity = 10 nos (2) Lightning arrestors shall be mounted on top of a mast of height 7m minimum above ground level using MS pipe of 100 mm minimum average diameter with painted finish; Each mast shall be secured by three steel stay wires that are suitably grouted. Masts shall have appropriate steel base plate for mounting on an RCC concrete foundation pedestal of 450x450 mm size, 1m depth below ground level, 300mm minimum above ground level, PCC 1:4:8 as the bottom layer (~100 mm thick), steel rods of diameter 8mm minimum, concrete M25 with four J bolts (M16) of 750mm long, with nuts and washers. (3) Two earthing chambers per lightning arrestor set using chemical earthing electrodes shall be constructed as per 4-679-05-00064.	
5.47	Lightning arrestor for control room Vendor shall supply and install 3 sets of lightning rod at the terrace of the Control room connected to earthing chemical electrode. BHEL approval shall be obtained for type of lightning rod.	
5.48	Supply & erection of Yard lights for each Inverter room switchyard and Control room switchyard (1) 25 W LED light, Quantity: 6 nos, for each Inverter room switchyard 25 W LED light, Quantity: 7 nos for Control room switchyard (2) 80 W Beam LED light, Quantity: 2 nos, on wall of Inverter room within the switchyard (3) 25NB bend pipes (1m running length) shall be supplied and fixed on angles/ poles of switchyard fencing. Balance 14 shall be fixed	

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	on the switchyard fencing poles. Suitable fixing arrangements shall be provided. (4) Light fitting, Crompton Greaves-make, model no. LSTO-30-CDL (30 W) shall be supplied and fitted on the GI bend pipes using necessary hardware. (5) CPVC pipe of 1.5", carrying 3.5cx2.5 sq-mm copper, armoured, PVC cable, from ground level up to Junction box. (6) 2 cores used for phase, neutral of yard light. (7) 1 core used for body earth purpose. (8) Junction box shall be at a height of 1m above ground level. (9) Junction box (IP65, polycarbonate), with 12 elmex-type, DIN rail of suitable length, MCB (1A, single pole) of Schneider or reputed make, 2 glands (Polyamide single compression) for 3.5Cx2.5 sq-mm cable, 1 gland (polyamide) for 2Cx1.5 sq-mm copper, unarmoured, PVC cable. (10) The junction box, cable lugs, steel bracket for mounting the box on the lighting pole and all hardware items shall be in vendor scope. (11) Glands shall be located at the bottom side of Junction box. (12) CPVC pipe of 1" shall be provided between junction box and bend pipe to guide the 2Cx1.5 sq-mm cable. (13) It shall be ensured that lamp is well above the fencing height, which is 3m above the ground level. (14) Vendor shall submit general arrangement and detailed drawings with bill of materials / quantities of the overall yard lighting arrangement to BHEL for approval.	
5.49	Supply & erection of Array lights for solar array field and periphery: - Along periphery 204 Nos of Light fitting, Crompton Greaves-make, model no. LSTO-30-CDL (30 W) - Within Solar array 77 Nos of Light fitting, Crompton Greaves-make, model no. LSTO-30-CDL (30 W) (1) Lighting poles shall be located at distributed locations in the solar array field as per layout that will be provided by BHEL at an appropriate time during period of execution. (2) 80NB pipes (length 2.8m) to be grouted with concrete foundation of depth 600 mm, with PCC 1:3:6 of 100mm layer (450x450mm), M25 concrete, foundation height 300mm above ground level. (3) 2 cores used for phase and neutral for yard light. (4) 3 cores used for 3-phase power supply that will be used for running the high pressure pump for module cleaning. (5) Additionally, 1Cx1.5 mm² copper, armoured, PVC cable shall be used for earthing the pole. (6) Junction box (IP65, polycarbonate), with 12 elmex-type, DIN rail of suitable length, MCB (1A, single pole) of Schneider or reputed make, 2 glands (nickel plated brass single compression) for 5Cx2.5 mm² cable, 1 gland (polyamide) for 2Cx1.5 mm² copper, unarmoured, PVC cable. Additionally, for yard lights of solar array field, the box shall have 3-phase 20A socket with cover.	

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	(7) Glands, socket shall be located at the bottom side of Junction box. (8) The junction box, cable lugs, steel mounting bracket and all hardware items shall be in vendor scope.	
5.50	Cable trench formation and laying of cables for yard lights Vendor shall construct the underground trench from control room to various parts of the solar array field, switchyard and compound wall for laying the cables for yard lights (1) Trench depth = 600 mm minimum (2) Trench width = 200 mm minimum (3) Sand as per IS: 383 of 100 mm layer thickness shall be laid at the bottom most level of trench. (4) Over the sand layer, cables shall be laid one adjacent to the other. Cables shall not be laid one over the other. In other words, only one layer of cables shall be allowed. (5) Over the layer of cables, one more layer of sand of 100mm shall be laid. (6) Then, a single layer of class-2 brick of 75 mm thickness shall be laid. (7) Trench shall then be filled up with refill soil. (8) Total length of trench required for yard lights, all the three categories (solar array, switchyard and compound wall / chain link fencing) put together ~ 4000m.	
5.51	Cable supply and terminations for yard lights / peripheral lights / solar lights (1) Cable termination: (a) Termination of cables, including unsleeving, crimping, connecting to the junction box and lamp shall be within scope of vendor. (b) Similarly, cables shall be terminated at the ACDB panel within the control room. (c) BHEL will provide the wiring scheme of ACDB panel. (2) Vendor shall supply following lengths of cable: (a) 3.5-c x 2.5 mm², Cu, armoured, PVC cable ~7500m (b) 2-c x 1.5 mm², Cu, unarmoured, PVC cable ~ 2000m (c) 1Cx 1.5 mm², Cu, armoured, PVC cable ~ 1200m (d) 1c x 25 mm², Cu, unarmoured PVC cable ~ 1000m	
5.52	Laying of pipelines between bore wells and overhead tank (1) CPVC pipes (2-inch) shall be laid underground (at depth of ~500 mm) from the three bore wells to overhead tank of Main control room. (2) All necessary CPVC fittings such as T-joints, bends, nipples, reducers, couplers shall be used as applicable. (3) Lines from the three bore wells shall have independent 2-inch non-returnable valves (forged steel) and 2-inch ball valve (forged steel). Further, the lines shall be interconnected to become a single line that shall be laid underground up to overhead tank. (4) Approximate length of CPVC line ~ 300m	

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	(5) Vendor shall submit a detailed water pipeline layout scheme with BoM from bore wells to OH tank for BHEL approval.	
5.53	SPV module cleaning system (1) Vendor shall lay 2-inch CPVC pipelines from overhead tanks to the solar array field with all necessary CPVC nipples, T-joints, reducers, bends, couplers etc. This forms the main header pipeline. Suitable valves such as brass valves of 2-inch etc shall be provided for this main header line. For the branching out lines that spread into various rows of the solar array to provide water delivery points for module cleaning, 1-inch CPVC pipelines shall be used. (2) A suitable centrifugal 3-phase pump of 2HP capacity shall be supplied and installed at a suitable location to draw the water from OH tank to solar array field for solar PV module cleaning. One spare pump shall also be supplied. (3) Starter and DP switch (1 set) shall be supplied and installed near ACDB panel for operating the 2HP pump. (4) Supply of electrical cables (with lugs, hardware) and wiring the pump up to the ACDB panel / starter in the control room shall be in vendor scope. Cable 3.5Cx 4 sq-mm, Cu, armoured, PVC cable shall be used. Length required ~50m. (5) CPVC pipelines shall be laid underground (at a depth of ~500 mm below ground level). (6) There shall be 50 Nos of minimum delivery points for module cleaning. At these delivery points, 1-inch riser lines shall be provided to tap the water from underground line to the delivery point ~300 mm above ground level. Ball valve forged steel type, 1-inch, with suitable nipple for connecting the hose pipe, shall be provided at each delivery point. (7) After installation and testing of water lines, excavated trenches shall be closed with refill soil. Further, the soil, all along the water lines, shall be suitably leveled and compacted. (8) Hosepipes (ribbed, flexible) of 50m long – 3 sets shall be provided for connecting the hose to a portable high pressure 3-phase pump (3-5 HP) that in turn will be connected to the nearest ball valve / nipple delivery point. Pump shall be of Bosch or any other reputed equivalent as shall be approved by BHEL. (9) Purpose of high pressure pump is to pressurize the water at the delivery end so that quantum of water consumption shall be minimized. 2 sets of this complete portable arrangement including pump shall be supplied by vendor. Portable arrangement shall have heavy duty wheels to ensure durability. Additionally, 3 sets of 8mm high pressure pipe of 50m length shall be supplied. (10) High pressure pipe shall be provided with nozzles or appropriate guns to direct the pressurized water on the surface of the module under cleaning. (11) Approximate length for 2-inch header line ~ 1200m (12) Approximate length for 1-inch header line ~ 3600m	

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5.54	Identification markings using paint and cable tags, as applicable to the individual cases and as approved by BHEL, shall be provided. All painting to black in yellow back-ground. (1) String monitoring junction boxes: Identification marking by way of painting on nearby module structure. (2) Individual structures to be labelled for identification by painting. (3) All switchyard equipment such as transformers, Outdoor VCB panels, and metering panels shall be provided with suitable identification markings using painting, with inscriptions as approved by BHEL. (4) Cable sizes with arrow marks in switchyard (for HT cables) using painting. (5) Identification markings for all the earth chambers (using painting) with inscriptions as approved by BHEL. (6) Cable tags using aluminum plate of 1-2 mm thickness with suitable inscriptions as approved by BHEL for all the power cables of the electrical panels such as PCUs, LT panels, Batteries, FCBC chargers, Annunciation panels, ACDB panel.	
5.55	Cable markers (1) Steel cable markers with suitable labels (DC cable, LT cable, HT cable, Data cable, CPVC water pipeline, etc.)and arrow marks (pointing to the cable destination) shall be supplied and installed along the cable trenches for following cases: a) For 1-c x 300 sq-mm cable from string monitoring boxes to control room: Quantity of markers = 125 Nos b) For data communication cables from string monitoring boxes to control room: Quantity of markers = 125 Nos c) For cables of yard lights of solar array field, compound wall/chain-link fencing and switchyard fencing: Qty of markers = 100 Nos d) For electrical cables of bore well connections: Qty of markers = 10 Nos e) For HT (33kV) cables within switchyard: Quantity of markers = 10Nos f) For aux transformer to ACDB panel Quantity of markers = 2 Nos g) For CPVC water pipelines, Quantity = 50 Nos (2) Cable markers shall be suitably grouted with concrete foundation depth of minimum 300 mm below the ground level. Cross section of foundation shall be minimum 200mm diameter. (3) Cable markers shall have a minimum height of 300 mm above the ground level. (4) Cable markers shall be suitably painted.	
5.56	Hoarding for the solar power plant. (1) Hoarding for the plant shall be made of 1500x1800x 2mm thick MS plate. Approximate dimension of board 1500x1800 mm.	

