



**Bharat Heavy Electricals Limited**  
(A Government of India Undertaking)  
Electronics Division  
Mysore Road, Bangalore - 560 026

# **TENDER DOCUMENT**

## **FOR**

**Balance of System works (Package-2) for 100MW  
(AC) Floating Solar Photovoltaic Grid-connected  
Power plant (Excluding Installation of floating SPV  
module array with SCB, ESE LA's and associated  
earthing) for NTPC at Ramagundam Thermal Power  
plant, Telangana**

**RFQ No.: EDN: PVENG:FSPV:NTPCR100MW:BOS2**

**Date: 15.04.2020**

**ISSUED BY:**

**PUNAM MISHRA**

**SR. MANAGER**

**SC&PV-ENGG.**

**BHEL-EDN, BANGALORE**



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## **PART-I OF THIS TENDER DOCUMENTS CONTAIN:**

1. Notice Inviting Tender
2. Technical-cum-commercial bid **(to be filled-up by tenderer and to be submitted with all required documents asked).**
3. Pre- Qualification Criteria
4. Instructions to Tenderer along with Enclosures
5. Special Condition of Contract along with its annexures
6. Scope of Work Cum Technical Specification
7. Unpriced Price Bid
8. BHEL General Conditions of Contract 2019 ("For items billed to Nodal"- wherever state Karnataka is mentioned in GCC it has to be read as Telangana and for Items billed to EDN state Karnataka only to be referred.)

## **PART-II: PRICE BID:**

1. Bill of quantity (BOQ) cum rate Schedule for scope of work

## **SUBMISSION OF OFFER:**

1. Part I: To be submitted in a separate sealed cover.
2. Part II: To be submitted in a separate sealed cover.
3. Part-I, Part-II sealed covers should be put in outer envelope and super scribing the Name of work, Tender Enquiry/RFQ number, Tender Due Date, Tender Submission address and Name & Address of the bidder. The bids without super scribing aforesaid details on outer envelope shall liable to be ignored.
4. The Bids shall be submitted/sent at following address:

**Office of AGM (SC&PV- PCG, M)**

SC & PV- ENGG., 5<sup>th</sup> Floor

New Engineering Building

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5. The bids should be submitted/received at above address before the submission date and time given in NIT below. Late offers shall not be considered.
6. Firms banned by BHEL are not eligible to participate in the tender. The tender envelope submitted by such a firms will not be opened for evaluation and no communication in this regard will be entertained. The list of firms is available on web site [www.bhel.com](http://www.bhel.com).



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## **NOTICE INVITING TENDER**

Tender Enquiry No. /RFQ No.: EDN: PVENG:FSPV:NTPCR100MW:BOS2

Date: 15.04.2020

BHEL-EDN Bangalore invites sealed bid in two part bid system (Part-I: Techno-commercial Bid; Part II: Price Bid) for following work from experienced and financially sound bidder who fulfil the qualifying criteria contained in the enclosed tender document:

- 1. Description of work:** Balance of System works (Package-2) for 100MW (AC) Floating Solar Photovoltaic Grid-connected Power plant at NTPC Ramagundam (Telangana)
- 2. Estimated Cost:** Rs. 17.55 Crores Plus Applicable GST
- 3. EMD Amount:** Rs. 27,55,500- **(Mandatory for MSME also)**
- 4. Security Deposit:** Applicable as per GCC Clause 1.9.
- 5. Tender Monitoring Authority (IEM):** Mr. A C Verma, IPS (Retd.) & Mr. V B Singh, IPS (Retd.)
- 6. Due Date and Time for Submission of Bid:** **27.04.2020 (1:00 PM)**
- 7. Due Date and Time for Opening of Techno-Commercial Bid:** **27.04.2020 (1:30 PM)**
- 8. BHEL** reserve the right to accept or reject any of the bid/all bids or cancel/withdraw invitation for bid without assigning any reason whatsoever and in such case no bidder/intending bidders shall have any claim arising out of such action by BHEL.
- 9.** The offers of the bidders who are on the banned list as also the offers of bidders, who engage the services of the banned firms, shall be rejected.
- 10. The bids shall be addressed to:**  
AGM (SC&PV- PCG, M)  
5<sup>TH</sup> FLOOR, N.E.B. BUILDING,  
BHEL-ELECTRONICS DIVISION,  
MYSORE ROAD, BANGALORE-560026  
Ph. No: 080-26998046/ 080-26998991

**Note:**

1. The contractors may personally visit the work place to understand the scope of work before submitting their bids.
2. For relevant details please visit our website "[www.bhel.com](http://www.bhel.com)". All subsequent corrigendum/amendment shall be published only on website and not in press. Hence, bidders are advised to always be in touch with our said website until the tender is finally opened.
3. Bidders desiring to be present for the opening shall depute their representatives with due letter of authorization presented well in advance.

NIT ISSUED BY:

Punam Mishra

Sr. Manager-SC&PV (Engg.)

Seal and sign of Bidder



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## **TECHNICAL-CUM-COMMERCIAL BID**

(To be furnished by the Bidders)

<b>Sl. No.</b>	<b>Description</b>	<b>Please Fill</b>
1	Name of the Firm (Bidder)	
2	Address of the Firm (Registered Office)	
3	Name of Contact Person	
4	Contact Numbers	
5	Email ID	

### **DOCUMENTS TO BE SUBMITTED BY BIDDER**

<b>Sl. No.</b>	<b>Description</b>	<b>Status</b>	<b>Remarks</b>
1	Earnest Money Deposit (EMD)	Submitted/ Not submitted	
2	Signed and stamped copy of tender documents	Submitted/ Not submitted	Signed and stamped Copy of all pages (all sections) of BHEL tender documents to be enclosed as a token of acceptance of all terms and conditions of the tender
3	Un-Priced bid (Price bid format without prices)	Submitted/ Not submitted	Bidder to sign and seal and give the concurrence of understanding the unpriced price bid. Bidder should not write anything other than his sign and seal on the Unpriced price bid. This unpriced bid to be submitted with the techno-Commercial bid.
4	Documents against pre-qualifying Criteria of Tender Documents	Submitted/ Not submitted	Signed and stamped copies of all documents as asked under qualifying criteria of the tender to be enclosed
5	Authorization for signing Tender Documents	Submitted/ Not submitted	Valid copy of power of attorney / authorized signatory to be enclosed as a proof of authorized representative of the firm
6	Signed and stamped copies of all Annexures to NIT	Submitted/ Not submitted	Duly filled, signed and stamped Copies of all Annexures, as applicable to be submitted

