

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

Tender Documents Supply, installation and commissioning of Balance of System items and including Operations & Maintenance of 5.67 MW Solar PV grid connected power plant at NEEPCO Monarchak site, Tripura

RFQ Ref: HBSMM20005 RFQ Date : 19.03.2014
RFQ Due Date: 11.04.2014

This Tender Document Contains:

- (1) Request For Quotation
- (2) Technical Specifications : PS- 439-871
- (3) Enclosures B,B1&B2,C : Commercial Terms & Conditions, Unpriced Bid Format and Price Bid Format, Milestone Payment Details
- (4) General Terms and Conditions (Doc Ref : EDN/IND/ENQ-01)

Note:

Part – I: **To be submitted in a separate sealed cover.**

Part – II: **To be submitted in a separate sealed cover.**

Part-I & Part-II sealed covers should be put in outer envelope and super scribed with RFQ No., RFQ date and due date along with the Name & Address of the tenderer.

Tender document should be dropped in Tender drop box super scribed “**SC&PV-MM**” kept in reception area of BHEL – Electronics Division, Bangalore.

For any clarification, the following may be contacted:

Mr. H B Srinivasa, Sr.Manager (SC&PV-MM)

Ph: 080-26998495/09449869655

e-mail : srinivasahb@bheledn.co.in

Ms. Iswarya Raveendran, Engineer (SC&PV-MM)

e-mail : iswarya@bheledn.co.in

PRICE BID												
RFQ No.HBSMM20005 RFQ DATE : 19.03.2014 DUE DATE : 11.04.2014 FOR BOS-NEEPCO,Tripura												
Sl No.	Material	Short Text	Quantity	Unit	Quoted	Taxes					Remarks	
						ED %	CST %	VAT %	WCT %	Service Tax %		
C.I&C												
1	PS0679037039	I&C: Temp site office stoage yard etc.	1	AU	YES/NO	NA	NA	NA	NA		Taxes Included	
Unit Rate in Words :												
2	PS0679037047	I&C: interconnection of SPV modules	1	AU	YES/NO	NA	NA	NA	NA		Taxes Included	
Unit Rate in Words :												
3	PS0679037055	I&C: Formtn of cbl trnch & laying of cbl	5	AU	YES/NO	NA	NA	NA	NA		Taxes Included	
Unit Rate in Words :												
4	PS0679037063	I&C: Erection of control room panels.	1	AU	YES/NO	NA	NA	NA	NA		Taxes Included	
Unit Rate in Words :												
5	PS0679037071	I&C: Erectn 1500kVA tran, firewal const	4	AU	YES/NO	NA	NA	NA	NA		Taxes Included	
Unit Rate in Words :												
6	PS0679037268	I&C: Cbl trench formation	4	AU	YES/NO	NA	NA	NA	NA		Taxes Included	
Unit Rate in Words :												
7	PS0679037098	I&C: Erctn FP-TP-SP,CT&PT, 750kVA tran	1	AU	YES/NO	NA	NA	NA	NA		Taxes Included	
Unit Rate in Words :												
8	PS0679037101	I&C: Swicyard leveling, jelly spreading	1	AU	YES/NO	NA	NA	NA	NA		Taxes Included	
Unit Rate in Words :												
9	PS0679037110	I&C: Erthg slr Arr,inv & main room, trans	1	AU	YES/NO	NA	NA	NA	NA		Taxes Included	
Unit Rate in Words :												
10	PS0679037128	I&C:Cbl trench Cbl lving Cbl termination	1	AU	YES/NO	NA	NA	NA	NA		Taxes Included	
Unit Rate in Words :												
11	PS0679037136	I&C: 33KV ppls with 2 st ACSR cdr lines	1	AU	YES/NO	NA	NA	NA	NA		Taxes Included	
Unit Rate in Words :												
12	PS0679037144	I&C: of vard lights fr solar array field.	1	AU	YES/NO	NA	NA	NA	NA		Taxes Included	
Unit Rate in Words :												
13	PS0679037152	I&C: sys bet cntrl room & 4 inv rooms	1	AU	YES/NO	NA	NA	NA	NA		Taxes Included	
Unit Rate in Words :												
14	PS0679037160	I&C: of mod cleaning system inc. trenches	1	AU	YES/NO	NA	NA	NA	NA		Taxes Included	
Unit Rate in Words :												
15	PS0679037179	I&C: of miscellaneous & safety items	1	AU	YES/NO	NA	NA	NA	NA		Taxes Included	
Unit Rate in Words :												
16	PS0679037187	I&C: Pre-comm insption/cheks/trsts MRT	1	AU	YES/NO	NA	NA	NA	NA		Taxes Included	
Unit Rate in Words :												
D.O&M												
1	PS0679037349	O&M per month as per clause 9.0: 1st yr	12	MON	YES/NO	NA	NA	NA	NA		Taxes Included	
Unit Rate in Words :												
2	PS0679037209	O&M per month as per clause 9.0: 2nd yr	12	MON	YES/NO	NA	NA	NA	NA		Taxes Included	
Unit Rate in Words :												
3	PS0679037217	O&M per month as per clause 9.0: 3rd yr	12	MON	YES/NO	NA	NA	NA	NA		Taxes Included	
Unit Rate in Words :												
4	PS0679037225	O&M per month as per clause 9.0: 4th yr	12	MON	YES/NO	NA	NA	NA	NA		Taxes Included	
Unit Rate in Words :												
5	PS0679037233	O&M per month as per clause 9.0: 5th yr	12	MON	YES/NO	NA	NA	NA	NA		Taxes Included	
Unit Rate in Words :												
E. Freight Charges including Service Tax @ 12.36% on 25% of Freight Value : Included in Unit rate												
F. Insurance Charges : Included in Unit rate												

NOTE :

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

2.The quoted prices shall be inclusive of all Taxes & Duties, Packing & Forwarding charges, Freight & Insurance.**3.However, the percentage of taxes considered against each item may pls be indicated in the column for Taxes for the purpose of availing Tax Credit.**

4. The above format shall be used for compliance.(Reproducing on your letter head is acceptable.)

Authorized Signatory with seal

Annexure C**PROJECT: 5.67MW,NEEPCO - CIVIL SCOPE****Civil Works : mile stone activity linked payment release on certification
(Ref Clause No.5c payment terms of Commercial terms & conditions Enclosure 2)**

SL NO	ITEM DESCRIPTION	QTY	UNIT	STAGES	%
1	Construction of storage yard	1	ST	Completion	90
2	Design & const of inv & Main CTRL Room	1	ST	Foundation up to plinth	20
				Column & slabs	30
				Brick work and lintel	20
				Completion	20
3	Land prep for instling slr mntg. structs	1	ST	Completion on Pro rata MW basis	90
4	Repair of brick road 3m width of 1 Km	1	ST	Completion on Pro rata length	90
5	Construction of asphaited road of 100m	1	ST	Completion	90
6	Strengthening of embarkment by pitching	1	ST	Completion on Pro rata SQMT basis	90
7	Construction of earth pits	177	ST	Completion	90

Balance 10% payment for all 7 items will be released on submission of PBG.

REQUEST FOR QUOTATION

	BHARAT HEAVY ELECTRICALS LIMITED Electronics Division PB No. 2606, Mysore Road Bangalore - 560026 INDIA	RFQ NUMBER: HBSMM20005 RFQ DATE : 19.MAR.2014	Due Date 11.APR.2014 Time: 13:00 HRS VENUE : NEW ENGG. BLDG
MMI:PU:RF:003			

(for all correspondence)

Purchase Executive : SRINIVAS H B
 Phone : 26998452
 Fax : 00918026989217
 E-mail: srinivasahb@bheledn.co.in

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

RFQ TERMS & CONDITIONS:

- 1.Submit offer in Two Part- Technical & Price Bid. Refer General Terms & Conditions as per SC&PV- General Terms & Conditions (Page 1 to 13).
- 2.Technical Specification PS-439-871 Rev 00.
- 3.Find attached Annexure B(Commercial Terms & Conditions),Annexure B1(Un Priced Bid Format) & Annexure B2 (Price Bid Format).
- 4.The date in Delivery Column of RFQ is tentative. Vendor to quote their delivery as indicated in Annexure B.

SI No.	Description	Qty	Unit	Delivery qty	Delivery Date
1	PS0679036849 Sub mercible pump sets,MC4,, HDPE pipes Submersible pumps sets (cl 5.5, 5.49), MC4 connectors (Cl 5.8), cable ties(cl 5.6), cable ducts, HDPE conduits(cl 5.10), cable lugs(cl , hardware, cable trays(cl 5.9), 120/300 sq. mm cbl support. Test Certificate	1	ST	1	08.OCT.2014
2	PS0679036865 Plante bat. Bank & Battery charger as per specs. PS-439-871 refer : cl.3.1, item no.3 Test Certificate	1	ST	1	08.OCT.2014
3	PS0679036873 Main ACDBs, Sub ACDBs & NGRson kits etc. as per specs. PS-439-871 refer : cl.3.1, item no.4 Test Certificate	1	ST	1	08.OCT.2014
4	PS0679036881 FP/DP/SP structure, SW/Yard fence, gate as per specs. PS-439-871 refer : cl.3.1, item no.5 Test Certificate	1	ST	1	08.OCT.2014
5	PS0679036890 ACSR conductor etc.termination kits etc. as per specs. PS-439-871 refer: cl.3.1, item no.6	1	ST	1	08.OCT.2014

For and On behalf of BHEL.

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SI No.	Description	Qty	Unit	Delivery qty	Delivery Date
	Test Certificate				
6	PS0679036903 Items of earthing systems as per specs. PS-439-871 refer : cl.3.1, item no.7	1	ST	1	08.OCT.2014
	Test Certificate				
7	PS0679036911 LA (ESE) & LA with earthing for Array & Cntrl Room as per specs. PS-439-871 refer : cl.3.1, item no.8	1	ST	1	08.OCT.2014
	Test Certificate				
8	PS0679036920 Module cleaning system as per specs. PS-439-871 refer : cl.3.1, item no.9	1	ST	1	08.OCT.2014
	Test Certificate				
9	PS0679036938 Items for yard lighting system as per specs. PS-439-871 refer : cl.3.1, item no.10	1	ST	1	08.OCT.2014

For and On behalf of BHEL.

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REQUEST FOR QUOTATION

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Sl No.	Description	Qty	Unit	Delivery qty	Delivery Date
	Test Certificate				
10	PS0679036946 Miscellaneous items. as per specs.PS-439--871 refer cl.3.1, item no.11 Test Certificate	1	ST	1	08.OCT.2014
11	PS0679036954 Fire alarm sys., Extinguishers etc. as per specs. PS-439-871 refer : cl.3.1, item no.12 Test Certificate	1	ST	1	08.OCT.2014
12	PS0679036962 Construction of storage yard as per Clause5.3 as per specs. PS-439-871 refer : cl.3.1, item no.13 Test Certificate	1	ST	1	08.OCT.2014
13	PS0679036970 Design & const of inv & Main CTRL Room Control room as per specs. PS-439-871 refer : cl.3.1, item no.14 Test Certificate	1	ST	1	08.OCT.2014
14	PS0679036989 Land prep for instling slr mntg. structs solar modules mounting structures as per specs. PS-439-871 refer : cl.3.1, item no.15	1	ST	1	08.OCT.2014

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Sl No.	Description	Qty	Unit	Delivery qty	Delivery Date
	Test Certificate				
15	PS0679036997 Repair of brick road 3m width of 1 Km length as per clause 5.38(i) as per specs. PS-439-871 refer : cl.3.1, item no.16	1	ST	1	08.OCT.2014
	Test Certificate				
16	PS0679037004 Construction of asphaited road of 100m to Main control room as per specs. PS-439-871 refer : cl.3.1, item no.2	1	ST	1	08.OCT.2014
	Test Certificate				
17	PS0679037012 Strengthening of embarkment by pitching as epr clause 5.38(iii) as per specs. PS-439-871 refer : cl.3.1, item no.18	1	ST	1	08.OCT.2014
	Test Certificate				
18	PS0679037020 Construction of earth pits as per specs. PS-439-871 refer : cl.3.1, item no.19	177	ST	177	08.OCT.2014
	Test Certificate				
19	PS0679037039 I&C: Temp site office stoage yard etc. I&C: Temp site office stoage yard b wells mvmnt of consignments. AS PER SPECS.PS-439-871 cl.3.1 item no. 20.	1	AU	1	08.OCT.2014
	Test Certificate				
	PS0679037047 I&C: interconnection of SPV modules &	1	AU	1	08.OCT.2014

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SI No.	Description	Qty	Unit	Delivery qty	Delivery Date
20	Installation of SMBs, Cable termination AS PER SPECS.PS-439-871 Cl.3.1 item no.21				
21	PS0679037055 I&C: Formtn of cbl trnch & laying of cbl laying of cables/MW AS PER SPECS.PS-439-871 Cl.3.1 item no.22	5	AU	5	08.OCT.2014
22	PS0679037063 I&C: Erection of control room panels, grouting, cable trays etc AS PER SPECS.PS-439-871 Cl.3.1 item no.23	1	AU	1	08.OCT.2014
23	PS0679037071 I&C: Erectn 1500kVA tran, firewal const const of inv room cbl trench etc AS PER SPECS.PS-439-871 Cl.3.1 item no.24	4	AU	4	08.OCT.2014
24	PS0679037098 I&C: Erctn FP-TP-SP,CT&PT, 750kVA tran I&C of Cable termination AS PER SPECS.PS-439-871 Cl.3.1 item no.26	1	AU	1	08.OCT.2014
25	PS0679037101 I&C: Swicyard leveling, jelly spreading, fencing , gates for 33KV SW yard AS PER SPECS.PS-439-871 Cl.3.1 item no.27	1	AU	1	08.OCT.2014
26	PS0679037110 I&C:Erthg slr Arr,inv & main room, trans I&C: of earthing systm fr solar array field earthing of inv room AS PER SPECS.PS-439-871 Cl.3.1 item no.29	1	AU	1	08.OCT.2014
	PS0679037128 I&C:Cbl trench Cbl lying Cbl termination	1	AU	1	08.OCT.2014

For and On behalf of BHEL. Page 5 OF 8

REQUEST FOR QUOTATION

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Sl No.	Description	Qty	Unit	Delivery qty	Delivery Date
27	I&C: Cbl trench Cbl lying Cbl terminations fr cntrl Cbls as/5.38-5.38 AS PER SPECS.PS-439-871 Cl.3.1 item no.28				
28	PS0679037136 I&C:33KV pols with 2 st ACSR cdr lines ACSR DOG Conductorn lines AS PER SPECS.PS-439-871 Cl.3.1 item no.30	1	AU	1	08.OCT.2014
29	PS0679037144 I&C of yard lights fr solar array field, switchyard & cable trench AS PER SPECS.PS-439-871 Cl.3.1 item no.31	1	AU	1	08.OCT.2014
30	PS0679037152 I&C sys bet cntrl room & 4 inv rooms I&C comm sys bet cntrl room & 4inv rooms AS PER SPECS.PS-439-871 Cl.3.1 item no.32	1	AU	1	08.OCT.2014
31	PS0679037160 I&C of mod cleaning system inc. trenches pipe lines, laying of p lines AS PER SPECS.PS-439-871 Cl.3.1 item no.33	1	AU	1	08.OCT.2014
32	PS0679037179 I&C of miscellaneous & safety items cable tags, danger boards AS PER SPECS.PS-439-871 Cl.3.1 item no.34	1	AU	1	08.OCT.2014
33	PS0679037187 I&C: Pre-comm insption/cheks/trsts MRT test co-ordination with CEA/CEIG AS PER SPECS.PS-439-871 Cl.3.1 item no.35	1	AU	1	08.OCT.2014
34	PS0679037209 O&M per month as per clause 9.0: 2nd yr Operations and maintenance monthly basis, payable quarterly :for Second Year	12	MON	12	08.OCT.2014

For and On behalf of BHEL.

REQUEST FOR QUOTATION

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SI No.	Description	Qty	Unit	Delivery qty	Delivery Date
	as per item 37 of PS-439-871.				
35	PS0679037217 O&M per month as per clause 9.0: 3rd yr Operations and maintenance monthly basis, payable quarterly :for Third Year as per item 38 of PS-439-871.	12	MON	12	08.OCT.2014
36	PS0679037225 O&M per month as per clause 9.0: 4th yr Operations and maintenance monthly basis, payable quarterly :for fourth Year as per item 39 of PS-439-871.	12	MON	12	08.OCT.2014
37	PS0679037233 O&M per month as per clause 9.0: 5th yr Operations and maintenance monthly basis, payable quarterly :for fifth Year as per item 40 of PS-439-871.	12	MON	12	08.OCT.2014
38	PS0679037250 LT/HT/data cables, termination kits etc. as per specs. PS-439-871 refer : cl.3.1, item no.2 Test Certificate	1	ST	1	08.OCT.2014
39	PS0679037268 I&C: Cbl trench formation & lying of 33 KV HT Cbl in inv room to Main HT panel As per PS-439-871 Cl.3.1 item no.25	4	AU	4	08.OCT.2014
40	PS0679037349 O&M per month as per clause 9.0: 1st yr Operations and maintenance monthly basis, payable quarterly :for First year as per item 36 of PS-439-871.	12	MON	12	08.OCT.2014

For and On behalf of BHEL.

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REQUEST FOR QUOTATION

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Sl No.	Description	Qty	Unit	Delivery qty	Delivery Date

Total Number of Items - 40

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 .

For and On behalf of BHEL.



**PURCHASE SPECIFICATION- GROUP: PHOTOVOLTAICS
SUPPLY OF BOS ITEMS, I&C, O&M FOR 5.67 MW SPV POWER
PLANT
AT NEEPCO MONARCHAK SITE, TRIPURA**

PS-439-871

Rev No: 00

PAGE : 1 OF 62

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

Technical Specification for

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

Operations & Maintenance of

5.67 MW Solar PV grid connected power plant at NEEPCO Monarchak site, Tripura

Revision details : R 00	Prepared:	Approved:	Date:
		V Radhakrishnan	17-March-2014



**PURCHASE SPECIFICATION- GROUP: PHOTOVOLTAICS
SUPPLY OF BOS ITEMS, I&C, O&M FOR 5.67 MW SPV POWER
PLANT
AT NEEPCO MONARCHAK SITE, TRIPURA**

PS-439-871

Rev No: 00

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1.0 Introduction

Bharat Heavy Electricals Limited (BHEL), Electronics Division, Bangalore is setting up a 5 MW Grid connected Solar Photovoltaic power Plant at Monarchak site, West Tripura, Tripura. Overall area of the plant is 25-30 acres. The site location is 80 Kms from Agartala airport and the site consignee is:

“Head of Project”,

North Eastern Electric Power Corporation Ltd (NEEPCO),

Monarchak, Sub-Division: Sonamura,

West Tripura District,

Tripura

This tender is for the Engineering, procurement, installation of the solar power plant.

1.1 Pre-Qualification criteria:

(i) Vendor should have carried out design, supply, installation and commissioning (or EPC contract) of a single solar photovoltaic power plants of at least 2 MW and above in India. Evidence of satisfactory completion certificates from clients must be submitted for the same along with technical offer. Projects other than solar power plant, such as roof-top installations, will not be considered.

(ii) Vendors currently executing of 10 MW and above solar power plants for BHEL projects will not be considered for participation.

1.2 PLANT DESCRIPTION:

The plant will have a solar array field with fixed angle of structures. The solar modules rating for the entire 5 MW array will be 240Wp and all solar modules shall be of same dimensions. Electrically, the array will have 4 nearly equal sub-arrays each of approx. DC power of 1260 KW and a single sub-array of approx. DC power 630 KW.

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

Sub-array	SMB	No of SMBs	Remarks
Sub array 1 to 4: 1260 KW	5 nos x 2	40 nos	Each SMB is a 22-input and 1-output type
Sub-array 5: 630 KW	5 nos x 1	5 nos	

The Inverter room houses the two nos of 630 KVA PCUs, 33 KV VCB, Battery bank, ACDB panel. The 1500 KVA transformer (of ONAN-type) is located outside the Inverter room. The output of the solar array (1260 KW) located close to the inverter room shall be inverted by two inverters (or PCUS). The AC output of the two PCUs in a single Inverter room shall be combined and stepped up to 33 KV voltage level through a **SINGLE 1500 KVA, two LV-winding ONAN transformer** to obtain 1.26MW AC output at 33 KV level. This is routed through a 33 KV VCB circuit breaker to the Main Control room which is located at a distance of 0.5 Km through 33 KV, 3-core x 185 mm² Al conductor, XLPE insulated and armoured cable through underground trenching. The cabling from two PCUs to the single Transformer to 33 KV VCB is as below:

From	To	Cable	Approximate length
630 KW PCU of Inverter room	33 KV, 1500 KVA transformer	3-runs of 300 mm ² per phase copper XLPE insulated and PVC sheathed cable	10m x 3 runs x 3 phases= 90 m per PCU
33 KV, 1500 KVA transformer	33 KV VCB panel in Inverter room	33 KV, 3-core, 185 mm ² , Aluminium cable, XLPE insulated and armoured HT cable	20m per Inverter room



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33 KV VCB panel	33 KV HT panel in Main control room	33 KV, 3-core, 185 mm ² , Aluminium cable, XLPE insulated and armoured HT cable	Inverter room 1: 330m Inverter room 2: 370m Inverter room 3: 210m Inverter room 4: 280m
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In addition, the Main control room houses a single 630 KW inverter and produces 630KW AC output at 33 KV level through a SINGLE 750 kVA, two LV-winding ONAN transformer. Hence the plant employs totally 9 x 630 KW PCUs to produce totally 5.67 MW AT 33 KV level through 4 transformers of 1500 KVA capacity and 1 no transformer of 750 KVA capacity.

The Main Control room houses the 33 KV HT Panel which combines all the 1260 KW outputs at 33 KV level (from the four Inverter rooms) and the single 630 KW output from the Single PCU in the Main control room to form totally 5.67 MW of AC output at 33 KV level. HT breaker panel includes VCB panels with 5 incomer VCB panels, 1 spare incomer VCB panel, 2 outgoer VCB panels, 1 VCB panel for Station transformer, 1 Bus PT panel.

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

Inverter rooms and Main control rooms: The work includes the design and construction the four nos of Inverter rooms and the single Main control room. The Inverter room is of approx. dimensions 10m x 8m and the Main control room is of 22m x 10m. All the rooms shall be of brick-wall superstructure construction and with roofs of sandwiched PUF pre-fab construction.

The total design of the room is included in the scope of work, including flooring, electrical power and lighting, fire detection system in Main control room and the four Inverter rooms.


The **Main control room** will comprise of the following rooms made by Aluminium partitions / paper boards as per approved drawings and of approximate details as below:

Space description	Houses	Approximate dimensions	Remarks
Power room	i. PCU – 1 no ii. 33KV HT panel – 1no (comprising of 10 panels)	18.5m (L) x 5.5m (W)	
Battery room	Two battery banks and two chargers	3.5m(L) x 5.5m(W)	
Office room	Furniture	5m(L) x 4m(W)	False ceiling provision
Pantry room	-	3m(L) x 4m(W)	
Toilet		3.2m(L)x3m(W)	
SCADA room	Desktop SCADA, UPS	3m(L) x 4m(W)	False ceiling provision
Store room		7.8m(L) x 4m(W)	

The HT panel has two outgoer VCB panels and both are ON simultaneously for exporting the power. 3-core x 400mm² cable is used for taking output from the Outgoer-1 and connected through a GOS switch (33 KV, 400 A) assembled on a Four-pole structure. This line is then connected through a Metering cubicle (with CT and PT) to a 33KV ACSR line of DOG conductor.

Likewise power from the Outgoer-2 is taken identically to the other 33 KV ACSR line. Both the 33 KV ACSR DOG lines run for one Km and terminated at the Main 33 KV switchyard. The work includes design and installation of the 33 KV line for a length of approx. 1 Km. Both the 33 KV lines will be terminated at the final 33 KV switchyard with individual GOS switch and Lightning arrester for both lines.

The 750 KVA transformer is located outside the main Control room.

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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.