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	(2) Similar plate mentioning salient details of transformers, switchyard details, DP / FP details, date of energisation, make / sl no, etc., to be displayed. (3) Board shall be given a red oxide coat and painted with black colour for background. Letters shall be written with white colour. (4) Board shall be fixed on a frame constructed using ISA 50x50x8 angles. Diagonal supports shall also be provided. The frame shall be supported by two vertical legs of ISA 75x75x8 that is grouted with concrete foundation. (5) Depth of foundation shall be 600 mm below ground level, with 100mm thick PCC layer 1:4:8 of 400x400mm, M25 concrete of 300x300mm, foundation pedestal of 200mm height above ground level. (6) Bottom level of board shall be at a height of 1.5m above the ground level. (7) Vendor shall submit the drawing of hoarding arrangement to BHEL for approval.													
5.57	Display boards and sign boards <table border="1"> <tr> <td>1</td><td>Board showing list of O&M staff with name, qualification and work responsibility</td><td>1 No</td></tr> <tr> <td>2</td><td>Board showing list of contact details of BHEL, O&M team, O&M security, police station, fire service, hospital, medical store with names, address, mobile numbers</td><td>2 Nos</td></tr> <tr> <td>3</td><td>Danger boards with details such as value of voltage for string monitoring boxes, PCUs, LT panels, Transformers, HT panels, Four pole / two pole structures in switchyard etc.</td><td>Quantity as required</td></tr> <tr> <td>4</td><td>Identification boards, of suitable sizes, within and outside control room such as Main control room, Inverter room, executive lounge, store room, security room, gents / ladies toilets etc. BHEL will provide the list.</td><td>20 Nos</td></tr> </table> (a) 5mm thick sun board with LG make vinyl sticker (computerized cutting and pasting) shall be used for Sl. Nos 4, 5, 8 and 9. (b) For others, flex banner with design & printing shall be used.	1	Board showing list of O&M staff with name, qualification and work responsibility	1 No	2	Board showing list of contact details of BHEL, O&M team, O&M security, police station, fire service, hospital, medical store with names, address, mobile numbers	2 Nos	3	Danger boards with details such as value of voltage for string monitoring boxes, PCUs, LT panels, Transformers, HT panels, Four pole / two pole structures in switchyard etc.	Quantity as required	4	Identification boards, of suitable sizes, within and outside control room such as Main control room, Inverter room, executive lounge, store room, security room, gents / ladies toilets etc. BHEL will provide the list.	20 Nos	
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5.58	Electrical insulation mat Total Quantity: 30 m of width 1m (1) Vendor shall supply electrical insulating mat as follows: (a) Make: M/s. Vardhman House Private Ltd or reputed equivalent as shall be approved by BHEL. (b) As per IS: 15652:2006 (c) Class B (d) Thickness 2.5 mm minimum (e) Colour: to be confirmed by BHEL (f) Max use voltage = 33kV (g) Marking of IS standard on the mat													

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	(2) Test certificate shall be provided by vendor (3) Vendor shall lay the mats in front of electrical panels (PCUs,) and ACDB panel in the Inverter and Main control rooms.																																																																			
5.59	Supply and Installation of Air conditioners, Minimum 3-star rating, Quantity: 2 sets Split air conditioner of 1.5T capacity with stabilizer (2 sets) shall be supplied and installed in SCADA room and Office room of the Main control room. Make: LG, Videocon, Blue Star or reputed equivalent that shall be approved by BHEL.																																																																			
5.60	EPABX COMMUNICATION SYSTEM: EPABX communication system shall be provided between the Control control room and the four Inverter rooms. The scope shall include supply and installation of communication system including cabling between the Main control room and the Inverter rooms.																																																																			
5.61	I & C of communication system including laying of telephone cables in trenches.																																																																			
5.62	Tool kits and instruments Vendor shall supply the following tool kits and instruments: A. Measuring instruments <table border="1"><tr><td>1</td><td>Digital Earth Resistance Tester</td><td>Cambridge Instruments</td><td>DET-2000</td><td>2 Nos</td></tr><tr><td>2</td><td>Digital multimeter</td><td>Reputed make</td><td>MOTWANE</td><td>2 Nos</td></tr><tr><td>3</td><td>AC-DC Clamp Meter</td><td>Lutron</td><td>MOTWANE</td><td>2 Nos</td></tr><tr><td>4</td><td>Thermometer, Laser Beam</td><td>Fluke</td><td>62 Mini</td><td>2 Nos</td></tr><tr><td>5</td><td>Digital thermometer (wall hanging)</td><td>Reputed Make</td><td></td><td>2 Nos</td></tr><tr><td>6</td><td>Digital Megger – 5KV</td><td>Shanti Electric Instruments, Nippen</td><td>MOTWANE</td><td>2 Nos</td></tr></table> Note: Make / model number shall be approved by BHEL prior to procurement. B. Tool kits <table border="1"><tr><td>1</td><td>Double ended spanner Set of sizes 10-11, 12-13, 14-15, 16-17, 17-18</td><td>2 Nos each</td></tr><tr><td>2</td><td>Screwdriver Set</td><td>1 Set</td></tr><tr><td>3</td><td>Crimping tool with Dye range 50-630 mm² cable, mechanical gear power, hand operated</td><td>1 Set</td></tr><tr><td>4</td><td>Crimping tool up to 6 mm² cable</td><td>1 set</td></tr><tr><td>5</td><td>Drilling machine AC, hand operated, with bit size up to 20 mm</td><td>1 set</td></tr><tr><td>6</td><td>Measuring Tape, 5m</td><td>2 Nos</td></tr><tr><td>7</td><td>Measuring Tape, 50 m</td><td>2 Nos</td></tr><tr><td>8</td><td>Allen Key set</td><td>1 Set</td></tr><tr><td>9</td><td>Adjustable spanner 2-inch size</td><td>1 No</td></tr><tr><td>10</td><td>Hammer</td><td>2 Nos</td></tr><tr><td>11</td><td>Rough file kit</td><td>1 Set</td></tr><tr><td>12</td><td>Platform balance, 50Kg range, 100g accuracy</td><td>1 No</td></tr></table>	1	Digital Earth Resistance Tester	Cambridge Instruments	DET-2000	2 Nos	2	Digital multimeter	Reputed make	MOTWANE	2 Nos	3	AC-DC Clamp Meter	Lutron	MOTWANE	2 Nos	4	Thermometer, Laser Beam	Fluke	62 Mini	2 Nos	5	Digital thermometer (wall hanging)	Reputed Make		2 Nos	6	Digital Megger – 5KV	Shanti Electric Instruments, Nippen	MOTWANE	2 Nos	1	Double ended spanner Set of sizes 10-11, 12-13, 14-15, 16-17, 17-18	2 Nos each	2	Screwdriver Set	1 Set	3	Crimping tool with Dye range 50-630 mm ² cable, mechanical gear power, hand operated	1 Set	4	Crimping tool up to 6 mm ² cable	1 set	5	Drilling machine AC, hand operated, with bit size up to 20 mm	1 set	6	Measuring Tape, 5m	2 Nos	7	Measuring Tape, 50 m	2 Nos	8	Allen Key set	1 Set	9	Adjustable spanner 2-inch size	1 No	10	Hammer	2 Nos	11	Rough file kit	1 Set	12	Platform balance, 50Kg range, 100g accuracy	1 No	
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	13	Cutting Pliers	2 Nos
	14	Nose Pliers	2 Nos
	15	Vacuum cleaner, of industrial type, for control room sweeping / cleaning.	1 No
	16	Blowers for cleaning the panels	2 Nos
	17	Grass cutting machine with spare blades (2 nos each), Heavy duty – Bosch-make	2 Nos
	Note: Prior to procurement, vendor shall obtain approval from BHEL for the make and specification of the items.		
5.63	Office furniture		
	1	Executive table, wooden type, complete with draws and side racks	2 sets
	2	Chairs, swivel type, with arm rest	10 Nos
	3	Sofa set with one teapoy	2 sets
	4	PC table with chairs	1 set
	5	Storage almirahs	2 Nos
	6	Filing cabinets	2 Nos
	Make: Godrej or reputed equivalent as shall be approved by BHEL. BHEL approval shall be obtained, prior to procurement, for the type of office furniture, for which catalog with model numbers, sizes / dimensions shall be submitted to BHEL.		
5.64	Fire alarm system for Main control room and Inverter rooms: (i) Fire alarm system with smoke detectors, hooters, manual call points, an electronic control panel and interconnection wiring shall be supplied and installed in the Main control room and the Four Inverter rooms. Make: Zicom or any other reputed equivalent as shall be approved by BHEL. (ii) Control panel (3 sets), in sheet steel enclosure, power coated finish, shall be a microprocessor based system with central processing unit, input / output modules, power supply with battery and battery charger, control electronics and display mechanisms. The panel shall be a 4-zone system with audio-visual provisions (LED indications and beeps) for zone-wise annunciation. Individual detector-wise traceability / addressability is not required. It shall have provisions for acknowledgement of alarm and manual resetting. Batteries used shall be lead acid maintenance free type provided with connecting leads. (iii) Smoke detectors shall be of conventional / optical / photoelectric type. It shall not be of ionization type that employs radioactive materials. (iv) Electrical hooters shall sound the alarm upon detection of smoke by the detectors. (v) Manual call point shall be with high-gloss finish, alarm LED provision, breakable glass unit, hammer and chain.		

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	(vi) All the system components shall be installed and commissioned using suitable wiring using copper cable, 2C x 1.5 mm², armoured, fire retardant low smoke PVC with casing / tubing of type and size, of required length, as approved by BHEL. Control panel: Control room – 1 no Inverter room -1 - 1 no Inverter room-2 - 1 no Smoke detectors: Control room – 15 nos Inverter room-1 - 4 nos Inverter room-2 - 4 nos Battery: Control room - 1 no Inverter room -1 & -2 - 1 no each Manual call point: Control room - 1 no Inverter room-1 & -2 - 1 no each Hooter: Control room - 2 nos Inverter room -1 & -2 - 1 no each (vii) Locations of sensors shall include cable trenches of control room as well. Vendor shall submit fire alarm layout / scheme to BHEL for approval.																							
5.65	Installation of Weather monitoring system: The following equipment to be installed by the vendor, inclusive of grouting: (i) Pyranometers, 2 Nos (ii) Anemometer, 1 No (ii) Ambient temperature sensor, 1 No (iii) Solar module temperature sensors (iv) Data logger, 1 No																							
5.66	Other safety related items (1) Safety gadgets <table><tr><td>1</td><td>Gas Mask</td><td>2 Nos</td></tr><tr><td>2</td><td>First Aid Box with essential medicines and bandage cotton, antibiotic cream, Dettol, etc.</td><td>6 sets</td></tr><tr><td>3</td><td>Hand Gloves 33 KV for GOS operation</td><td>2 sets</td></tr><tr><td>4</td><td>Hand Gloves 1KV for Maintenance of SMB</td><td>2 sets</td></tr><tr><td>5</td><td>Discharge rod</td><td>3 Nos</td></tr><tr><td>6</td><td>Safety Helmet</td><td>10 Nos</td></tr></table> (2) Fire extinguishers and sand buckets, as follows, shall be supplied and commissioned at the power plant. BHEL approval shall be obtained for locations at which they shall be kept. <table><tr><td>1</td><td>Dry powder fire extinguisher (stored pressure type)</td><td>Capacity: 10 Kg IS: 13849, CM/L-7759096 Suitability for Class A, B & C fire, related to solid combustibles, flammable liquid and gases.</td><td>12Nos</td></tr></table>	1	Gas Mask	2 Nos	2	First Aid Box with essential medicines and bandage cotton, antibiotic cream, Dettol, etc.	6 sets	3	Hand Gloves 33 KV for GOS operation	2 sets	4	Hand Gloves 1KV for Maintenance of SMB	2 sets	5	Discharge rod	3 Nos	6	Safety Helmet	10 Nos	1	Dry powder fire extinguisher (stored pressure type)	Capacity: 10 Kg IS: 13849, CM/L-7759096 Suitability for Class A, B & C fire, related to solid combustibles, flammable liquid and gases.	12Nos	
1	Gas Mask	2 Nos																						
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	2	Carbon dioxide (CO ₂) type fire extinguisher with trolley	Capacity: 9 Kg IS: 2878 Suitability for Class B&C fires involving flammable liquids & gases, electronic equipment.	12Nos	
	3	Sand buckets	GI fire buckets (as per IS: 2546) with suitable steel stand and cover arrangement. All items shall be painted with red oxide and BHEL approved red paint. BHEL approval shall be obtained for the overall arrangement. Each set of stand shall carry four sand buckets. A suitable cover shall be designed and provided to protect the buckets from rain.	3 sets	
5.67	PEST CONTROL: Vendor shall supply and install materials for pest control against snakes, rats in the Inverter room-1, -2 and Control room.				
5.68	Miscellaneous items: Supply of the following items: (i) 1-inch PVC pipes, quantity: 6000m (ii) M-10 x 45 mm GI bolts with washers plain/spring and M-10 nut, quantity: 100 sets (iii) Hardwares for structure to structure GI 25x3 strip shorting, quantity: 1800 sets (iv) Heavy duty 300mm dia PVC pipe, quantity: 60m (v) hardware various types: 50 Kgs (vi) GI wire SWG 12, quantity 500m (vii) Sintex tanks 6000 litres, quantity: 3 nos				
5.69	(i) Pre-commissioning inspections / checks / tests on equipment, (ii) Synchronization with grid and (iii) Post-commissioning operation of the plant: (h) Minimum pre-commissioning checks to be carried out: (a) Verification of firmness of terminations in all electrical equipment: - All 80 nos of SMBs, - 8 nos of PCUs in Inverter rooms- 1 and -2, - 33kV VCBs in Inverter rooms-1, -2 and Control room - Transformers, FP/DP/SP structure items (GOS, LAs), SCADA stations, weather monitoring equipment. (b) Verification of earthing for all these electrical equipment. (c) Measurement and verification of parameters at string monitoring boxes at solar array field: string current, voltage, combined SMB output current, module temperature, SMB temperature.				