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7	PF Code Number	Submitted/ Not submitted	Copy of the Certificate to be enclosed
8	ESI Code Number	Submitted/ Not submitted	Copy of the Certificate to be enclosed
9	PAN Number	Submitted/ Not submitted	Copy of the PAN Card to be enclosed
10	Income Tax Return (of last 3 yrs)	Submitted/ Not submitted	Copy of the ITR to be enclosed
11	GSTN No. & State Code	Submitted/ Not submitted	Copy of the Certificate to be enclosed
12	List of machineries/equipment available with bidder	Submitted/ Not submitted	A list of machineries/equipment available with bidder to be submitted
13	Electronic Funds Transfer (EFT) form	Submitted/ Not submitted	Fill the EFT form enclosed with tender and submit it in original
14	Integrity Pact	Submitted/ Not submitted	Duly filled Integrity pact to be submitted as per format attached
15	Constitution of Firm	_____	Individual / Sole Proprietorship Concern/Partnership Firm / Public Ltd. Company/Pvt. Ltd. (Proof to be submitted)

## ACCEPTANCE OF BIDDER

Sr. No.	Description	Status	To be filled by Bidder
1	Validity of Offer (90 days from the date of tender Opening)	Accepted/ Not Accepted	
2	Accept to pay statutory payments like ESI, PF, BOCW, etc., as per terms and conditions of BHEL and Govt. guideline's	Accepted/ Not Accepted	
3	Penalty as per BHEL General conditions of contract 2019 clause 2.7.9	Accepted/ Not Accepted	
4	BHEL reserves right to conduct reverse auction.	Accepted/ Not Accepted	
5	In order to complete the project in the specified months schedule, bidder to deploy separate Four gangs/teams (or) more as per site requirement for each individual activities along with tools and machineries.	Accepted/ Not Accepted	
6	Scope of Work cum technical specification as per PS-439-1332 Rev. 00	Understood and accepted/ Not accepted	
7	Acceptance to execute the order in Total	Accepted/ Not Accepted	

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8	BHEL Payment terms acceptance as specified in Special Conditions of Contract	Accepted/ Not Accepted	
9	The bidder should encourage to use local labor that has the necessary skills as per the requirement of work.	Accepted/ Not Accepted	
10	Before engaging the labour in to work, Contractor should get the NOC from labours' native police station as well as NOC from local police station (If applicable). Contractor is required to comply with NTPC's CLIMS system for identification and movement of labour in their work site.	Accepted/ Not Accepted	
11	Completion period of work awarded: 5 (five) Months from date of placement of order/handing over of site.	Accepted/ Not Accepted	

**Note: The above techno-commercial bid shall be duly filled properly and required documents, as asked shall be attached by bidder.**



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## PRE-QUALIFICATION CRITERIA

1. Bidders should have executed works of similar nature of works during last Ten (10) years as per below, as on the date of opening of Technical Bid.

**One** similar work of value not less than **6 crores** (Excluding all taxes).

OR

**Two** similar works of value each not less than **4 crores** (Excluding all taxes)

OR

**Three** similar works of value each not less than **3 crores** (Excluding all taxes)

Note:

I. The term "Similar works" means works experience of any of the following categories:

❖ Bidder to have any kind of experience in the execution of Land mounted or Roof top Solar plants for 10 MW or above.

OR

❖ Bidder should have successfully executed work order for execution of Floating Solar plants for 100kw or above.

OR

❖ Bidder should have work experience in field of reservoir/lake/river water activity or any water works such as dredging /silt removal/construction /cable or pipe laying works or works in the water reservoirs of thermal plants.

II. For the above activities the term '**executed**' means the bidder should have achieved the criteria specified above even if the total contract has not been completed or closed.

Copy of orders and performance report/completion certificate/tax invoice copies or delivery challans/other relevant documents of successful execution of the order is to be submitted.

2. Average annual financial turn over during the last 3 years, ending 31st March of the previous financial year, should be **Rs 5.265 crores**. Audited Profit & loss account and balance sheet to be submitted for FY 2016-17, 2017-18 and 2018-19. CA Certificate for turnover to be submitted along with Balance sheet.

BHEL reserves the right to verify the documents submitted by the contractor. During verification, if it is found fake/forged/manipulated, suitable penal action shall be taken against bidder as per extent guidelines of BHEL for suspension of business dealing.

In case the Tenderers not fulfilling the above conditions, the offer is liable for rejection.

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## **INSTRUCTIONS TO TENDERER**

1. All entries in tender documents should be in one ink (preferably blue ink). Erasing and overwriting is not permitted. All corrections should be duly signed by tenderer concerned.
2. Tenderers shall fill in all the required particulars in the blank space provided for this purpose in the tender documents and also sign in each and every page of the tender document s attached before submitting tender.
3. Unit rate/percentage above or below estimate should be quoted in figures as well as in words in Indian Currency only i.e. Rupees and Paisa with reference to each item and for the items shown in the rate schedule. These rates shall be for the finished work at site. The rate shall include all taxes and duties payable on account of Octroi, Sales Tax, tax on work contract etc., and also expenses towards PF and ESI contributions and all other expenses related to work.
4. In case the rate quoted in figures differs from those quoted in words, the lower of the rates quoted will be taken as the tendered rate and shall be binding on the tenderer.
5. In Price bid bidders are advised to quote their best prices (% over the estimate +/\_ ) as no further price bids will be accepted in case BHEL decides to open price bids instead of reverse auction.
6. Bidders to submit the unpriced copy of the price schedule for compliance to the terms and quantities indicated in the price schedule along with the technical bid duly stamped according their acceptance. (Mandatory requirement).
7. The tenderer shall note that, No Claim for variation of rates, on the ground that existing statutory levies have been increased / decreased or those new statutory levies have come into effect after tender, or on any other ground, will be entertained.
8. The rate quoted in the tender shall remain valid for a period of 'THREE MONTHS' from the date of opening tender.
9. Tenderer shall not increase quoted rates, once the tenderer has submitted offers/quotation/price and during execution of contract in case tender is accepted.
10. Successful bidder should execute the work strictly in accordance with Tender schedule quoted rates as accepted by BHEL.
11. The rates quoted should be exclusive of all taxes arising on the transaction. Tax shall be indicated separately as applicable.
12. Before tendering, the tenderer is advised to inspect the site of work and its environments and be well acquainted with the actual working and other prevailing conditions, position of material and labor. They should be well versed with BHEL Conditions of Contract, instruction to the tenderers, technical specification, schedule of works and all other documents which form part of the agreement to be entered into subsequent to award of work.
13. The tenderer should be specially note that it is tenderers responsibility to provide any items which is not specifically mentioned in the specifications and scope, but which is necessary to complete

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the work and tenderers shall make his own arrangements for the transport of personnel and equipment to the site and for the stay and boarding facilities of their team at site during the course of work. Vendor shall ensure safety of the operating team and personnel at site during the execution of work.