2.0 Documents enclosed with this specification

1	Tentative site layout with locations of solar array, Inverter rooms, Main control room, drains, pathways,	3-679-05-00680
2	Tentative layout of Inverter room	4-679-05-00055
3	Tentative layout of Main control room	4-679-05-00054
4	Chain-link fencing for transformer yard and Main switchyard	3-679-05-000676
5	Earth chamber	4-679-05-00056
6	Electrical schematic of Main ACDB panel and Inverter room Switchboards	3-679-05-00686
7	Soil report – SBC, C, Phi, Gamma values and other details	19 pages
8	Soil - Electrical resistivity report	11 pages

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 MC4 connectors (Cl 5.8), cable ties (cl 5.6), cable ducts, HDPE conduits (cl 5.10), cable lugs (cl , hardware, cable trays (cl 5.9), Submersible pumps sets (cl 5.5)	1 set
2	Supply of LT / HT power cables (i) 3.5-cx25 mm ² Cu conductor, PVC cable (cl 5.20), (ii) 1-cx300 mm ² Cu conductor, XLPE, unarm cable (cl 5.16) (iii) 3-cx185mm ² Al and 3-Cx400mm ² Al, 33 KV HT power XLPE arm cables (cl 5.20), (iv) Data communication cables (cl 5.40) (v) 33kV termination kits (cl 5.21), (vi) 5-Cx2.5 mm ² PVC ins and arm cable (Cl 5.53), (vii) 2-c x 1.5 mm ² PVC ins and sheathed unarm cable (Cl 5.53), (viii) 1-c x 1.5 mm ² PVC unarm cable (Cl 5.53), (viii) 3.5-Cx95 mm ² Cu conductor, XLPE arm cable (cl 5.20), (ix) Optic fibre cable (cl. 5.41) (x0 Miscellaneous cables, low quantity	1 set
3	Supply of Battery bank 110 volts, 125 AH capacity of PLANTE cells, Lead-acid type with Battery charger 135 volts / 25 Amps capacity, (cl 5.43)	2 sets
4	Supply of Main ACDB (1 no) and Switchboards (4 nos) (cl 5.27), Supply of NGRs – Solid earthing copper strip for 5 nos for 1500 KVA transformers / 750 KVA transformer (Cl. 5.18a)	1 set
5	Supply of items of Four pole, double pole, single pole structures (Cl 5.22), 33kV earth mat materials (Cl 5.46), Auxiliary transformer (Cl 5.28), GOS switches and earth switches (Cl 5.23), Lightning arrestors/surge suppressors (Cl 5.24), Combined CTs / PTs and Metering panels (Cl 5.26), , CT/PT wiring cables, Items of switchyard fencing gate, angles (Cl 5.34), with all related miscellaneous accessories and hardware as per clauses 5.23–5.33	1 set
6	Supply of 33 KV poles, associated insulators, DOG ACSR conductor (Cl 5.30) of 7 Km length for two separate lines L1 and L2 of 3-phase for a distance of approx. 1 Km and with accessories required as disc insulators, stay sets, connectors, cross arm, clamp, ACSR conductor, stay and earth wire as per Cl 5.30	1 set



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7	Supply of items of earthing system for solar array field (CI 5.44), Inverter room panels and Main control room panels (CI 5.45) and Transformer yards for Inverter rooms / switchyard of Main control room equipment including chemical earth electrodes (CI 5.46) including GI flats, copper strips, CPVC pipes, Chemical electrodes, including earth pits provision, all related miscellaneous hardware etc.	1 set
8	Supply of lightning arrestors for solar array field (ESE type) with earthing items (CI 5.47) and lightning rod with earthing items for control room (CI 5.45)	1 set
9	Supply of items of module cleaning system such as pumps, CPVC pipes with fittings, ball valves, nipples (CI 5.55)	1 set
10	Supply of items for yard lighting system such as pole pipes, lamps, lamp fittings, CPVC pipes, junction boxes, cable lugs, related accessories, hardware as per clauses 5.49 to 5.51.	1 set
11	Supply of miscellaneous items such as cable tags (CI 5.56) , danger boards, cable markers (CI 5.57), hoarding board (CI 5.58), sign boards and display boards (cl 5.59), electrical insulation mat (CI 5.60), Chequered plates (CI 5.61), Air conditioners (CL 5.62), Tool kits and Measuring instruments (CL 5.65), Office furniture (CI 5.66)	1 set
12	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, Porta-cabin, Safety gadgets, EPABX communication system as per clauses 5.64, 5.67 and 5.68.	1 set

CONSTRUCTION-related

13	Construction of storage yard as per clause 5.3	1 AU
14	Design and construction of Inverter rooms (4 nos) and Main control room (1 no) complete of civil construction inclusive of foundations, electrical works with brick-wall superstructure and sandwiched PUF construction as per clauses 5.32, 5.33	1 AU
15	Land preparation for installation of solar modules mounting structures for 0.6 MW of solar modules of area of approx. 3 acres land area including suitable levelling as required	1 AU
16	Repair of brick road of 3 m width for a length of 1 Km and to make it WBM standard as per clause 5.38(i)	1 AU
17	Construction of asphalted road of length 100 m to Main control room as per clause 5.38(ii)	1 AU
18	Strengthening of embankment by pitching as per clause 5.38(iii)	1 AU
19	Construction of earth pits as per drawing no. 4-679-05-00053	177AU

I & C-related

20	I&C: Temporary site office, storage yard, bore wells, unloading / movement of consignments, as per clauses 5.1, 5.2, 5.3	1 AU
21	I&C: Interconnection of SPV modules, installation of string monitoring boxes including separate grounding/ earthing connection and cable terminations and inspection thereof as per clauses 5.6 to 5.11	1 AU
22	I&C: Formation of cable trenches and laying of 120 mm ² cables, per MW basis, as per clause 5.13 (1 AU = 1 MW) as per clause 5.13	5 AU
23	I&C: Erection of control room electrical panels including grouting, erection of cable trays and cable supports in both Inverter rooms and Main control 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	1 AU




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24	I&C: Erection of 1500 KVA transformers with pedestal and Fire-walls construction of Inverter rooms, cable trench formation including cable laying for 33 KV HT cable from corresponding transformer to VCB in Inverter, termination of HT cables in VCB as per clauses 5.17, 5.18, 5.19	4 AU
25	I&C: Cable trench formation and laying of 33 KV HT cable from corresponding 33 KV VCBs in Inverter rooms to the Main HT Panel in the Main control room including termination of cables. Switchyard leveling, jelly spreading, fencing including gate as per clause 5.20	4 AU
26	I&C: Erection of Four-pole structure, Two-pole structure and Single pole with GOS / Lightning arrestors, CTs / PTs and Metering cubicles including termination of cables in 33 KV switchyard of Main control room – cl. 5.25 and 5.26 Erection with pedestal of 750 KVA transformer with construction of Fire-walls of Main control room, cable trench formation including cable laying for 33 KV HT cable from corresponding transformer to VCB in Inverter / Main Control room, termination of HT cables in VCB. Switchyard leveling, jelly spreading, fencing including gate as per clauses 5.33 and 5.34.	1 AU
27	I&C: Switchyard leveling, jelly spreading, fencing including gates for 33 KV switchyard associated with Main control room and Inverter room, Fire walls as per clauses 5.35, 5.36, 5.37	1 AU
28	I&C: Cable trenches, cable laying, cable terminations for control and optic fibre cables related to remote annunciation and SCADA as per clauses 5.36 to 5.38, 5.39, 5.40, 5.41, 5.42 and 5.42a.	1 AU
29	I&C of earthing system for solar array field, Earthing of Inverter room / Main control room panels including laying of copper strips. Design and installation of Earth mat for switchyard of Main control room Dual earthing of 1500 / 750 KVA transformers – Body earth and Neutral earth equipment including installation of Chemical electrodes, erection & electrical interconnection of earth chambers as per clauses 5.44, 5.45, 5.46 Installation of lightning arrestors (ESE) as per clause 5.47	1 AU
30	I&C of 33 KV poles with foundations with two sets of 33 KV ACSR DOG conductor lines for a distance of 1 Km from Main control room switchyard to the Evacuation area including termination as per clauses 5.29, 5.30	1 AU
31	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
32	Supply, installation and communication system between Main control room and the four Inverter rooms as per clause 5.64	1 AU
33	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
34	I&C of miscellaneous and safety items such as cable tags, danger boards, cable markers, hoarding board, sign boards, display boards, electrical insulation mat, chequered plates, 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
35	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
36	Operations and Maintenance per month : First year	12 Mon
37	Operations and Maintenance per month : Second year	12 Mon


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38	Operations and Maintenance per month : Third year	12 Mon
39	Operations and Maintenance per month : Fourth year	12 Mon
40	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, unloading, storage, handling, erection of these items are within the scope of vendor. However, insurance for these items are within BHEL scope.

1	Solar PV Modules, 240 watts	23616 nos
2	Solar array structures (24-modules per structure) with modules mounted on the Fixed tilt-type structures	984 nos
3	Cable, 1Cx 6 mm ² unarm (connection of PV modules to string monitoring boxes)	Approx: 65 + 65 Kms
4	Cable, 1C x 120 mm ² arm (for connection from arrays up to PCUs in control room)	Approx: 7 + 7 Kms
5	String monitoring boxes with mounting fixtures	45 sets
6	Power conditioning units (PCUs) of 630 Kw	9 sets
7	Transformers 1500 kVA, 33kV/300V-300V (1 HV winding, 2 LV windings)	4 Nos.
8	Transformers 750 kVA, 33kV/300V (1 HV winding, 1 LV winding)	1 no.
9	33 KV VCBs INDOOR type	4 nos
10	HT panels (Indoor type) including VCBs, CTs, PTs, Relays, C&R panels (5 incomers, 1 VCB for station transformer, 1 spare incomer & 2 outgoing (including 1 redundant / standby outgoing panel)	1 set
11	Weather monitoring equipment for solar irradiation, wind velocity, ambient temperature, module temperature including supply and termination of data cables for the same. (Cable laying in vendor scope)	1 set
16	SCADA data station with PC, Data loggers, accessories and software	1 set
17	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)	-
18	Pathways, approach roads, drains within the solar array plant area	-

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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) Technical offer with covering letter (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 (v) Company brochure.
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" vendor to record comments
5.1	<p>Setting up of temporary site office</p> <p>(1) Vendor shall set up a temporary site office using porta-cabin of minimum 200 ft² within 10 days from the date of purchase order to enable speedy commencement of site activities.</p> <p>(2) Cabin shall be retained at the site until completion of 3 months after commissioning.</p> <p>(3) Cabin shall be furnished with essential amenities such as two work tables, six chairs and necessary number of power points, lamps and fans.</p>	
5.2	<p>Electrical power and water for construction</p> <p>(1) BHEL shall organize necessary electrical power supply for construction activities and also for the porta-cabin.</p> <p>(2) BHEL shall also provide water for construction activities.</p> <p>(3) Vendor shall arrange drinking water for the site engineers of BHEL and the staff/employees of vendor.</p>	
5.3	<p>Construction of temporary yard for safe storage of all BHEL as well as vendor supplied items</p> <p>(1) Vendor shall, at a suitable location at the site, as decided based on discussions with BHEL site engineer, construct WITHIN FIFTEEN DAYS OF ISSUANCE OF PURCHASE ORDER a temporary yard for safe storage of BHEL as well as vendor supplied items. This includes storage of all items such as electrical panels (PCUs, HT panels, Battery banks, Battery chargers), transformers, cables, string monitoring boxes, spares, tools, instruments etc. The vendor shall make available a suitable quantity of tarpaulins for coverage of the equipment.</p> <p>(2) Area of storage yard shall be approximately 1500 m². Typical size shall be 30m x 50m.</p> <p>(3) Storage of solar PV modules: Solar modules shall be supplied in carton boxes. Separate overhead covered shed to be made for area of 500 m².</p> <p>(4) An appropriate portion of yard area of dimensions 20m x 10m shall be provided with suitable roof (asbestos or FRP) supported by steel poles that shall be grouted using suitable concrete foundations within 15 days of PO issuance by BHEL.</p> <p>(5) Necessary raised / covered arrangements shall be provided to the individual panels / equipment to ensure that these items are not affected by water at the ground level during time of rain storm, flood etc.</p> <p>(6) Yard shall be fenced all around with a steel gate of width of 5m minimum. Height of fence and gate shall be 2.5m minimum above the ground level.</p>	<p>Vendor to confirm YES / No</p> <p>Yes / No, confirm</p> <p>Vendor to confirm YES / No</p>



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	<p>(7) Suitable fencing shall be provided using steel poles at every 3m intervals and barbed wires between the poles.</p> <p>(8) Gate shall be suitably secured to the fencing poles and shall be provided with lock and key.</p>	
5.4	<p>Receipt, unloading, safe storage and movement of BHEL and vendor supplied items:</p> <p>(1) Vendor shall organize all necessary resources such as labour, machinery and tools (cranes, hydra, forklifts, transportation trucks / trolleys, lifting accessories) for unloading all the items received at the site and subsequent movement to the storage yard. Similar arrangements shall also be made by vendor for movements of the items from storage yard to the point of construction.</p> <p>(2) Vendor shall maintain proper documentation / compilation of all the records related to shipping (invoices, delivery challans) and shall take verification and approval from BHEL site engineer for every consignment. The documents shall be suitably preserved for further handing over to BHEL.</p> <p>(3) Safeguarding the items from pilferage is responsibility of vendor. For this purpose, vendor shall post adequate watch and ward for the yard on round-the-clock basis.</p> <p>(4) Registers shall be maintained for the yard to keep track of incoming / outgoing items.</p> <p>(5) Vendor shall arrange for necessary insurance for the items supplied by himself up to the time of commissioning.</p> <p>(6) BHEL will ensure insurance for all the BHEL supplied items.</p>	
5.5	<p>Construction of bore wells including hydro survey, water analysis, electrical cabling and plumbing works.</p> <p>(1) Three bore wells shall be dug at locations as identified and as certified by BHEL.</p> <p>(2) Bore wells shall be of necessary depth based on water table at the identified locations.</p> <p>(3) Water analysis shall be carried out and report submitted to BHEL.</p> <p>(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.</p> <p>(5) Casing as required shall be provided for the pump.</p> <p>(6) Pump and the electrical cables shall be in vendor scope of supply. 5Cx 4 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.</p> <p>(7) Length of cable required ~ 600m.</p> <p>(8) Pump make: CGL, Suguna, Kirloskar or any other reputed equivalent as shall be approved by BHEL.</p>	
5.6	<p>Interconnection of SPV modules to form strings: Supply of SPV modules is in BHEL scope, type L20220 type, 240 watts, drawing reference 3-679-02-00351, Total quantity = 23,616 nos.</p>	



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	<p>Erection of mounting structures and mounting of the SPV modules on the structures are in BHEL scope.</p> <p>Vendor shall interconnect the modules as follows:</p> <ul style="list-style-type: none">(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, 24 modules shall be connected in series for L20220 type. Each set of connections is called as a series string. Thus, 984 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. <p>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. BHEL approval shall be obtained for the selected brand and sizes of cable tie.</p> <ul style="list-style-type: none">(g) Cables shall not be loosely hanging.	
<p>5.7</p>	<p>Installation of string monitoring boxes</p> <ul style="list-style-type: none">(1) Supply of string monitoring boxes (SMB), 45 sets, is in BHEL scope. These are 22-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 are in BHEL scope of supply.(4) Drawings and details of SMBs and the fixtures will be provided to the vendor after placement of purchase order.(5) Vendor shall grout the stands of the SMBs into the ground using RCC foundation with M25 concrete and steel rods of 8mm minimum diameter. Depth of foundation shall be a minimum of 800mm below the ground level. Foundation shall be raised up to a level of 300mm minimum above the ground level.(6) Foundation drawing shall be submitted to BHEL for approval.(7) SMBs shall be fixed on the stands using the hardware that are supplied by BHEL as part of SMB assembly kit.(8) All tools necessary for mounting shall be in vendor scope. <p>SEPARATE EARTH / GROUND CONNECTION THROUGH SEPARATE EARTH PIT WITH CHEMICAL ELECTRODE FOR EVERY TWO ADJACENT SMBs TO BE MADE.</p>	



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5.8	<p>Interconnection of Series-connected module strings to SMB using 6 mm² cable:</p> <ol style="list-style-type: none">(1) Each SPV module string shall be connected to SMB using 1cx 6 mm² cable (copper, PVC insulation, PVC outer sheath, IS: 1554 part-1) supplied by BHEL. Overall diameter ~ 9 mm. Diameter under the outer sheath (over the insulation) ~ 4.8 mm.(2) SPV module is provided with positive and negative cables (4 mm²) having male and female parts of MC4 type connectors.(3) Vendor shall supply plug connectors of MC4 type, each set having a pair of male and female parts, to join the 6 mm² cable with SPV module cable.(4) MC4 connectors shall have rating of 1000VDC (IEC), rated current of 30A, Type approved by TUV Rheinland for product safety.(5) Approved make: Multi-contact (MC4).(6) Total quantity of MC4 connector sets required = 1400 sets (Each set having a male and a female part) inclusive of extra spare 400 sets.(7) Two sets of tool kits (with plastic box enclosure) shall be supplied. This shall include crimping plier MC4, open end spanner set MC4, stripping plier MC4, socket wrench insert to tighten, socket wrench insert to secure, inserts for both 4 mm² and 6 mm² (of both pliers).(8) Note: For any other equivalent make of plug connectors and tool sets, BHEL approval shall be taken prior to procurement.	
5.9	<p>Routing of 1Cx 6 mm² cable:</p> <ol style="list-style-type: none">(1) 6 mm² cables connecting the SPV module strings to SMBs shall be neatly routed along a PVC cable tray, 2mm thick x 150mm minimum width x 25 mm max height, of Elcon or any other reputed equivalent as shall be approved by BHEL.(2) Cable tray with cover shall run along the stretch of structures up to the SMB box.(3) Make, dimensions, specifications of the cable tray shall be submitted to BHEL for approval.(4) Cable ties, nylon polyamide 6.6 UV stabilized black, UL94 flammability rating V2, operating temperature up to 85^oC, shall be used to arrest any possibility of movement or sagging. Cable ties shall be of make: 3M, Phoenix contact, Weidmuller, Hellermannntyton, Panduit. Width of the cable ties shall be a minimum of 4.5 mm.(5) Total length of cable tray with cover required ~ 500 m	



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5.10	<p>Underground laying of 6 mm² cables between SOLAR ARRAY rows:</p> <p>(1) HDPE double walled corrugated (DWC) pipe shall be used to guide the 6 mm² cables underground from one row to the other. Quantity: 3000 metres (IN VENDOR'S SCOPE)</p> <p>(2) Where 6 mm² cables run between two rows of structure, HDPE DWC pipe shall be within scope of vendor supply.</p> <p>(3) Specification of HDPE DWC pipe: As per IEC 61386 part 1-4; ID shall be selected to accommodate the number of 6 mm² cables to be guided. However, ID shall be minimum 63mm.</p> <p>(4) Make: Jyoti Electricals or reputed make as shall be approved by BHEL.</p> <p>(5) Make, part number, sizes / dimensions shall be submitted to BHEL for approval.</p> <p>(6) Details of cable trench: (a) Trench depth = 450 mm minimum (b) Trench width = 200 mm minimum (c) Bottom layer shall be sand of IS: 383 with 100mm thick. (d) HDPE conduit shall be laid over the sand layer. (e) Another layer of sand of 100 mm thick. (f) Trench shall, then, be filled with refill soil and compacted.</p>	
5.11	<p>Connecting the 6 mm² cables on input side of SMBs:</p> <p>(1) 6 mm² cables of positive and negative polarities originating from SPV module strings shall be terminated at the input side of SMBs.</p> <p>(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.</p> <p>(3) Cable lug shall be in vendor scope of supply. Type of lug (pin type) shall be in accordance with the termination arrangement within the SMB. Quantity for 6 mm² ~ 2500 sets (cable lug + any hardware if required).</p> <p>(4) Any other hardware, if necessary for fulfilling the connection, such as bolts, nuts, screws, washers shall be in vendor scope of supply. In such a case, all hardware shall be of SS304.</p> <p>(5) All necessary tools such as pliers, strippers, crimping tool shall be in vendor's scope.</p>	



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5.12	<p>Connecting the 120 mm² cables on output side of SMBs</p> <p>(1) BHEL-supplied Cables of 1Cx120 mm² (copper 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 the colour: red and black, respectively.</p> <p>(2) Overall diameter of cable ~ 24mm.</p> <p>(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 that are also supplied by BHEL along with SMBs.</p> <p>(4) Cable lug shall be in vendor scope of supply. Lug shall be tinned copper of appropriate duty and size. Make: Dowell's / 3M or any other reputed equivalent as shall be approved by BHEL.</p> <p>Quantity required ~ 90 Nos + 30 nos (SPARE), totally 120 nos</p> <p>(5) Hardware such as bolts, nuts, plain washers and spring washers shall be in vendor scope of supply. The size and type of these shall be in accordance with termination arrangement on the bus bar.</p> <p>(6) All necessary tools such as pliers, strippers, crimping tool shall be within vendor scope.</p>	
5.13	<p>Cable trenches for laying power cables from SMBs to Inverter rooms 1 to 4 and Main control room:</p> <p>(1) 1Cx 120 mm² (copper, armoured, PVC insulation, PVC sheath) cables of positive (red) and negative (black) polarities are routed from SMB boxes to Power Conditioning Units (PCUs) kept at each INVERTER ROOMS 1 to 4 and MAIN CONTROL ROOM. BHEL will furnish SMBs details of output cables routed to the four Inverter rooms.</p> <p>(2) Overall diameter of cable ~ 24 mm.</p> <p>(3) These cables shall be laid underground from the point near SMB to a point close to the control room.</p> <p>(4) Two cables (+, -) from each of the 45 SMBs.</p> <p>(5) Tentative location of Inverter rooms 1 to 4 is shown in BHEL drawing no. 3-679-05-00680 CUMULATIVE TOTAL LENGTH OF TRENCHES: 1500 METRES</p> <p>(6) Vendor shall construct the underground trench as follows:</p> <p>(a) Trench depth = 750 mm minimum</p> <p>(b) Trench width shall vary en route to Inverter room, based on the number of cables. As the cables join from SMBs en route, bunching takes place and the width of trench shall increase. Max trench width expected = 2m.</p> <p>(c) Sand as per IS: 383 of 100 mm layer thickness shall be laid at the bottom most level of trench.</p> <p>(d) Over the sand layer, cables shall be laid one adjacent to the other. Cables shall not be laid one over the other. In other words, only one layer of cables shall be allowed.</p> <p>(e) Over the layer of cables, one more layer of sand of 100mm shall be laid.</p>	



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	<p>(f) Then, a single layer of class-2 brick of 75 mm thickness shall be laid.</p> <p>(g) Trench shall then be filled up with refill soil.</p> <p>(h) Subsequently, land over the cable trench shall be leveled and compacted firmly.</p>	
<p>5.14</p>	<p>(i) POSITIONING OF EQUIPMENTS IN INVERTER ROOMS 1-4: - PCUs, 33 KV HT VCB panels, ACDB panels, Cable trays in trenches, data stations(Loggers) of SCADA</p> <p>(ii) POSITIONING OF EQUIPMENTS IN MAIN CONTROL ROOM- PCU, HT Panel, battery banks, FCBC battery charger panels, ACDB panel, data stations of SCADA, Cable trays in trenches.</p> <p>(1) Vendor shall organize necessary resources such as labour, cranes, hydra, forklifts, transportation trucks / trolleys and other accessories for movements and positioning of the items as below within the Inverter rooms 1-4:</p> <p>(a) 630kW PCU panels: 1 set (each ~2500 Kg)</p> <p>(b) ACDB panel: 1 set (~800 Kg)</p> <p>(c) 33 KV Indoor HT panel: 1 set (1000 Kgs)</p> <p>(d) Data loggers and station for SCADA: 1 set (~500 Kg)</p> <p>(e) Control desk with PCs and accessories: 1 set</p> <p>(2) Panels shall be placed over the cable trenches in control room, in the exact sequence and locations as shown in BHEL drawings that will be provided to vendor at an appropriate time during the period of execution.</p> <p>(3) Panels shall be suitably grouted using welding / bolting methods as appropriate. BHEL approval shall be obtained for the grouting arrangement. All necessary hardware for the same shall be within vendor scope of supply.</p> <p>(4) 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.</p> <p>Vendor shall supply cable trays as follows:</p> <p>(a) Perforated GI, Hot dip galvanized</p> <p>(b) Thickness = 3 mm, Depth = 40 mm, Width = 750 mm</p> <p>(c) Normal type trays: 110 m maximum (total length)</p> <p>(5) Corner-bend trays, Qty: 6 nos</p> <p>(6) Vendor shall fix the cable trays on the projecting steel sections in cable trench of control room.</p> <p>(7) Suitable cut outs shall be made in the cable trays to provide path for the cable to reach the lower level trays.</p> <p>(8) Adjacent cable trays shall be interconnected using suitable hardware items that shall be in vendor scope of supply.</p> <p>(9) Cables shall be laid over the cable trays and neatly dressed using appropriate cable ties etc.</p> <p>(10) For 120 mm² cables, cable support structure within control room (close to the entry holes) shall be provided to avoid sagging strain on the cables. Supports shall be made using suitable ISA MS angles (75x6 minimum) suitably painted with red oxide and BHEL</p>	



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	<p>approved black paint. BHEL approval shall be taken for the support arrangement. A maximum of four such support structures shall installed within control room and close to the cable entry holes.</p> <p>(11) 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.</p> <p>(12) 1Cx300mm² 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></p>	
5.15	<p>Power cable terminations on DC side of PCUs in control room:</p> <p>(1) On DC side, for each PCU, vendor shall carry out the cable terminations for 6 positive and 6 negative inputs connections – unsleeving, crimping and connecting.</p> <p>(2) BHEL shall supply the cables (1Cx120 mm² copper, armoured, PVC insulation, PVC sheath), cable glands, cable lugs, bolts, nuts and washers.</p> <p>(3) All tools and accessories required to carry out the termination shall be within scope of vendor.</p>	
5.16	<p>300 mm² Power cable terminations on AC (LT) side for PCUs and 1500 / 750 kVA transformers</p> <p>(1) On AC side, 3-phase 3-wire power cable interconnections shall be made between PCUs and 1500 kVA transformers using 3-runs per phase of 1cx300mm² copper, XLPE insulated, PVC sheathed, unarmoured, PVC cable.</p> <p>(2) On AC side, 3-phase 3-wire power cable interconnections shall be made between PCUs and 750 kVA transformers using 2-runs per phase of 1cx300mm² copper, XLPE insulated, PVC sheathed, unarmoured, PVC cable.</p> <p>(3) Quantity of cable required: 1500 metres</p> <p>(4) For cable terminations at 1500 / 750 kVA transformer end, Vendor shall supply the cables, cable lugs, bolts, nuts, plain washers, spring washers. Copper lugs shall be of tinned copper. Bolts, nuts, plain washers shall be of SS304 type. Spring washers shall be zinc plated steel. All these shall be of Dowell's / 3M or reputed equivalent as shall be approved by BHEL. Considering 4 transformers of 1500 kVA each having two LV windings and the single 750 transformer, total quantity of lugs, hardware required = 78 sets.</p> <p>(5) For cable terminations at PCU panels, BHEL shall supply the cables, cable glands, cable lugs, bolts, nuts, plain washers and spring washers.</p> <p>(6) Vendor shall make the measurements between the equipment, cut the cables to the required lengths, fix them with glands, unsleeve them at the ends, crimp them with the lugs and terminate them at the respective bus bar provisions within the panels.</p>	



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	<p>(7) There are 9 PCUs of 630kW with built-in Air Circuit Breakers, and 4 Transformers of 1500 kVA and a single 750 KVA transformer.</p> <p>(8) All tools and accessories required to carry out the termination shall be within scope of vendor.</p> <p>(9) Cable supporting structure shall be installed between Inverter room / Main control room 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. Drawing of cable supporting structure shall be submitted to BHEL for approval. Quantity of cable support structure with cover = 5 sets.</p> <p>(10) FRP cover to be provided over the cables</p>	
5.17	<p>Foundation pedestals and outdoor installation of 1500kVA, 33kV/350-350V transformers and 750 kVA, 33kV/350V supplied by BHEL</p> <p>(1) Number of transformers = 4 sets + 1 set of 1500 kVA and 750 kVA respectively.</p> <p>(2) Vendor shall construct RCC foundation for each set of transformer. Following are the requirements :</p> <p>(a) Weight of each transformer ~ Max 6500 / 4000 Kg</p> <p>(b) Soil report is enclosed.</p> <p>(c) Approximate size of foundation ~ 4000 x 3500 mm (L x B)</p> <p>(d) Foundation below ground level shall include PCC 1:3:6 layer (~200 mm) and if required based on site conditions, sand and boulder layers also shall be required to strengthen the foundation, in which case overall foundation depth shall be ~ 600mm.</p> <p>(e) Foundation pedestal height above the ground level ~ 500 mm that includes M25 concrete with steel rods of 8mm minimum diameter for skin reinforcement all around with inside steel chairs.</p> <p>(f) Hardware arrangements (steel bolts, plates, nuts, washers), which will be part of foundation pedestal for anchoring the transformer, shall be provided as per BHEL drawing.</p> <p>(g) Pedestal shall be provided with cement plastering all around to achieve a smooth finish and painted with two coats of approved brand and colour water proofing cement paint. Second coat of painting shall be carried out after installation of transformer.</p> <p>(3) Transformer and its accessory parts such as radiators, cable boxes, hardware as supplied by BHEL shall be moved from storage yard and positioned on foundation pedestal. All parts and hardware</p>	



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	<p>shall be assembled as per guidance at site provided by BHEL / transformer vendor.</p> <p>(4) Vendor shall provide all necessary support and assistance to the representative of transformer manufacturer during installation:</p> <p>(a) Oil filling in all transformers.</p> <p>(b) Measurement of parameters: insulation resistance etc.</p> <p>(c) Connections to marshalling box</p> <p>(5) Vendor shall submit drawing of transformer foundation to BHEL for approval.</p>	
5.18	<p>Firewalls around 1500 kVA and 750 kVA transformers</p> <p>(1) Firewall shall be constructed on two sides at right angles so shield the 1500 kVA transformer from the Inverter/control room.</p> <p>(2) Quantity of firewalls = 10 Nos. (5 nos x 2 sides)</p> <p>(3) Soil report is enclosed.</p> <p>(4) Length of firewall ~4000 + 4000mm; Height ~3500 mm above ground level.</p> <p>(5) Wall shall be 230mm thick with suitable reinforcing steel and concrete for stability.</p> <p>(6) Foundation for a minimum depth of 900 mm below ground level. This shall include PCC 1:4:8 as the bottom layer.</p> <p>(7) Firewall shall be finished with cement plaster and water proof cement paint of BHEL approved colour all around.</p> <p>(8) Any specific regulations of NEEPCO/ CEA/ CEIG shall be duly considered.</p> <p>(9) Vendor shall provide the firewall drawing to BHEL for approval.</p>	
5.18a	<p>NGRs or Solid grounding of the transformers:</p> <p>For each of the 1500 KVA / 750 KVA transformers, solid grounding by copper strip of min 50x5 mm shall be provided. The vendor shall submit the design / calculation of the same before procurement.</p>	
5.19	<p>Cable trench and laying of power cables in switchyard of Main control room and Transformer yards for the four Inverter rooms (both HT and LT cables):</p> <p>Vendor shall construct underground RCC cable trench (rectangular cross section) with RCC slab for laying the 33kV cables. Outline of layouts is as per 4-679-05-00055 and -00054.</p> <p>(i) RCC trench outside each INVERTER ROOM is for running of cables</p> <p>- between HT side of the 1500 / 750 kVA transformer and Single VCB panel (3Cx185 mm² cables). Total running length of trench = 10 m maximum.</p> <p>- Transformer data cables of OTI/WTI/others from the transformer marshalling box to the local SCADA panel</p> <p>RCC trench for each INVERTER ROOM and MAIN CONTROL ROOM for running of cables:</p> <p>(a) For 3cx185 mm² cables from the various Inverter rooms to the corresponding Incomer panels,</p>	