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	(d) Measurement and verification of parameters on DC input side of PCUs: DC current and voltage; Vendor shall support the PCU engineer on these tests. (e) Insulation resistance measurements (megger tests) for all the electrical equipment of control room and switchyard. (f) Functional checks for PCUs: Vendor shall support the PCU engineer during the pre-commissioning tests. (g) Functional checks for transformer marshalling box: Availability of AC/DC power supply, (b) Responses of the relays at HT panels and corresponding indications at annunciation panel by simulating the alarm / trip of Buchholz, PRV, WTI, OTI, LOLA at marshalling box. (h) The vendor shall arrange for an Electrical Contractor to perform the following: (1) Functional checks for HT panels / transformers: - Transformer oil filtration at time of commissioning of 2800 kVA transformers including Oil BDV test for all five transformers - Over-current tripping of all incomers / outgoers by primary current injection - UV / OV tripping of Bus PT by simulating bus voltage - Differential relays testing - Earth fault trip of all incomers / outgoers - Functioning of electromagnetic and numerical relays - VCBs ON / OFF - Availability of AC/DC power supplies, spring charging, LED indications, Verification of interlock operations related to incomer and outgoer VCBs. (2) Earth measurements: - Measurements of earth resistance in the Solar array field - Measurements of earth resistance in the Inverter rooms switchyard - Measurements of earth resistance in the Main control room switchyard (3) Pre-commissioning tests on transformers, CTs, PTs, Lightning arrestors, GOS switches, vacuum circuit breaker, relays, etc: Usually performed tests are indicated as below. However, exact type of tests required to be conducted at site prior to commissioning shall be in line with WBSEDCL / CEA requirements. (a) Transformers: IR tests, ratio tests, excitation current measurement, magnetic balance test on HV, short circuit test, excitation test LV side, vector group test. (b) 33kV vacuum circuit breaker panels: IR tests and continuity tests for panels, IR values for CTs/PTs, excitation test on CTs, primary injection tests for CTs, ratio test for PTs (c) Auxiliary transformers: IR tests, ratio tests.	
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	(d) Relays in HT panels: open/close, tripping, primary injection tests. (e) Outdoor CTs/PTs: IR tests, Polarity tests, Ratio tests, Burden tests, Winding resistance tests, Primary injection tests, excitation tests. (f) Lightning arrestors: IR tests (g) GOS switches: IR and contact resistance tests. This being a CRITICAL ACTIVITY for satisfactory commissioning, the credentials of vendor to be given to BHEL for approval – BHEL approval (for testing agency for the tests) to be taken.	
5.70	Coordination with state departments for necessary approvals and clearances for commissioning (1) Vendor shall coordinate / liaison with concerned WBSEDCL/MRT departments to fix up test schedules and witness by their representatives. (1) Vendor shall prepare and submit the reports to MRT departments and obtain their approval through necessary liaison activities. (2) Vendor shall coordinate and liaison with CEA/ WBSEDCL/ CEIG, prepare and submit the applications with necessary enclosures on behalf of BHEL and obtain their approval: - Approval for BHEL drawings - Approval for synchronization of plant with grid. - CEIG inspection of power plant - Provisional CEIG clearance to proceed with commissioning 1. Vendor shall implement corrective steps on the observations of CEIG, follow-up with them and obtain final clearance for licensed operation of the plant on a continuous basis. Note: Scope of coordinating with state departments such as CEA, WBSEDCL, CEIG to get the clearances / approvals for licensed / statutory operation of the power plant on a continuous basis includes all transactions required for successful liaison and clearances. Application fees and renewal fees (say, in the form of DD) to be enclosed with application / renewal documents shall be in the scope of BHEL. All other expenses in the above process shall be in the scope of vendor including for liasioning with CEIG / CEA for clearance.	

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

6.1	BHEL shall witness routine / acceptance tests performed at manufacturer works for following items. Vendor shall accordingly provide inspection call to BHEL, with submission of quality assurance plan to BHEL in advance. - HDPE DWC pipe - RSJ poles - Gang operated switch 400A, 33kV without earth switch - Gang operated switch 400A, 33kV with earth switch	
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e. Lightning arrestors 42kV, 10kA f. Outdoor CTs / PTs g. Tri vector meter ER300P h. Auxiliary transformer 100kVA, 33kV/415V, ONAN i. Drop out fuse units j. Disc insulators and other overhead line accessories k. ACSR DOG conductor l. All cables	
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7.0 General conditions applicable during installation and commissioning phase

7.1	Water required for construction works shall be organized by vendor. Bore wells, which are deliverables of vendor as part of this contract, shall be dug in the beginning stages so that bore well water itself can be used for the construction purposes. In case bore well is not successful, vendor shall make their own alternate arrangements (tankers).	
7.2	All machinery such as cranes, hydra, JCBs, forklifts, transport trucks, trolleys necessary for movement of materials shall be organized by the vendor.	
7.3	All necessary tools and tackles such as crimping tool (including heavy duty tools for crimping copper cables up to 300 mm ²), screw driver set, power screwdrivers, cutting pliers, nose pliers, spanner sets, adjustable spanners, hole saw cutter set, bending tools, torque wrenches, hack saw blades, pipe wrenches, flat / round files, HV termination tools, drilling machines, welding machines, concrete mixers, steel bar bending tools / templates for RCC works, spade, shovel, hammer shall be organized by the vendor.	
7.4	All necessary measuring instruments such as digital multimeters, electrical testers, meggers (1kV, 2.5kV, 5kV), lamp load testers for solar array string measurements, earth resistance meters, weighing machines, water level indicators shall be organized by the vendor.	
7.5	Vendor shall make their own arrangements for necessary food, drinking water and accommodation for their labour and employees posted at the site. Similarly, food and drinking water required at the site, during the construction operations, shall also be in scope of vendor.	
7.6	Vendor shall organize all necessary steps to meet statutory requirements such as labour license, PF, ESI and also ensure compliance with relevant acts such as minimum wages act, income tax act, employee insurance act for their labour deployed at site.	
7.7	Vendor shall maintain updated labour register, with name, age, qualification, salary, attendance details at the site.	
7.8	Vendor shall use danger boards, wherever required, to ensure safety of the persons during the work at site.	
7.9	Vendor shall adhere to all necessary safety norms such as use of helmet, goggles, hand gloves, gumboots, aprons etc. It is the ultimate responsibility of the vendor in all respect to prevent accidents at the site and safeguard their labour from accidents.	
7.10	Vendor shall, at the completion of every work, clear off the debris, which resulted out of the work. In case of excavation work such as cable trench, vendor shall finish the land neatly with necessary leveling, rolling.	

	PURCHASE SPECIFICATION- GROUP: PHOTOVOLTAICS SUPPLY OF BOS ITEMS, I&C, O&M FOR 10 MW (AC) SPV POWER PLANT AT WBSEDCL MEJIA SITE, WEST BENGAL	PS-439-1082
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7.11	Vendor shall carry out the work without causing inconvenience to other contract groups at the site. In case of conflicts with other groups, vendor shall ensure that the matter is resolved at once amicably so that the progress of work is not affected.	
7.12	Any damages on the building, structures attributable to the acts of labour / employees of vendor shall be rectified and made good by the vendor at their own cost.	
7.13	No child labour shall be employed for execution of the present contract.	
7.14	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 vendor as part of the offer.	
7.15	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) shall be earthed.	
7.16	Any deviations shall be discussed with BHEL site engineers and implementation shall be taken up only after approval from BHEL.	
7.17	Vendor shall submit periodic status report, on daily as well as weekly consolidated basis, to BHEL on the progress of the contract.	

8.0 Operations and Maintenance

8.1	Date of commencement of operations and maintenance: Zero date for O&M shall be the actual date on which the complete 10 MW is commissioned and synchronized for export of power to 33kV grid. In addition the following works shall be completed for O & M period to start: (i) Solar modules water cleaning system should be completed and commissioned (ii) Lighting system for the entire solar array should be completed. In the absence of this, only monitoring charges shall be applicable.	
8.2	Period for O&M Vendor shall operate and maintain the power plant for a period of FIVE YEARS from the zero date as above.	
8.3	O&M personnel 1. Vendor shall deploy following minimum personnel: (a) One technical-cum-administrative in-charge having graduation in electrical / electronics engineering and experience with overall responsibility for complete plant operations. The in-charge shall have competence to deftly handle technical and operational / crisis problems. (b) Four working level staff with ITI / diploma level qualifications in engineering with competence for operating electrical / electronics /	

	PURCHASE SPECIFICATION- GROUP: PHOTOVOLTAICS SUPPLY OF BOS ITEMS, I&C, O&M FOR 10 MW (AC) SPV POWER PLANT AT WBSEDCL MEJIA SITE, WEST BENGAL	PS-439-1082
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	mechanical equipment, taking measurements, data logging / maintaining registers, preparation of reports in computer. (c) Four unskilled persons for regular house-keeping (cleaning / mopping) and water cleaning of SPV modules. Note: At least one among the technical personnel shall essentially be a certified / licensed person for HT operations (33kV minimum). This is a mandatory requirement. (d) Totally 10 security persons – 4 security persons in day shift and 6 persons in night shift after plant commissioning. 2. Vendor shall provide separately identifiable uniforms for the respective office staff. 3. Similarly, O&M personnel shall be provided with raincoats, toolsets, earthing rods, safety gloves, safety goggles, gumboots, helmets and all other personal protective equipment (PPE) that will be relevant to ensure human safety. 4. Names, qualification, work responsibility of personnel shall be listed on a display board within control room. 5. Attendance register shall be maintained for both the teams. 6. Vendor shall ensure statutory requirements such as ESI, PF and labour license for their O&M personnel posted at site. 7. BHEL shall have right to disallow any O&M employee, if found unfit to perform. BHEL instructions issued in writing shall be binding on vendor who shall replace the person. 8. O&M personnel at site shall conform to general regulations in force at site and to any special instructions from BHEL administration. 9. O&M personnel at site shall be deemed to be aware of damages and risks incidental to conditions of BHEL land and works from time to time and BHEL shall not be responsible for any injury to personnel arising there from. 10. Training to O&M personnel It is the absolute responsibility of vendor to ensure imparting of necessary training to their O&M personnel to get them acquainted with the operations of various electrical and mechanical equipment of the power plant. For this purpose, vendor shall identify the O&M personnel well in advance and involve them during installation and commissioning stages so that they become well versed with various functional aspects of the power plant. 11. Availability of O&M personnel at power plant (a) Vendor shall ensure that operating staff are present in the power plant during plant operating time of the day.	
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	PURCHASE SPECIFICATION- GROUP: PHOTOVOLTAICS SUPPLY OF BOS ITEMS, I&C, O&M FOR 10 MW (AC) SPV POWER PLANT AT WBSEDCL MEJIA SITE, WEST BENGAL		PS-439-1082
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	(b) Vendor shall ensure that certain minimum operating staffs are present at the power plant even on festivals, public holidays and any other unique occasions so that the plant is run under competent supervision on all days. 12. O&M personnel shall, strictly, not use any part of the power plant for their personal / residential purposes. Their presence at the plant shall, strictly, be meant only for the purpose of operation and maintenance of plant.	
8.4	O&M operations – daily basis (1) Water cleaning of SPV modules (2) Control room and Inverter rooms cleaning – dry sweeping, wet mopping (3) Water wash cleaning of toilets, urinals in Main control room (4) Gardening of landscaping areas: watering of plants, trimming of plants as applicable and necessary. (5) Logging of DC, AC, grid parameters (current, voltage, power, energy) at PCUs & HT panels, transformer temperatures, equipment tripping/ breakdown, grid outage as per BHEL formats. (6) SCADA data station / PC operations for daily monitoring of weather parameters, trend graphs and urgent reporting to BHEL in case of any problems / anomalies observed with any of the parameters. (7) Drinking water to be arranged for O&M personnel at site. (8) Maintenance of stock of SPARES ITEMS. (9) Grass cutting.	
8.5	O&M activities – weekly basis (1) Removal of garbage from solar array field, switchyard, roads, drains, pathways, sand buckets; logging in registers with signatures of operating persons and in-charge. (2) Monitoring and logging of fire extinguisher levels / pressures as per BHEL formats	
8.6	O&M activities – monthly basis (1) Inspection of fire extinguishers (weight, pressure indication, physical status) followed by refilling actions, if necessary, based on indications. Report to be submitted as per BHEL approved recording formats. (2) Earthing resistance measurements for solar array structures, control room equipment, switchyard equipment, lightning arrestors (ESE): measured values shall be recorded in registers and reported to BHEL as per BHEL approved recording formats. (3) Submission of values / status of plant parameters and events for the corresponding month, as below, as per BHEL approved formats: - Daily values of solar array strings (SMB parameters) - Daily values of weather parameters (solar energy, wind speed, ambient temperature) - Daily energy generation - Events (with date, time) of faults / tripping / breakdown of equipment - Events (with date, time) of grid outage - Events (with date, time) of equipment damages, accidents and thefts	