14. Details and quantities of each item of work shown in the bill of quantities attached here to only approximate. They are given as a guide for the purpose of tendering only and are liable for variation and alteration at the discretion of the competent authority. The work under each item as executed shall be measured and price at the corresponding rates to be quoted by the Contractor in the bill of quantities attached hereto.
15. In the event of the tender being submitted by a firm the tender must be signed separately and legibly by each partner or member of the firm or in their absence, by the person holding the power of Attorney on behalf of firm concerned. In the later case, a copy of the power of Attorney duly attested by the Gazetted Officer must accompany the tender.
16. The BHARAT HEAVY ELECTRICALS LIMITED reserve the right to reject any or all the tenders received or accept any tender or part thereof without assigning reason thereof. In the case of acceptance of a part of tender, the time for completion may also be reduced to the extent considered necessary by the accepting authority.
17. Conditional and Unsigned tenders, tenders which are incomplete or otherwise considered defective, tenders which are not in accordance with the tender conditions laid down by the accepting officer and tenders not submitted in the prescribed forms are liable to be rejected.
18. The Contractors responsibility under this contract shall commence from date of receipt of the order or acceptance of tender.
19. Tenders submitted by speed post or courier service shall be posted with due consideration of any delay in postal delivery. Tenders received after the due date and time of opening tenders are liable to be rejected.
20. Scope of works of tenderers includes deployment of manpower, equipments etc. to carry out the given work and submission of test reports drawing etc. as per condition of contract, Technical specification and schedule of works. BHEL shall not provide any equipment/ manpower / material for the work.
21. Any covering letter and comments of the tenderer should be submitted along with the offer.
22. Should a tenderer or a contractor has a relative or in the case of firm or company, any of its shareholders relative is employed in Bharat Heavy Electricals Limited, the authority inviting tenders shall be informed of this fact at the time of submission of the tender, failing which tender may be disqualified or if such fact subsequently comes to light.
23. Contractor shall insure all his labourers and material. Any claim by his Employees for damages shall be settled by the Contractor even if action is against BHEL or to reimburse the legal expenses incurred by BHEL.

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24. Any action brought in by anybody on BHEL regarding patent, right etc., used by Contractor in execution of work shall be defended by the Contractor and / or reimburse BHEL the cost of the same.
25. Contractor shall produce necessary records, documents; explanation whenever he is called upon to do by any Government Agencies.
26. No extra items of work shall be carried out by the contractor other than those authorized to do so in writing by the Engineer-in-charge. For any such items of work executed as per instructions of Engineer-in-charge, the rates will be fixed on the basis BHEL terms and condition.
27. In case, work is not completed as per the BHEL scope due to any unforeseen reasons, contractor has to complete the job at later stage without any extra charge. No overturn charges shall be paid in case of extension of work schedule.
28. Bidders should study the prevailing Market trend of Construction materials/laborers/other relevant requirement before quote and submit the competitive price.
29. The bidders should carry out preliminary survey at proposed work site before submission of offer to ensure that the rate quoted for the relevant schedule of items are correct.
30. Tenders without Earnest Money Deposit receipt are liable to reject. No interest will be paid on the earnest money deposit.
31. The Earnest money deposit may be furnished in the following modes of deposit:
  - a) Banker's cheque/ Pay order/Demand draft in favour of BHEL EDN, Bangalore – 560026.
  - b) Through online from SBI Collect.
  - c) Electronic Fund Transfer credited in BHEL account (before tender opening)
  - d) Fixed Deposit Receipt (FDR) issued by Scheduled Banks/ Public Financial Institutions as defined in the Companies Act (FDR should be in the name of the Contractor, a/c BHEL)
  - e) In addition to above, the EMD amount in excess of Rs Two lakh may also be accepted in the form of Bank Guarantee from scheduled bank. The Bank Guarantee in such cases shall be valid for at least six months. The format of BG for EMD submission is attached with tender documents.

### **Guidelines for payment of EMD Fee through SBI Collect**

- Step-1: Please enter the following link in your internet address browser or click on the following link.  
<https://www.onlinesbi.com/sbicollect/icollecthome.htm>. Please click on "proceed" after Clicking "Check Box" to proceed for payment
- Step-2 : Now the SBI's SB-Collect site gets opened. Please select State of Corporation as "Karnataka" and type of Corporation as "PSU-Public Sector Undertaking" and then click on "Go" appearing on the screen.

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- Step-3 : Now select “ Bharat Heavy Electricals Ltd. ” from the dropdown table appearing against “Industry Name” and click Submit.
- Step-4: Now select “Others ” from the dropdown table appearing against “Category” and click Submit
- Step-5: The below screen (similar) will appear. Please select sub category “EMD” and fill up other details and transfer money.

32. For refund of Earnest Money Deposit, the tenderer should fill the enclosed EFT form, obtain the Banker's signature and also enclose a photocopy of cancelled cheque leaf.
33. Bidder whose tender is accepted signs contract agreement within fifteen days (15 days) of the date of the order directing to do so, the amount of Earnest Money already deposited by bidder will be forfeited and acceptance of the tender withdrawn.
34. If after opening of tenders a tenderer revokes the tender or increase of earlier quoted rates or after acceptance of his tender does not commence the work in accordance with the instruction of Engineer- in-charge, the Earnest Money Deposited by bidder will be forfeited and acceptance of bidder's tender withdrawn.
35. If only a part of work included in the tender had been awarded to the tenderer, the amount of Earnest Money to be retained will be based on value of the contract so awarded.
36. The tenderers should enclose relevant documents regarding constitution of firm i.e. Individual / Sole Proprietorship Concern / Partnership Firm / Public Limited Company / Private Limited.
37. Tenders submitted by speed post or courier service shall be posted with due consideration of any delay in postal delivery. Tenders received after the due date and time of opening tenders shall be rejected.