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	<p>(b) For 3cx185 mm² from VCB panel in Main control room to the Station transformer (c) For the 2 runs of 3cx400mm² cables from the Outgoer VCB panels in the Main control room to four-pole structure (d) SCADA cables to SCADA panel Total running length of trench = 10 m maximum.</p> <p>Following shall be considered in trench construction: (a) Slabs shall have hooks / handles to facilitate lifting / opening / movements. (b) Slab level shall be above jelly level by a minimum of 50 mm. (c) Trench width shall be based on bunching of cables from transformers towards HT panels. Accordingly, width shall vary en route. Alternately, an average constant width shall be maintained. (d) Trench depth shall be minimum 600mm. Trench layout and trench drawings shall be submitted to BHEL for approval.</p> <p>Steel structures for transformers LV cables: Between LV side of the 1500 / 750 KVA transformer and PCU: Steel structure for carrying of 1-c x 300 mm² XLPE cables shall be installed. The structure shall be ladder type with min five pairs of legs. Legs shall be grouted to the ground at depth of min 0.7m. The structure shall be able to withstand the weight of the cables. The structure shall raise the height of cables atleast 1 m above NGL. Vendor shall obtain BHEL approval for drawing of structure. FRP tray for covering cables. Quantity of structures: 5 sets</p>	
<p>5.20</p>	<p>Cable trench between Main control room and the four Inverter rooms: Cable trench shall be formed running between the Main control room and the Inverter rooms is for the following cables: (i) 3cx185mm² 33 KV cables from VCB panel in Inverter room to HT panel in Main control room (ii) SCADA cables from Inverter room SCADA panel to Main SCADA desk in Main control room (iii) 3.5-c x 25 mm² copper cable for distribution of Auxiliary power from Main control room to Inverter rooms</p> <p>Details of cable trench: (a) Trench depth = 750 mm minimum (b) Trench width = 1000 mm minimum (c) Sand as per IS: 383 of 100 mm layer thickness shall be laid at the bottom most level of trench. (d) Over the sand layer, cables shall be laid one adjacent to the other. Cables shall not be laid one over the other. In other words, only one layer of cables shall be allowed. (e) Over the layer of cables, one more layer of sand of 100mm shall be laid. (f) Then, a single layer of class-2 brick of 75 mm thickness shall be laid.</p>	



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	<p>(6) All tools and accessories required to carry out the termination shall be within the scope of vendor.</p> <p>(7) Since no cable glands are provided for these cases, vendor shall apply suitable grade of bitumen, RTV or any other sealant as shall be approved by BHEL, for sealing the gap around the cable at the cable entry of transformers and HT panels.</p>	
5.22	<p>RSJ poles, Qty: 7 nos</p> <p>(1) Vendor shall supply rolled steel joist beams (RSJ I-beams) with length of 175x 85mm and minimum 11m as per IS: 2062-1992 (hot rolled steel) with dimensions as per IS: 808-1989 and tolerances as per IS: 1852-1985. Beams shall be hot-dip galvanized or suitably painted based on NEEPCO requirements.</p> <p>(2) The cross section dimensions of RSJ poles shall be as per NEEPCO requirements meant for four pole / double pole structures.</p> <p>(3) Vendor shall submit the dimension details of RSJ poles. BHEL approval shall be obtained for the brand and supplier of the poles.</p> <p>(4) Vendor shall provide inspection call to BHEL for witnessing acceptance tests at manufacturer works. Quality inspection plan shall be submitted to BHEL prior to inspection call.</p> <p>(5) Test reports shall be submitted to BHEL.</p> <p>(6) Quantity = 7 Nos (four pole structure: 1 set x 4 Nos + double pole structure: 1 set x 2 Nos) + Single-pole structure</p> <p>(7) RSJ poles shall be grouted with a foundation depth of 2.0m minimum below ground level. RCC foundation (M25 concrete, with steel rods of minimum 8mm) shall be constructed over PCC layer of 1:3:6 (100 mm thick). Cross section size of foundation shall be in line with NEEPCO requirements. RCC foundation shall be up to a level of ~500mm above ground level.</p> <p>(8) Vendor shall submit drawing of RSJ pole foundation for BHEL approval.</p>	
5.23	<p>Gang operated switch (Air break switch), triple pole, double break, HORIZONTAL, DOUBLE-BREAK and centrally rotating type:</p> <p>(1) Rated voltage: 36 kV</p> <p>(2) Operating voltage: 33 kV</p> <p>(3) Impulse withstand voltage: 75 kV peak</p> <p>(4) Power frequency withstand voltage (1 min): 35 kV rms</p> <p>(5) Continuous current rating: 400 Amps Short-time current rating: 40 kA</p> <p>(7) Construction: Triple pole, Three insulators per pole, double break, centrally rotating type</p> <p>(8) Insulators: Porcelain type conforming to IS 2544 / IEC 273, made of homogeneous material with uniform glazing, free from cavities and other flaws, with high quality smooth finish. Fixed electrical contacts are supported by the insulators.</p> <p>(9) Mounting base: The three poles shall be mounted on a rigid 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.</p> <p>(10) Electrical contacts: All current carrying parts shall be made of electrolytic copper (silver plated). The fixed contacts shall be of spring-</p>	



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	<p>loaded pressure type so as to ensure firm contact and proper alignment. (The springs shall not carry any current). Arcing contacts shall be provided with spring assisted operation.</p> <p>(11) Earthing terminals: Two terminals with adequate size to carry full short circuit current; shall be provided on the frame of each pole.</p> <p>(12) Coupling rod: 25mm nominal bore GI pipe medium gauge</p> <p>(13) Operating rod: 32 mm nominal bore GI pipe medium gauge single length 6m.</p> <p>(14) Standard: IS: 9921 part 1 to 4 / IEC 265 part 1</p> <p>(15) Drawing / Catalogue shall be submitted by the vendor for BHEL approval.</p> <p>(16) Approved make: ELECTROLITES (Jaipur), LAMCO, GR power or reputed equivalent as shall be approved by BHEL.</p> <p>(17) QUANTITY OF GOS SWITCHES REQUIRED AS A WHOLE:</p> <p>(a) 2 sets with earth switch (manually operated) – 36 kV, 400 Amps at Evacuation point</p> <p>(b) 4 sets without earth switch: One set each for Line 1 / Line 2 / Aux transformer / Spare at Main control room</p>	
<p>5.24</p>	<p>LIGHTNING ARRESTORS for switchyard (Surge suppressors)</p> <p>(1) Arrestor rating: 32kV, 10kA, Class-3 with IB</p> <p>(2) Type: Metal oxide Gapless lightning arrestor</p> <p>(3) Make: LAMCO (Hyderabad), ELECTROLITES (Jaipur) or any other reputed equivalent to be approved by BHEL.</p> <p>(4) Standard: IS 3070 (part-3) 1993 & IEC 60099-4 of 2004</p> <p>(5) Test report to be furnished</p> <p>(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.</p> <p>(7) Total quantity required = 18 nos DISTRIBUTION: 6 nos at 33 KV switchyard + 6 nos at Evacuation point + 6 extra for spares</p>	
<p>5.25</p>	<p>Installation of four pole structure with GOS switches and Lightning arrestors</p> <p>The switchyard comprises of one four pole structure. The installation requirements are as follows:</p> <p>(1) Vendor shall install four pole structure that carries the following items:</p> <p>(a) RSJ poles with foundation as per clause above : 4 Nos</p> <p>(b) GOS switches (Air break switch), 3 pole, double break, horizontal, centrally operated, 33 kV, 400A as per IS:9921 part 1-4, without earth switch: 2 sets</p> <p>(c) Lightning arrestors (surge suppressors) of 30 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</p> <p>(2) Base channels of 75x40x6 mm minimum shall be used for mounting the lightning arrestors.</p> <p>(3) Insulators as per IS: 2544 / IEC 273 shall be used wherever required to maintain HV isolation from RSJ poles.</p>	



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	<p>(4) CPVC pipes shall be used to guide the XLPE HT cables (33kV, 3-Cx185mm² cable) reaching the four pole structure from the two outgoer HT 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. Diameter of CPVC pipe shall be in accordance with diameter of 3Cx185 mm² cable. Length shall be a minimum of 4m. Quantity of CPVC pipes = 2 Nos.</p> <p>(5) The two 3cx400 mm² XLPE cables from the two outgoer VCB panels shall be separately connected to two GOS switches.</p> <p>(6) The other end of the each GOS shall be connected to CT / PT and an ABT meter in Metering cubicle.</p> <p>(7) From each of the Metering cubicles, it is connected to the 33 KV ACSR conductor lines through 33 KV drop-out fuses.</p> <p>(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 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 NEEPCO requirement shall be provided by the vendor.</p> <p>(9) Vendor shall submit general arrangement and detailed drawings with bill of materials/ quantities of the four pole structure set with individual item description, quantity, make, specs / ratings for BHEL approval.</p> <p>Note: All MS parts of FP structure shall be suitably painted using red oxide and BHEL approved silver colour paint.</p>	
5.26	<p>METERING CUBICLES:</p> <p>(1) TWO SEPARATE METERING PANELS / CUBICLES, each having TWO NOS of L&T-make ABT Electronic TRIVECTOR METER ER300P (class 0.2s) with RS485 port, MODBUS RTU protocol, with downloading license shall be supplied and installed close to the CT/PT units using appropriate steel fixtures (angles etc.,) and hardware. The panels shall be either ground-mounted using foundation pedestal or mounted on a suitable pole structure directly. Either way, the panel shall be at an elevated position (~1 m above ground level) for comfortable viewing of readings. In case of ground-mounting, either foundation pedestal itself shall be elevated (with steps) or suitable mounting fixtures of required height shall be grouted to the foundation. Foundation depth min 600 mm, with PCC 1:3:6 layer of ~100 mm thick, M25 concrete, brick masonry for steps etc. Cable connections, via appropriate flexible corrugated electrical conduits, shall be made between CT/PTs and meters. Both cables and flexible corrugated electrical conduits (UPVC) in vendor scope. Common Meter Reading Instrument as per IEC-62056, Sands make (CMRI-1006) or BHEL approved equivalent along with optical probes to be provided (2 sets).</p>	



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	<p>(2) Combined CT / PT , Quantity: 2 sets – one for each ABT-meter CT details: CT ratio – 150 / 5-5 Amps, CL:0.2s, 15 VA PT details: PT ratio- 33kV/$\sqrt{3}$:11V/$\sqrt{3}$, CL:0.2s, 100 VA Outdoor oil-immersed combined CT/PT set for metering purpose. The CTs and PTs shall have two cores on their secondary side both meant for metering. CT and PT shall be manufactured in accordance with IS: 2705 / IEC 185 and IS: 3156 / IEC 186 respectively. Note: In case combined CT/PT is not available, separate CTs and PTs shall be procured (either three phase or three units of single phase). Accordingly, selection of CT/PT units shall be approved by BHEL prior to procurement. Approved makes: LAMCO, ASCOT</p> <p>Suitable arrangement, using base channels min 100x50x6mm, shall be provided for mounting the CT/PT sets on the four pole structure. Mounting arrangement shall be approved by BHEL prior to procurement. Note: All MS parts of DP structure shall be suitably painted using red oxide and BHEL approved silver colour paint.</p>	
5.27	<p>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 500 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: (a) Main ACDB - Quantity: 1 no (b) Switchboards - Quantity: 4 nos (c) 3.5cx25 mm² copper armoured PVC cable – Quantity: 2000m (d) 3.5cx95 mm² copper armoured XLPE cable – Quantity: 100m</p> <p>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)</p>	



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	<p>Electrical details for MAIN ACDB PANEL:</p> <ul style="list-style-type: none">- Electrical scheme for switchboard in each of the four inverter rooms as per sheet 1 of 2, drawing no. 3-679-05-00686 <p>Metering: Voltmeter, Ammeter, KWH meter (Model EM 6400 with MODBUS 485 output, Make: CONZERV)</p> <p>Main ACDB shall have common bus with coupler for TGBPP supply and for take of outputs to Sub ACDBs.</p> <p>The ACDB panel has have provision for correction and maintaining power factor to minimum 0.9 for a maximum inductive load of 25 KVA.</p> <p>Electrical details for Switchboard distribution boards:</p> <ul style="list-style-type: none">- Electrical scheme for switchboard in each of the four inverter rooms as per sheet 2 of 2, drawing no. 3-679-05-00686. <p>Detailed drawings to be submitted for approval prior to clearance for manufacturing.</p>	
5.28	<p>Supply and Installation of Auxiliary transformer, Double pole structure and drop out fuses on the HT side:</p> <p>Vendor shall supply and install a double pole structure that carries the following items:</p> <p>(1) Outdoor, Oil immersion type, ONAN, 3-phase, Dyn11, 500kVA, 33kV/415V (+/-10%), 50Hz +/- 3% transformer, Class A insulation, percent impedance 4.5%, bushings on HV side, cable box with bottom side cable entry on LV side, as per IS: 2026 for auxiliary power consumption to internal utilities of the power plant. Other parameters:</p> <ul style="list-style-type: none">- Winding material: Electrolytic grade copper- 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 : 8 KW- Maximum No load loss @ 75°C: 0.9 KW- Silica gel- HV side delta, LV side star with 4-wire, neutral terminal brought out separately and earthed through NGR / 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. <p>(2) Transformer shall be mounted on concrete pedestal at a height 1.5 metres from the ground level. The drawing for the concrete pedestal shall be approved by BHEL prior to procurement / fabrication. 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).</p>	



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	<p>Make: M/s. Electrolites (Jaipur) or reputed equivalent as shall be approved by BHEL.</p> <p>(3) Electrical interconnections up to the transformer bushings on HV side shall be made using ACSR conductors.</p> <p>(4) 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.</p> <p>(5) 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 dampers, spacers, stay sets, cross-arms as applicable to the context shall be provided by the vendor.</p> <p>(6) 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.</p> <p>Note: All MS parts of FP structure shall be suitably painted using red oxide and BHEL approved silver colour paint.</p>	
5.29	<p>Design and supply of ACSR Overhead conductor lines (DUAL LINE) from Main control room switchyard to Evacuation point:</p> <p>(1) Vendor shall design the 33 KV line route from the 33 KV switchyard of the Main control room to the Evacuation point. Vendor shall supply all the items required including poles, 7/4.09 DOG type ACSR conductors, disc insulators and all accessories associated with installation for 3-phase 33KV line for 1.5 Kms distance for use as overhead lines for carrying the power from the Main control room final point to the Evacuation point.</p> <p>(2) 11m PSC concrete poles shall be used.</p> <p>(3) ACSR DOG conductor shall be as per IS:398 part-II 1996.</p> <p>(4) Connection shall be through stringing / jumpering of ACSR conductors.</p> <p>(5) Vendor shall submit test certificates for ACSR conductors for BHEL scrutiny and acceptance.</p> <p>(6) Total length of 3-phase ACSR DOG type conductor to be supplied ~7 Kms adequate for two three-phase lines each of approx. 1 Km length.</p> <p>Approved makes of ACSR conductor: Smita, Hindustan Vidyut Products, APAR Industries, CABCON</p>	
5.30	<p>Supply and Installation of poles and ACSR DOG conductor from Main control room to the final Evacuation point:</p> <p>(1) The power evacuation from the Main control room switchyard is through the two ACSR DOG conductor lines mounted on the single pole structure. It shall have required disc insulators for terminating the ACSR conductors.</p>	



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(2) Steel tubular poles (Designation 540-SP-57 as per IS:2713) or RSJ poles of 11 m length shall be installed with an RCC foundation as follows:

- Depth of foundation below ground level = 1.55m minimum.
- PCC bed of 760x760x75 mm at the bottom of pit
- Size of RCC: 760x610 mm minimum
- Concrete pedestal above ground level: 500 mm minimum with sloped coping on top
- Steel rods (Minimum 8 mm diameter) and stirrups shall be as per BHEL drawing that will be furnished at an appropriate time during the period of execution.
- Concrete mix shall be M15 grade

(3) All necessary overhead line accessories such as disc insulators, stay sets, connectors, cross arm, clamp, ASCR conductor, stay and earth wire as applicable to the requirement, shall be used in accordance with IE rules for receiving and diverting the second grid line in a perpendicular direction towards the corresponding GOS switch of four pole structure.

(i) Vendor shall design the line route from Main control room to Evacuation point.

(ii) Steel tubular poles (Designation 540-SP-57 as per IS:2713) of minimum 11 m length shall be used.

(iii) The poles shall carry two three-phase 33 KV lines.

(iv) The span between poles shall be 40m or as per standards

Sl No	Description	Quantity
1	11m steel pole, SP-54	32 nos
2	33 KV V-cross arm MS 100x50x50x6.4mm, 19 Kgs each	96 nos
3	Guarding channel MS channel 100x50x6.4mm	12 nos
4	MS pole clamp, Cross arm clamp, Guarding clamp	48 nos
5	GI wire 8 SWG	30 nos
6	Bolts, nuts and spring washers (M-16)	80 Kgs
7	33 kV pin insulators with pin	72 nos
8	Earthing set	25 sets
9	Barbed wire GI type "A"	60 Kgs
10	All parts to be painted with two coats of red oxide and silver paint	21 litres of each
11	Disc insulators, disc fittings	48 nos
12	Stay wires 7/8	250 m
13	Stay set	20 nos
14	Danger plates, Number plates, P.G. Clamps	4 nos
15	Black bituminous paint	21 litres
16	Concreting (expected qty)	26 cu m

(v) The components shall consist of minimum of the following:



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	<p>(vi) Vendor shall submit drawing for location of poles for approval, including foundation details for BHEL approval.</p> <p>(vii) At the Evacuation point, the ACSR conductor shall be terminated on existing RSJ poles / cross-bars. This termination shall be through 33KV, 400 A GOS switches and six nos of 36V Lightning arrestors for both sets shall be provided.</p> <p>(4) Vendor shall submit a general arrangement drawing with detailed bill of materials / quantities of the single pole structure with individual item description, quantity, make, specs / ratings for BHEL approval.</p> <p>(5) Test certificate as per IS standards shall be submitted.</p> <p>(6) Vendor shall provide general arrangement and detailed drawings with bill of materials / quantities of the single pole structure with individual item description, quantity, make, specs / ratings for BHEL approval.</p>	
<p>5.31</p>	<p>Power cable terminations at 500kVA transformer, Main ACDB and Distribution boards:</p> <p>(1) Vendor shall carry out termination on LT side of 500kVA 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.</p> <p>(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.</p> <p>(3) Quantity of cable ~ 100 m</p> <p>(4) All tools and accessories required to carry out the termination shall be within the scope of vendor.</p> <p>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.</p> <p>QTY: Approx. length of 3.5-Cx95mm² XLPE arm cable: 100 metres</p> <p>QTY: Approx. length of 3.5-Cx25mm² PVC arm cable: 2000 metres.</p>	
<p>5.32</p>	<p>Design & construction of Inverter room on a complete basis, 4 nos</p> <p>Vendor scope: Design and construction of Main control room</p> <p>Design scope: Submission to BHEL all drawings associated with the construction</p> <p>Construction: As per approved drawings of BHEL</p> <p>Ground to be prepared at 2 feet above NGL</p> <p>Reference: BHEL drawing no. 4-679-05-00055</p> <p>The Inverter room shall be of brick-wall superstructure type with suitable foundations and of approx. overall dimensions of 10m x 8m x 4m height. The roof of the Inverter room shall be of sandwiched type</p>	<p>Construction of Inverter rooms to be started immediately – within 10 days of Purchase order and completed in Eight weeks</p> <p>Accepted YES / NO</p>



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	<p>with PUF insulation of min thickness of 25mm and of Double-sloping roof. The superstructure brick structure shall be plastered and painted suitably. The construction includes supply of all items for electrical power supply, light fixtures, fans, exhaust fans, toilet fixtures, cable trench angles and chequered plate covers, all tiles, electrical fittings as Distribution boxes, etc. It shall have the following provisions:</p> <p>The Inverter room shall be of brick-wall superstructure type with suitable foundations and of approx. overall dimensions of 10m x 8m x 4m height. The roof of the Inverter room shall be of sandwiched type with PUF insulation of min thickness of 25mm. The Inverter room shall have the following provisions:</p> <ul style="list-style-type: none"> (i) Internal cable trench of width 1.2m, depth 1m to be constructed. Three ISMC angles ISMC 100 shall be 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. (ii) Chequered plate cover for trench of 6 mm thickness (Final Black colour painted) to cover cable trench after equipment installation. (iii) Provision of ROLLING SHUTTER MIN 3 M WIDTH and door separately (iv) Flooring of non-skid tiles, Adequate lighting (v) Plastering of walls with paint scheme for walls (vi) All around plinth protection (vii) Door and windows to have lintels protection (viii) DBs for power distribution <p>The vendor shall obtain BHEL comments/approval before starting construction:</p> <ul style="list-style-type: none"> (i) Foundations drawings (ii) General arrangement of windows, rolling shutter, door (iii) Trench layout and trench drawing (iv) Windows location and lintel drawing (iv) Power scheme 	
<p>5.33</p>	<p>Design and construction of Main control room on a complete basis, Quantity: 1 no Vendor scope: Design and construction of Main control room Design scope: Submission to BHEL all drawings associated with the construction Construction: As per approved drawings of BHEL Ground to be prepared at 2 feet above NGL Reference: BHEL drawing no. 4-679-05-00054</p> <p>The Main control room shall be of brick-wall superstructure type with suitable foundations and of approx. overall dimensions of 20m x 8m x 4m height. The roof of the Inverter room shall be of sandwiched type with PUF insulation of min thickness of 25mm and of Double-sloping roof. The superstructure brick structure shall be plastered and painted suitably. The construction includes supply of all items for electrical power supply, light fixtures, fans, exhaust fans, toilet fixtures, cable</p>	<p>Construction of Main control room to be started immediately – within 10 days of Purchase order and completed within 8 weeks</p> <p>Accepted YES / NO</p>



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	<p>trench angles and chequered plate covers, all tiles, electrical fittings as Distribution boxes, etc. It shall have the following provisions:</p> <ul style="list-style-type: none"> (i) Provision of Power room, office room, SCADA room, toilets (ii) False ceiling provision for Office and SCADA rooms with split A-C of 1.5 tonne capacity (iii) Provision of septic tank for toilet and other drain (iv) Provision of Water tank of 6000 litres capacity (v) Provision of exhaust fans of 400 watts capacity, Qty: 6 nos (vi) Partitions of rooms shall be aluminium glass /bonded sheet for Office room, SCADA room, Battery room, Store room, Power room (vii) Internal cable trench of width 1.2m, depth 1m to be constructed. Three ISMC angles ISMC 100 shall be 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. (ix) Chequered plate cover for trench of 6 mm thickness (Final Black colour painted) to cover cable trench after equipment installation. (x) Provision of ROLLING SHUTTER MIN 3 M WIDTH and door separately (ix) Flooring of non-skid tiles, wall plastering and emulsion painting of walls on both inside and outside walls (x) Adequate lighting and fans (xi) Foundations for the superstructure (xii) All around plinth protection (xiii) Door and windows to have lintels protection (xiv) Provision of DBs for electrical power distribution (xv) Plinth protection to be provided all around <p>The vendor has furnish the following to BHEL for comments / approval:</p> <ul style="list-style-type: none"> (i) Foundations drawings (ii) General arrangement of windows, rolling shutter, door (iii) Trench layout and trench drawing (iv) Windows location and lintel drawing (iv) Electrical Power scheme (v) Details of roofing material <p>The vendor shall construct the complete Main control room after BHEL approval.</p>	
<p>5.34</p>	<p>Erection of switchyard fencing with gate (of Main control room): Vendor shall provide all around chain-link fencing to the switchyard of the (Main control room) with gate at one location as shall be decided by BHEL site engineer.</p> <ul style="list-style-type: none"> (a) Fencing shall be as per BHEL drawing 3-679-05-00633. (b) GI Fence length ~ 70 m Single gate with 3m width (2x 2.5m) x 3m height, Frame of 50x50mm MS pipes with 4mm thick <ul style="list-style-type: none"> - 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 (one coat) and paint of approved colour and type. 	



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	<p>(c) Suitable concrete foundation shall be provided of minimum 400mm depth</p> <p>(d) 1-inch chain link fencing of GI wire thickness of min 2mm shall be provided. Cross angular supports to be provided for the chain-link fencing. GI flats supports at bottom of fence to be provided.</p> <p>(e) Vendor shall submit drawings of the foundation and of the gate for BHEL approval.</p> <p>For the Inverter room, similar fencing and Gate to be provided around the single 1500 kVA transformer with single gate.</p>	
5.35	<p>Switchyard leveling, jelly spreading and fire wall in Inverter room transformer yard area</p> <p>(1) In the Inverter room switchyard area, only the 1500 KVA ONAN transformer is located outside. After installation of the transformers / associated earthing equipment and RCC trench for LT and HT cables, the vendor shall level the ground with an appropriate slope to drain away rain water to the drain / soak pit. This work shall include, wherever necessary, land-filling and compaction with suitable soil manually or with rollers, as applicable, as per site conditions, to prevent stagnation of water within switchyard expected size: 10 m x 10 m.</p> <p>(2) Two Fire walls at right angles shall be provided for the area surrounding the 1500 KVA ONAN transformer.</p> <p>(3) Stone jelly of 20mm shall be spread uniformly with a layer of minimum 100 mm thick around the 1500 kVA transformer area except for the stretches of WBM road and concrete slabs of cable trenches and other occupied foundation areas. Approximate area for stone jelly spreading ~ 100 m².</p>	
5.36	<p>Switchyard leveling, jelly spreading and Fire-wall in Main control room switchyard area</p> <p>(1) In the Main control room switchyard area, the equipment located outside are the 750 KVA ONAN transformer, associated earthing equipment, Four-pole structure, Two-pole structure and Single pole structure. After installation of the transformers / associated earthing equipment and RCC trench for LT and HT cables, the vendor shall level the ground with an appropriate slope to drain away rain water to the drain / soak pit. This work shall include, wherever necessary, land-filling and compaction with suitable soil manually or with rollers, as applicable, as per site conditions, to prevent stagnation of water within switchyard expected size : 20 m x 10 m.</p> <p>(2) Two nos of Fire walls at right angles shall be provided for the area surrounding the 750 KVA ONAN transformer.</p> <p>(3) Stone jelly of 20mm shall be spread uniformly with a layer of minimum 100 mm thick throughout the switchyard area except for the stretches of WBM road and concrete slabs of cable trenches and other occupied foundation areas. Approximate area for stone jelly spreading ~ 100 m².</p> <p>(4) WBM road of minimum width 3m shall continue up to near transformer for vehicular movement for maintenance.</p>	



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	(5) It shall be ensured that levels of WBM road and concrete slab of cable trench shall be at a higher level than stone jelly level at least by 50mm.	
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5.38	<p>Repair of Brick road, Provision of asphalted road, Embankment support:</p> <p>(i) The vendor shall arrange to repair the existing 3m brick road surrounding the solar array plant area. This includes removing broken bricks and placing new bricks as required. On top of the bricks, two layers of WBM grade-2 material with each layer having 75 mm thickness, along with screening and binding materials to achieve desired compaction. The length of the road is approximately 1000 metres.</p> <p>(ii) Provision of asphalted road for length of 100 metres of 5 m width. Vendor shall furnish detailed drawing for approval.</p> <p>(iii) Support of embankment by pitching for a length of 500m and height of 2 metres by provision of boulders with cement, etc.</p>	
5.39	<p>Support and assistance for SCADA integration for the power plant Introduction to the SCADA of the Plant:</p> <p>SCADA for the power plant comprises of the following:</p> <p>(i) Data loggers located at each of the Inverter rooms 1 to 4 for capturing the data from the various equipment and converting the digital / analog signals to optical signals for transmission by the optical fibre cable.</p> <p>(ii) Data station panel and PC based control desk with software located at the Main control room to collect, store, process and report the following data parameters of power plant</p> <ol style="list-style-type: none"> String monitoring boxes in solar array field: string current, voltage, box temperature, module temperature, status of SPD and load break switch in SMBs Weather monitoring equipment: solar irradiation, ambient temperature, wind velocity and module temperature. At Inverter rooms: PCU data signals: DC input /AC output parameters of inverters, grid data, fault status and events logged, ACB status. At Inverter rooms: 33 KV VCB: Status, status of protection relays of transformers, oil / winding temperatures, LOLA At Main 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. At Main control room: Power conditioning units in the Inverter rooms: DC input / AC output parameters of inverters, grid data, fault status and events logged, ACB status. 	