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	g. Activities of module cleaning (4) Monthly reports shall be submitted to BHEL for all the above data. (5) Energy generation / meter reading report to be prepared and submitted to the concerned EB department. Signatures from NEEPCO and substation representatives shall be obtained wherever required. (6) CUTTING OF GRASS IN THE SOLAR ARRAY FIELD	
8.7	O&M activities - quarterly basis (1) Cleaning of PCUs, LT panels, HT panels, battery chargers to remove accumulated dust. (2) Monitoring and status review, followed by rectification / calibration / replenishment / replacement actions as necessary and applicable for following: (a) Spare items of all electrical equipment (b) First aid box items - medicines and accessories (c) Safety gadgets (d) Tool kits and measuring instruments (e) Yard lights (f) Pumps, starters (g) Control room appliances: air conditioners, lights, fans, exhaust fans, switch boards (3) Pest control for control room (rats, snakes) – sprays, chemicals, medicines to be applied wherever required. (4) Submission of quarterly report on above activities to BHEL.	
8.8	O&M activities – half yearly basis (1) Cleaning of overhead tank	
8.9	O&M activities – yearly basis (1) BDV measurements for oil samples from all the transformers and submission of report to BHEL. (2) Filtration of oil to be arranged, if required, based on BDV measurement report. (3) Lubrication of moving contacts (VCBs, GOS switches, Earth switches) with appropriate grease etc (4) Cleaning of sewerage lines, septic tanks (if found necessary) (5) Painting of main gate, switchyard gate / fencing, earthing chambers, other steel structures within control room and switchyard if required based on conditions of rusting etc. (6) Checking tightness of hardware in solar array structures and tightening wherever required. (7) Checking tightness of power cable terminations in SPV modules (MC4), SMBs, electrical panels of control room and switchyard	
8.10	O&M activities – (as and when required) (1) Monitoring and operation of plant electrical equipment as and when required: (a) GOS Air break switches (with / without earth switch) (b) VCB on/off: local operations from outdoor HT panel and remote operations from indoor remote annunciation panel (c) Settings of numerical relays in HT panels: review and revision in consultation with BHEL.	

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	(d) ACB and MCCB on/off operations on LT side (e) PCU operations: emergency close, LCD displays (selection of settings, monitoring the DC/AC/event/fault status parameters), operation of duct fans (f) Battery and battery charger operations (g) Bore well pump operations to fill the overhead tanks (2) Coordinating, on behalf of BHEL, and obtaining renewal of statutory licenses, clearances and approvals from state departments such as CEA / CEIG. (3) Repair and replacement of vendor supplied items, by vendor, with urgent action plans and implementation, when the items are found non-working / damaged. The same shall be reported to BHEL within 12 hours from time of observation. (4) Reporting, on an immediate basis (within max 2 hours) of functional problems / damages in BHEL supplied items to facilitate repair / replacement by BHEL. Further, vendor shall correspond / coordinate with respective equipment vendors / service centers, on behalf of BHEL, for getting the service engineers to the site. Later, coordinating with the service engineers during their visit to site, and assisting them in the trouble shooting process until the problem is resolved. Vendor shall report to BHEL (within max 2 hours) immediately after the problem is resolved. (5) Vendor shall keep updating the spares inventory at the site every time there is consumption of spare items towards replacement. In case of shortage of spares, the same shall be reported on an urgent basis (with max 2 hours) to BHEL. (6) Coordinating with sub-station upon grid failures, line problems and implementing the needful steps to restore the plant to normal operation. (7) Theft incidents: immediate reporting to BHEL, filing FIRs with police stations on behalf of BHEL, coordination for site inspection by insurance companies and clearance of insurance claims, logging of events (date, time) and maintaining records. (8) Accidents: immediate reporting to BHEL, coordinating with hospitals, logging of events (data, time) and maintaining records	
8.11	Vendor shall ensure completion of following line activities in order to raise bill on regular periods as mentioned below: A. Solar module cleaning - QUARTERLY B. Grass cutting maintenance work - QUARTERLY C. Monitoring of plant operations monthly submission of reports of daily & monthly generation /Exports reports, material stock list ,String Currents, Earth Resistance Measurements & Reports - QUARTERLY D. Regular O&M works - QUARTERLY	

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	E. Miscellaneous works including Maintenance of Vendor supplied items - QUARTERLY F. Fire Extinguishers Checking & Refilling- YEARLY G. Security works - QUARTERLY	
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99800 50 679 3
DRAWING NO.

3

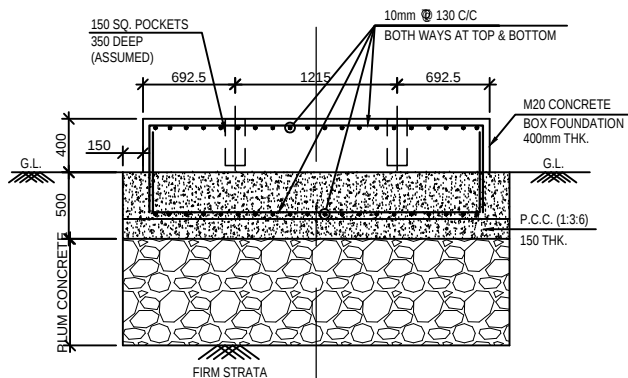
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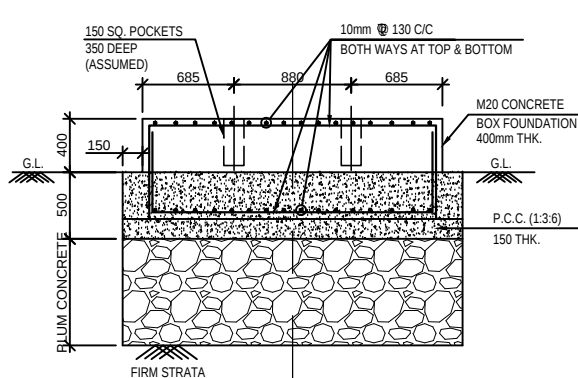
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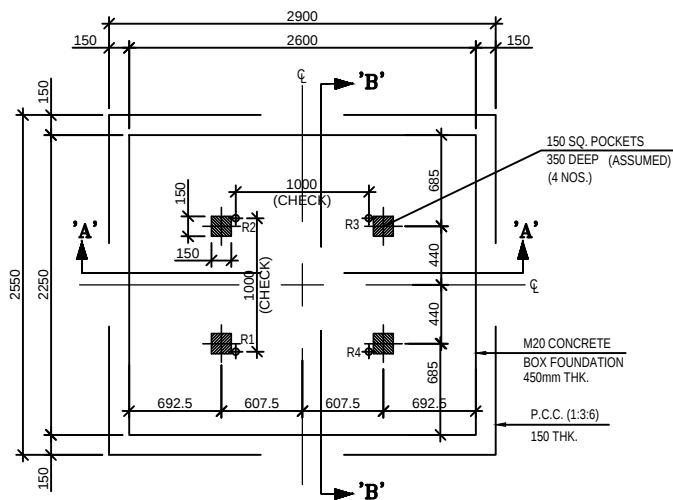
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SECTION A-A



SECTION B-B



PLAN OF FOUNDATION LEVEL

GENERAL NOTES:

- 1) ASSUMED S. B. C. OF SOIL= 4.0 T/m²
- 2) ALL FOOTINGS SHALL BE BOX TYPE FOOTINGS, U.N.O.
- 3) CLEAR COVER TO REINFORCEMENT FOR FOOTING SHALL BE 50mm.
- 4) IF IN DOUBT, PLEASE ASK.
- 5) ALL REINFORCING STEEL SHALL BE HYSD BARS CONFIRMING TO I.S. 1786-1979 (GRADE Fe 415)
- 6) ALL CONCRETE SHALL BE MADE IN M-20 GRADE, UNLESS OTHERWISE SPECIFIED.
- 7) CONTRACTOR SHALL CHECK ALL DIMENSIONS & LEVELS BEFORE EXECUTION OF WORK
- 8) DISCREPANCY IN DRAWING, IF ANY, SHALL BE BROUGHT TO THE NOTICE OF THE SITE ENGINEER, PRIOR TO CONSTRUCTION.
- 9) DIMENSIONS & LEVELS ARE TO UNFINISHED SURFACES EXCLUDING FINISHES, COATING, LININGS ETC. (U.N.O.)
- 10) ALL DIMENSION ARE IN MM UNLESS OTHERWISE STATED.
- 11) DO NOT SCALE THE DRAWING. WRITTEN DIMENSION TO BE FOLLOWED.
- 12) PLUM CONCRETE SHOULD BE OF 1:5:10 RATIO.

FINISH:

2 COATS OF WHITE CEMENT PAINT.

PROJECT : 10MWp SOLAR POWER PROJECT
CUSTOMER : WBSEDCL**BHARAT HEAVY ELECTRICALS LIMITED.**
ELECTRONICS DIVISION, BANGALORE

DRN	NAME	SIGN.	DATE	No. OF VAR
CKD	VRK		030117	
APPD	VRK		030117	

DEPT. SC&PV
CODE 439FOR UNSPECIFIED-TOLERANCES
REFER ED 0230499SCALE
1 : 1

WEIGHT(Kg)

REF. TO ASSY. DRG.

ITEM NO.

No. OF ITEM

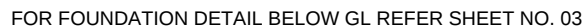
2800KVA TRANSFORMER
FOUNDATION DETAILSDRAWING NO.
3 679 05 00866REV.
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SHEET NO. 01

NO. OF SHEETS 01

INVENTORY NO.