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38. If proprietor or partner of a firm expires after the submission of tender or after the acceptance of tender, BHEL reserves the right to cancel the contract if the character of the firm undergoes a substantial change.
39. THE BHARAT HEAVY ELECTRICALS LIMITED will not be bound by any power of Attorney granted by the tenderer or changes in the composition of firm made subsequent to signing of the contract. They may however recognize such power of Attorney and changes after obtaining proper legal advice.
40. If the tenderer deliberately gives wrong information on tender regarding past unsatisfactory performance with BHEL sister units, BHEL reserves the right to reject such tender at any stage including contract execution period.
41. Words imparting the singular number shall also be deemed to include the plural number and vice-versa where the context so require.
42. The General and Special Conditions are complementary to each other and where they are in conflict, the special condition shall prevail.
43. The expenses for completing the stamping agreement shall be paid by the contractor.
44. Unless or otherwise stated above tendered work includes men, material, machine and commissioning of equipment as agreed to in the contract.
45. After completing of the job, the contractor has to furnish actual drawings of work done in consultation with Engineer-in-charge.
46. Any covering letter and comments of the tenderer should be submitted along with the offer.
47. Cement and steel for carrying out Civil Works will have to be procured by the Contractor. Steel for Materials shall be accompanied with Test certificates and connected dispatch documents for proof of source from approved manufacturer's works or stockyard. The Contractor shall provide all the materials needed for trial run, testing including chemicals, consumables etc. In quoting their rates, the Contractors are advised to take into account the cost of the above materials. All the construction materials should be approved by BHEL before commencement of work. All structural steel and Reinforcement steel to be procured from SAIL, JSW Steel Ltd, Jindal Steel & Power, Tata steel Ltd. (for Reinforcement steel/TMT, RINL (for long products/Rolled sections and Reinforcement steel/TMT bars), Essar Steel India Ltd. (for Flat products/ Steel Plates), Electrosteel steel Ltd. (for Reinforcement steel/TMT bars) and Monnet Ispat and Energy Ltd. (for long products/Rolled sections and Reinforcement steel/TMT bars).
48. Should a tenderer or a contractor has a relative or in the case of firm or company, any of its shareholders relative is employed in Bharat Heavy Electricals Limited, the authority inviting tenders shall be informed of this fact at the time of submission of the tender, failing which tender may be disqualified or if such fact subsequently comes to light.
49. These 'INSTRUCTIONS TO TENDERER' & GENERAL CONDITIONS OF CONTRACT OF BHEL' shall be deemed to form an integral part of the Contract agreement for the work to be entered into. The Contractor has to scrutinize the same, and when submitting his tender, indicate

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his acceptance of both. In cases of variation between the two in any matter, the conditions in the 'THE INSTRUCTIONS TO TENDERER' shall prevail.

50. All operations to be carried out by the Contractor during the execution of the contract such as module assembling, earthing wiring etc., shall be done with proper equipment to be brought by the tenderer. Contractor shall make his own power and water supply.
51. The Contractor shall comply with the provision of Employees Provident Fund's and miscellaneous Provisions Act 1952 and rules, regulations and other orders issued there under. He as an employer shall be liable to pay employer's contribution/deductions towards PF under the PF Act in respect of all labour employed by him for the execution of the contract in accordance with the provisions of the Employees' Provident Funds and Miscellaneous Provisions Act, 1952 as amended from time to time. For this purpose he shall indicate the code number obtained from the Regional Provident Fund Commissioner or he should obtain a code number if he has not and produce the Photostat copy of the challan receipt of monthly remittance of the contribution made by him to the Commissioner. He shall also furnish such returns such returns as are due, under the Act, to be sent to the appropriate authorities through the Principal Employer".
52. The Contractor should get himself registered with the E.S.I Authorities as an independent Employer, obtain a separate code number and remit the dues in respect of the Labour employed by him for the work and produce the challan/Receipts of remittance of the ESI contributions due under the E.S.I Act to the Company authorities. He shall also furnish such returns, as are due, under the Act, to be sent to the appropriate authorities' through the Principal Employer. The contractor can remit their ESI & PF through a sub-agent who processes the ESI & PF code and agrees to enter an MOU with the contractor.
53. If any action is brought in by P.F. Commissioner/ESI authorities on BHEL for the work done by the Contractor for his labourers regarding PF/ESI amount due, short remittances, non-remittances etc., the Contractor shall defend the case on behalf of BHEL and / or reimburse BHEL the expenses so incurred.
54. The Contractor shall apply and obtain license under Contract labour (R&A) Act 1970 and comply the relevant provisions of this Act in respect of the labour employed by him for executing this contract. The contractor shall furnish necessary returns to the authority through the Principal Employer.
55. Contractor shall insure all his labourers and material. Any claim by his Employees for damages shall be settled by the Contractor even if action is against BHEL or to reimburse the legal expenses incurred by BHEL.
56. Any action brought in by anybody on BHEL regarding patent, right etc., used by Contractor in execution of work shall be defended by the Contractor and / or reimburse BHEL the cost of the same.
57. Contractor shall produce necessary records, documents; explanation whenever he is called upon to do by any Government Agencies.
58. Contractor should obtain "Workmen Compensation Policy" for their Employees.

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### **59. Boat, Safety Jacket, Tools etc.:**

Unless otherwise specified in the tender schedule, the rates for all items will be deemed to include boat, safety jacket for worker involved in the work.

No separate payment will be made for dewatering (including seepage, surface drainage and monsoon water) desludging and allied operations at any stage of the work, and the cost of such operations will be deemed to be included in the contract rates.

No separate payment will be made for curing including pumping of curing water where ever necessary.

### **60. Extra Items**

No extra items of work shall be carried out by the contractor other than those authorized to do so in writing by the Engineer-in-charge. For any such items of work executed as per instructions of Engineer- in-charge, the rates will be fixed on the basis indicated under clause 50 as per terms and conditions of BHEL.

### **61. Participation in the tender:**

In event of multiple Bids of related parties like sister concern, common representative, same signature or same phone nos. on the bids or any other documents which can prove that the two companies are related to each other, the same shall be treated as Cartel formation and BHEL will not accept such multiple bids .Hence bidders are advised to submit only one bid from among the related parties.

### **62. Reverse Auction:**

BHEL reserves the right to go for Reverse Auction (RA) (Guidelines as available on [www.bhel.com](http://www.bhel.com)) instead of opening the sealed envelope price bid, submitted by the bidder. This will be decided after techno-commercial evaluation. Bidders to give their acceptance with the offer for participation in RA. Non-acceptance to participate in RA may result in non-consideration of their bids, in case BHEL decides to go for RA.

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

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

If it is found that L1 bidder has quoted higher in online sealed bid in comparison to envelope sealed bid for any item(s), the bidder will be issued a warning letter to this effect. However, if the



# **Bharat Heavy Electricals Limited**

**(A Government of India Undertaking)**

Electronics Division

Mysore Road, Bangalore - 560 026

same bidder again defaults on this count in any subsequent tender in the unit, it will be considered as fraud and will invite action by BHEL as per extant guidelines for suspension of business dealings with suppliers/ contractors (as available on [www.bhel.com](http://www.bhel.com)).