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	<p>(1) Vendor shall provide support and assistance to BHEL in following activities:</p> <p>(a) Formation of underground cable trenches</p> <ul style="list-style-type: none"> - cable laying for data communication cables from 1500 KVA transformer to Data logger in Inverter room using 10-core, 0.5 mm², copper, screened cable, Qty: Approx. 15 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 - cable laying for data communication cables from 750 KVA transformers / Metering cubicles to SCADA panel in Main control room using 10-core, 0.5 mm², copper, screened cable, Qty: 20m <p>(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</p> <p>(c) Data cable laying from PCUs, ACDB panels to Data loggers with 1-pair, twisted 0.5 mm², copper, screened cable</p> <p>(d) Data cable terminations at PCUs, ACDB panels, transformers and 33KV VCB panels and cable laying to the Data logger.</p>	
<p>5.40</p>	<p>Cable trenches for laying Data communication cables from SMBs to Inverter rooms 1-4.</p> <p>The following is the details of SMBs to PCUs: SMB1 to SMB5 & SMB6 to SMB10: PCU1 & PCU2 in Inverter room 1 SMB11 to SMB15 & SMB16 to SMB20: PCU3 & PCU4 in Inv room 2 SMB21 to SMB25 & SMB26 to SMB30: PCU1 & PCU2 in Inv room 3 SMB31 to SMB35 & SMB36 to SMB40: PCU3 & PCU4 in Inv room 4</p> <p>(1) Data communication cables shall be laid from SMBs to the Data logger panel in the respective Inverter room.</p> <p>(2) Cable specification:</p> <ul style="list-style-type: none"> - Cable, 1.1kV grade, 1 pair x 0.5 mm², annealed tinned copper drain wire, stranded, PVC type-A insulation, twisted pair, overall shielded with aluminium backed polyester film / mylar sheet, inner sheath of extruded PVC type ST1, Galvanized steel strip / round wire armoured as per IS, outer sheath of extruded FRLS PVC type ST1 conforming to IS: 1554 / part-1 with latest amendments up to date. - Approximate outer diameter = 9 mm - Make: Polycab, Advanced cables, Lapp or any other reputed equivalent as shall be approved by BHEL. <p>(3) Cable shall be within vendor scope of supply.</p> <p>(4) Length of cable required ~ 5000 m</p> <p>(5) This cable is meant for RS485 interfacing. The RS485 output of SMBs shall be daisy-chain looped using this cable. Approximately every 10 SMBs shall be daisy-chained to form one cable connection running up to SCADA room. In such a case, since 45 SMBs are there, approximately 4 / 5 cables will be running from solar array field to SCADA control panel, placed in the Main control room.</p> <p>(6) These data cables shall be laid underground using separate cable trench. In other words, these cables shall not be laid along with power cables. A minimum distance of 500mm shall be maintained</p>	



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	<p>between the data cable trench and power cable trench to avoid EMI interference.</p> <p>(7) Underground laying shall be ensured even within the daisy-chain looping between adjacent SMBs.</p> <p>(8) Cable trench shall be as per details below:</p> <p>(a) Trench depth = 600mm minimum</p> <p>(b) Trench width shall be 200mm minimum</p> <p>(c) Bottom layer shall be sand as per IS: 383 with 100mm layer thickness.</p> <p>(d) Data cable shall be laid over the sand.</p> <p>(e) Another layer of sand, 100 mm thick, shall be laid.</p> <p>(f) A single layer of brick, class-2, 75mm thick, shall be laid over the sand.</p> <p>(g) Trench, then, shall be filled up with refill soil.</p> <p>(9) Total length of trench ~ 4000m</p>	
5.41	<p>Fibre optic cable supply and laying:</p> <p>Optic fibre cable for connecting the Data loggers in the Inverter rooms to the Data station panel in Main control room.</p> <p>(i) The specification of the Optic fibre cable is: MLM Unitube armoured cable, 6 fibre, MONOTUBE, Make: FINOLEX CABLES</p> <p>(ii) Quantity of Optic fibre cable required: 2500 m</p> <p>The Optic fibre cable shall be laid in HDPE conduits with suitable couplers for sealed joining of the conduits.</p> <p>(1) These data cables (details under following section), which are within the vendor scope of supply, shall be laid in HDPE conduits and underground as follows:</p> <p>(a) Trench depth = 600mm minimum</p> <p>(b) Trench width shall be 200mm minimum</p> <p>(c) Bottom layer shall be sand as per IS: 383 with 100mm layer thickness.</p> <p>(d) Data cable shall be laid over the sand.</p> <p>(e) Another layer of sand, 100 mm thick, shall be laid.</p> <p>(f) A single layer of brick, class-2, 75mm thick, shall be laid over the sand.</p> <p>Trench, then, shall be filled up with refill soil and suitably compacted.</p>	
5.42	<p>Cable trench and laying of data communication cables in switchyard of Inverter room and Main control room.</p> <p>(i) Data cables in Transformer yard in Inverter room:</p> <p>(a) 1500 VA transformers to 33kV VCB panel in Inverter rooms using 10-core, 0.5 mm² copper conductor, PVC insulated, shielded and armoured cable, Quantity: 20 m per run and totally 200m</p> <p>(ii) Data cables in switchyard in Main control room:</p>	



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	<ul style="list-style-type: none"> (a) 750 kVA transformers to 33kV HT panel in main control room using 10-core, 0.5 mm² copper conductor, PVC insulated, shielded and armoured cable, Qty: 20 m (b) 500 kVA transformer to 33 kVA HT panel, Qty: 10 m (c) Metering cubicles to SCADA panel, 2-c, 0.5 mm² copper, PVC insulated, shielded and armoured cables (iii) These data cables (details under following section), which are within the vendor scope of supply, shall be laid underground as follows: <ul style="list-style-type: none"> (g) Trench depth = 600mm minimum (h) Trench width shall be 200mm minimum (i) Bottom layer shall be sand as per IS: 383 with 100mm layer thickness. (j) Data cable shall be laid over the sand. (k) Another layer of sand, 100 mm thick, shall be laid. (l) A single layer of brick, class-2, 75mm thick, shall be laid over the sand. (m) Trench, then, shall be filled up with refill soil and suitably compacted. 	
<p>5.42a</p>	<p>(1) Data cable terminations in Inverter room and its switchyard Vendor shall carry out data cable terminations at 1500 kVA transformers, HT panels, Metering panels, ACDB panels and PCUs.</p> <ul style="list-style-type: none"> (a) Terminations at Marshalling box of the 1500kVA transformer (b) 33kV VCB 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 630 KW PCU for capturing ON/OFF status of ACBs for SCADA purpose and also Modbus (e) Termination at the 630 KW PCU for capturing the power, current RS485 MODBUS communication cable connections <p>(2) Data cable terminations in Main control room and its switchyard</p> <ul style="list-style-type: none"> (a) Terminations at Marshalling box of the 750kVA transformer (b) Termination at the Metering panels (c) Termination at the Marshalling box of the Aux transformer (d) Termination at the EM6400 in the 5 incomers, 1 spare incomer and 2 outgoers for capturing the power, current (e) Terminations between 9 sets of HT panels: Buchholz relay, pressure release valve, low oil level, WTI, 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 shall be within vendor scope of supply. <p>Cable specification as follows:</p>	



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	<p>Cable, 1.1kV grade, copper conductor, stranded, PVC type-A insulation, twisted pair, overall shielded with aluminium backed mylar sheet in combination with ATC drain wire of 0.5 mm², inner sheath of extruded PVC type ST1, Galvanized steel strip / round wire armoured as per IS, outer sheath of extruded FRLS PVC type ST1, conforming to IS:1554 / part-1 with latest amendments up to date.</p> <p>(c) Approximate quantity requirements of cables for the above purposes as follows:</p> <p>(i) 1 Pair x 0.5 mm² ~ 200m (PCUs, to Data logger / SCADA panel)</p> <p>(ii) 10 Pair x 0.5 mm² ~ 100m (VCB panel to Data logger / SCADA panel)</p> <p>(iii) 10 Pair x 0.5 mm² ~ 100m (1500 / 750 kVA transformer to Data logger / 33 KV VCB panel separately)</p> <p>(d) Make of cables: Polycab, Advanced cables, Lapp or any other reputed equivalent as shall be approved by BHEL.</p> <p>(e) Cable lugs and all hardware required for making the above terminations shall be in vendor scope of supply.</p> <p>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 cables. Cable shall be laid from battery bank (for DC) and ACDB panel (for AC).</p>	
<p>5.43</p>	<p>Battery bank and chargers for Main control room:</p> <p>(i) Vendor shall supply 110 volts / 125 AH battery bank with Float-cum-boost charger 135V / 25 Amps, Qty: 2 sets</p> <p>(ii) The cells shall be of PLANTE-type, YCP 11, lead-acid type, make: EXIDE</p> <p>(iii) The supply shall include racks, intercell connectors etc., required for installation of the battery banks.</p> <p>(iv) The two battery banks / chargers shall be connected so that one comes into load upon failure of the other.</p>	
<p>5.44</p>	<p>Earthing of solar array structures</p> <p>(1) Vendor shall interconnect solar array structures using bolting with 25x6 mm GI strips. Total length of 25X6mm GI strips required ~ 1000 m.</p> <p>(2) A length of GI flat strip (75 x 8mm) shall run for interconnecting these interconnected structures.</p> <p>(3) Chemical electrodes shall be used for earthing connection. Chemical earthing electrode of MS pipe 3000 mm long, Zn coated, hot dip galvanized, OD = 50 mm shall be supplied by vendor.</p> <p>(4) Quantity of chemical electrodes for solar array structures and SMBs earthing = 120 sets.</p> <p>(5) 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.</p> <p>(6) Procedure for installation of chemical electrodes as per the manufacturer's instructions should be followed.</p> <p>a) After finishing the pit work, pour a few buckets of water around the pit.</p>	



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	<p>(7) Earth chambers of brick masonry shall be constructed as per BHEL drawing 4-679-05-00053. All items of earth chambers, including lid, shall be in vendor scope of supply.</p> <p>(8) Earth chambers shall be interconnected for every 1MW of the solar array field, using 75x8 mm GI strip that shall be laid underground. Length of 75x8 GI strip ~ 2000 m</p> <p>(9) 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 (75x8 mm) from adjacent electrodes shall be terminated at this link, which shall, in turn, be connected to the electrode. Joining of 75x8 mm GI strips at intermediate positions, wherever applicable, shall be made using either welding or bolting method. Either way, the overlapping of the two strips shall be for a minimum length of 150mm. Welding shall be for the entire overlapping length. In case of bolting, minimum three bolt joints shall be used per overlap length.</p> <p>(10) All GI strips and all hardware (nuts, bolts, washers) shall be in vendor scope of supply.</p> <p>(11) 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. No of chemical electrodes to be used: min. 120 nos in the entire 5 MW solar array field. Approved makes: M/s. ASHLOK-make type T-19 (OD:50mm) and MS pipe of length 3m or BHEL - approved equivalent</p>	
<p>5.45</p>	<p>EARTHING FOR EQUIPMENTS IN INVERTER ROOM and MAIN CONTROL ROOM(PCUs, ACDB panels, SCADA panels): 50mm x 4mm copper lines shall be laid in the cable trenches of control room. Copper strips shall be in vendor scope of supply. Total length of copper strips required ~ 30m.</p> <p>(1) Strips shall be covered by heat-shrinkable sleeves Copper strips shall be anchored to the cable trench wall using insulation bush supports. Quantity of supports required ~ 30 Nos.</p> <p>(2) Expansion bolts of appropriate size (Minimum M8) shall be used to fix the insulation bush supports.</p> <p>(3) BHEL will provide the earthing line layout drawing.</p> <p>(4) 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.</p> <p>(5) 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</p>	



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	<p>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.</p> <p>(6) 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.</p> <p>(7) 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.</p> <p>(8) Expansion bolts, cable lugs and all hardware required for this activity shall be within vendor scope of supply.</p> <p>(9) Chemical earth electrodes are required to be provided for the following:</p> <ul style="list-style-type: none"> - Transformer body, 2 nos - Transformer neutral, 2 nos - Fencing, 1 no <p>The resistance as measured at the individual electrodes measured in isolation from the remaining shall be less than 0.5 ohm.</p> <p>Total chemical electrodes per Inverter room: 8 nos Total chemical electrodes for four Inverter rooms: 32 nos</p>	
<p>5.46</p>	<p>Earthing of switchyard equipment in switchyard of Main control room:</p> <p>5.28(i) Vendor shall design Earth mat for the entire switchyard area of 20m x 10. The approved design shall be implemented 1 m below the ground level and all body earth shall be connected to the earth mat.</p> <p>(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 4-679-05-00053.</p> <ul style="list-style-type: none"> (1) 750 kVA Transformers body earth – 2 nos (2) FP structure, GOS-1 switch body earth – 1 no (3) FP structure 2, GOS-2 switch body earth – 2 nos (4) Lightning arrestors – 2 nos (5) Metering CTs / PTs body earth – 2 nos (6) Metering panel 1 body earth – 2 nos (7) Metering panel 2 body earth – 2 nos (8) Aux transformer, body earth – 2 nos (9) Aux transformer, neutral earth – 2 nos (10) 1Cx300 mm² cables structure – 1 no (12) Switchyard fencing – 2 Nos <p>Total number of chemical electrodes required for switchyard = 20 Nos + 5 nos(for equipment earths), Totally: 25 nos</p>	



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	<p>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.</p> <p>Vendor shall carry out all the necessary GI laying and interconnections.</p> <p>Vendor shall carry out measurement of earth resistance in all the cases that shall be witnessed, verified and certified by BHEL site engineer.</p>	
<p>5.47</p>	<p>Lightning protection for site using Lightning arrestors (ESE) type The vendor shall provide protection against lightning for the entire solar site using ESE-type and tested and approved to establish their coverage radius as per NF C 17 102(2011) standard. The radius coverage design should be as per Level 1 protection.</p> <p>(1) Early streamer emission lightning arrestors as per standards: UNE 21186 and NF C-17 102, with counters and earthing systems. The approved makes of ESE Lightning arrestors are LPI, PROLITE</p> <p>(2) Quantity = As required, minimum 10 nos for LPI-make Vendor to submit drawing for lightning area coverage, based on which quantity is finalized.</p> <p>(3) Lightning arrestors shall be mounted on top of a mast of height 12m minimum above ground level using MS pipe of 100 mm minimum average diameter with painted finish; Each mast shall be secured by three steel stay wires that are suitably grouted. Masts shall have appropriate steel base plate for mounting on an RCC concrete foundation pedestal of 450x450 mm size, 1m depth below ground level, 300mm minimum above ground level, PCC 1:4:8 as the bottom layer (~100 mm thick), steel rods of diameter 8mm minimum, concrete M25 with four J bolts (M16) of 750mm long, with nuts and washers.</p> <p>(4) Three earthing chambers per lightning arrestor set using chemical earthing electrodes shall be constructed as per 4-679-05-00053.</p> <p>(5) All mechanical and electrical connections, cables, junction boxes, hardware shall be within vendor scope.</p> <p>(6) Vendor shall submit general arrangement and detailed drawings with bill of materials / quantities of the overall lightning arrestor arrangement including foundation pedestal details to BHEL for approval.</p>	
<p>5.48</p>	<p>Lightning arrestor for control room Vendor shall supply and install 1 set of lightning rod with earthing set at the terrace of the control room. BHEL approval shall be obtained for type of lightning rod.</p>	
<p>5.49</p>	<p>Yard lights for Main control room switchyard</p> <p>(1) 20 yard lights</p> <p>(2) 25NB bend pipes (1m running length) shall be supplied and fixed on angles/ poles of switchyard fencing. Among the 20 lights, 6 shall be fixed on control room wall that is within yard. Balance 14 shall</p>	



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	<p>be fixed on the switchyard fencing poles. Suitable fixing arrangements shall be provided.</p> <ol style="list-style-type: none">(3) Light fitting, Bajaj make, model BJS 2A 136 CFL (20 W) shall be supplied and fitted on the GI bend pipes using necessary hardware.(4) CPVC pipe of 1.5", carrying 5Cx2.5 sq-mm copper, armoured, PVC cable, from ground level up to Junction box.(5) 2 cores used for phase, neutral of yard light.(6) 1 core used for body earth purpose.(7) 2 cores unused(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 (nickel plated brass single compression) for 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 CFL 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.	
5.50	<p>Yard lights for solar array field – 60 NOS and type as below</p> <ul style="list-style-type: none">- Along periphery 30 nos of LOW PRESSURE SODIUM VAPOUR LAMPS, 18 WATTS- Within Solar array 30 nos of toroidal 20 W CFL <ol style="list-style-type: none">(1) 50 yard lights – dome type(2) Lighting poles shall be located at distributed locations in the solar array field as per layout that will be provided by BHEL at an appropriate time during period of execution.(3) 80NB pipes (length 2.8m) to be grouted with concrete foundation of depth 600 mm, with PCC 1:3:6 of 100mm layer (450x450mm), M25 concrete, foundation height 300mm above ground level.(4) Dome type light fitting with 20W CFL TOROIDAL bulb Make: Supreme, Model: CFL Bollard Cast Aluminium (or) reputed equivalent as shall be approved by BHEL.(5) CPVC pipe of 1.5-inch, carrying 5Cx2.5 sq-mm copper, armoured, PVC cable from ground level up to Junction box.(6) 2 cores used for phase and neutral for yard light.(7) 3 cores used for 3-phase power supply that will be used for running the high pressure pump for module cleaning.(8) Additionally, 1Cx1.5 mm² copper, armoured, PVC cable shall be used for earthing the pole.(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 (nickel plated brass single compression) for 5Cx2.5	



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	<p>mm² cable, 1 gland (polyamide) for 2Cx1.5 mm²copper, unarmoured, PVC cable. Additionally, for yard lights of solar array field, the box shall have 3-phase 20A socket with cover.</p> <p>(10) Glands, socket shall be located at the bottom side of Junction box.</p> <p>(11) The junction box, cable lugs, steel mounting bracket and all hardware items shall be in vendor scope.</p> <p>(12) Vendor shall submit general arrangement and detailed drawings with bill of materials / quantities of the overall yard lighting arrangement including foundation pedestal details to BHEL for approval.</p>	
5.51	<p>Yard lights for the transformer yard of the Inverter room: 20 yard lights</p> <p>(1) 25NB bend pipes (1m running length) shall be supplied and fixed on angles/ poles of compound wall / chain link fencing. Suitable fixing arrangements shall be provided.</p> <p>(2) Light fitting, Bajaj make, model BJS 2A 136 CFL (20 W) shall be supplied and fitted on the GI bend pipes using necessary hardware.</p> <p>(3) CPVC pipe of 1.5", carrying 5Cx2.5 mm² copper, armoured, PVC cable, from ground level up to Junction box.</p> <p>(4) 2 cores used for phase and neutral of yard light.</p> <p>(5) 1 core used for body earth purpose.</p> <p>(6) 2 cores unused</p> <p>(7) Junction box (IP65, polycarbonate), with 12 Elmex-type, DIN rail of suitable length, MCB (1A, single pole) of Schneider or reputed make, 2 glands (nickel plated brass single compression) for 5Cx2.5 mm² cable, 1 gland (polyamide) for 2Cx1.5 mm² copper, unarmoured, PVC cable.</p> <p>(8) Glands, socket shall be at the bottom side of Junction box.</p> <p>(9) The junction box, cable lugs, mounting bracket for fixing junction box and all hardware items shall be in vendor scope.</p> <p>(10) Out of 50 junction boxes, 20 shall be provided with 3-phase 20A socket with cover for running the high pressure pump for module cleaning.</p> <p>(11) Jn box shall be at a height of 1m above ground level.</p> <p>(12) CPVC pipe of 1" shall be provided between junction box and bend pipe to guide the 2Cx1.5 mm² cable.</p> <p>(13) It shall be ensured that CFL lamp is well above the fencing, which is 3m above the ground level.</p> <p>(14) Vendor shall submit general arrangement and detailed drawings with bill of materials / quantities of the overall yard lighting arrangement to BHEL for approval.</p>	
5.52	<p>Cable trench formation and laying of cables for yard lights</p> <p>Vendor shall construct the underground trench from control room to various parts of the solar array field, switchyard and compound wall for laying the cables for yard lights</p> <p>(1) Trench depth = 600 mm minimum</p> <p>(2) Trench width = 200 mm minimum</p> <p>(3) Sand as per IS: 383 of 100 mm layer thickness shall be laid at the bottom most level of trench.</p>	



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	<p>(4) Over the sand layer, cables shall be laid one adjacent to the other. Cables shall not be laid one over the other. In other words, only one layer of cables shall be allowed.</p> <p>(5) Over the layer of cables, one more layer of sand of 100mm shall be laid.</p> <p>(6) Then, a single layer of class-2 brick of 75 mm thickness shall be laid.</p> <p>(7) Trench shall then be filled up with refill soil.</p> <p>(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.</p>	
5.53	<p>Cable requirements and terminations for yard lights / peripheral lights / solar lights</p> <p>(1) Cable termination:</p> <p>(a) Termination of cables, including unsleeving, crimping, connecting to the junction box and lamp shall be within scope of vendor.</p> <p>(b) Similarly, cables shall be terminated at the ACDB panel within the control room.</p> <p>(c) BHEL will provide the wiring scheme of ACDB panel.</p> <p>(2) Vendor shall supply following lengths of cable:</p> <p>(a) 5Cx 2.5 mm², Cu, armoured, PVC cable ~5000m</p> <p>(b) 2Cx 1.5 mm², Cu, unarmoured, PVC cable ~ 500m</p> <p>(c) 1Cx 1.5 mm², Cu, armoured, PVC cable ~ 300m</p> <p>(3) Vendor shall supply following lengths of CPVC pipes:</p> <p>(a) CPVC, 1-inch & 1.5-inch pipe : 200m & 100 respectively</p>	
5.54	<p>Laying of pipelines between bore wells and overhead tank</p> <p>(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.</p> <p>(2) All necessary CPVC fittings such as T-joints, bends, nipples, reducers, couplers shall be used as applicable.</p> <p>(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.</p> <p>(4) Approximate length of CPVC line ~ 250m</p> <p>(5) Vendor shall submit a detailed water pipeline layout scheme with BoM from bore wells to OH tank for BHEL approval.</p>	
5.55	<p>SPV module cleaning system</p> <p>(1) Vendor shall lay 2-inch CPVC pipelines from overhead tanks to the solar array field with all necessary CPVC nipples, T-joints, reducers, bends, couplers etc. This forms the main header pipeline. Suitable valves such as brass valves of 2-inch etc shall be provided for this main header line. For the branching out lines that spread into various rows of the solar array to provide water delivery points for module cleaning, 1-inch CPVC pipelines shall be used.</p> <p>(2) A suitable 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.</p>	



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	<ul style="list-style-type: none"> (3) Starter and DP switch (1 set) shall be supplied and installed near ACDB panel for operating the 2HP pump. (4) Supply of electrical cables (with lugs, hardware) and wiring the pump up to the ACDB panel / starter in the control room shall be in vendor scope. Cable 5Cx 2.5 sq-mm, Cu, armoured, PVC cable shall be used. Length required ~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 (13) Vendor shall submit detailed scheme with BoM etc for module cleaning system from OH tank to solar array field. 	
<p>5.56</p>	<p>Identification markings using paint and cable tags, as applicable to the individual cases and as approved by BHEL, shall be provided:</p> <ul style="list-style-type: none"> (1) String monitoring junction boxes: Identification marking by way of painting on nearby module structure. (2) All switchyard equipment such as transformers, HT panels, and metering panels shall be provided with suitable identification markings using painting, with inscriptions as approved by BHEL. (3) Cable sizes with arrow marks in switchyard (for HT cables) using painting. (4) Identification markings for all the earth chambers (using painting) with inscriptions as approved by BHEL. (5) Cable tags using aluminium plate of 1-2 mm thickness with suitable inscriptions as approved by BHEL for all the power cables of the 	



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	electrical panels such as PCUs, LT panels, Batteries, FCBC chargers, Annunciation panels, ACDB panel.	
5.57	<p>Cable markers</p> <p>(1) Steel cable markers with suitable labels (DC cable, LT cable, HT cable, Data cable, CPVC water pipeline etc)and arrow marks (pointing to the cable destination) shall be supplied and installed along the cable trenches for following cases:</p> <p>a) For 120 sq-mm cable from string monitoring boxes to control room: Quantity of markers = 125 Nos</p> <p>b) For data communication cables from string monitoring boxes to control room: Quantity of markers = 125 Nos</p> <p>c) For cables of yard lights of solar array field, compound wall/chain-link fencing and switchyard fencing: Qty of markers = 100 Nos</p> <p>d) For electrical cables of bore well connections: Qty of markers = 10 Nos</p> <p>e) For HT (33kV) cables within switchyard: Quantity of markers = 10Nos</p> <p>f) For aux transformer to ACDB panel Quantity of markers = 2 Nos</p> <p>g) For CPVC water pipelines, Quantity = 50 Nos</p> <p>(2) Cable markers shall be suitably grouted with concrete foundation depth of minimum 300 mm below the ground level. Cross section of foundation shall be minimum 200mm diameter.</p> <p>(3) Cable markers shall have a minimum height of 300 mm above the ground level.</p> <p>(4) Cable markers shall be suitably painted.</p>	
5.58	<p>Hoarding for the solar power plant.</p> <p>(1) Hoarding for the plant shall be made of 1500x1800x 3mm thick MS plate. Approximate dimension of board 1500x1800 mm.</p> <p>(2) Similar plate mentioning salient details of transformers, switchyard details, DP / FP details, date of energisation, make / sl no, etc to be displayed.</p> <p>(3) Board shall be given a red oxide coat and painted with black colour for background. Letters shall be written with white colour.</p> <p>(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.</p> <p>(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.</p> <p>(6) Bottom level of board shall be at a height of 1.5m above the ground level.</p> <p>(7) Vendor shall submit the drawing of hoarding arrangement to BHEL for approval.</p>	