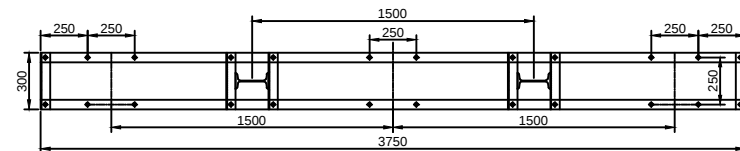
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33KV PT

NOTE: 1. FINISH - 2 COATS OF WHITE CEMENT ON PEDESTALS.
2. ALL MS ANGLE - 2 COATS OF RED OXIDE AND 2 COATS OF AL PAINT.

DEPT. SC&PV	FOR UNSPECIFIED-TOLERANCES		SCALE 1 : 1	WEIGHT(Kg)	REF. TO ASSY. DRG.	ITEM NO.	No. OF ITEM
CODE 439	REFER ED 0230499						
TITLE STRUCTURE ASSEMBLY & FOUNDATION IN 33kV SWITCHYARDS OF INV & CONTROL ROOM				DRAWING NO. 3 679 05 00865		REV. 00	
SHEET NO. 01					NO. OF SHEETS 03		



PLAN
33KV CT

PROJECT : 10MWp SOLAR POWER PROJECT
CUSTOMER : WBSIEDCL

 BHARAT HEAVY ELECTRICALS LIMITED. ELECTRONICS DIVISION, BANGALORE	DRN	NAME	SIGN.	DATE	No. OF VAR
		SAN		301216	
	CKD	VRK		301216	
	APPD	VRK		301216	

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

**STRUCTURE ASSEMBLY & FOUNDATION
IN 33kV SWITCHYARDS OF INV & CONTROL ROOM**

DRAWING NO.		REV.
3 679 05 00865		00
SHEET NO. 01	NO. OF SHEETS 03	

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REF. DRG.NO.

SIGN & DATE

INVENTORY NO.

3 679 05 00865
DRAWING NO.

3

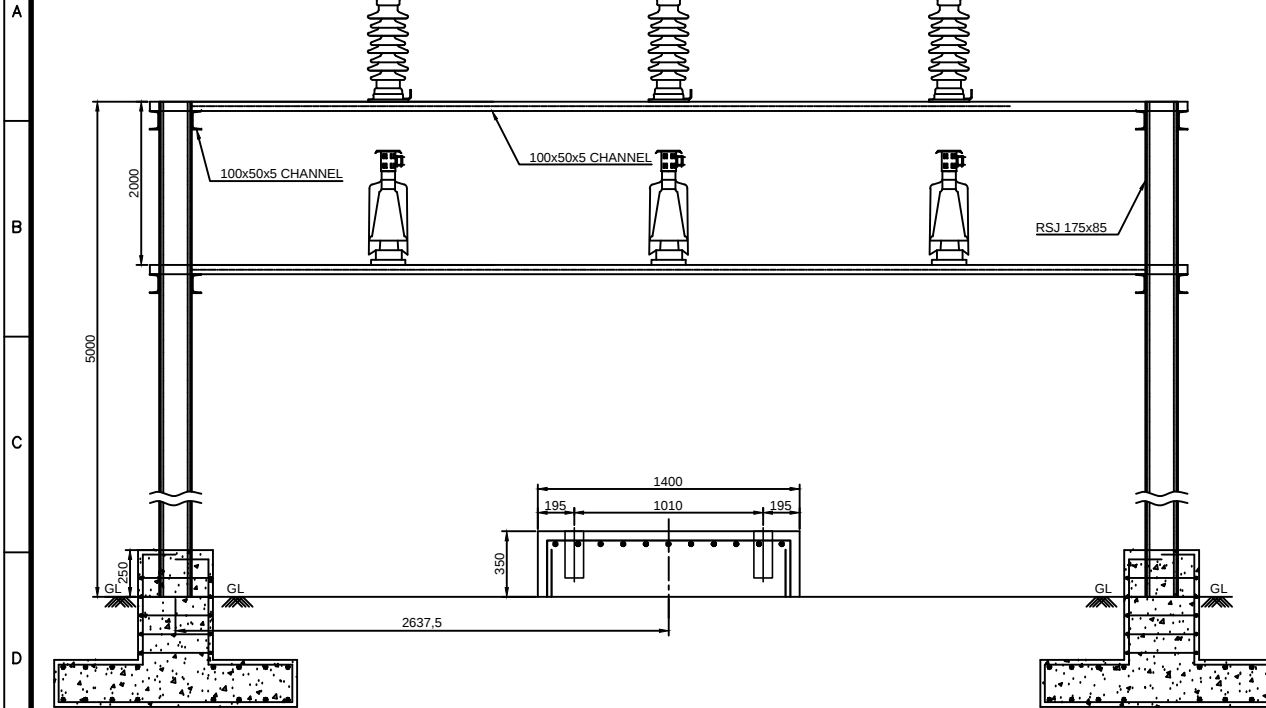
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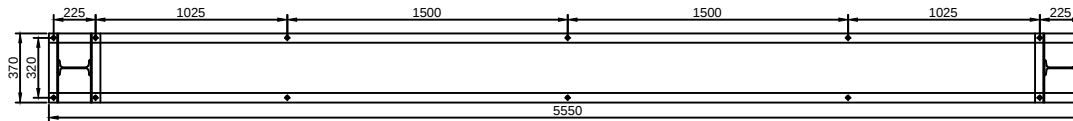
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ELEVATION

FOR FOUNDATION DETAIL BELOW GL REFER SHEET NO. 03



AUX. TRANSFORMER, GOS & SS ARRANGEMENT

PROJECT : 10MWp SOLAR POWER PROJECT
CUSTOMER : WBSEDCLBHARAT HEAVY ELECTRICALS LIMITED.
ELECTRONICS DIVISION, BANGALORE

DRN	NAME	SIGN.	DATE	No. OF VAR
CKD	SAN		301216	
APPD	VRK		301216	

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

FIRST ISSUE

DEPT.
SC&PV
CODE
439FOR UNSPECIFIED-
TOLERANCES
REFER ED 0230499SCALE
1 : 1

WEIGHT(Kg)

REF. TO ASSY. DRG.

ITEM NO.

No. OF ITEM

STRUCTURE ASSEMBLY & FOUNDATION
IN 33kV SWITCHYARDS OF INV & CONTROL ROOM

DRAWING NO.

3 679 05 00865

REV.
00

SHEET NO. 02

NO. OF SHEETS 03

INVENTORY NO.

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3 679 05 00865



PROJECT : 10MWp SOLAR POWER PROJECT								
CUSTOMER : WBSedCL								
 BHARAT HEAVY ELECTRICALS LIMITED. ELECTRONICS DIVISION, BANGALORE					NAME	SIGN.	DATE	No. Of VAR
				DRN	SAN		301216	
				CKD	VRK		301216	
				APPD	VRK		301216	
DEPT. SCP V	FOR UNSPECIFIED- TOLERANCES REFER ED 0230499		SCALE NTS	WEIGHT(Kg)	REF. TO ASSY. DRG.		ITEM NO.	No. Of ITEM
CODE 439								
TITLE PILE FOUNDATION DETAILS					DRAWING NO.			REV
					3 679 05 00865			00
					SHEET NO. 03		NO. OF SHEETS 03	

89800 90 679 3

DRG. No.

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REF. DRG. No.

SIGN. & DATE

INVENTORY No.

A

B

C

D

E

F

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A

B

C

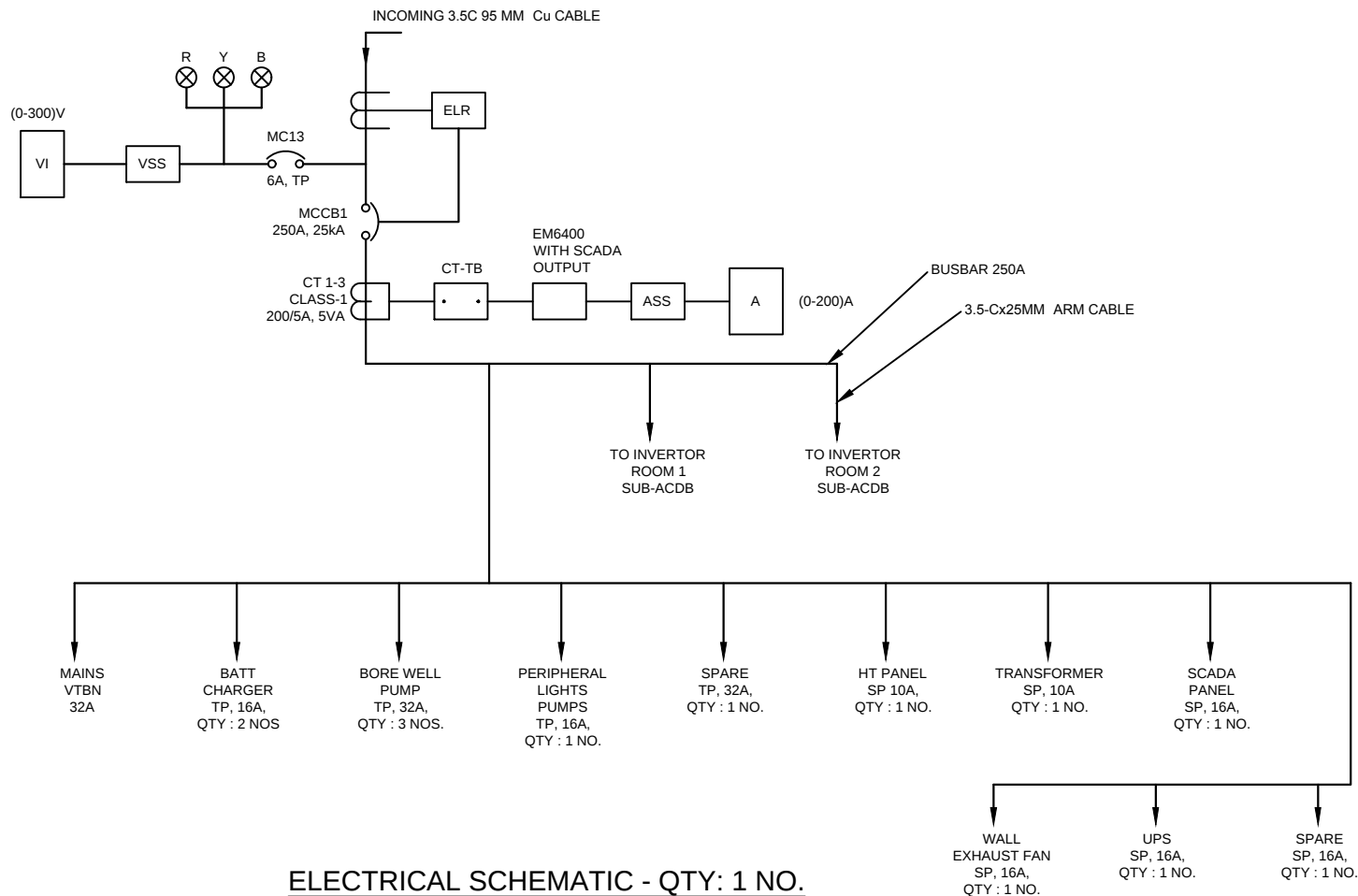
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G

FOR TENDER PURPOSE ONLY



PROJECT : 10MW (AC) GRID INTERACTIVE POWER PLANT
CUSTOMER : WBSIEDCL-MEJIA & CHHARRAH

BHARAT HEAVY ELECTRICALS LIMITED.
ELECTRONICS DIVISION, BANGALORE

CARD CODE

TITLE:

SCHEMATIC FOR MAIN ACDB

No. OF

SHTS

02

SHT

No.

01

REV

00

MO No.

AS PER OPEN TOLERANCE
TO ED 0230499

DRG. No.