### **63. Information to The Tenderer:**

- I. Successful Bidder should establish their Site office at Construction site, including common facilities such as toilet, water, electricity etc. in consultation with BHEL. Contractor has to arrange water and power as required for completing the job in the stipulated time frame at their own cost.
- II. The bidders should furnish "Site Inspection Certificate" in Annexure enclosed herewith.
- III. Bidders should study the prevailing Market trend of Electrical materials/laborers/other relevant requirement before quote and submit the competitive price.
- IV. The bidder should encourage to use local labor that has the necessary skills as per the requirement of work.
- V. Before engaging the labour in to work, Contractor should get the NOC from labours' native police station as well as NOC from local police station (If applicable).
- VI. The bidders should carry out preliminary survey at proposed construction site before submission of offer to ensure that the rate quoted for the relevant schedule of items are correct.
- VII. Contractor to note BHEL reserves the right to get any part of the work done through other agency or deploy BHEL's own/hired/otherwise arranged resources, at the risk and cost of the contractor after due notice of a period of two weeks by BHEL, in the event of:
  - a) Contractors continued poor progress
  - b) Withdrawal from or abandonment of the work before completion of the work.
  - c) Contractor's inability to progress the work for completion as stipulated in the contract
  - d) Poor quality of work
  - e) Corrupt act of Contractor
  - f) Insolvency of the contractor
  - g) Persistent disregard to the instructions of BHEL
  - h) Assignment, transfer, sub-letting of contract without BHEL's written permission
  - i) Non fulfillment of any contractual obligations
  - j) In the opinion of BHEL, the contractor is overloaded and is not in a position to execute job as per required schedule.
- VIII. The liquidated damages/penalties arising out of Risk and Cost as explained under Sl.no (vii). BHEL shall recover the amount from any money due from Contractor, or from any money due to the contractor including security deposit, or by forfeiting any T & P or material of the contractor under this contract or any other contract of BHEL or by any other means or any combination thereof.
- IX. Documents to be submitted on award of work (as applicable):
  - a) Security deposit in the form of Cash/DD/ NSC's / Kisan Vikas Patra / FDR / Bank Guarantee in favour of BHEL
  - (b) Electronic Fund Transfer Form duly signed & sealed by banker along with cancelled cheque copy

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## **Bharat Heavy Electricals Limited**

**(A Government of India Undertaking)**

Electronics Division

Mysore Road, Bangalore - 560 026

- (c) Labour license of the workmen engaged valid for contract period (If applicable)
- (d) Electrician qualification certificate (minimum ITI certificate/B license) for electrical work.
- (d) Workmen Compensation Insurance Policy for the workmen engaged valid for contract period
- (e) Deduction of statutory taxes (as applicable) at source would be enforced from the running bills at the rates prescribed unless exemption certificate is produced from the concerned authorities.

**X.** The following documents are to be submitted along with the Running Account Bills for process of payment

- a) Tax Invoice with details of GST number of BHEL and contractor.
- b) Measurement books duly filled and signed by officials of BHEL and contractor
- c) Provident PF Remittance challan for the bill duration.
- d) ESI Remittance challan for the bill duration.
- e) Invoice submitted along with running bills to indicate the GST amount charged and bear GST NUMBER etc. as per prevailing taxes. Bill submitted subsequently to be accompanied with a declaration that GST liability on the earlier bill has been discharged.
  - i) by paying money to the Government (along with Tax paid Challan Copy)
  - ii) by utilization of Input GST Credit
- f) Field quality assurance documents (as applicable) as per instruction of Engineer In-charge.

**64. Integrity Pact (IP):**

IP is a tool to ensure that activities and transactions between the Company and its Bidders/Contractors are handled in a fair, transparent and corruption free manner. A panel of Independent External Monitors (IEMs) have been appointed to oversee implementation of IP in BHEL.

The IP as enclosed with the tender is to be submitted (duly signed by authorized signatory who signs in the offer) along with techno-commercial bid. Only those bidders who have entered into such an IP with BHEL would be competent to participate in the bidding. In other words, entering into this Pact would be a preliminary qualification.

Details of IEM for this tender is furnished below:

**Name: Shri Arun Chandra Verma, IPS (Retd.) and Shri Virendra Bahadur Singh, IPS (Retd.)**

Please refer Section-8 of the IP for Role and Responsibilities of IEMs. In case of any complaint arising out of the tendering process, the matter may be referred to the IEM mentioned in the tender.

No routine correspondence shall be addressed to the IEM (phone/ post/ email) regarding the clarifications, time extensions or any other administrative queries, etc. on the tender issued. All such clarification/ issues shall be addressed directly to the tender issuing department.

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**(A Government of India Undertaking)**

Electronics Division

Mysore Road, Bangalore - 560 026

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### **GENERAL CONDITIONS OF CONTRACT/TECHNICAL SPECIFICATION**

It is hereby agreed by me/us that the BHEL General Conditions of Contract including subsequent amendments/ additions/deletions to clauses if any, and conditions pertaining the settlement of disputes by Arbitration form an integral part of the tender documents and that the tender submitted by me/ us is subject to the aforesaid BHEL General Conditions of Contract/ Technical Specification for BOS1 works which has been read and accepted by me/us.



# **Bharat Heavy Electricals Limited**

**(A Government of India Undertaking)**

Electronics Division

Mysore Road, Bangalore - 560 026

ENCLOSURE: A

## **CLAUSE 20 OF GENERAL CONDITIONS OF CONTRACT**

### **LABOUR**

The Contractor shall employ labour in sufficient numbers either directly or through sub-contractors to maintain the required date of progress and of quality to ensure workmanship of the degree specified in the contract and to the satisfaction of the Engineer-in-charge. The contractor shall not employ in connection with the works any person who has not completed his eighteen years of age.

The contractor shall furnish to the Engineer-in-charge at the intervals specified by him. A distribution return of the number and description by trades of the work people employed on the works. The Contractor shall also submit on the 4th and 19th or every month to the Engineer-in-charge a true statement showing in respect of the second half of the preceding month and the first half of the current month (i) the accidents that occurred during the said fortnight showing the circumstances under which they happened and the extent of damage and injury caused by them and (ii) the number of female workers who have been allowed maternity benefits as provided in the maternity benefit Act, 1961 or Rules made there under and the amount paid to them.

The contractor shall pay to labour employed by him either directly or through sub-contractors wages not less than fair wages as defined in the contractors Labour Regulations.

The Contractor shall in respect of labour employed by him either directly or through sub- contractors comply with or cause to be complied by with sub-contractors, labour Regulations in regard to all matters provided therein.