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<p>5.59</p>	<p>Display boards and sign boards</p> <table border="1"> <tr> <td>1</td> <td>Board displaying instruction chart for restoration of person from Electric Shock</td> <td>2 Nos</td> </tr> <tr> <td>2</td> <td>Board displaying instruction chart for artificial respiration</td> <td>2 Nos</td> </tr> <tr> <td>3</td> <td>Board displaying dos and donts</td> <td>1 No</td> </tr> <tr> <td>4</td> <td>Board displaying fire extinguishers details and operations</td> <td>2 Nos</td> </tr> <tr> <td>5</td> <td>“No smoking” board</td> <td>5 Nos</td> </tr> <tr> <td>6</td> <td>Board showing list of O&M staff with name, qualification and work responsibility</td> <td>1 No</td> </tr> <tr> <td>7</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>8</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>9</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> <p>(a) 5mm thick sun board with LG make vinyl sticker (computerized cutting and pasting) shall be used for SI Nos 4, 5, 8 and 9. (b) For others, flex banner with design & printing shall be used.</p>	1	Board displaying instruction chart for restoration of person from Electric Shock	2 Nos	2	Board displaying instruction chart for artificial respiration	2 Nos	3	Board displaying dos and donts	1 No	4	Board displaying fire extinguishers details and operations	2 Nos	5	“No smoking” board	5 Nos	6	Board showing list of O&M staff with name, qualification and work responsibility	1 No	7	Board showing list of contact details of BHEL, O&M team, O&M security, police station, fire service, hospital, medical store with names, address, mobile numbers	2 Nos	8	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	9	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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<p>5.60</p>	<p>Electrical insulation mat Total Quantity: 60m of width 1m</p> <p>(1) Vendor shall supply electrical insulating mat as follows:</p> <ul style="list-style-type: none"> (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 <p>(2) Test certificate shall be provided by vendor</p> <p>(3) Vendor shall lay the mats in front of electrical panels (PCUs,) and Indoor 33kV VCB panels in the Inverter and Main control rooms.</p>																												
<p>5.61</p>	<p>Checkered plate for Cable trench in Inverter rooms and main control room: Checkered plate for closing the cable trenches (a) behind the panels such as PCUs, ACDB panels in control room and also (b) other open areas of cable trench</p>																												



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	<p>(1) Plate shall have a suitable handle (welded to the plate) to facilitate ease of lifting and movements.</p> <p>(2) Plate thickness = 6mm</p> <p>(3) Width = 1200 mm max, total length required: 60 metres</p> <p>(4) These width and length dimensions are indicative. Actual dimensions shall be based on site conditions.</p> <p>(5) Plate shall be red oxide coated followed by black painting.</p> <p>(6) BHEL approval shall be obtained for overall arrangement of checkered plate.</p>	
5.62	<p>Air conditioners, Minimum 3-star rating, Quantity: 2 sets</p> <p>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.</p>	
5.63	<p>Landscaping:</p> <p>Vendor shall design and submit to BHEL landscaping around the Main control room.</p>	
5.64	<p>EPABX COMMUNICATION SYSTEM:</p> <p>EPABX communication system shall be provided between the Main 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.</p>	



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5.65	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></td><td>2 Nos</td></tr><tr><td>3</td><td>AC-DC Clamp Meter</td><td>Lutron</td><td>DM-6506</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>Megger – 5KV</td><td>Shanti Electric Instruments, Nippen</td><td></td><td>2 Nos</td></tr><tr><td>7</td><td>Electrical Tester</td><td>Reputed Make</td><td></td><td>2 Nos</td></tr></table> <p>Note: Make / model number shall be approved by BHEL prior to procurement.</p> B. Tool kits	1	Digital Earth Resistance Tester	Cambridge Instruments	DET-2000	2 Nos	2	Digital multimeter	Reputed make		2 Nos	3	AC-DC Clamp Meter	Lutron	DM-6506	2 Nos	4	Thermometer, Laser Beam	Fluke	62 Mini	2 Nos	5	Digital thermometer (wall hanging)	Reputed Make		2 Nos	6	Megger – 5KV	Shanti Electric Instruments, Nippen		2 Nos	7	Electrical Tester	Reputed Make		2 Nos														
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	<table border="1"> <tr> <td data-bbox="295 291 368 331">4</td> <td data-bbox="368 291 1007 331">PC table with chairs</td> <td data-bbox="1007 291 1169 331">1 set</td> </tr> <tr> <td data-bbox="295 331 368 371">5</td> <td data-bbox="368 331 1007 371">Storage almirahs</td> <td data-bbox="1007 331 1169 371">2 Nos</td> </tr> <tr> <td data-bbox="295 371 368 412">6</td> <td data-bbox="368 371 1007 412">Filing cabinets</td> <td data-bbox="1007 371 1169 412">2 Nos</td> </tr> </table> <p>Make: Godrej or reputed equivalent as shall be approved by BHEL. BHEL approval shall be obtained, prior to procurement, for the type of office furniture, for which catalog with model numbers, sizes / dimensions shall be submitted to BHEL.</p>	4	PC table with chairs	1 set	5	Storage almirahs	2 Nos	6	Filing cabinets	2 Nos	
4	PC table with chairs	1 set									
5	Storage almirahs	2 Nos									
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5.67	<p>Fire alarm system for Main control room and Inverter rooms:</p> <p>(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.</p> <p>(ii) Control panel (1 set), in sheet steel enclosure, power coated finish, shall be a microprocessor based system with central processing unit, input / output modules, power supply with battery and battery charger, control electronics and display mechanisms. The panel shall be a 4-zone system with audio-visual provisions (LED indications and beeps) for zone-wise annunciation. Individual detector-wise traceability / addressability is not required. It shall have provisions for acknowledgement of alarm and manual resetting. Batteries used shall be lead acid maintenance free type provided with connecting leads.</p> <p>(iii) Smoke detectors shall be of conventional / optical / photoelectric type. It shall not be of ionization type that employs radioactive materials.</p> <p>(iv) Electrical hooters shall sound the alarm upon detection of smoke by the detectors.</p> <p>(v) Manual call point shall be with high-gloss finish, alarm LED provision, breakable glass unit, hammer and chain.</p> <p>(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.</p> <p>Control panel: Main control room – 1 no Inverter room - 1 no</p> <p>Smoke detectors: Main control room – 15 nos Inverter room - 4 nos</p> <p>Battery: Main control room - 1 no Inverter room - 1 no</p> <p>Manual call point: Main control room - 1 no Inverter room - 1 no</p> <p>Hooter: Main control room - 2 nos Inverter room - 1 no</p> <p>(vii) Locations of sensors shall include cable trenches of control room as well. Vendor shall submit fire alarm layout / scheme to BHEL for approval.</p>										



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5.68	<p>Other safety related items</p> <p>(1) Safety gadgets</p> <table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 5%; text-align: center;">1</td> <td style="width: 60%;">Gas Mask</td> <td style="width: 35%; text-align: center;">2 Nos</td> </tr> <tr> <td style="text-align: center;">2</td> <td>First Aid Box with essential medicines and bandage cotton, antibiotic cream, Dettol, etc.</td> <td style="text-align: center;">6 sets</td> </tr> <tr> <td style="text-align: center;">3</td> <td>Hand Gloves 33 KV for GOS operation</td> <td style="text-align: center;">2 sets</td> </tr> <tr> <td style="text-align: center;">4</td> <td>Hand Gloves 1KV for Maintenance of SMB</td> <td style="text-align: center;">2 sets</td> </tr> <tr> <td style="text-align: center;">5</td> <td>Discharge rod</td> <td style="text-align: center;">2 Nos</td> </tr> <tr> <td style="text-align: center;">6</td> <td>Safety Helmet</td> <td style="text-align: center;">10 Nos</td> </tr> </table> <p>(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.</p> <table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 5%; text-align: center;">1</td> <td style="width: 25%;">Dry powder fire extinguisher (stored pressure type)</td> <td style="width: 50%;">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 style="width: 20%; text-align: center;">18Nos</td> </tr> <tr> <td style="text-align: center;">2</td> <td>Carbon dioxide (CO₂) type fire extinguisher with trolley</td> <td>Capacity: 9 Kg IS: 2878 Suitability for Class B&C fires involving flammable liquids & gases, electronic equipment.</td> <td style="text-align: center;">18Nos</td> </tr> <tr> <td style="text-align: center;">3</td> <td>Sand buckets</td> <td>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.</td> <td style="text-align: center;">5 sets</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	2 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.	18Nos	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.	18Nos	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.	5 sets	
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																														
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5.69	<p>(i) Pre-commissioning inspections / checks / tests on equipment, (ii) Synchronization with grid and (iii) Post-commissioning operation of the plant:</p> <p>(h) Minimum pre-commissioning checks to be carried out:</p> <p>(a) Verification of firmness of terminations in all electrical equipment:</p> <ul style="list-style-type: none"> - All 45 nos of SMBs, - 8 nos of PCUs in Inverter rooms 1-4, 1 no PCU in Main control room - 33kV VCBs in Inverter rooms 1-4, - HT panels in Min control room, - Transformers, FP/DP/SP structure items (GOS, LAs), SCADA stations, weather monitoring equipment. 																															



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<p>(b) Verification of earthing for all these electrical equipment.</p> <p>(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.</p> <p>(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.</p> <p>(e) Insulation resistance measurements (megger tests) for all the electrical equipment of control room and switchyard.</p> <p>(f) Functional checks for PCUs: Vendor shall support the PCU engineer during the pre-commissioning tests.</p> <p>(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.</p> <p>(h) The vendor shall arrange for an Electrical Contractor to perform the following:</p> <p>(1) Functional checks for HT panels / transformers:</p> <ul style="list-style-type: none">- Transformer oil filtration at time of commissioning of transformers (1500 kVA / 750 kVA 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. <p>(2) Earth measurements:</p> <ul style="list-style-type: none">- 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 <p>(3) Pre-commissioning tests on transformers, CTs, PTs, Lightning arrestors, GOS switches, vacuum circuit breaker, relays, etc:</p> <p>(1) Usually performed tests are indicated as below. However, exact type of tests required to be conducted at site prior to commissioning shall be in line with NEEPCO / CEA requirements.</p> <p>(a) Transformers: IR tests, ratio tests, excitation current measurement, magnetic balance test on HV, short circuit test, excitation test LV side, vector group test.</p>	
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	<p>(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</p> <p>(c) Auxiliary transformers: IR tests, ratio tests.</p> <p>(d) Relays in HT panels: open/close, tripping, primary injection tests.</p> <p>(e) Outdoor CTs/PTs: IR tests, Polarity tests, Ratio tests, Burden tests, Winding resistance tests, Primary injection tests, excitation tests.</p> <p>(f) Lightning arrestors: IR tests</p> <p>(g) GOS switches: IR and contact resistance tests.</p> <p>Appropriate Licensed testing agency shall be arranged for the tests.</p>	
<p>5.70</p>	<p>Coordination with state departments for necessary approvals and clearances for commissioning</p> <p>(1) Vendor shall coordinate / liaison with concerned TNEB/MRT departments to fix up test schedules and witness by their representatives.</p> <p>(2) Vendor shall prepare and submit the reports to MRT departments and obtain their approval through necessary liaison activities.</p> <p>(3) Vendor shall coordinate and liaison with CEA/ NEEPCO/ CEIG, prepare and submit the applications with necessary enclosures on behalf of BHEL and obtain their approval:</p> <ul style="list-style-type: none">(a) Approval for BHEL drawings(b) Approval for synchronization of plant with grid.(c) CEIG inspection of power plant(d) Provisional CEIG clearance to proceed with commissioning <p>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.</p> <p>Note: Scope of coordinating with state departments such as CEA, NEEPCO, 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.</p>	



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6.0 Vendor scope of supply

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

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

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

#	Item description	Quantity	Extra Qty for Spares	Clause Reference for Specification
1	Submersible pump 3-phase, 5HP for bore wells	3 sets		5.5
2	Cable, 5Cx 4 sq-mm, Cu, armoured, PVC	~ 600m		5.5
3	MC4 connectors	1000 sets	300 sets	5.8
4	Tool kits for MC4 connectors	2 sets		5.8
5	Cable ties	As required		5.6, 5.9
6	PVC cable tray for 6 mm ² cables	500 m		5.9
7	HDPE DWC pipe for underground laying of 6mm ² cables	~ 1200m		5.10
8	Cable lugs, hardware for 1-Cx 6 mm ² cables	2500 sets		5.11
9	Cable lugs, hardware for 1-Cx120 sq-mm cables	120 sets		5.12
10	Cable trays in control room: Normal type	20x4+30=110 m		5.14
11	Cable trays in control room: Corner bends	6 pcs		5.14
12	Cable support structure(inclined) for 1-C 120mm ² cables	5 sets		5.14
13	Cable support structure (Inclined) for 1-C 300mm ² cables	5 sets		5.19
14	Hardware for grouting control room panels	As required		5.14
15	Cable lugs, hardware for 1-Cx 300 sq-mm cables connection on LV side of 1500kVA / 750kVA transformers	78 sets		5.16
17	Hardware requirements for foundation positioning / anchoring of transformers	5 sets		5.17
18	Cable, Single-core, 1.1kV, 300mm ² , copper conductor, XLPE insulated, PVC insulated cable	1500 m		5.16
19	Cable, 33kV, 3-Cx185 mm ² Al conductor, armoured HT cable	~ 2000 m		5.20
20	Cable, 33kV, 3-Cx400 mm ² HT armoured cable	~ 100 m		5.20
21	Cable 3-Cx95mm ² , copper conductor, XLPE ins, PVC sheathed, armoured cable	~ 100 m		5.31
22	Cable 3-Cx25mm ² , copper conductor, XLPE ins, PVC sheathed, armoured cable	2000 m	-	5.31



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22	Termination kits, INDOOR TYPE, 36kV Indoor type for 3-Cx185mm ² cable with cable lugs, hardware	19 sets	2 spares	5.21
23	Termination kits, INDOOR TYPE, 36kV indoor type for 3-Cx400mm ² cable with cable lugs, hardware	2 sets	1 sp	5.21
24	Termination kits, 36kV indoor type with cable lugs, hardware for 3-Cx 400 mm ² cable	2 sets	1 sp	5.21
25	Termination kits, 36kV outdoor type with lugs, hardware for 3-Cx 400 mm ² cable	2 sets	2 sets	5.21
26	RSJ Poles	4+2+4=10 Nos	2 nos	5.22
27	GOS switches 400A, 33kV without earth switch	3 sets	1 set	5.23
28	GOS air break switches 400A, 33kV with earth switch	2 sets	1 set	5.23
29	Lightning arrestors for switchyard 32kV, 10kA class-3	12 Nos	3 Nos	5.25
30	Supporting BOQ items of four pole structure such as disc insulators, cross-arms / base channels, connectors, CPVC pipe, hardware	1 set		5.25
31	Outdoor CTs / PTs (If Single phase type - 3 each) with two metering cores: Either 1 combined set or individual 1-phase CTs / PTs	2 sets		5.26
32	Metering panels with two nos each of ER300P meter per panel including license with MRI instrument, optical probes	2 sets		5.26
33	Cable 1 pair x 2.5 sq-mm, copper, PVC with flexible corrugated electrical conduit for CT, PT connection to metering panel with necessary length.	1 set		5.27
34	Supporting BOQ items of double pole structure for Aux transformer such as disc insulators, cross-arms / base channels, connectors, hardware	1 set		5.28
35	Auxiliary transformer 500kVA, 33kV/415V ONAN	1 set		5.28
36	Drop out fuse set on HV side of 500kVA transformer	3 sets		5.28
37	ACDB panel and Switchboards	1 no + 4 nos		5.27
38	ACSR conductor DOG type, 7/4.09 (for two 3-phase power lines for about 1.3 Kms length)	~ 7000m		5.29
39	Supporting BOQ items of for each PSC pole as single pole structure such as PSC pole, Double cross assembly with clamps, other accessories, Cross arm assembly, GI stay set assembly, stay clamps assembly, 33 KV disc insulators with socket, 33 KV pin insulators with pins, Danger plate, barbed wire, etc.	As per BOQ in clause no. 5.30		5.30
40	Cable glands, cable lugs and hardware for LV side of Aux transformer	1 set		5.27
41	Main ACDB panel and Switchboards	1 + 4 nos		5.27
43	Cable glands, cable lugs and hardware for ACDB panel	1 set		5.27
44	GI fence for switchyard, transformer yards	~ 120m		5.34
45	Steel angles, strips, hardware etc for switchyard fencing	1 set		5.34
46	MS gate 3.5m wide x 3m tall for switchyard	5 Nos		5.34
47	Stone jelly 20mm for main control room switchyard: Approximate area 500 sq-m x 100 mm layer thickness	1 Lot		5.36
48	Stone jelly 20mm for Inverter room transformer yard: Approximate area 10 sq-m x 100 mm layer thickness	1 Lot		5.35



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48	Data cable 1 pair x 0.5 mm ²	~ 5500 m		5.40,5.42, 5.43
51	Data cable 10 pair x 0.5 mm ²	~ 200 m		5.38
52	Optic fibre cable	~ 2500 m		5.41
53	Data cable 50-core 0.5 mm ² , copper screened and arm cable	50 metres		
54	Battery bank 110 V, 125 AH, Plante type	2 sets		5.42
55	Battery charger, 135 volts, 25 Amps	2 sets		5.42
56	GI strip 25x6 for solar array earthing	1000 m		5.44
57	Chemical electrode with chemicals and earth chamber materials for solar array structures	120 sets		5.44
58	GI strip 75x8 mm for solar array earthing	~ 1800 m		5.44
59	50x 4 copper strips for control room panel earthing	~ 90 m		5.40
60	Cable lugs, hardware for 6 mm ² cable earthing	As required		5.40
61	Chemical electrodes with chemicals and earth chamber materials for control room panels in Main control room and Inverter rooms	5 + 12 sets		5.45
62	Cable 1Cx 25 mm ² copper conductor, PVC cable	~ 150 m		5.40
63	Cable lugs and hardware at both ends of 1C x 25 mm ²	6 sets		5.40
64	CPVC pipe, 1-inch, for 1Cx 25 mm ² cable earthing	~ 100 m		5.40
65	CPVC joints, bends, elbows for 1Cx 25 mm ² cable	As required		5.40
66	Expansion bolts, hardware for insulation bush supports	~ 100 sets		5.40
67	GI strip 50x5 mm for switchyard equipment earthing	~ 300 m		5.44
68	Chemical electrodes with chemicals and earth chamber materials for Main control room switchyard and Inverter rooms transformer yards	20 + 20 sets		5.45, 5.46
69	Lightning arrestors (ESE) with counter, earth systems	10 sets		5.47
70	Masts for Lightning arrestors (ESE) with hardware	10 sets		5.47
71	Chemical electrode with chemicals and earth chamber materials for lightning arrestors (ESE)	20 sets		5.47
72	Stay wire sets for LA (ESE): three wire sets per LA	10 sets		5.47
73	Lightning rod with earthing set for Main control room	1 set		5.48
74	Yard lights for switchyard of Main control room with fitting for switchyard with 25NB bend pipes, junction boxes, 1-inch, 1.5-inch CPVC pipe, glands, cable lugs, hardware, etc.	20 sets		5.49
75	Yard lights for Solar array field (CFL toroidal: 30 nos, 18 Sodium Low pressure: 20 nos) with fittings for solar array field with 80NB pipes, junction boxes, 1-inch, 1.5-inch CPVC pipe, glands, sockets, cable lugs, hardware	50 sets		5.50
76	Yard lights with fittings for Transformer yard of Inverter rooms with 25NB bend pipes, junction boxes, 1-inch, 1.5-inch CPVC pipe, glands, sockets, cable lugs, hardware etc	30 sets		5.51
77	Cable 5Cx 2.5 mm ² copper, PVC arm cable for yard light system	~ 5000 m		5.53
78	Cable 2Cx 1.5 mm ² copper, PVC unarm cable for yard light system	~ 500 m		5.53
79	Cable 1Cx 1.5 mm ² copper, PVC unarm cable for yard light system	~ 300 m		5.53



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80	CPVC pipe, 1-inch size, for yard light system	~ 200 m		5.53
81	CPVC pipe, 1.5 inch size, for yard light system	~ 100 m		5.53
82	CPVC pipe, 2 inch size for bore wells to OH tank	~ 250 m		
83	CPVC fittings T-joints, bends, nipples, reducers, couplers etc for bore wells to OH tank	As required		
84	Valves such as ball valves, non-returnable valves, etc for bore wells to OH tank	As required		
85	Cable, 5Cx 2.5 sq-mm for	~ 50 m		
86	CPVC pipe, 2-inch, for module cleaning system	~ 1200 m		5.55
87	CPVC pipe, 1 inch, for module cleaning system	~ 3600 m		5.55
88	Centrifugal pump, 3 phase, 2HP with starter, DP switch, cables, hardware etc	1 set	1 set	5.55
89	Ball valves, forged steel type, 2-inch for the main header line	As required		5.55
90	Ball valves, forged steel type, 1-inch with nipples	50 sets		5.55
91	Hose pipes ribbed, flexible (50 m)	3 sets		5.55
92	High pressure pipe (8mm) of 50m length with nozzles	3 sets		5.55
93	High pressure pump on portable arrangement, 3-5 HP	1 set	1 set	5.55
94	Cable tags, aluminium plate for all SMBs, electrical panels	1 set		5.56
95	Danger boards for SMBs, electrical panels, transformers	1 set		
96	Cable markers for cable trenches of 120 mm ² in solar array (125 Nos), data cable in solar array (125 Nos), bore well cable (10 Nos), 33kV cable (100 Nos), yard lights cable (100 Nos), Aux transformer LV cable (100 Nos), CPVC water pipeline (50 Nos).	1 set		5.57
97	Hoarding plate at the plant entrance with mounting items	1 set		5.58
98	Display boards and Sign boards	1 set		5.59
99	Electrical insulation mat 1m width x 2.5 mm thick	60 m length		5.60
100	Checkered plate 6mm thick, 1200mm max width	60m long		5.61
101	Air conditioner, 3-star, split type, 1.5 T	2 sets		5.62
102	EPABX communication system	1 set		5.64
103	Tool kits and instruments	1 set		5.65
104	Office furniture	1 set		5.66
105	Fire alarm system with spares	5 sets	As included	5.67
106	Safety gadgets	1 set		5.61
107	Fire extinguishers	1 set		5.61

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

7.1	BHEL shall witness routine / acceptance tests performed at manufacturer works for following items. Vendor shall accordingly provide inspection call to BHEL, with submission of quality assurance plan to BHEL in advance. a. HDPE DWC pipe b. RSJ poles c. Pre-stressed concrete (PSC) poles	
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	<p>d. Gang operated switch 400A, 33kV without earth switch e. Gang operated switch 400A, 33kV with earth switch f. Lightning arrestors 32kV, 10kA g. Outdoor combined CTs / PTs – combined unit / individual units h. Tri vector meter ER300P i. Auxiliary transformer 500kVA, 11kV/415V, ONAN j. Drop out fuse units k. Disc insulators and other overhead line accessories l. ACSR DOG conductor m. All cables: (i) Cable 3.5-Cx 25 mm², 1100V, Al, PVC, armoured, PVC, FRLS (ii) Cable 1-Cx 25 mm², 1100V, Cu, PVC, armoured, PVC, FRLS (iii) Cable 5Cx 4 sq mm², 1100V, Cu, PVC, armoured, PVC, FRLS (iv) Cable 5-Cx 2.5 mm², 1100V, Cu, PVC, armoured, PVC, FRLS (v) Cable 2-Cx 1.5 mm², 1100V, Cu, PVC, armoured, PVC, FRLS (vii) Cable 3-Cx 185 mm², 11kV, Al, XLPE, armoured, PVC, FRLS (viii) Cable 3-Cx 400 mm², 11kV, Al, XLPE, armoured, PVC, FRLS (ix) Data cables 0.5 sq-mm (1 pair, 5 pair, 10 pair), Twisted pair, PVC, shielded, armoured, PVC, FRLS (x) Optic fibre cable n. Chemical safe earth electrodes o. Lightning arrestor (ESE) p. Submersible pump 3HP q. Centrifugal pump 2HP r. High pressure pump 3-5 HP s. Ball valves t. CPVC pipes 1-inch, 1.5 inch, 2-inch u. Air conditioner v. Fire alarm system w. Fire extinguishers x. Electrical insulation mat y. 36kV termination kits (indoor, outdoor) Note: In case the item is bought out from dealers, test certificates, as per relevant IS / IEC standards, as issued by manufacturer shall be submitted to BHEL. However, prior approval shall be obtained from BHEL for procurement of the item from dealers.</p>	
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8.0 General conditions applicable during installation and commissioning phase

8.1	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).	
8.2	All machinery such as cranes, hydra, JCBs, forklifts, transport trucks, trolleys necessary for movement of materials shall be organized by the vendor.	
8.3	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	



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	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.	
8.4	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.	
8.5	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.	
8.6	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.	
8.7	Vendor shall maintain updated labour register, with name, age, qualification, salary, attendance details at the site.	
8.8	Vendor shall use danger boards, wherever required, to ensure safety of the persons during the work at site.	
8.9	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.	
8.10	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.	
8.11	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.	
8.12	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.	
8.13	No child labour shall be employed for execution of the present contract.	
8.14	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.	
8.15	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.	
8.16	Any deviations shall be discussed with BHEL site engineers and implementation shall be taken up only after approval from BHEL.	



**PURCHASE SPECIFICATION- GROUP: PHOTOVOLTAICS
SUPPLY OF BOS ITEMS, I&C, O&M FOR 5.67 MW SPV POWER
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8.17	Vendor shall submit periodic status report, on daily as well as weekly consolidated basis, to BHEL on the progress of the contract.	
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9.0 Operations and Maintenance

9.1	Date of commencement of operations and maintenance: Zero date for O&M shall be the actual date on which the complete 5.67 MW is commissioned and synchronized for export of power to 33kV grid.	
9.2	Period for O&M Vendor shall operate and maintain the power plant for a period of FIVE YEARS from the zero date as above.	
9.3	O&M personnel 1. Vendor shall deploy following minimum personnel: (a) 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) Three working level staff with ITI / diploma level qualifications in engineering with competence for operating electrical / electronics / mechanical equipment, taking measurements, data logging / maintaining registers, preparation of reports in computer. (c) Three 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) Separate security personnel are not required as the plant is inside NEEPCO compound. 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.	