3 679 05 00868

89800 50 679 3

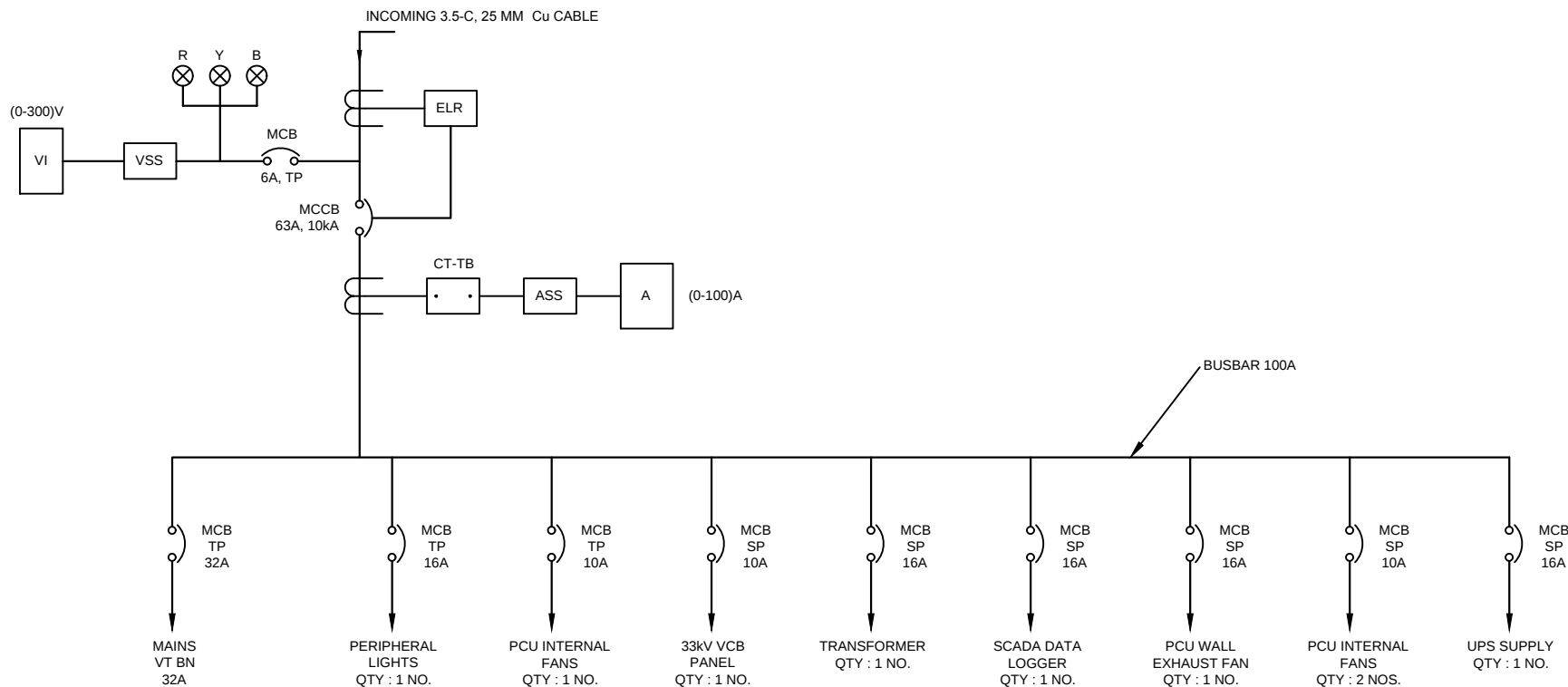
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REF. DRG. No.

SIGN. & DATE

INVENTORY No.



ELECTRICAL SCHEMATIC - QTY : 2 NOS.

PROJECT : 10MW (AC) GRID INTERACTIVE POWER PLANT
CUSTOMER : WBSIEDCL-MEJIA & CHHARRAH

BHARAT HEAVY ELECTRICALS LIMITED.
ELECTRONICS DIVISION, BANGALORE

TITLE: INVERTOR ROOM 1-2
SUB ACDB PANEL

CARD CODE

No. OF SHTS	02
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SHT No.	02
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MO No.	AS PER OPEN TOLERANCE TO ED 0230499	DRG. No. 3 679 05 00868	REV 00
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FIRST ANGLE PROJECTION

69800 90 629 E

DRG. No.

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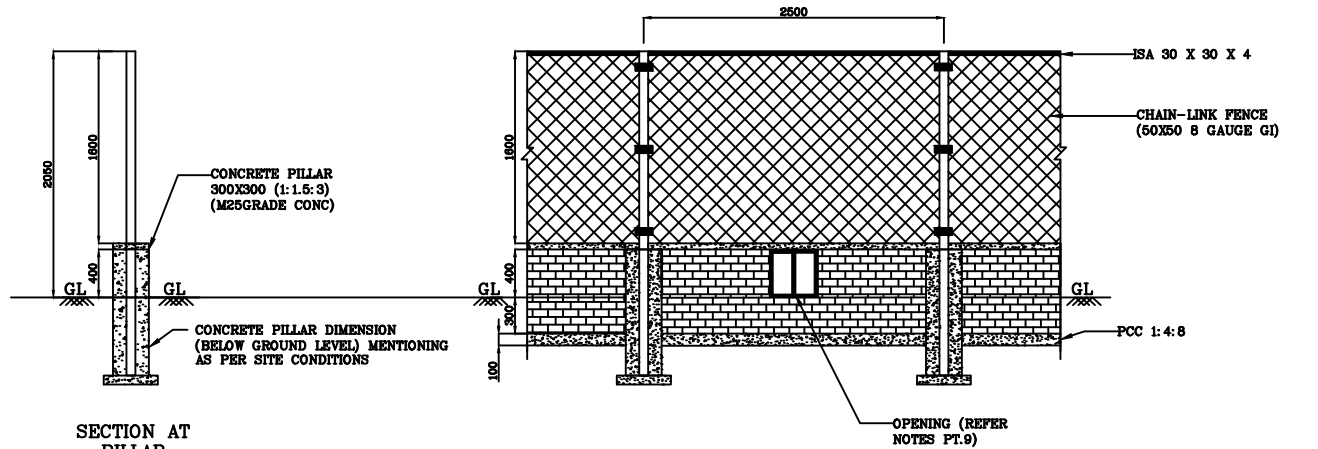
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(ALL DIMENSIONS ARE IN mm)

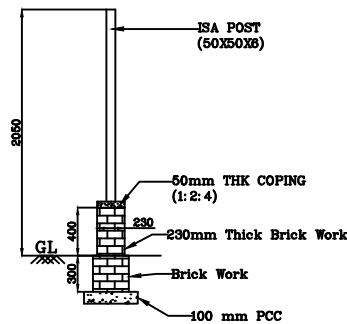
NOTES:

1. VERTICAL POSTS SHALL BE MS ANGLE POSTS AND SHALL CONFORM TO IS: 808-1989.
2. CHAIN-LINK MESH SHALL BE SECURED TO VERTICAL POSTS BY EMPLOYING MS FLAT STRIPS (30mm WIDE, 4mm THICK AND 100mm LONG) AT TOP, BOTTOM AND CENTER USING MS ZINC PLATED HARDWARE.
3. VERTICAL POSTS SHALL BE GIVEN A SECONDARY COAT OF SYNTHETIC ENAMEL PAINT OVER A PRIMER COAT OF RED-OXIDE.
4. BRICKWORK SHALL BE COMMON BURNT CLAY BRICKS CLASS DESIGNATION 7.5 IN CEMENT MORTAR 1:6.
5. MASONRY ABOVE GROUND LEVEL SHALL BE PLASTERED IN 12mm THICK CEMENT MORTAR 1:6 OVERLAID BY 2 COATS OF WHITE CEMENT PAINT.
6. 1900MM LONG STRUTS SHALL BE PROVIDED AT EVERY 20M INTERVAL. STRUTS SHALL BE AFFIXED TO VERTICAL POSTS AT ONE END AND EMBEDDED IN P.C.C. 1:2:4 BLOCKS (450 X 230 X 350MM) AT THE OTHER END.
7. CORNER POSTS SHALL BE PROVIDED USING THE METHODOLOGY AS MENTIONED IN POINT-8.
8. OPENINGS OF SIZE 350 X 350MM WITH MS GRILLS/RODS (AS SHOWN) SHALL BE PROVIDED, ABOVE GL, TO FACILITATE DRAINAGE OF WATER AWAY FROM PLANT PREMISES. REQUIRED SIZE OPENING WITH MS GRILL/RODS SHALL BE PROVIDED WHERE THE SITE DRAINS CROSSES THE FENCING. THE SIZE WILL BE AS PER THE CROSSING DRAIN SECTION.
9. LAYOUT OF FENCING SHALL BE PROVIDED AS PER THE ACTUAL SITE BOUNDARY PERIMETER SUBSEQUENT TO TOPOGRAPHICAL SURVEY AND VALIDATION OF BOUNDARY POINTS.
10. THIS FENCING DRAWING IS ONLY FOR THE AREA ENCOMPASSING TRANSFORMER YARDS AND SWITCHYARD OF MAIN CONTROL ROOM.
11. ISA 30 X 30 X 4 RUNNING SUPPORT SHALL BE PROVIDED AT THE TOP OF THE CHAIN-LINK. THE ANGLES SHALL BE FIXED TO THE VERTICAL POSTS BY WELDING / BOLTING WITH HIGH TENSILE STEEL BOLTS OF MIN. M10. THE CHAIN-LINK FENCE SHALL BE AFFIXED TO THESE ANGLES AT MINIMUM 3 POINTS IN EACH SPAN OF 2.5M.

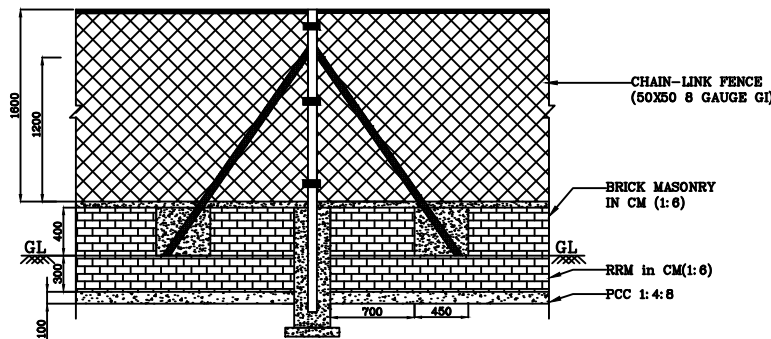


SECTION AT PILLAR

SECTIONAL ELEVATION



SECTION AT TOE-WALL



SECTIONAL ELEVATION WITH ISA 65X85X5 STRUT POSTS (REFER NOTES PT. 8)

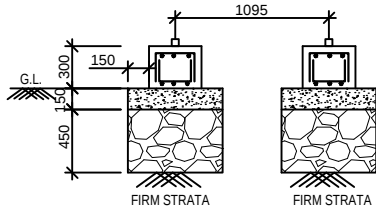
PROJECT: 10MWp (AC) SOLAR PHOTOVOLTAIC PLANT,
CUSTOMER: WBSEDCL

BHARAT HEAVY ELECTRICALS LIMITED.
ELECTRONICS DIVISION, BANGALORE

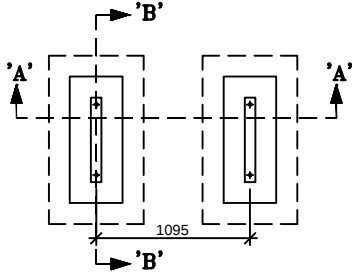
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		CHECKED	00		CHECKED	00					
		APPROVED			APPROVED						
FIRST ISSUE			DRAWN	SAN		240117					
			CHECKED	VRK		240117					
			APPROVED	VRK		240117					

TITLE: CHAIN-LINK FENCING FOR TRANSFORMER YARD (OF INVERTER ROOM) AND SWITCH YARD (OF MAIN CONTROL ROOM)	No. OF SHEETS	01
	SHEET No.	01

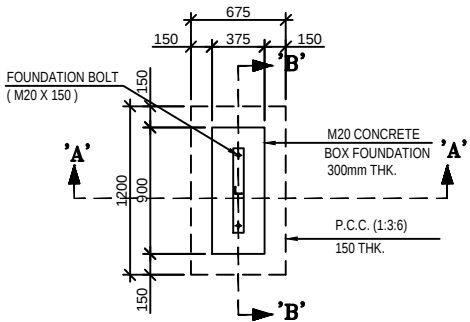
DRG. No. 3 679 05 00869 REV 00



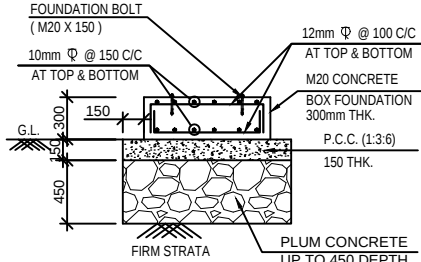
SECTION A-A



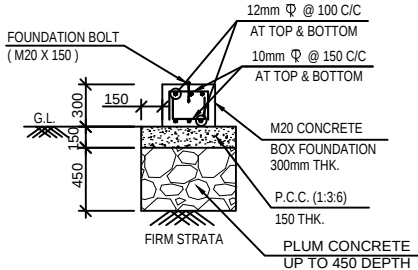
PLAN OF FOUNDATION LEVEL



PLAN OF FOUNDATION LEVEL



SECTION B-B



SECTION A-A

DESIGN CONSIDERATIONS:

- 1) ASSUMED S. B. C. OF SOIL= 4.0 T/m²
- 2) STATIC LOAD ON EACH SUPPORT = 130 KG. (MAX.)
- 3) NUMBERS OF SUPPORTS = 3 NOS.
- 4) NO DYNAMIC LOAD ASSUMED.