The Contractors shall comply with the provisions of the payment of wages Act, 1936, Minimum Wages Act, 1948, Workmen's Compensation Act 1923, Industrial Disputes Act, 1947, Maternity Benefit Act 1961 or any modifications there of or any other law relating thereto and rules made there under from time to time.

The Contractors shall be liable to pay his contribution and the employees' contribution of the State Insurance Scheme in respect of all labour employed by him for the execution of the contract, in accordance with the provision of "The Employees', State Insurance Act, 1948", as amended from time to time. The Contractors shall apply to the ESI Authorities, get himself registered with them and obtain a code Number. He shall pay the remittances under his code Number only. The Contractor shall be liable to pay his contribution and the Employees' contribution towards PF as per Provident Fund Rules and Regulations in respect of all labour employed by him for the execution of the contract.

The contractor shall apply to the PF Authorities, get himself registered and obtain a code number from them. He shall pay the remittances towards PF under his code Number only. The Engineer-in-charge shall on a report having been made by an Inspecting Officer as defined in the Contractors Labour Regulations have the power to deduct from the moneys due to the Contractor any sum required or estimated to be required for making good the loss suffered by a worker or workers by reason of non-fulfillment of the conditions of the contract for the benefit of workers, non - payment of wages or of deductions made from him or their wages which are not justified by the terms of the contract or non-observance of the said contractor's Labour Regulations.

The Contractors shall indemnify the BHEL against any payment to be made under and for observance of the regulation aforesaid without prejudice to his right to claim indemnity from these sub-contractors.

### **MODEL RULES FOR LABOUR WELFARE**

The Contractor shall at his own expense comply with or cause to be complied with model Rules for Labour Welfare as appended to these conditions or rules framed by Government from time to time for the protection of health and for making sanitary arrangements for workers employed directly or indirectly on the works, In case the Contractors fails to make arrangements as aforesaid the Engineer-in- charge shall be entitled do so and recover the cost thereof from the contractor.

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# **Bharat Heavy Electricals Limited**

**(A Government of India Undertaking)**

Electronics Division

Mysore Road, Bangalore - 560 026

ENCLOSURE: B

## **SAFETY CODE**

### **RESPONSIBILITIES OF THE CONTRACTOR IN RESPECT OF SAFETY OF MEN, EQUIPMENT, MATERIAL AND ENVIRONMENT**

1. Before commencing the work, contractor shall submit a "SAFETY PLAN" to the authorized BHEL Official. The 'SAFETY PLAN' shall indicate in detail the measure that would be taken by the contractor to ensure safety of men, equipment, material and environment during execution of the work. The plan shall take care to satisfy all requirements specified hereunder. During negotiations before placing of work order and during execution of the contract BHEL shall have right to review and suggest modification in the Safety Plan. Contractor shall abide by BHEL decision in this respect.
2. The contractor shall take all necessary safety precautions and arrange for appropriate appliances as per direction of BHEL or its authorized officials to prevent loss of human lives, injuries to personnel engaged, and damage to property and environment.
3. The contractor shall provide to its work force and ensure the use of the following personal protective equipment as found necessary and as directed by the authorized BHEL Officer:
  - (i) Safety life jacket to IS 6685/SOLAS
  - (ii) Safety Shoes conforming to IS-1989: 1978.
  - (iii) Eye and Face protection devices conforming to IS-8520: 1977 and IS-8940: 1978.
  - (iv) Hand and body protection devices conforming to: IS-2573: 1975

IS-6994: 1973

IS-8807: 1978

IS-8519: 1977

All tools, tackles, lifting appliances, material handling equipment scaffolds, cradles, safety nets, ladders, equipment's etc. used by the contractor shall be of safe design and construction. These shall be tested and certificate of fitness obtained before putting them to use and from time to time as instructed by authorized BHEL Official who shall have the right to ban the use of any item.

All electrical equipment's, connections and wiring for constructions power, its distribution and use shall conform to the requirement of the Indian Electricity Act and Rules. Only electricians licensed by the appropriate statutory authority shall be employed by the contractor to carry out all types of electrical works.

All electrical appliances including portable electric tools used by the contractor shall have safe plugging system to source of power and be appropriately earthed. The contractor shall not use any hand lamp energized by electric power with supply voltage of more than 24 volts. For work in confined space lighting shall be arranged with power sources of not more than 24 volts.

The Contractor shall adopt all fire safety measures as laid down in the "Code for fire Safety at Construction Sites" issued by the Safety Department of the Construction Management (HQ) of BHEL and as per directions of the authorized BHEL Official. A copy of the above referred "Code of Fire Safety at the Construction Sites" shall be made available by BHEL to the contractor for reference, on demand by the contractor, during tendering stage itself.

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## **Bharat Heavy Electricals Limited**

**(A Government of India Undertaking)**

Electronics Division

Mysore Road, Bangalore - 560 026

Where it becomes necessary to provide and/or store petroleum products, explosives, chemicals and liquid or gaseous fuel or any other substance that may cause fire or explosion, the contractor shall be responsible for carrying out such provisions and/or storage in accordance with the rules and regulations laid down in the relevant government acts, such as Petroleum Act, Explosives Act, Petroleum and Carbides of Calcium Manual of the Chief Controller of Explosives, Govt. of India. etc., prior approval to the authorized BHEL Official at the site shall also be taken by the contractor in all such matters.

The contractor shall arrange at his cost (wherever not specified) appropriate illumination at all work spots for safe working when natural daylight may not be adequate for clear visibility.

The contractor shall be held responsible for any violation of statutory regulations local, state or central and BHEL instructions that may endanger safety of men, equipment, material and environment in his scope of work or another contractor or agencies. Cost of damages if any, to life and property arising out of such violation of statutory regulations and BHEL instructions shall be borne by the contractor.

In case of a fatal or disabling injury accident to any person at construction sites due to the lapses by the contractor, the victim and/or his/her dependents shall be compensated by the contractor as per statutory requirements. However, if considered necessary, BHEL shall have the right to impose appropriate financial penalty on the contractor and recover the same from payments due to the contractor for suitably compensating the victim and/or his/her dependents. Before imposing any such penalty, appropriate enquiry shall be held by BHEL giving opportunity to the contractor to present his case.

In case of any damage to property by the contractor, BHEL shall have the right to recover cost of such damages from payments from payments due to the contractor after holding an appropriate enquiry.

In case of any delay in the completion of a job due to mishaps attributable to lapses by the contractor; BHEL shall have to recover cost of such delay from payments due to the contractor, after notifying suitably and giving him opportunity to present his case.