**PURCHASE SPECIFICATION- GROUP: PHOTOVOLTAICS
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	<p>8. O&M personnel at site shall conform to general regulations in force at site and to any special instructions from local NEEPCO administration.</p> <p>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.</p> <p>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.</p> <p>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. (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.</p> <p>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.</p>	
<p>9.4</p>	<p>O&M operations – daily basis</p> <p>(1) Water cleaning of SPV modules</p> <p>(2) Main control room and Inverter rooms cleaning – dry sweeping, wet mopping</p> <p>(3) Water wash cleaning of toilets, urinals in Main control room</p> <p>(4) Gardening of landscaping areas: watering of plants, trimming of plants as applicable and necessary.</p> <p>(5) Logging of DC, AC, grid parameters (current, voltage, power, energy) at PCUs & HT panels, transformer temperatures, equipment tripping/ breakdown, grid outage as per BHEL formats.</p> <p>(6) SCADA data station / PC operations for daily monitoring of weather parameters, trend graphs and urgent reporting to BHEL in case of any problems / anomalies observed with any of the parameters.</p> <p>(7) Drinking water to be arranged for O&M personnel at site.</p> <p>(8) Maintenance of stock of SPARES ITEMS.</p>	
<p>9.5</p>	<p>O&M activities – weekly basis</p> <p>(1) Removal of garbage from solar array field, switchyard, roads, drains, pathways, sand buckets; logging in registers with signatures of operating persons and in-charge.</p> <p>(2) Monitoring and logging of fire extinguisher levels / pressures as per BHEL formats</p>	



**PURCHASE SPECIFICATION- GROUP: PHOTOVOLTAICS
SUPPLY OF BOS ITEMS, I&C, O&M FOR 5.67 MW SPV POWER
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9.6	<p>O&M activities – monthly basis</p> <ol style="list-style-type: none"> (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: <ol style="list-style-type: none"> a. Daily values of solar array strings (SMB parameters) b. Daily values of weather parameters (solar energy, wind speed, ambient temperature) c. Daily energy generation d. Events (with date, time) of faults / tripping / breakdown of equipment e. Events (with date, time) of grid outage f. Events (with date, time) of equipment damages, accidents and thefts g. Activities of module cleaning (4) Monthly reports shall be submitted to BHEL for all the above data. (5) Energy generation / meter reading report to be prepared and submitted to the concerned EB department. Signatures from NEEPCO and substation representatives shall be obtained wherever required. (6) CUTTING OF GRASS IN THE SOLAR ARRAY FIELD 	
9.7	<p>O&M activities - quarterly basis</p> <ol style="list-style-type: none"> (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: <ol style="list-style-type: none"> (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. 	
9.8	<p>O&M activities – half yearly basis</p> <ol style="list-style-type: none"> (1) Cleaning of overhead tank 	
9.9	<p>O&M activities – yearly basis</p> <ol style="list-style-type: none"> (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. 	



**PURCHASE SPECIFICATION- GROUP: PHOTOVOLTAICS
SUPPLY OF BOS ITEMS, I&C, O&M FOR 5.67 MW SPV POWER
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	<ul style="list-style-type: none"> (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 	
<p>9.10</p>	<p>O&M activities – (as and when required)</p> <ul style="list-style-type: none"> (1) Monitoring and operation of plant electrical equipment as and when required: <ul style="list-style-type: none"> (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. (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) Maintenance of the 33kV transmission line from the switchyard at the Main control room to the Evacuation point. This includes repair of line, replacement of insulators, etc. (3) Coordinating, on behalf of BHEL, and obtaining renewal of statutory licenses, clearances and approvals from state departments such as CEA / CEIG. (4) 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. (5) 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. (6) 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. 	



**PURCHASE SPECIFICATION- GROUP: PHOTOVOLTAICS
SUPPLY OF BOS ITEMS, I&C, O&M FOR 5.67 MW SPV POWER
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	<p>(7) Coordinating with sub-station upon grid failures, line problems and implementing the needful steps to restore the plant to normal operation.</p> <p>(8) Theft incidents: immediate reporting to BHEL, filing FIRs with police stations on behalf of BHEL, coordination for site inspection by insurance companies and clearance of insurance claims, logging of events (date, time) and maintaining records.</p> <p>(9) Accidents: immediate reporting to BHEL, coordinating with hospitals, logging of events (data, time) and maintaining records.</p>	
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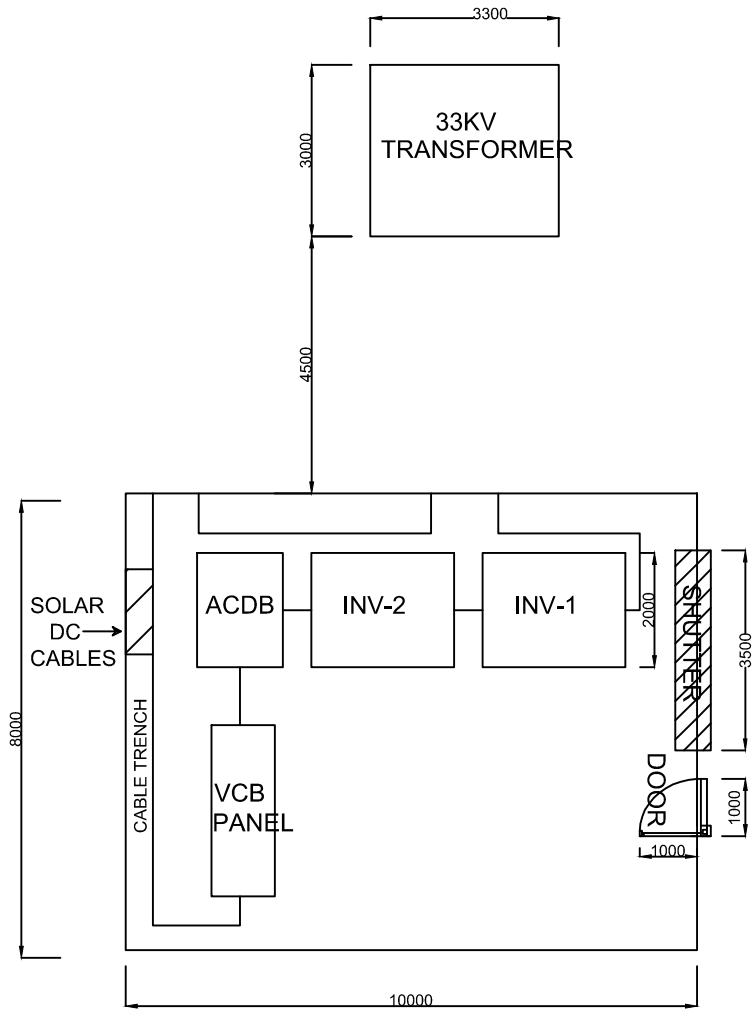
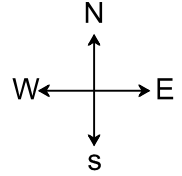
10.0 Documents to be submitted for BHEL approval after receipt of purchase order

10.1	BHEL approval shall be obtained for the following technical documents, which shall be submitted to BHEL in phased manner based on priority sequence of activities. However, it shall be ensured that all documents are submitted within 10 days from date of purchase order.	
10.2	Vendor, make, model number / part number, specification / sizes / dimensions / drawings / datasheets of all the vendor supplied items as listed in clause 6.0.	
10.3	<p>General arrangement drawings / schemes / layouts with bill of materials / quantities shall be submitted for the following:</p> <ol style="list-style-type: none">(1) Transformer foundation pedestal(2) Firewalls(3) HT panel foundation pedestal with shed(4) RCC trench for HT cables of switchyard(5) Cable support structure for 1Cx300 sq-mm cables between control room and transformers(6) RSJ pole foundations(7) PSC pole foundation(8) Four pole structure sets (1 and 2)(9) Double pole structure set(10) Single pole structure set(11) Lightning arrestor arrangement with foundation details(12) Yard lights – solar array field, switchyard, compound wall/chain link fencing(13) Water pipeline layout from bore wells to OH tank(14) Water pipeline layout from OH tank to solar array field for module cleaning system(15) Fire alarm system scheme / layout(16) Cable support structures and cable ladders within control room	

DRAWING NO. 4 679 05 00055

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

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

TYPE OF PRODUCT OR NAME OF CUSTOMER/PROJECT

	BHARAT HEAVY ELECTRICALS LIMITED.		DRN	NAME	SIGN.	DATE	No. OF VAR
	ELECTRONICS DIVISION, BANGALORE		CKD	MANI		140214	
	APPD	VRK			140214		

DEPT. SC&PV	FOR UNSPECIFIED-TOLERANCES REFER ED 0230499		SCALE 1 : 1	WEIGHT(Kg)	REF. TO ASSY. DRG.	ITEM NO.	No. OF ITEM
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TITLE **INVERTER ROOM LAYOUT**
NEEPCO , MONARCHAK

DRAWING NO. **4 679 05 00055**

SHEET NO. 01 NO. OF SHEETS 01

REV. 00

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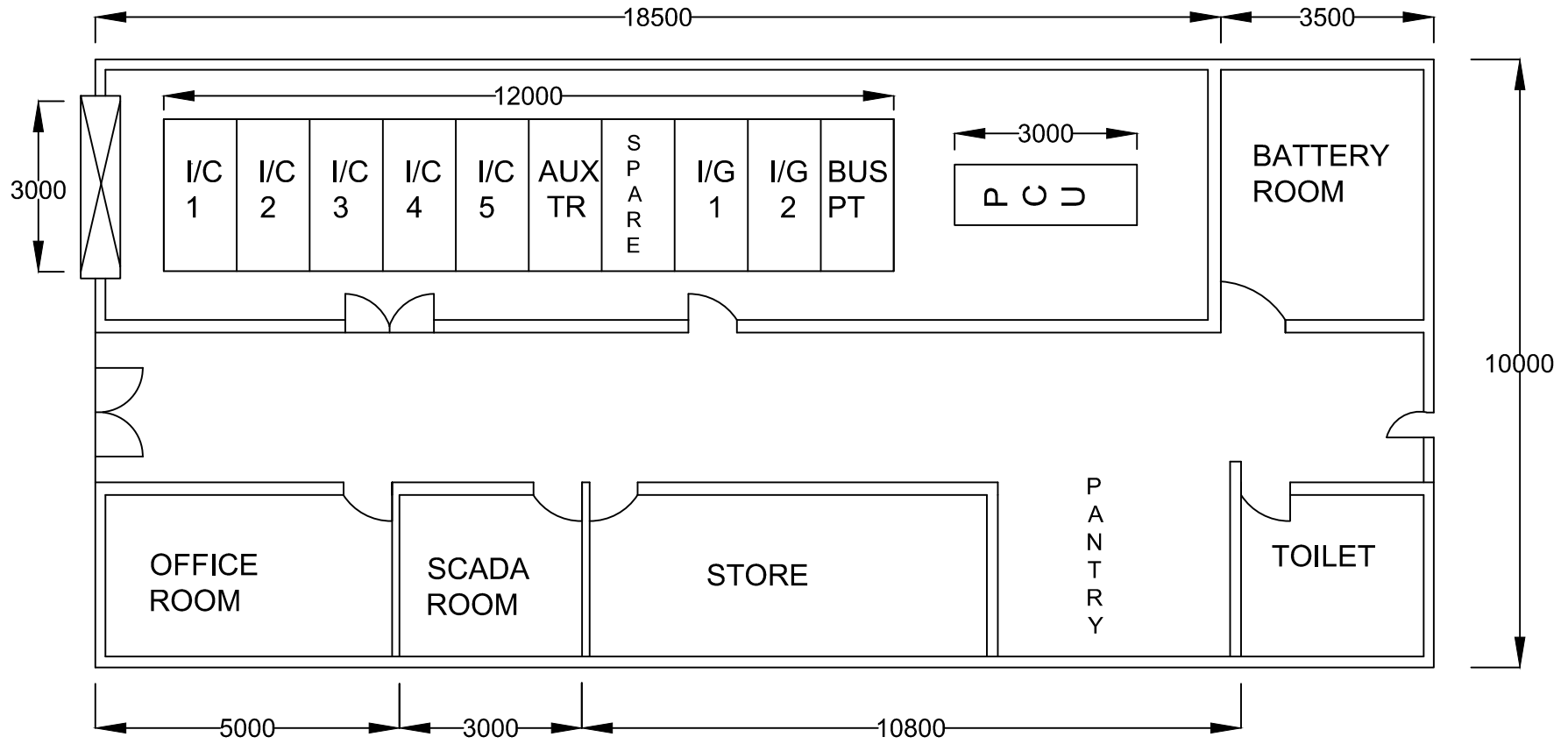
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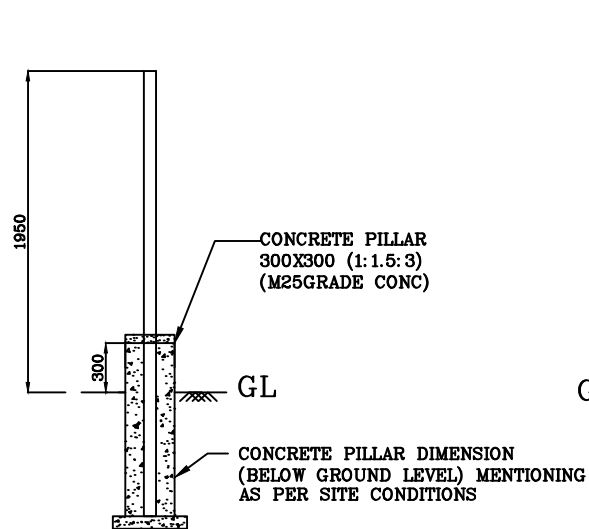


TYPE OF PRODUCT OR NAME OF CUSTOMER/PROJECT										
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					APPD	VRK		140214		
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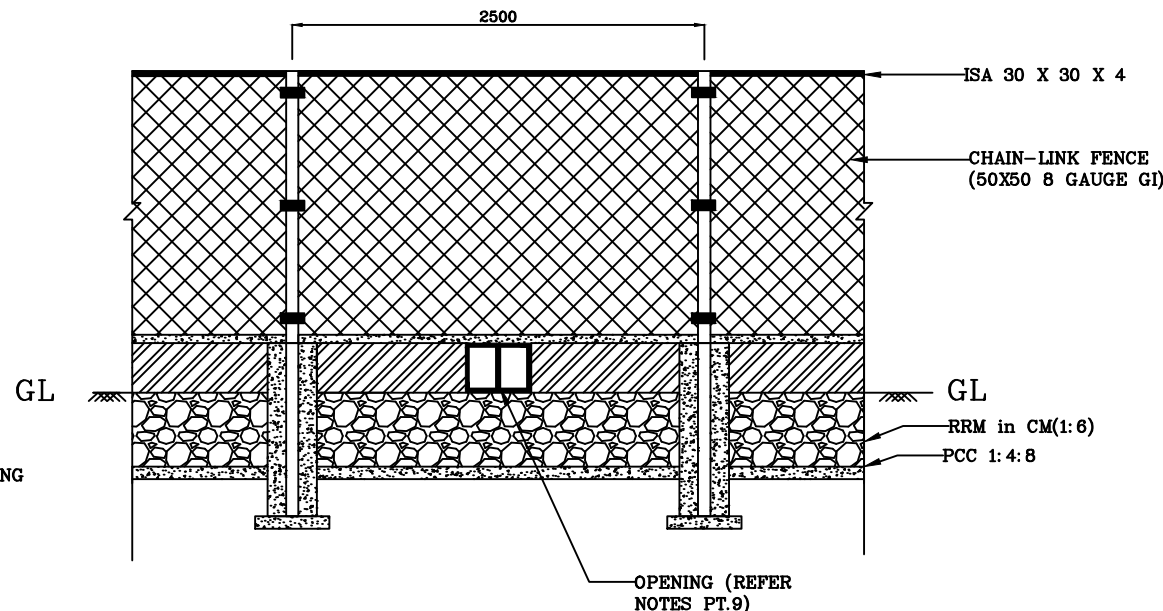
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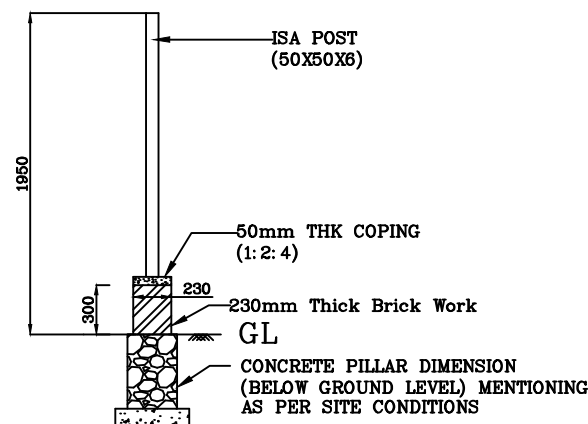
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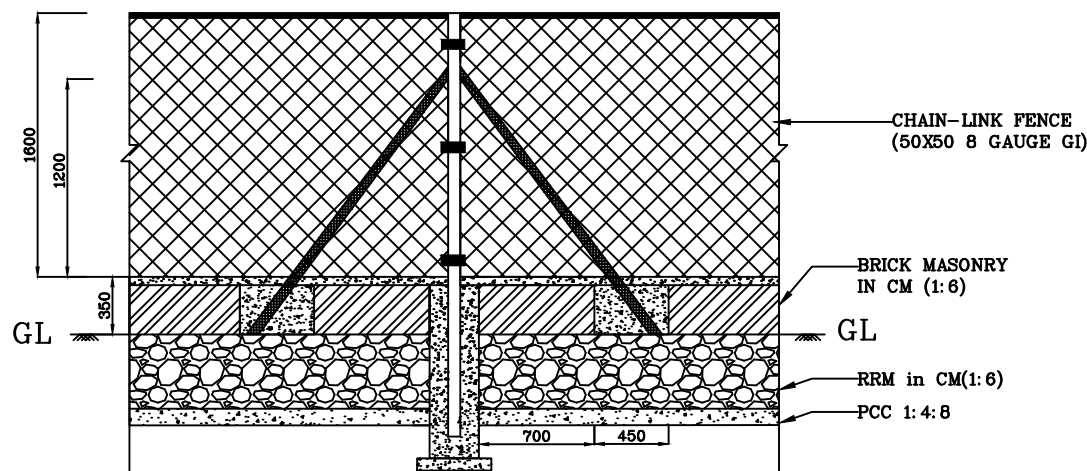
SECTION AT PILLAR



SECTIONAL ELEVATION



SECTION AT TOE-WALL



SECTIONAL ELEVATION WITH ISA 65X65X5 STRUT POSTS (REFER NOTES PT. 8)

NOTES:

- VERTICAL POSTS SHALL BE MS ANGLE POSTS AND SHALL CONFORM TO IS: 808-1989.
- 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.
- VERTICAL POSTS SHALL BE GIVEN A SECONDARY COAT OF SYNTHETIC ENAMEL PAINT OVER A PRIMER COAT OF RED-OXIDE.
- BRICKWORK SHALL BE COMMON BURNT CLAY BRICKS CLASS DESIGNATION 7.5 IN CEMENT MORTAR 1:6.
- MASONRY ABOVE GROUND LEVEL SHALL BE PLASTERED IN 12mm THICK CEMENT MORTAR 1:6 OVERLAID BY 2 COATS OF WHITE CEMENT PAINT.
- 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.
- CORNER POSTS SHALL BE PROVIDED USING THE METHODOLOGY AS MENTIONED IN POINT-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.
- LAYOUT OF FENCING SHALL BE PROVIDED AS PER THE ACTUAL SITE BOUNDARY PERIMETER SUBSEQUENT TO TOPOGRAPHICAL SURVEY AND VALIDATION OF BOUNDARY POINTS.
- THIS FENCING DRAWING IS ONLY FOR THE AREA ENCOMPASSING TRANSFORMER YARDS AND SWITCHYARD OF MAIN CONTROL ROOM.
- 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.

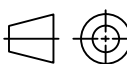
PROJECT: 5MWp SOLAR PHOTO VOLTAIC PLANT,
CUSTOMER: NEEPCO, MONARCHAK

BHARAT HEAVY ELECTRICALS LIMITED.
ELECTRONICS DIVISION, BANGALORE

REV.	DATE	ALTERED	REV.	DATE	ALTERED	REV	NAME	SIGN	DATE
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						DRAWN	MANI		15022014
						CHECKED	SC		15022014
						APPROVED	VRK		15022014



DEPT. CODE



TITLE: CHAIN-LINK FENCING FOR TRANSFORMER YARD
(OF INVERTER ROOM) AND SWITCH YARD (OF MAIN
CONTROL ROOM)

No. OF SHEETS 01

SHEET No. 01

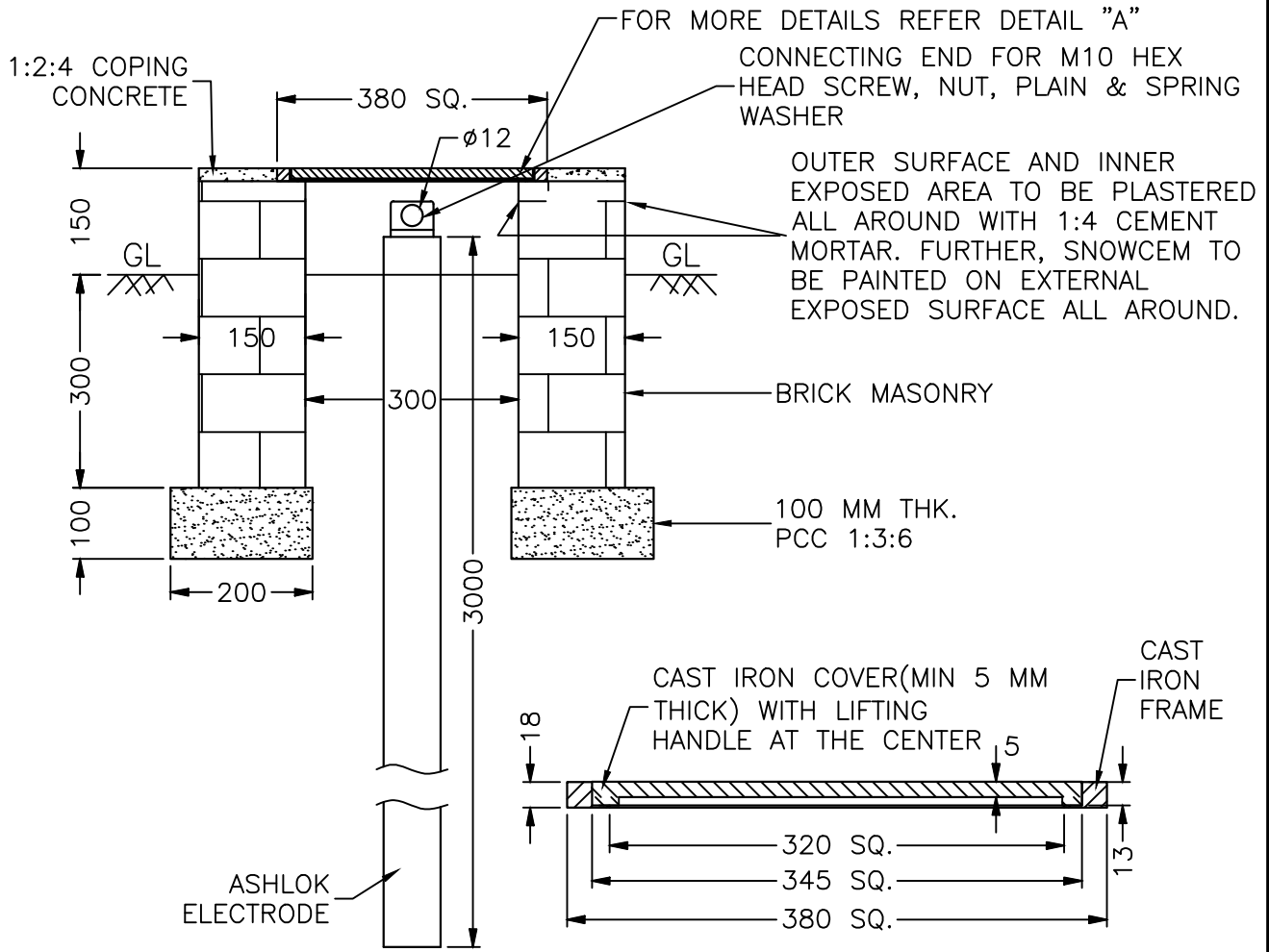
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		APPROVED			APPROVED	
						STATUS OF DRAWING
						DISTRIBUTION OF PRINTS



DETAIL "A"

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

SIGN & DATE		BHARAT HEAVY ELECTRICALS LIMITED, ELECTRONICS DIVISION, BANGALORE	DRN	NAME	SIGN.	DATE	No. OF VAR
			CKD	MANI		150214	
			APPD	SC		150214	
				VRK		150214	

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

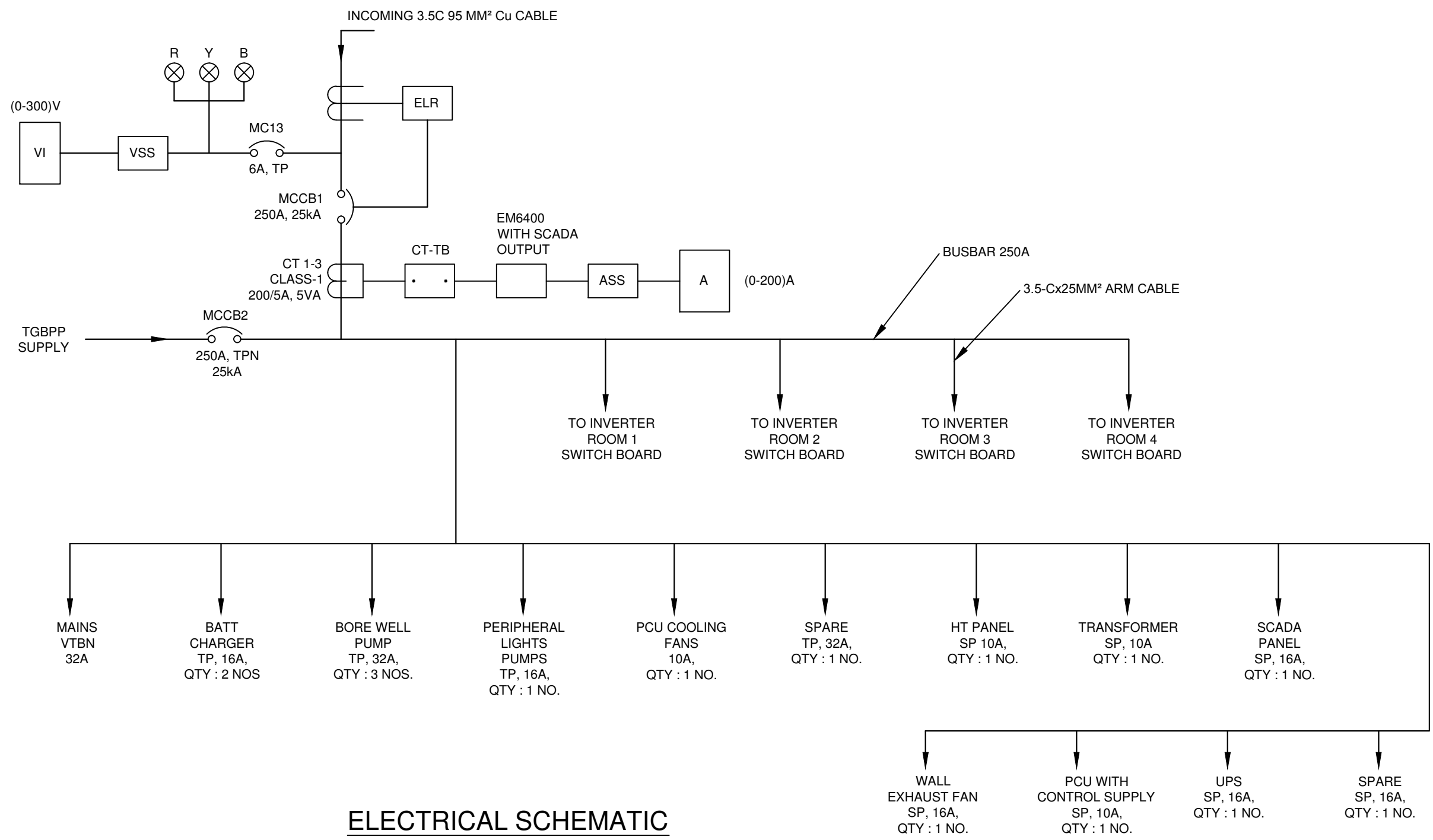
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EARTHING CHAMBER FOR CHEMICAL EARTHING AT NEEPCO, MONARCHAK SITE. FOR TENDER PURPOSE	4 679 05 00056	00
	SHEET NO. 01	NO. OF SHEETS 01

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INVENTORY No.