REFERENCE DRAWING:

DRG.NO.- HEN MI PV SMB - 847 - 14 - 1
APPROVED BY BHEL EDN, BANGLORE.

GENERAL NOTES:

- 1) ASSUMED S. B. C. OF SOIL= 4.0 T/m²
- 2) ALL FOOTINGS SHALL BE BOX TYPE FOOTINGS, U.N.O.
- 3) CLEAR COVER TO REINFORCEMENT FOR FOOTING SHALL BE 50mm.
- 4) IF IN DOUBT, PLEASE ASK.
- 5) ALL REINFORCING STEEL SHALL BE HYSD BARS CONFIRMING TO I.S. 1786-1979 (GRADE Fe 415/500)
- 6) ALL CONCRETE SHALL BE MADE IN M-20 GRADE, UNLESS OTHERWISE SPECIFIED.
- 7) CONTRACTOR SHALL CHECK ALL DIMENSIONS & LEVELS BEFORE EXECUTION OF WORK
- 8) DISCREPANCY IN DRAWING, IF ANY, SHALL BE BROUGHT TO THE NOTICE OF THE SITE ENGINEER, PRIOR TO CONSTRUCTION.
- 9) DIMENSIONS & LEVELS ARE TO UNFINISHED SURFACES EXCLUDING FINISHES, COATING, LININGS ETC. (U.N.O.)
- 10) ALL DIMENSION ARE IN MM UNLESS OTHERWISE STATED.
- 11) DO NOT SCALE THE DRAWING. WRITTEN DIMENSION TO BE FOLLOWED.

PROJECT : 10MWp SOLAR POWER PROJECT
CUSTOMER : WBSEDCL

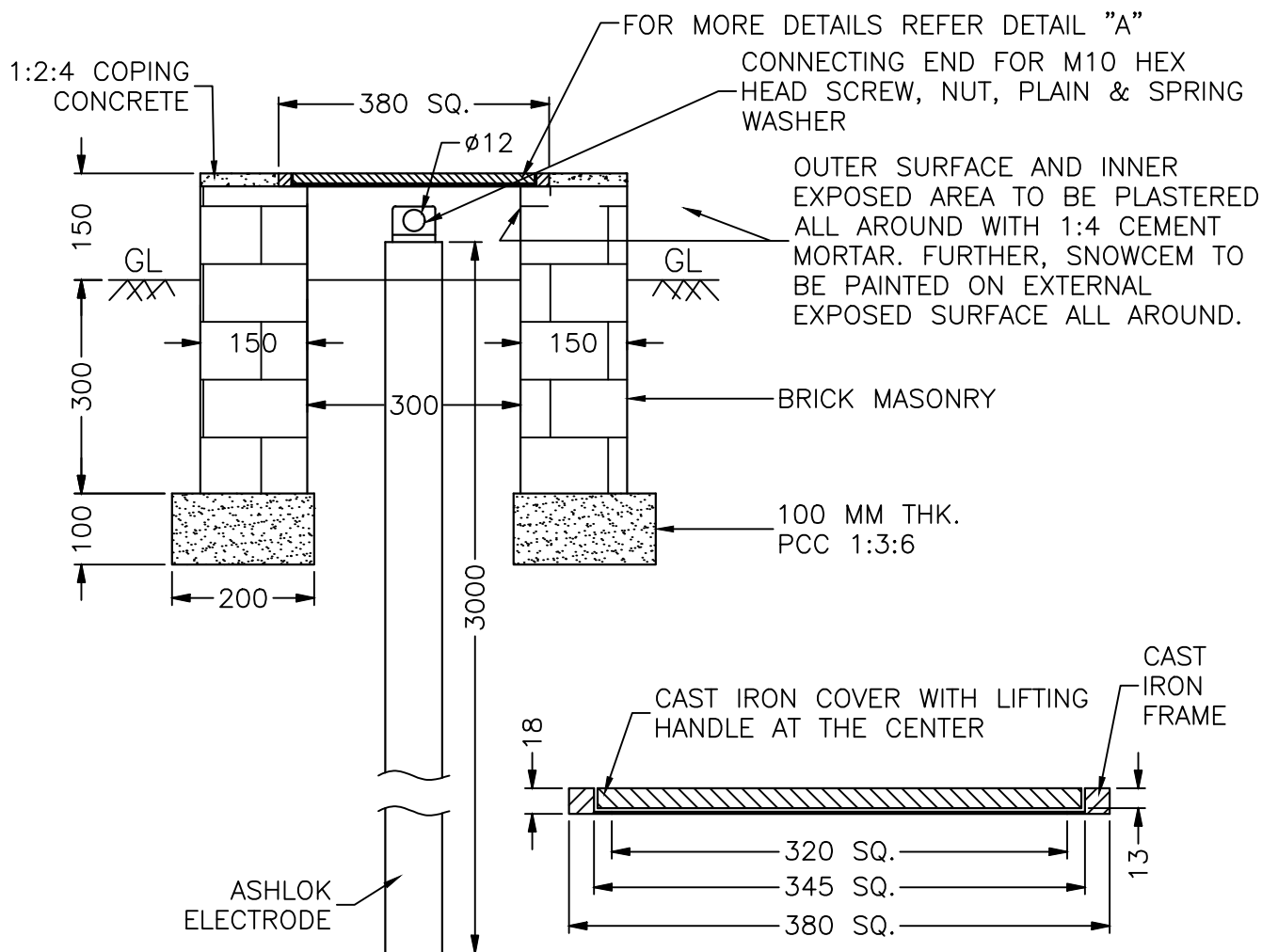


BHARAT HEAVY ELECTRICALS LIMITED.
ELECTRONICS DIVISION, BANGLORE

DRN	NAME	SIGN.	DATE	No. OF VAR
CKD	VRK		240117	
APPD	VRK		240117	

DEPT. SC&PV	FOR UNSPECIFIED-TOLERANCES REFER ED 0230499		SCALE 1 : 1	WEIGHT(Kg)	REF. TO ASSY. DRG.	ITEM NO.	No. OF ITEM
CODE 439							
TITLE SMB FOUNDATION DETAILS				DRAWING NO. 3 679 05 00870		REV. 00	
				SHEET NO. 01		NO. OF SHEETS 01	

FIRST ANGLE PROJECTION						(ALL DIMENSIONS ARE IN MM)							
Desig. of the Company	REV.	DATE	ALTERED	REV.	DATE	ALTERED	ADDITIONAL INFORMATION						
			CHECKED			CHECKED							
			APPROVED			APPROVED							
				00	First Issue			STATUS OF DRAWING					
								DISTRIBUTION OF PRINTS					



DETAIL "A"

FOR TENDER PURPOSE ONLY

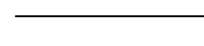
REMARKS	ITEM NO.	DESCRIPTION	STD.	MATERIAL CODE	A	UNIT	UNIT Wt.(Kg)
				MATERIAL SPECN.	C		QUANTITY

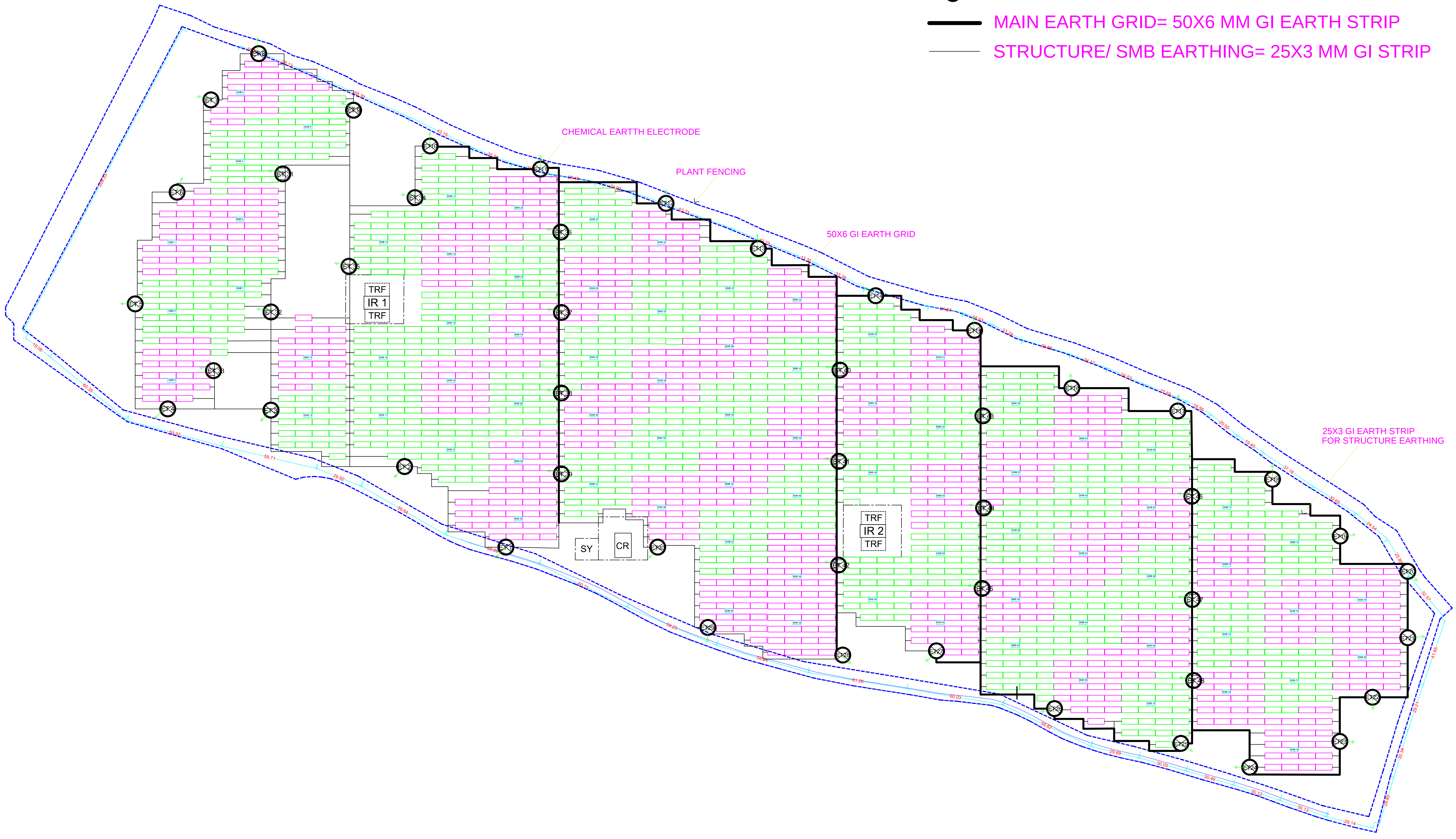


BHARAT HEAVY ELECTRICALS LIMITED.
ELECTRONICS DIVISION, BANGALORE

DRN	NAME	SIGN.	DATE	No. OF VAR
CKD	SAN		170117	
APPD	VRK		170117	

DEPT. SC&PV	FOR UNSPECIFIED TOLERANCES REFER ED 0230499		SCALE NTS	WEIGHT (Kg)	REF. TO ASSY. DRG.	ITEM NO.	No. OF ITEM
CODE 439							
TITLE GENERAL ARRANGEMENT OF CHEMICAL EARTHING AT WBSEDCL FOR CHHARRAH AND MEJIA SITES				DRAWING NO. 4 679 05 00064		REV. 00	
				SHEET NO. 01		NO. OF SHEETS 01	

-  TOTAL NO. OF DC EARTH PITS=48 NOS
-  MAIN EARTH GRID= 50X6 MM GI EARTH STRIP
-  STRUCTURE/ SMB EARTHING= 25X3 MM GI STRIP



REV.	DATE	ALTD	CHD	APPD	REV.	DATE	ALTD	CHD	APPD	REV.	DATE	ALTD	CHD	APPD	REV.	DATE	ALTD	CHD	APPD

DEPT.	SC&PV
DISTRIBUTION	
SIGN.	