If the contractor fails to improve the standards of safety in its operation to the satisfaction of BHEL after being given a reasonable opportunity to do so; and/or if the contractor fails to take appropriate safety precautions or to provide necessary safety devices and equipment or to carry out instructions regarding safety issued by the authorized BHEL Official, BHEL shall have the right to take corrective steps at the risk and cost of the contractor after giving a notice of not less than seven days indicating the steps that would be taken by BHEL.

The contractor shall submit report of all accidents, fires and property damage, dangerous occurrence to the authorized BHEL Official immediately after such occurrence, but in any case not later than twelve hours of the occurrence. Such reports shall be furnished in the manner prescribed by BHEL. In addition, the contractor to the authorized BHEL Official shall also submit periodic reports on safety from time to time as prescribed.

Before commencing the work, the contractor shall appoint/nominate a responsible officer to supervise implementation of all safety measures and liaison with his counterpart of BHEL.

If safety record of the contractor in execution of the awarded job is to the satisfaction of Safety Department of BHEL, issue of an appropriate certificate to recognize the safety performance of the contractor may be considered by BHEL after completion the job

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# **Bharat Heavy Electricals Limited**

**(A Government of India Undertaking)**

Electronics Division

Mysore Road, Bangalore - 560 026

ENCLOSURE: C

## **CLAUSE 58 OF GENERAL CONDITIONS OF CONTRACT**

### **ARBITRATION:**

Except where otherwise provided for in the contract all questions and disputes relating to the meaning of the specifications, designs, drawings and instructions herein before mentioned and as to the quality of workmanship or materials used on the work or has been other as to any other questions, claim, right, matter or thing whatsoever in any way arising out of or relating to the contract, designs, drawings, specifications, estimates, instructions, orders or these conditions or otherwise concerning the works, of or the execution or failure to execute the same whether arising during the program progress of the work or after the completion or abandonment thereof shall be referred to the sole arbitration of the Executive Director/General Manager of BHEL and if the Managing Executive Director/General Manager Chief Engineer is unable or unwilling to act, to a as the sole arbitration of some other person appointed by the Executive Director / General Manager, willing to act as such Arbitrator. There will be no objection if the arbitrator so appointed is an employee of BHEL EDN or an employee of any other unit of BHEL and that he had to deal with the matters to which the contract relates and that in the course of its his duties as such he had expressed views on all or any of the matters in dispute or difference. The Arbitrator to whom the to matter is originally referred being transferred or by vacating his office or being unable to act for any reason, such Executive Director / General Manager as aforesaid at the time of such transfer, vacation of office or inability to act, shall appoint account another person to act as arbitrator in accordance with the terms of the contract, such person shall be entitled to proceed with the reference from the stage at which it was left by his predecessor. It is also a term of this contract that no person other than a person appointed by such Executive Director/General Manager or an employee appointed as arbitrator as aforesaid should act as arbitrator and the arbitrator shall give reasons for the award.

Subject as aforesaid the provision of the Arbitration Act, 1940 or any statutory modification or re-enactment thereof and the rules made there under and for the time being in force shall apply to the arbitration proceeding under this clause.

It is a term of a contract that the party involving invoking arbitration shall specify the dispute or disputes to be referred to arbitration under this clause together with the amount or amounts claimed in respect of each such dispute.

The arbitrator(s) may from time to time with consent of the parties enlarge extend the time, for making the publishing the awards.

The work under the contract shall, if reasonably possible, continue during the arbitration proceeding and no payment due to or payable to the contractor shall be withheld on account of such proceedings.

The arbitrator shall be deemed to have entered on the reference on the date he issued notice to both the parties fixing the date of the hearing.

The arbitrator shall give a separate speaking award in respect of each dispute or difference referred to him.

The venue of arbitration shall be such place as may be fixed by the arbitrator in his sole discretion. The award of the arbitrator shall be final, conclusive and binding on all parties to this contract.

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**(A Government of India Undertaking)**

Electronics Division

Mysore Road, Bangalore - 560 026

## **SPECIAL CONDITIONS OF CONTRACT**

### **1. GENERAL**

The special conditions of contract and other contract documents are complimentary to each other and shall be read in conjunction with each other. In case of any conflict of meanings between the special conditions of contract and the BHEL General Conditions of Contract the provisions of the special conditions of contract shall override the corresponding provisions of the BHEL General Conditions of Contract.

### **2. SITE CONDITIONS**

- a) Before tendering the Contractor shall get themselves acquainted with site conditions such as quality of reservoir water likely to be encountered during the course of the work etc., The rates quoted by the contractor shall be deemed to have been quoted after getting acquainted with the prevailing site conditions. No claims on the pretext of ignorance of site conditions shall be entertained.
- b) The site of work is as mentioned in the Tender document.

### **3. SITE FACILITIES**

#### **A. Reservoir Details**

Reservoir details:

Full reservoir Level (FRL):168 M

Minimum Drawdown Level (MDDL):162.30 M

The Employer will allot land near reservoir as available free of cost to the contractor for his office stores. He must maintain the areas allotted to him in a neat and clean conditions as required by the Employer. The contractor shall provide adequate storage and office facilities with approval from the Engineer. The rate quoted by the contractor shall be deemed to include for these and no separate payment will be made towards these. On completion of work, the site shall be cleaned by the contractor of all materials, temporary debris, rubbish plants and equipment's, belonging to the contractor at no extra cost. The site and surroundings shall be handed over in a neat and clean condition. In case of any failure by the contractor, the employer will get inside cleared at risk and cost of the Contractor.

#### **B. POWER AND WATER SUPPLY**

Facilities for drawing Power and water required at site for execution of the works shall be arranged by the contractor at his expense and risk. The necessary source for power & water supply has to be organized by vendor. Necessary distribution box, extension board points duly earthed, and with armoured safe power cables to be laid across the field provided point shall be in the scope of the tenderer. Further, laying of water intake and distribution pipes across the Site to various points of work from Electricity source provided water source point shall be in the scope of the tenderer. If required.

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# **Bharat Heavy Electricals Limited**

**(A Government of India Undertaking)**

Electronics Division

Mysore Road, Bangalore - 560 026

D.G generation sets shall be provided for Power arrangement by the contractor at his own cost. The tenderer shall make provision for temporary storage of water at suitable locations with pump if required to reach the water supply to work areas. The contractor will have to make his own arrangements for the same, without claiming any extra charge for the power and water drawal and distribution equipment.

## **4. MACHINERY:**

The Contractor shall at his own expense, supply all tools, plant and equipment (hereinafter referred to as T & P) required for execution of contract, as specified in the tender documents. whole of the works shall be executed in perfect conformity with the specifications and drawings. If contractor perform any works in a manner contrary to the specifications and drawings and without reference to the Engineer- in-charge, he shall bear all the costs arising or ensuring there from.