ELECTRICAL SCHEMATIC

PROJECT : 5MW GRID INTERACTIVE POWER PLANT
CUSTOMER : NEEPCO at MONARCHAK, TRIPURA

BHARAT HEAVY ELECTRICALS LIMITED.
ELECTRONICS DIVISION, BANGALORE

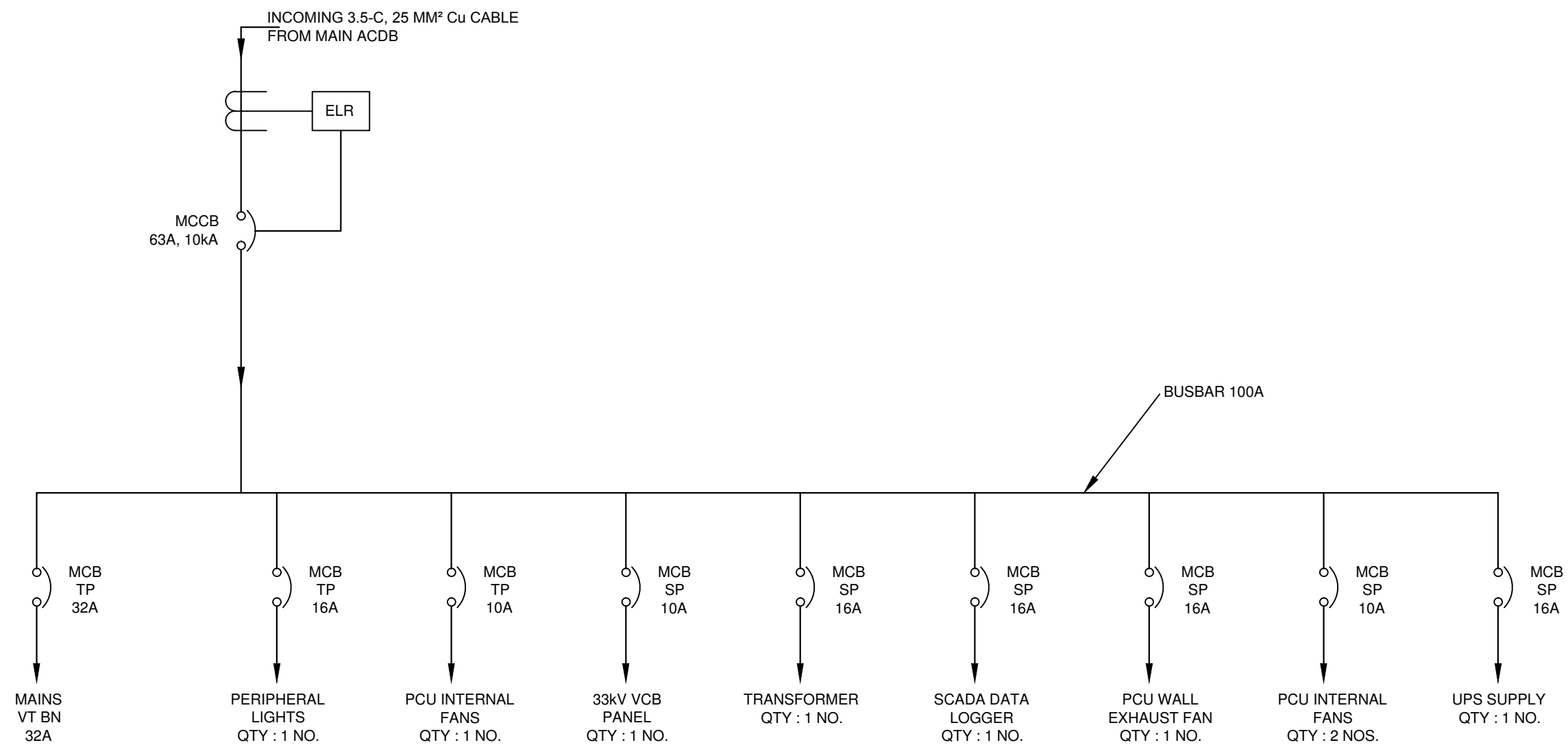
TITLE: SCHEMATIC FOR MAIN ACDB

MO No. AS PER OPEN TOLERANCE TO ED 0230499 DRG. No. **3 679 05 00686**

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		APPROVED			APPROVED									
				FIRST ISSUE			DRAWN	SAN	Sd/-	110314		No. OF SHTS	02	
							CHECKED	KK	Sd/-	110314	SCPV	439	SHT No.	01
							APPROVED	VRK	Sd/-	110314			REV	00

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ELECTRICAL SCHEMATIC

PROJECT : 5MW GRID INTERACTIVE POWER PLANT
CUSTOMER : NEEPCO at MONARCHAK, TRIPURA

BHARAT HEAVY ELECTRICALS LIMITED.
ELECTRONICS DIVISION, BANGALORE

TITLE: **INVERTOR ROOM 1-4 SWITCH BOARD**

NO. OF SHTS: 02
 SHT No.: 02

REV.	DATE	ALTERED	REV.	DATE	ALTERED	NAME	SIGN	DATE		
		CHECKED			CHECKED				DEPT.	CODE
		APPROVED			APPROVED					
			00			FIRST ISSUE				
						DRAWN	SAN	Sd/-	110314	
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						APPROVED	VRK	Sd/-	110314	

REF. DRG. No.

SIGN. & DATE

INVENTORY No.

A

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Job No: 3203

**REPORT ON
GEOTECHNICAL INVESTIGATION WORK FOR
5 MW SOLAR POWER PLANT AT NEEPCO, MONARCHAK SITE,
WEST TRIPURA DISTRICT, TRIPURA**

ERT Report

Clients :

**M/s. Bharat Heavy Electricals Limited
Electronics Division
Post Box No. 2606, Mysore Road, Bangalore - 560026**

Foundation Consultants :

**C. E. Testing Company Pvt. Limited
AN IS / ISO 9001 : 2008 COMPANY
124A, N.S.C. BOSE ROAD : Kolkata - 700 092
Phones : 2428-6221/22/23 Fax : (033) 2428-6220
Email : cetest@vsnl.com**

February – 2014

REPORT ON
SOIL RESISTIVITY TEST (ERT) FOR
PROPOSED 5MW SOLAR POWER PLANT AT NEEPCO,
MONARCHAK SITE, WEST TRIPURA DIST.,
TRIPURA

INTRODUCTION:

Soil Resistivity Test was carried out for Geotechnical Investigation Work for 5 MW solar power plant of NEEPCO at Monarchak in the state of Tripura.

Earth Resistivity Test (ERT), a typical kind of soil resistivity survey was conducted at 9 (Nine) locations in the said site using Indian Standard Code: IS- 3043. The survey was conducted from 11.02.2014 to 13.02.2014.

METHODOLOGY:

The Soil Resistivity Survey is a method to find out the Electrical Resistivity (Specific Resistance) of a medium. It is the resistance offered by a unit cube of a particular medium (so called strata below the ground level) when a unit current passes perpendicular to the surface of a cross-sectional area A. The relation is given by Ohm's Law is –

$$\rho = R \frac{A}{l} \text{ ohm} \cdot \text{m} = \text{ohm} \cdot \text{m} \text{ where}$$

ρ = Resistivity, R = resistance offered by the medium of length L and Cross – sectional area A.

In electrical resistivity survey a known current I (direct current or low frequency alternating current) is sent into the ground through a pair of current electrodes A & B and the potential difference (ΔV) created in the medium is measured between another pair of electrodes M & N. The resistivity of the formation is then given

$$\rho = K \frac{\Delta V}{I} \text{ where } \rho \text{ is the apparent resistivity, } K \text{ is the geometric factor.}$$

In the Earth Resistivity Test, the Wenner configuration was followed. In this configuration two potential electrodes M & N are placed in a line with the current electrodes A & B, all four being situated equidistance from one to another and disposed symmetrically with respect to a central point such that $AM=MN=NB=a$. The outer two electrodes A & B were used for sending current (I) and inner two M & N were used for measuring the potential differences (ΔV). The distance between each consecutive electrode (a) was kept constant and was progressively increased to reach the depth at which resistivity information are wanted. Suitable electrode spacing determines the conductivity of the top soil as well as the various subsurface layers occurring in the area under study. At each location, 4 sets of observations were taken for each of the electrode spacing (a) in Eight directions (N-S,E-W,NE-SW & NW-SE) and in eight different electrode spacing viz,: a = 0.50m, 1.0m, 2.0m, 3.0m, 4.0m and 5.0m were used to know the nature of change of resistivity.

The apparent resistivity was determined by the formula –

$$\rho = 6.28 a \frac{\Delta V}{I}$$

where 'a' is the distance between the two consecutive

Electrodes and $\frac{\Delta V}{I}$ is R which is the observed resistance for measuring resistivity. A

Resistivity Meter model DDR -3 of GEO SENSOR make was used during the operation.

The mean value of the resistivity estimated was taken as the representative one. The depth of investigation in an isotropic and homogeneous formation can be approximated to the distance between the consecutive two electrodes (a).

INTERPRETATION:

ERT observations were taken on 9 (Nine) locations distributed over the different building and structure positions as given in the work schedule of the Client and for direction of observations also followed the same work schedule.

The summarized result of the resistivity measurements along with the co-ordinates and the RL at different locations are given in the table annexed hereto.

All the ERT curves are plotted as "a" (m) vs. ρ (ohm-m) and are exhibited in the form plates annexed hereto.

It may also please be noted that in the present investigation we have measured only the apparent resistivity which may be taken as a first approximation to the weighted average of the true resistivity of the subsurface stratum in which the current lines flow.

Since our limit of observation is 20mts. below the ground level, our concern is also limited within the top of the geological succession of rocks.

The general geological scenario of the places of the surveyed area is having the top soil as the loose clayey soil extending up to a depth of 2 to 3 mts., thereafter starts the sandy clay, then exists blackish clay within the limit of our investigation. In general, all the ERT curves exhibit a nature mostly of Q-type curves which is indicative of the fact that the resistivity gradually decreases with depth constantly and after certain depth there is little increase in the order of resistivity.

APPARENT RESISTIVITY VALUES

ERT No. 01 (E=323771.803, N=2592540.579, RL=14.692M)

SI No.	S (M)	Apparent Electrical Resistivity (Ohm-m)				Mean
		(N - S)	(E - W)	(NE - SW)	(NW - SE)	
1	0.5	572.01	461.00	525.00	462.00	505.00
2	1.0	517.04	434.01	485.59	454.14	472.70
3	2.0	461.32	451.26	463.83	441.21	454.41
4	3.0	330.05	294.22	256.50	237.64	279.60
5	4.0	260.89	229.62	228.83	210.76	232.52
6	5.0	191.72	165.01	201.15	183.87	185.44

Mean Resistivity at ERT-01 is 354.94 Ohm-m.

ERT No. 02 (E=323918.917, N=2592501.076, RL=15.275M)

SI No.	S (M)	Apparent Electrical Resistivity (Ohm-m)				Mean
		(N - S)	(E - W)	(NE - SW)	(NW - SE)	
1	0.5	1825.00	1800.02	1848.58	1882.00	1838.90
2	1.0	1679.43	1622.82	1710.88	1748.62	1690.44
3	2.0	752.94	726.55	730.32	734.09	735.98
4	3.0	731.77	701.59	741.20	695.93	717.62
5	4.0	560.75	539.38	579.61	534.98	553.68
6	5.0	389.73	377.16	418.02	374.02	389.73

Mean Resistivity at ERT-02 is 987.72 Ohm-m.

ERT No. 03 (E=323918.474, N=2592440.763, RL=13.620M)

SI No.	S (M)	Apparent Electrical Resistivity (Ohm-m)				Mean
		(N - S)	(E - W)	(NE - SW)	(NW - SE)	
1	0.5	223.00	263.50	291.50	288.96	266.74
2	1.0	201.91	239.65	273.62	270.47	246.41
3	2.0	143.30	167.18	142.04	152.10	151.16
4	3.0	106.60	129.38	101.84	104.12	110.49
5	4.0	90.08	103.51	87.54	87.11	92.06
6	5.0	73.55	77.63	73.23	70.09	73.63

Mean Resistivity at ERT-03 is 156.75 Ohm-m.

ERT No. 04 (E=324059.966, N=2592378.597, RL=15.589M)

SI No.	S (M)	Apparent Electrical Resistivity (Ohm-m)				Mean
		(N - S)	(E - W)	(NE - SW)	(NW - SE)	
1	0.5	342.47	388.42	356.25	365.25	363.10
2	1.0	310.10	332.74	314.50	325.82	320.79
3	2.0	226.26	250.14	241.34	257.69	243.86
4	3.0	243.29	224.43	260.27	245.18	243.29
5	4.0	174.37	210.28	183.57	220.18	197.10
6	5.0	105.45	196.12	106.86	195.18	150.90

Mean Resistivity at ERT-04 is 253.17 Ohm-m.

ERT No. 05 (E=324201.275, N=2592300.627, RL=16.807M)

SI No.	S (M)	Apparent Electrical Resistivity (Ohm-m)				Mean
		(N - S)	(E - W)	(NE - SW)	(NW - SE)	
1	0.5	1342.44	1485.63	1410.55	1499.47	1434.52
2	1.0	1239.13	1396.38	1270.58	1446.70	1338.20
3	2.0	461.32	573.19	467.60	583.25	521.34
4	3.0	367.77	390.40	377.20	405.49	385.22
5	4.0	174.37	210.28	183.57	220.18	314.64
6	5.0	220.01	246.73	264.01	245.47	244.06

Mean Resistivity at ERT-05 is 706.33 Ohm-m.

ERT No. 06 (E=324059.278, N=2592486.073, RL=14.269M)

SI No.	S (M)	Apparent Electrical Resistivity (Ohm-m)				Mean
		(N - S)	(E - W)	(NE - SW)	(NW - SE)	
1	0.5	242.44	261.48	255.59	260.44	254.99
2	1.0	202.54	231.47	215.12	225.81	218.74
3	2.0	111.87	120.67	120.67	115.64	117.21
4	3.0	80.53	84.12	82.42	86.38	83.36
5	4.0	77.04	81.51	79.09	84.52	80.54
6	5.0	73.55	78.89	75.75	82.66	77.71

Mean Resistivity at ERT-06 is 138.76 Ohm-m.

ERT No. 07 (E=323925.057, N=2592597.540, RL=13.849M)

SI No.	S (M)	Apparent Electrical Resistivity (Ohm-m)				Mean
		(N - S)	(E - W)	(NE - SW)	(NW - SE)	
1	0.5	355.90	385.40	362.48	372.90	369.17
2	1.0	335.89	371.11	339.66	358.53	351.30
3	2.0	319.28	353.22	325.56	345.68	335.94
4	3.0	256.50	271.58	258.38	284.79	267.81
5	4.0	207.46	213.90	209.34	219.87	212.64
6	5.0	158.41	156.21	160.29	154.95	157.47

Mean Resistivity at ERT-07 is 282.39 Ohm-m.

ERT No. 08 (E=323986.574, N=2592703.605, RL=14.497M)

SI No.	S (M)	Apparent Electrical Resistivity (Ohm-m)				Mean
		(N - S)	(E - W)	(NE - SW)	(NW - SE)	
1	0.5	444.40	450.52	431.25	432.50	439.67
2	1.0	361.05	365.45	352.87	359.79	359.79
3	2.0	277.80	287.85	257.69	289.11	278.11
4	3.0	233.86	248.95	211.23	228.21	230.56
5	4.0	192.52	199.28	179.79	189.70	190.32
6	5.0	151.18	149.61	148.35	151.18	150.08

Mean Resistivity at ERT-08 is 274.76 Ohm-m.

ERT No. 09 (E=323858.965, N=2592658.788, RL=13.930M)

SI No.	S (M)	Apparent Electrical Resistivity (Ohm-m)				Mean
		(N - S)	(E - W)	(NE - SW)	(NW - SE)	
1	0.5	385.90	391.60	379.60	380.50	384.40
2	1.0	334.63	336.52	332.11	333.37	334.16
3	2.0	183.52	199.86	170.95	177.24	182.89
4	3.0	108.07	125.42	106.56	124.85	116.23
5	4.0	86.10	95.87	86.13	95.11	90.80
6	5.0	64.12	66.32	65.69	65.37	65.38

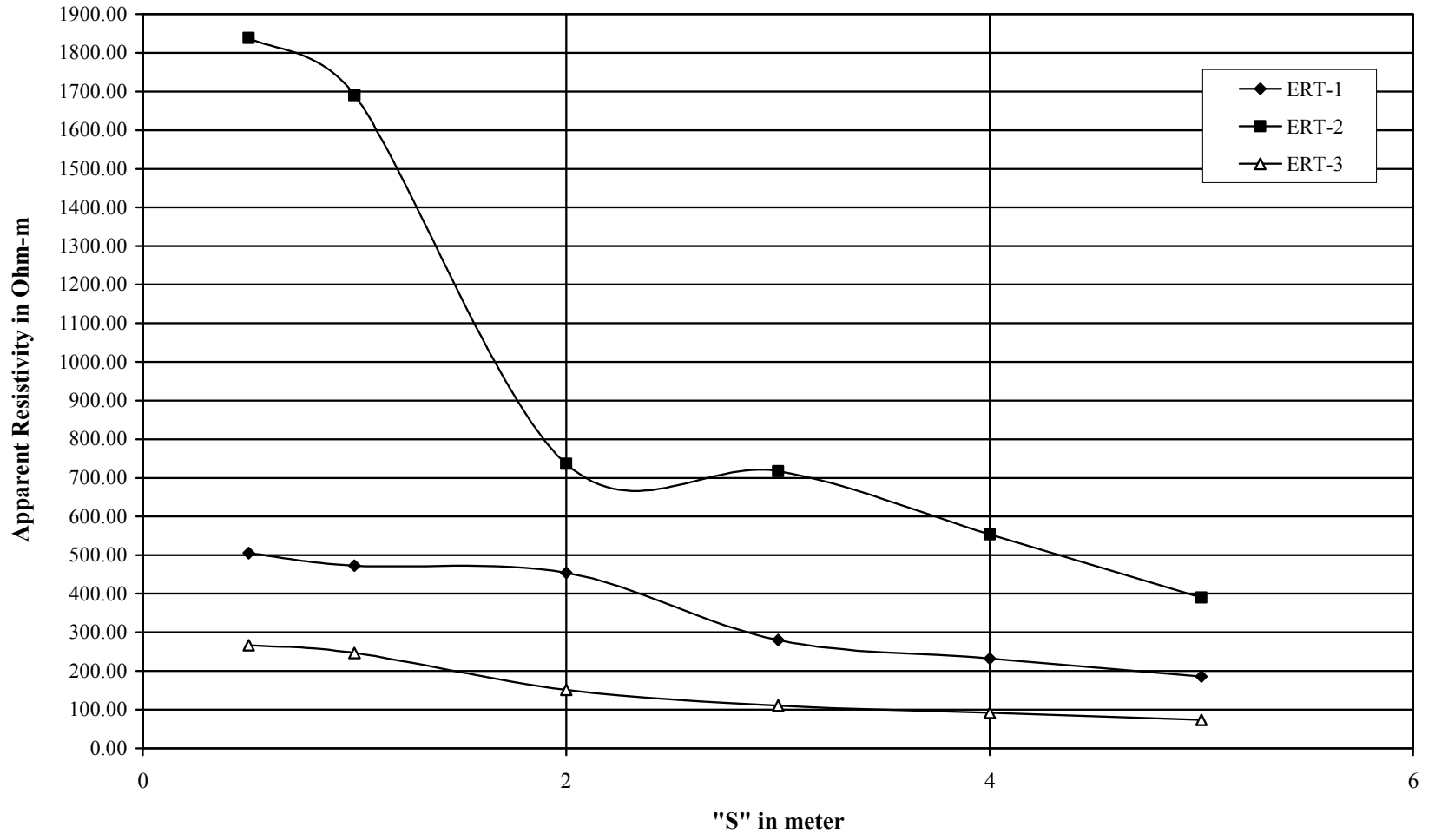
Mean Resistivity at ERT-09 is 195.64 Ohm-m.

Project: Soil Inv. for 5MW Solar Power Plant at NEEPCO, Monarchak Site, West Tripura Dist. Tripura.

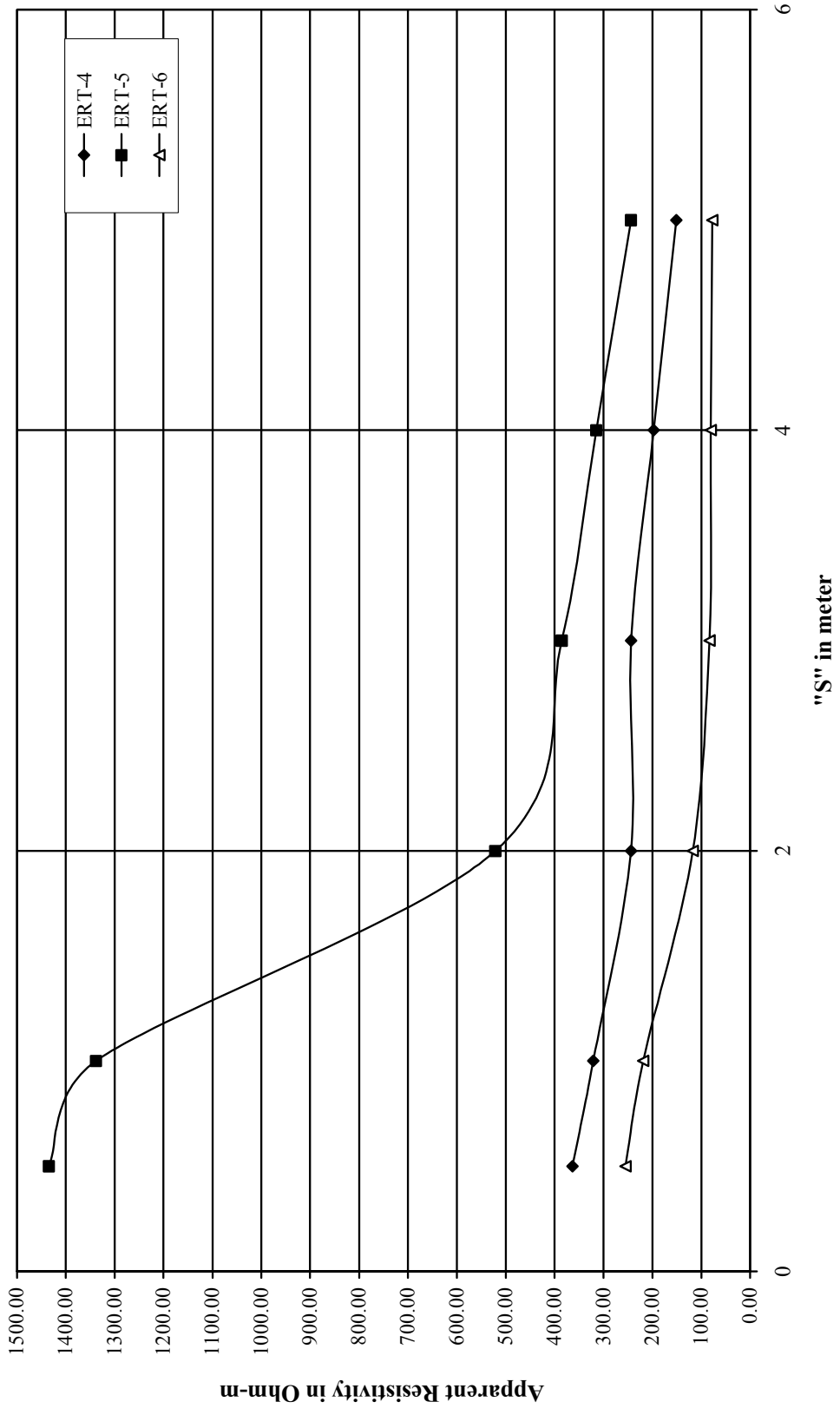
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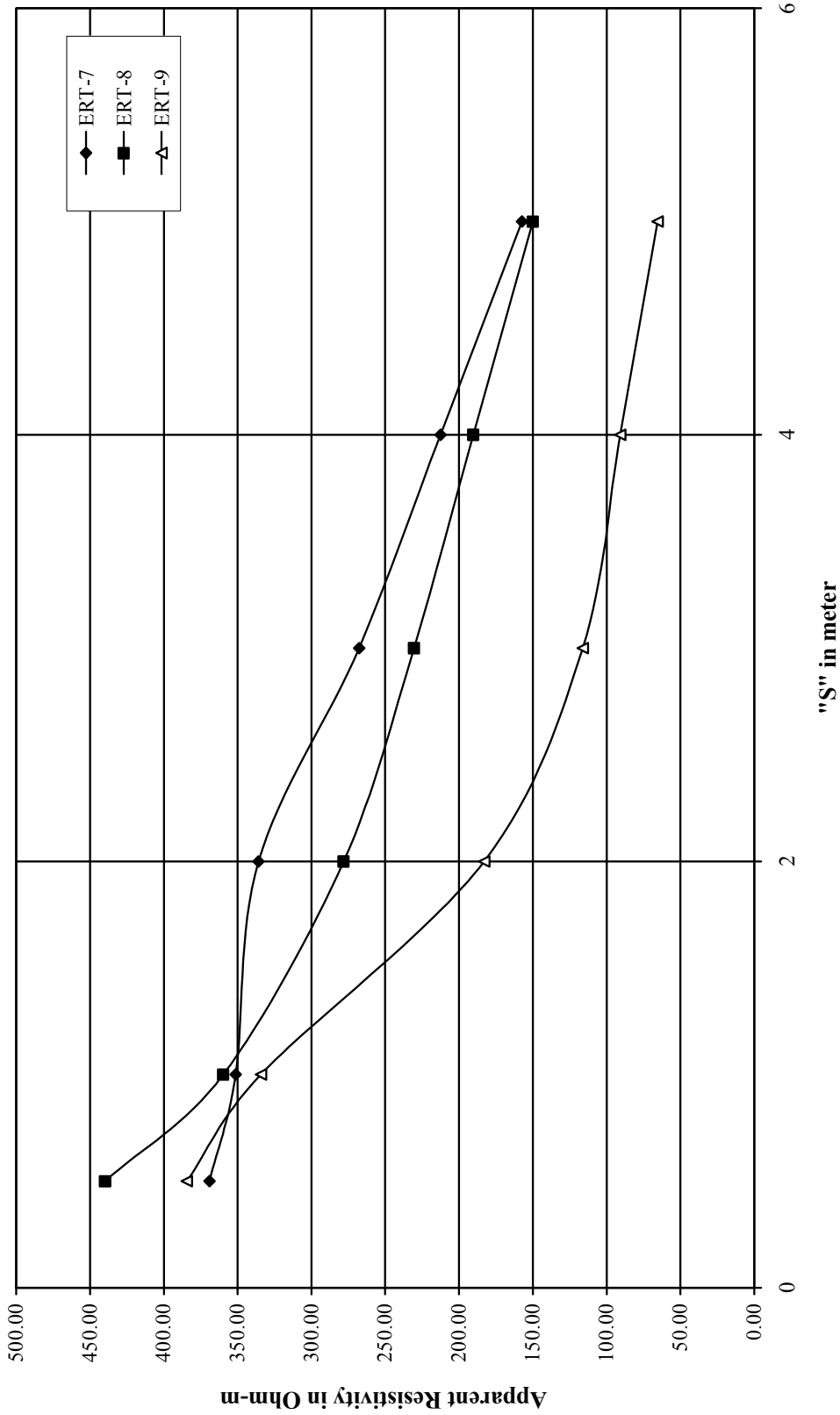
APPARENT RESISTIVITY CURVES



Apparent Resistivity Curves for ERT-1 to 3



Apparent Resistivity Curves for ERT-4 to 6



Apparent Resistivity Curves for ERT-7 to 9

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

Enquiry - General Terms & Conditions (Two part bid)

I. Enquiry / Request for Quotation (RFQ):

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

II. General Terms and conditions:

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

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

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

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

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

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

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

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

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

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

Signature of tenderer / with seal

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

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

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

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

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

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

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

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

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

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

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

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

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

11. Installation & Commissioning:

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

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

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

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

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

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

12. FIRM PRICE:

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

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

13. TERMS OF PAYMENT:

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

The payment terms are as follows:

SIGHT DRAFT PAYMENT (direct payment):

SUPPLY :

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

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

(B) FOR INDIGENOUS PURCHASE (DIRECT PAYMENT):

1. For Supply :

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

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

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

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

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

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

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Warranty period.