WBSEDCL 10MW PV POWER PLANT AT MEJIA, W.B.

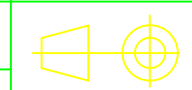


BHARAT HEAVY ELECTRICALS LTD
ELECTRONICS DIVISION, BANGALORE

TITLE

SOLAR ARRAY EARTHING SCHEME

SCALE



DRAWING NO.

BH-WBSEDCL-MEJIA-DG-004

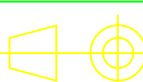
SHEET

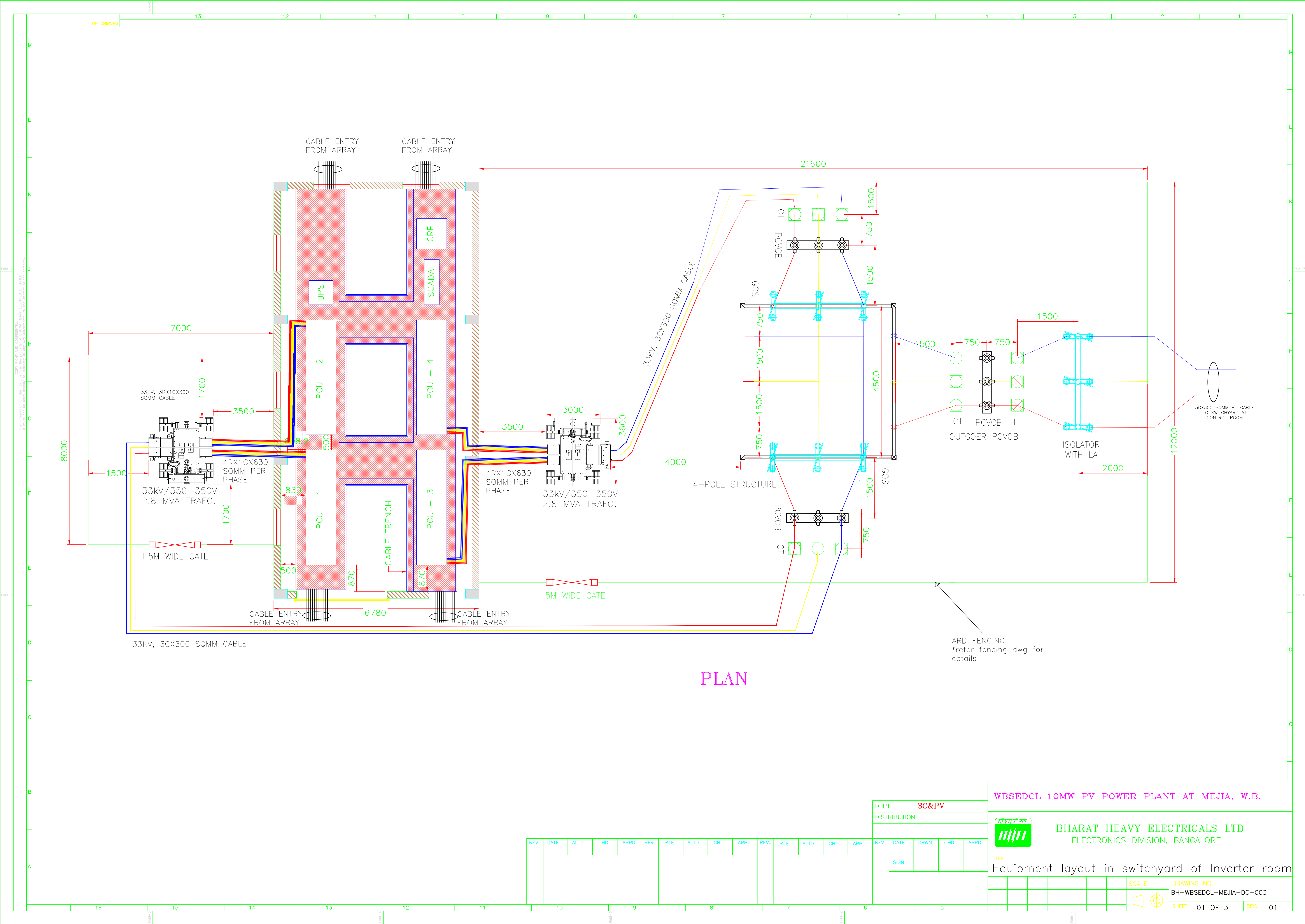
01

REV.

01

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WBSDCL 10MW PV POWER PLANT AT MEJIA, W.B.									
		BHARAT HEAVY ELECTRICALS LTD ELECTRONICS DIVISION, BANGALORE							
TITLE									
SOLAR ARRAY, SMB AND DC CABLE LAYOUT									
						SCALE	DRAWING NO.		
							BH-WBSDCL-MEJIA-DG-006		
							SHEET 01 OF 02	REV.	02



PLAN

REV.	DATE	ALTD	CHD	APPD	REV.	DATE	ALTD	CHD	APPD	REV.	DATE	ALTD	CHD	APPD

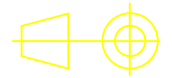
DEPT.	SC&PV
DISTRIBUTION	
SIGN.	

WBSEDCL 10MW PV POWER PLANT AT MEJIA, W.B.



BHARAT HEAVY ELECTRICALS LTD
ELECTRONICS DIVISION, BANGALORE

TITLE
Equipment layout in switchyard of Inverter room

SCALE	DRAWING NO. BH-WBSEDCL-MEJIA-DG-003
	SHEET 01 OF 3 REV. 01



DC cable trench

Plant fencing

SYMBOL	DESCRIPTION	QUANTITY
☹	25W LED	252

LIGHTING LAYOUT ON BOUNDARY AND INTERNAL PATHWAYS

REV.	DATE	ALTD	CHD	APPD	REV.	DATE	ALTD	CHD	APPD	REV.	DATE	ALTD	CHD	APPD	REV.	DATE	ALTD	CHD	APPD

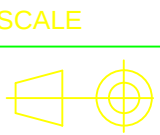
DEPT. SC&PV
DISTRIBUTION

WBSEDCL 10MW PV POWER PLANT AT MEJIA, W.B.

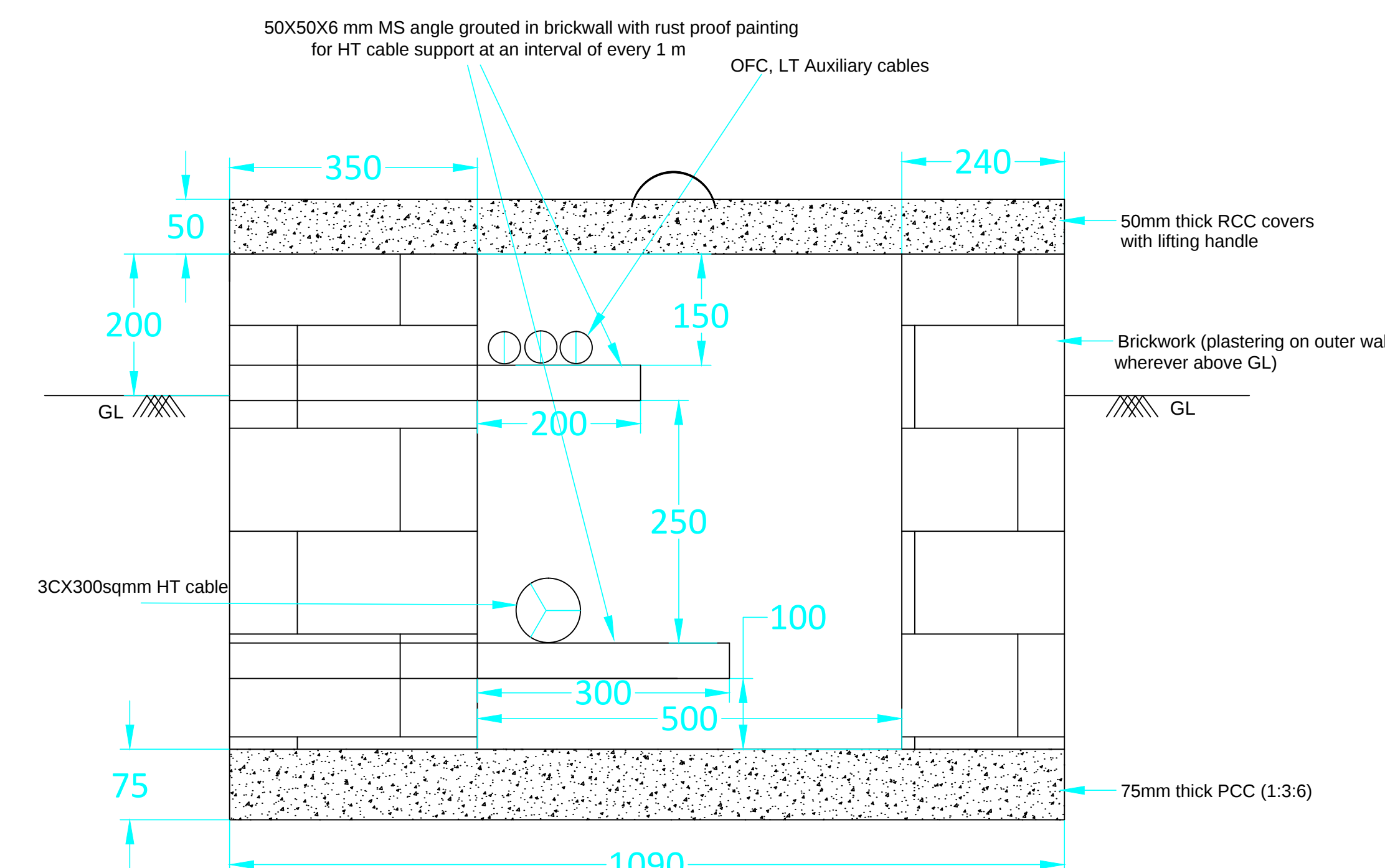


BHARAT HEAVY ELECTRICALS LTD
ELECTRONICS DIVISION, BANGALORE

TITLE SOLAR ARRAY, SMB AND DC CABLE LAYOUT



SCALE
DRAWING NO.
BH-WBSEDCL-MEJIA-DG-009
SHEET 01 OF 02 REV. 00



TRENCH FOR RS485, DC CABLES (6sqmm in conduit & 300sqmm cables)
SECTION A-A

SCALE	DRAWING NO.	
	BH-WBSEDCL-MEJIA-DG-007	
	SHEET 01	REV. 02