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

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

14. PENALTY:

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

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

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

15. PBG:

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

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

16. TERMS OF DELIVERY:

(a) FOR IMPORTED PURCHASE:

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

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

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

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

(b) FOR INDIGENOUS PURCHASE:

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

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

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

17. DELIVERY REQUIREMENT:

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

18. VALIDITY:

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

19. POST-ORDER REQUISITES:

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

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

20. RISK PURCHASE:

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

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

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

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

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

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

25. LOADING FACTORS:

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

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

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

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

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

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

B.For non compliance of standard Terms of Penalty

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

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

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

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

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

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

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

Signature of tenderer / with seal

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

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

Ref: CONTRACT PERFORMANCE GUARANTEE.

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

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

Note:

- (1) To be executed in Non-Judicial stamp paper by any authorized Indian Bank.
- (2) To be submitted directly by banker to concerned executive in purchase dept., Please give BHEL address to banker.
- (3) Do not enclose with Bank document.
- (4) Any Modification & omissions to this are not permitted

Signature of tenderer / with seal

ANNEXURE - F**PERFORMANCE BANK GUARANTEE
(FOR INDIGENOUS PURCHASE ORDERS)**

THIS DEED OF GUARANTEE made and executed on the _____ day of _____ (year), by the _____ (Bank), registered under the Companies Act 1956/Nationalized Bank constituted under the Banking Companies (acquisition and transfer of undertakings) Act constituted under the State Bank of India Act / Subsidiary Banks Act, having its registered / head office at _____ represented herein by its Branch Manager / authorized representative Sri. _____ & Sri. _____ (Hereinafter called 'guarantor' which term shall mean and include its successors and assigns)

IN FAVOUR OF BHARAT HEAVY ELECTRICALS LIMITED

_____ (Buyer's Name), a company registered under the companies Act, 1956 having its registered office at BHEL House at Siri Fort , New Delhi-100 049 and its Electronics Division at Mysore road, Bangalore-26 (hereinafter referred to as the 'Company' Which term shall include its successors and assigns):

Whereas the company has placed an order on _____ (State the name of the company / firm and its address) (hereinafter referred to as the 'Supplier' which term shall mean and include its liquidators, successors and assign) for the supply of system under order / Contract No. Dt. _____

AND WHEREAS the supplier has agreed to supply the materials and carryout the works as detailed and in accordance with the terms set out in the said order/contract.

AND WHEREAS the company is not required to pay to the supplier a sum of Rupees _____ being the 10% of the value of the goods supplied / Works performed / Services rendered under the said order / contract between the supplier and the company, till the company is satisfied with the mechanical Warranties and the performance standards stipulated in the said order / contract between the company and the supplier has been duly fulfilled, except against a Bank Guarantee for the said sum of Rs _____ in favour of the company by reputed Bank, in which case the company has agreed to make payment to the supplier of the said sum of Rupees _____ being (...%) of the value of the goods supplied / Works performed / Services rendered under the agreement between the supplier and the company and the Guarantor has at the request of the supplier, agreed to furnish this Guarantee subject to the terms and conditions stated below:

NOW THIS DEED WITNESSES THAT IN pursuance of the above said agreement, the guarantor hereby agrees and covenants With company is as follows :-

- 1) That during the period this contract of Guarantee remains effectual, the guarantor shall be liable in respect of the amount due and owing to the company in respect of the payments to the extent of Rs _____ (in words) _____ against any loss or damage caused to or suffered by the company by reasons of any breach of the terms of the said order / contract / Agreement by the supplier.
- 2) The Guarantor hereby undertakes to pay the amounts due and payable under this guarantee without any demur, merely on demand from the company intimating that the amount claimed is due by way of loss or damage caused to or suffered or would be caused or suffered by the supplier of any terms contained in the said order / contract. Any such demand made on the guarantor shall be conclusive as regards the amount due and payable by the Guarantor irrespective of the fact whether the Contractor / supplier admits or denies.
- 3) The Guarantor further agrees that the agreement herein contained shall remain in force and effect till all the supplies to be made / Works to be performed / Services to be rendered under the said order / contract / agreement are completed to the entire satisfaction of the company or till company certifies that the terms and conditions of the said order / contract / agreement have been fully and properly carried out by the said supplier and accordingly discharges the Guarantee. Unless a demand or claim under this guarantee is made on the guarantor in writing on or before the expiry of claim period indicated in clause 6 below, the guarantor shall be discharged from all the liability under this guarantee thereafter.
- 4) The guarantor further agrees with the company that the company shall have the fullest liberty without the consent of the guarantor and without effecting in any manner the obligations of the guarantor hereunder to vary any of the terms of the said order / contract / agreement or extend the time of performance by the said supplier from time to time or refrain from exercising the power exercisable by the company against the said supplier or to forebear or omit to enforce any of the terms and conditions relating to the said order / contract / agreement, and the guarantor shall not be relieved of its liability in whole or in part , by reason of any act, commission or forbearance on the part of the company or by reason of any such variation, or extension being granted to the said

Signature of tenderer / with seal

supplier or by reason of any such matter or thing whatsoever which under the law relating to sureties would but for this provision have effect of so relieving the guarantor.

- 5) The guarantor undertakes not to revoke this guarantee during its currency except with the previous consent of the company in writing.
- 6) Notwithstanding anything herein above contained, the liability of the guarantor under these presents is restricted to Rs _____. The guarantee shall be in force till its expiry on _____ unless a demand is made on the guarantor within SIX months from the date of expiry, all the liability of the guarantor under this guarantee shall stand fully discharged. The decision of the claimant in regard to breach of contract is final and binding on the Bank.

IN WITNESS whereof, the guarantor, acting through it authorized representative has executed this deed of Guarantee on the day, month and year first above written.

(Seal of the Bank to be affixed)

WITNESS

- 1.
- 2.

Note:

- (1) To be executed in INR 100 Non-Judicial stamp paper by any authorized Indian Bank.
- (2) To be submitted directly by banker to concerned executive in purchase dept., Please give BHEL address to banker.
- (3) Do not enclose with Bank document.
- (4) Any Modification & omissions to this are not permitted.

ANNEXURE – G

BHEL MEMBER BANKS (CONSORTIUM BANKS)**PBG SHALL BE ISSUED FROM THE FOLLOWING BANKS OR THEIR BRANCH OFFICES ONLY**

1	STATE BANK OF INDIA
2	PUNJAB NATIONAL BANK
3	HDFC BANK
4	SYNDICATE BANK
5	CANARA BANK
6	INDIAN BANK
7	ST. BANK OF HYDERABAD
8	ICICI BANK
9	STANDARD CHARTEREDBANK
10	UCO BANK
11	KOTAK MAHINDRA
12	ORIENTAL BANK OF COMMERCE
13	STATE BANK OF TRAVANCORE
14	CENTRAL BANK
15	IDBI BANK
16	FEDERAL BANK
17	HSBC LTD
18	DEUTSCHE BANK
19	CORPORATION BANK
20	CITI BANK
21	BANK OF BARODA
22	ABN AMRO BANK
23	UNITED BANK OF INDIA
24	VIJAYA BANK
25	UNION BANK OF INDIA
26	PUNJAB & SIND BANK
27	ANDHRA BANK
28	BANK OF INDIA
29	AXIS BANK

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

Signature of tenderer / with seal

COMMERCIAL TERMS & CONDITIONS (to be enclosed with TECHNO-COMMERCIAL BID) (For Indigenous Purchase Orders)				
RFQ No.HBSMM20005 RFQ DATE : 19.03.2014 DUE DATE : 11.04.2014 FOR BOS-NEEPCO,Tripura				
Sl No.	Terms	BHEL Term	Confirmation	Deviation / Remarks
1	Bidding	(a) Bid has to be submitted as Two Part – in two sealed covers-Techno Commercial Bid(Part-1) & Price Bid (Part-II)- clearly written on each cover both put in a single sealed envelope super-scribed with RFQ No. and Due date.	Acceptable / Not acceptable	
		(b) Documents as called in Pre-Qualification Criteria (Clause 1.1 of PS-439-871) to be submitted along with technical bid(Part-1).	Acceptable / Not acceptable	
		(c) Annexures-B & B1 to be submitted along with technical bid (Part-1) & Annexure-B2 to be submitted along with Price bid (Part-II).	Acceptable / Not acceptable	
		(d) Clause-wise compliance to BHEL Purchase specification along with all documents as called in Technical specification to be submitted along with technical bid(Part-1).	Acceptable / Not acceptable	
2	Price Basis	Firm i.e., from the date of PO to completion of supply if I&C is not applicable. If I&C is in supplier's scope, then the prices shall remain Firm till commissioning & handing-over of the complete system. (PVC clause not acceptable).	Acceptable / Not acceptable	
3	Terms of Delivery	Free On Road Basis to Project site :NEEPCO MONARCHAK SITE,TRIPURA	Acceptable / Not acceptable	
4	Delivery Period	(a) Supply : Completion within twelve (12) weeks from the date of Drawing Approval. Drawing Submission : Within one (1) week from PO date.	Acceptable / Not acceptable	
		(b) I&C : Completion within four(4) weeks from supply date.	Acceptable / Not acceptable	
		(c) Civil Works : Completion within sixteen (16) weeks from the date of Drawing Approval.	Acceptable / Not acceptable	
5	Payment Term	(a)Supply : Payment of 80% basic Supply value + 100% Taxes shall be made with 45 days credit from the date of receipt of material at site. 10% on completion of I&C and certification line item wise on pro-rata basis. Balance 10% on execution of PBG valid for warranty period + 6 months claim period from any of the BHEL Consortium banks.	Acceptable / Not acceptable	
		(b)I&C : 90% on completion of I&C and certification line item wise on pro-rata basis.Balance 10% on execution of PBG valid for warranty period + 6 months claim period from any of the BHEL Consortium banks.	Acceptable / Not acceptable	
		(c)Civil Works : 90% on completion of milestone activity (Refer Annexure C)and certification line item wise on pro-rata basis.Balance 10% on execution of PBG valid for warranty period + 6 months claim period from any of the BHEL Consortium banks.	Acceptable / Not acceptable	
		(d) O&M: 100% O&M charges are payable on quarterly basis against report certified by BHEL		
		(d)For any other deviation loading will be done as per clause 25(A) of Enquiry - General Terms & Conditions (Ref : SCPV/BOS/01-Rev 00)	Acceptable / Not acceptable	
6	Excise Duty	(a) To confirm whether applicable. If applicable, indicate prevailing rate of Excise duty.	Applicable / Not applicable	Prevailing rate of Excise duty : %
		(b) BHEL is trying to avail Customs Duty & Excise duty exemption.Successful bidder shall support with all relevant documents.	Acceptable / Not acceptable	
7	Sales Tax	(a) To confirm whether applicable. If applicable, indicate prevailing rate of Sales Tax against Form c.	Applicable / Not applicable	Prevailing rate of Sales Tax against Form c: %
		(b) For issue of form "C", vendor has to furnish "E1/E2" form.Please confirm that "E1/E2 Sale form" will be submitted.	Acceptable / Not acceptable	
		(c) Wherever E1/E2 transactions are made, CST will not be reimbursed	Acceptable / Not acceptable	
8	Value Added Tax	Since it is inter-state movement of goods, VAT is not applicable. Only CST against form C is applicable.	Applicable / Not applicable	CST applicable @.....%
		Both are in the same State, VAT is applicable please indicate VAT applicable.	Applicable / Not applicable	VAT applicable @.....%
9	Octroi	To confirm whether applicable, if applicable indicate current rate of Octroi.	Applicable / Not applicable	Octroi.....%
10	Service Tax	To confirm whether applicable, if applicable indicate current rate of Service Tax.Furnish Service Tax Regn. No. Confirmation that Service Tax register is maintained.	Applicable / Not applicable	Service Tax% Service Tax Regn. No. S.Tax Register maintained : Yes/No

COMMERCIAL TERMS & CONDITIONS (to be enclosed with TECHNO-COMMERCIAL BID) (For Indigenous Purchase Orders)				
RFQ No.HBSMM20005 RFQ DATE : 19.03.2014 DUE DATE : 11.04.2014 FOR BOS-NEEPCO,Tripura				
SI No.	Terms	BHEL Term	Confirmation	Deviation / Remarks
11	Works Contract Tax	Vendor shall ensure quoting WCT inclusive.TDS applicable as per provisions of Tripura VAT Act. Vendor to be registered under Tripura VAT, file returns & remit applicable VAT/WCT.Declaration in Form as per Tripura VAT to be submitted by vendor.TDS is applicable as per provisions of Tripura VAT Act. The WCT% included in the offer shall be indicated for availing credit wherever applicable..	Acceptable / Not acceptable	WCT @% included in quoted rate
12	Freight	Freight shall be included (since it is on FOR basis to site) in unit rate quoted.	Acceptable / Not acceptable	
13	Insurance	Transit insurance is in vendor scope in addition to the insurance as per Clause 5.4(5) of PS-439-871.Insurance shall be included in the unit rate quoted.	Acceptable / Not acceptable	
14	Evaluation of L1 vendor	(a)Over all L1 of Supply + I&C + Civil Works + O&M on "FOR" basis to site will only be considered.	BHEL	
		The percentage of Supply, Civil works and I&C values shall be in the range indicated below(approximately,with overall tallying to 100%) : (a) Supply : 42-46% (b) I&C : 18-22% (c) Civil : 18-22% (d) O&M : 14-18%	Acceptable / Not acceptable	
15	Warranty	Supply : 60 months from the date of I&C or 63 months from the date of supply whichever is earlier.	Acceptable / Not acceptable	
16	Pre Shipment Inspection	Pre Shipment Inspection will be carried out by BHEL/Customer for which test report shall be sent one week in advance.	Acceptable / Not acceptable	
17	Penalty	Penalty of 0.5% per week at the basic price of the good for undelivered quantity of supply portion, subject to a maximum of 10%. For Supply, Pre Shipment Inspection Call Letter Date (Receipt of test report) will be treated as delivery for purpose of penalty. For other activities the activity completion date as certified by Engg. will be considered for penalty calculation.	Acceptable / Not acceptable	
		For any deviation, loading will be done as per Clause 25.B of Enquiry - General Terms & Conditions(Ref : SCPV/BOS/01-Rev 00)	Acceptable / Not acceptable	
18	Road Permit	Road permit if applicable will be given by BHEL before Dispatch of ordered Items	BHEL	
19	PBG	(a)PBG shall be furnished in the BHEL prescribed format. (b) Deviation if any Please specify	Acceptable / Not acceptable	
20	Despatch Documents	Complete set of despatch documents in 3 sets shall be forwarded to BHEL directly. Despatch documents include Commercial Invoice, Excise Invoice (if ED is applicable), Lorry receipt (L/R), Packing list, Warranty certificate, Insurance intimation letter, & Original Performance Bank Guarantee (Directly from issuing bank to BHEL). One set of Invoice, Packing list and L/R shall be faxed immediately after despatch to BHEL-EDN, Bangalore.	Acceptable / Not acceptable	
21	Reverse Auction	BHEL reserves the right to conduct Reverse auction.Procedure for the same will be informed by BHEL . Please confirm your acceptance for reverse auction.	Acceptable / Not acceptable	
22	Other terms & conditions	For any other Terms and Conditions, kindly refer to the enclosed Enquiry - General Terms & Conditions(Ref : SCPV/BOS/01-Rev 00)	Acceptable / Not acceptable	
24	Validity	(a) Quotation should remain valid for a period of 90 days from the due date	Acceptable / Not acceptable	
		(b)Deviation if any Please specify	(b)	
25	Bank Charges	(a) All Bank charges to respective accounts	Acceptable / Not acceptable	
		(b) Deviation if any Please specify	(b)	

AUTHORISED SIGNATORY WITH SEAL

TECHNICAL BID ENCLOSURE FOR COMPLIANCE OF QUOTE : UNPRICED BID											
RFQ No.HBSMM20005 RFQ DATE : 19.03.2014 DUE DATE : 11.04.2014 FOR BOS-NEEPCO,Tripura											
SI No.	Material	Short Text	Quantity	Unit	Quoted	Taxes					Remarks
						ED %	CST %	VAT %	WCT %	Service Tax %	
A. SUPPLY											
1	PS0679036849	Sub mercible pump sets,MC4,, HDPE pipes	1	ST	YES/NO				NA	NA	Taxes Included
2	PS0679037250	LT/HT/data cables, termination kits etc.	1	ST	YES/NO				NA	NA	Taxes Included
3	PS0679036865	Plante bat. Bank & Battery charger	1	ST	YES/NO				NA	NA	Taxes Included
4	PS0679036873	Main ACDBs, Sub ACDBs & NGRson kits etc.	1	ST	YES/NO				NA	NA	Taxes Included
5	PS0679036881	FP/DP/SP structure, SW/Yard fence, gate	1	ST	YES/NO				NA	NA	Taxes Included
6	PS0679036890	ACSR conductor etc.termination kits etc.	1	ST	YES/NO				NA	NA	Taxes Included
7	PS0679036903	Items of earthing systems	1	ST	YES/NO				NA	NA	Taxes Included
8	PS0679036911	LA (ESE) & LA with earthing for Array	1	ST	YES/NO				NA	NA	Taxes Included
9	PS0679036920	Module cleaning system	1	ST	YES/NO				NA	NA	Taxes Included
10	PS0679036938	Items for yard lighting system	1	ST	YES/NO				NA	NA	Taxes Included
11	PS0679036946	Miscellaneous items.	1	ST	YES/NO				NA	NA	Taxes Included
12	PS0679036954	Fire alarm sys., Extinguishers etc.	1	ST	YES/NO				NA	NA	Taxes Included
B.CIVIL											
1	PS0679036962	Construction of storage yard	1	ST	YES/NO	NA	NA	NA			Taxes Included
2	PS0679036970	Design & const of inv & Main CTRL Room	1	ST	YES/NO	NA	NA	NA			Taxes Included
3	PS0679036989	Land prep for instling slr mntg. structs	1	ST	YES/NO	NA	NA	NA			Taxes Included
4	PS0679036997	Repair of brick road 3m width of 1 Km	1	ST	YES/NO	NA	NA	NA			Taxes Included
5	PS0679037004	Construction of asphaited road of 100m	1	ST	YES/NO	NA	NA	NA			Taxes Included
6	PS0679037012	Strengthening of embarkment by pitching	1	ST	YES/NO	NA	NA	NA			Taxes Included
7	PS0679037020	Construction of earth pits	177	ST	YES/NO	NA	NA	NA			Taxes Included

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TECHNICAL BID ENCLOSURE FOR COMPLIANCE OF QUOTE : UNPRICED BID											
RFQ No.HBSMM20005 RFQ DATE : 19.03.2014 DUE DATE : 11.04.2014 FOR BOS-NEEPCO,Tripura											
SI No.	Material	Short Text	Quantity	Unit	Quoted	Taxes					Remarks
						ED %	CST %	VAT %	WCT %	Service Tax %	
C.I&C											
1	PS0679037039	I&C: Temp site office stoage yard etc.	1	AU	YES/NO	NA	NA	NA	NA		Taxes Included
2	PS0679037047	I&C: interconnection of SPV modules	1	AU	YES/NO	NA	NA	NA	NA		Taxes Included
3	PS0679037055	I&C: Formtn of cbl trnch & laying of cbl	5	AU	YES/NO	NA	NA	NA	NA		Taxes Included
4	PS0679037063	I&C: Erection of control room panels,	1	AU	YES/NO	NA	NA	NA	NA		Taxes Included
5	PS0679037071	I&C: Erectn 1500kVA tran, firewal const	4	AU	YES/NO	NA	NA	NA	NA		Taxes Included
6	PS0679037268	I&C: Cbl trench formation	4	AU	YES/NO	NA	NA	NA	NA		Taxes Included
7	PS0679037098	I&C: Erctn FP-TP-SP,CT&PT, 750kVA tran	1	AU	YES/NO	NA	NA	NA	NA		Taxes Included
8	PS0679037101	I&C: Swicyard leveling, jelly spreading,	1	AU	YES/NO	NA	NA	NA	NA		Taxes Included
9	PS0679037110	I&C:Erthg slr Arr,inv & main room, trans	1	AU	YES/NO	NA	NA	NA	NA		Taxes Included
10	PS0679037128	I&C:Cbl trench Cbl lying Cbl termination	1	AU	YES/NO	NA	NA	NA	NA		Taxes Included
11	PS0679037136	I&C:33KV pols with 2 st ACSR cdr lines	1	AU	YES/NO	NA	NA	NA	NA		Taxes Included
12	PS0679037144	I&C of yard lights fr solar array field,	1	AU	YES/NO	NA	NA	NA	NA		Taxes Included
13	PS0679037152	I&C sys bet cntrl room & 4 inv rooms	1	AU	YES/NO	NA	NA	NA	NA		Taxes Included
14	PS0679037160	I&C of mod cleaning system inc. trenches	1	AU	YES/NO	NA	NA	NA	NA		Taxes Included
15	PS0679037179	I&C of miscellaneous & safety items	1	AU	YES/NO	NA	NA	NA	NA		Taxes Included
16	PS0679037187	I&C: Pre-comm insptn/cheks/trsts MRT	1	AU	YES/NO	NA	NA	NA	NA		Taxes Included
D.O&M											
1	PS0679037349	O&M per month as per clause 9.0: 1st yr	12	MON	YES/NO	NA	NA	NA	NA		Taxes Included
2	PS0679037209	O&M per month as per clause 9.0: 2nd yr	12	MON	YES/NO	NA	NA	NA	NA		Taxes Included
3	PS0679037217	O&M per month as per clause 9.0: 3rd yr	12	MON	YES/NO	NA	NA	NA	NA		Taxes Included
4	PS0679037225	O&M per month as per clause 9.0: 4th yr	12	MON	YES/NO	NA	NA	NA	NA		Taxes Included
5	PS0679037233	O&M per month as per clause 9.0: 5th yr	12	MON	YES/NO	NA	NA	NA	NA		Taxes Included
E. Freight Charges including Service Tax @ 12.36% on 25% of Freight Value : Included in Unit rate											
F. Insurance Charges : Included in Unit rate											

NOTE :

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

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

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

4. The above format shall be used for compliance.(Reproducing on your letter head is acceptable.)

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PRICE BID												
RFQ No.HBSMM20005 RFQ DATE : 19.03.2014 DUE DATE : 11.04.2014 FOR BOS-NEEPCO,Tripura												
Sl No.	Material	Short Text	Quantity	Unit	Unit Rate (Rs.)	Total Value(Rs.) (Qty X Unit Rate)	Taxes					Remarks
							ED %	CST %	VAT %	WCT %	Service Tax %	
A.SUPPLY												
1	PS0679036636	1500kVA33kV ONAN 3wdg Indoor Transformer	4	ST						NA	NA	Taxes Included
	Unit Rate in Words :											
2	PS0679036644	750kVA33kV ONAN 2wdg Indoor Transformer	1	ST						NA	NA	Taxes Included
	Unit Rate in Words :											
3	PS0679036652	CABLE 1C 6 SQMM COPPER XLPE BLACK	75000	M						NA	NA	Taxes Included
	Unit Rate in Words :											
4	PS0679036660	CABLE 1C 6 SQMM COPPER XLPE RED	75000	M						NA	NA	Taxes Included
	Unit Rate in Words :											
5	PS0679036679	CABLE 1C 120 SQMM COPPER XLPE BLACK	7000	M						NA	NA	Taxes Included
	Unit Rate in Words :											
6	PS0679036687	CABLE 1C 120 SQMM COPPER XLPE RED	7000	M						NA	NA	Taxes Included
	Unit Rate in Words :											
7	PS0679036699	Supply of ducts,exhaust fans: PCU 630kVA	9	ST						NA	NA	Taxes Included
	Unit Rate in Words :											
8	PS0679036707	Supply of power conditioning unit 630kVA	9	ST						NA	NA	Taxes Included
	Unit Rate in Words :											
9	PS0679036849	Sub mercible pump sets,MC4,, HDPE pipes	1	ST						NA	NA	Taxes Included
	Unit Rate in Words :											
10	PS0679036865	Plante bat. Bank & Battery charger	1	ST						NA	NA	Taxes Included
	Unit Rate in Words :											
11	PS0679036873	Main ACDBs, Sub ACDBs & NGRson kits etc.	1	ST						NA	NA	Taxes Included
	Unit Rate in Words :											
12	PS0679036881	FP/DP/SP structure, SW/Yard fence, gate	1	ST						NA	NA	Taxes Included
	Unit Rate in Words :											
13	PS0679036890	ACSR conductor etc.termination kits etc.	1	ST						NA	NA	Taxes Included
	Unit Rate in Words :											
14	PS0679036903	Items of earthing systems	1	ST						NA	NA	Taxes Included
	Unit Rate in Words :											
15	PS0679036911	LA (ESE) & LA with earthing for Array	1	ST						NA	NA	Taxes Included
	Unit Rate in Words :											
16	PS0679036920	Module cleaning system	1	ST						NA	NA	Taxes Included
	Unit Rate in Words :											
17	PS0679036938	Items for yard lighting system	1	ST						NA	NA	Taxes Included
	Unit Rate in Words :											
18	PS0679036946	Miscellaneous items.	1	ST						NA	NA	Taxes Included
	Unit Rate in Words :											
19	PS0679036954	Fire alarm sys., Extinguishers etc.	1	ST						NA	NA	Taxes Included
	Unit Rate in Words :											
20	PS0679037250	LT/HT/data cables, termination kits etc.	1	ST						NA	NA	Taxes Included
	Unit Rate in Words :											
21	PS0679037365	Structurr as per BHEL drg3-679-05-00673	1000	M						NA	NA	Taxes Included
	Unit Rate in Words :											
B.CIVIL												
1	PS0679036962	Construction of storage yard	1	ST	YES/NO			NA	NA	NA		Taxes Included
	Unit Rate in Words :											
2	PS0679036970	Design & const of inv & Main CTRL Room	1	ST	YES/NO			NA	NA	NA		Taxes Included
	Unit Rate in Words :											
3	PS0679036989	Land prep for instling slr mntg. structs	1	ST	YES/NO			NA	NA	NA		Taxes Included
	Unit Rate in Words :											
4	PS0679036997	Repair of brick road 3m width of 1 Km	1	ST	YES/NO			NA	NA	NA		Taxes Included
	Unit Rate in Words :											
5	PS0679037004	Construction of asphaited road of 100m	1	ST	YES/NO			NA	NA	NA		Taxes Included
	Unit Rate in Words :											
6	PS0679037012	Strengthening of embarkment by pitching	1	ST	YES/NO			NA	NA	NA		Taxes Included
	Unit Rate in Words :											
7	PS0679037020	Construction of earth pits	177	ST	YES/NO			NA	NA	NA		Taxes Included
	Unit Rate in Words :											

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