- a) All technical documents regarding the construction of works are given in the metric system and work should be carried out according to metric system.
- b) The work shall be carried out as per detailed drawings supplied by the employer. The working drawings shall be emailed progressively to the contractor free of cost. The contractor shall keep one set of drawings (duly protected from dust and wear and tear) at his own expenses always available at site for reference of Engineer-in-charge and other representatives.
- c) The works shall be carried out as per detailed specifications enclosed with the tender. For items for which there is no mention in the drawings, detailed specification relevant IS specification (latest edition) shall be followed.
- d) The contractor shall submit to the Employer for their approval complete drawings, of all temporary works and staging which he may require for carrying out the works shown in the drawings.

He shall at the same time if so required by the Employer submit his calculations relating to strength and anticipated deflection in respect of any aforesaid temporary works. He shall also submit for the approval of Employer drawings showing the methods he proposes to adopt for the erection of the various parts of the temporary works. Any modification to the drawings that may be required by the Employer shall be made by the contractor at his own cost. However, notwithstanding the approval of modification required for temporary works, the contractor shall be fully responsible for their efficiency, security and maintenance and for all obligations and risks in regard to such works, specified or implied in this contract and be shall reinstate the same at his own cost, should any mishap or accident occur causing damage or injury there from, subject however, to such clauses of the General conditions as may be applicable in such cases.

## **5. BENCH MARKS AND REFERENCE POINTS**

The contractor shall construct and maintain proper benchmarks and reference points at the allotted area near bank of reservoir on BHEL supervision, no separate payment shall be made for this and rates quoted deemed to include this cost. Surveying where ever required is in contractor scope.

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# **Bharat Heavy Electricals Limited**

**(A Government of India Undertaking)**

Electronics Division

Mysore Road, Bangalore - 560 026

## **6. SAFETY PRECAUTIONS**

The contractor shall at times observe the safety code and make necessary action as required in the tender. In default thereof, the employer may get this done departmentally or through other agencies and recover the cost from the contractor. The Contractors shall also abide by all the security regulations promulgated from time to time by employer.

## **7. RATES**

The rates to be quoted are intended to provide for works duly and properly completed in accordance with the general and special conditions of contract and specifications and drawings together with such alteration and/or conditions as may be required / ordered without prejudice to the generality thereof shall include for detail of construction which are obviously and fairly intended and which may not have been specifically referred in these documents and working drawings and but are essential for execution and satisfactory completion of work including those of minor nature and shall be deemed to include and cover internal the followings.

- a) Arrangements for obtaining the clearance wherever required from statutory bodies, regarding license for construction, permanent electricity, water supply, and sanitary connections including payment of necessary fees, inspection charges and obtaining financial certificates for using these services. The various items rates quoted in the schedule as applicable shall be deemed to include the above services and no separate payments shall be made towards these.
- b) The cost of all superintendence and labour materials, tools, plants, equipment's, mobilizing and demobilizing equipment fuel lubricants, fixture, transport charges, temporary and permanent works and quarrying charges, testing, screening, washing, handling of materials, stacking and removal charges, of any rejected materials and water and power arrangements and satisfactory maintenance of the same satisfactory completion of the work intended.
- c) All fees, duties, royalties, rent and compensation to owner for water pollution or taxes and impositions payable to local authorities, which the contractor may become liable or may be put to under any provision of the law for the purpose of in connection with the execution of the contract including levies payable on the transactions.
- d) Settings out of works profiles etc., and of construction repair and up-keep of all centre lines, bench marks and levels and page there of including provisions of drilling on reservoir bed for earth electrode.
- e) Supply of complete, Moulds, cost of testing of materials etc.
- f) Working in all conditions including in/under water liquid, conditions etc., and shall also include under water activity.
- g) In the interest of completion of work within the stipulated time, certain works are to be carried out during the monsoon period also. No separate payment will be made to the contractor for such works and it will be deemed to be included in the contract rates.

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# **Bharat Heavy Electricals Limited**

**(A Government of India Undertaking)**

Electronics Division

Mysore Road, Bangalore - 560 026

- h) All materials and labour required for water activity in a protection against risk of accidents and for providing necessary/life jacket, boat, safety belts etc., during the progress of work.
- i) Cleaning the site after the completion of work all debris, left out construction materials machine equipment's, temporary offices, stores, works shop etc., including dressing the area neat and clean shape.
- j) Such other incidental charges or contingencies as may have been provided for in the specifications.

## **8. LABOUR COLONIES**

Labour camp will not be permitted within the project premises.

## **9. ESCALATION**

The rates to be quoted by the tenderer shall be firm and shall cover and include all statutory levies, arising from, acts passed by parliament or by state legislature, the rates shall further be deemed to include statutory levies arising from such Acts, Central or State, which may come in to force subsequent to submission of tenders. The tenderer shall note that no claim for enhancement of rates, on the ground that existing statutory levies have been increased, or that new statutory levies have come in to effect after tender, or on any other ground, will be entertained on any account.

## **10. QUANTITY**

The probable quantities of the several items of work are furnished in the schedule of quantities. It must be clearly understood that neither the probable quantities nor the value of individual items nor the aggregate value of the entire work shall be binding on the Employer/Engineer does not in any way assure the contractor or Guarantee that the said probable quantities are correct or that the work will correspond to these. The Employer/Engineer reserve the right to omit, vary or add to the item/work described in the schedule, of quantities and no claim for compensation will be entertained on this account.

## **11. VARIATION/DEVIATION IN QUANTITIES**

The contractor shall not make any alteration in addition to or omission from the work as described in the tender document except in pursuance of the written instructions of the Engineer-in-charge. No such deviation from the work described in the tender documents shall be valid unless the same has been specifically confirmed and accepted by the accepting officer in writing and incorporated in the contract. The rates quoted are firm for deviation subject to minimum of (-) 20% and maximum (+) 20% of the total value of work awarded. Deviation beyond the above limits is subject to the standard terms and conditions of BHEL.

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## **Bharat Heavy Electricals Limited**

(A Government of India Undertaking)

Electronics Division

Mysore Road, Bangalore - 560 026

### **12. MATERIALS**

BHEL will not supply any materials unless otherwise specified.

### **13. SUPPLY BY CONTRACTOR**

The work is for a completed job including labour and supply of all materials except those otherwise specified in the bid document.

The material and works shall be subject to inspection and test as per field quality plan (FQP) duly approved by BHEL/ NTPC.

All materials supplied by the contractor according to the contract conditions shall be subject to inspection and passing by the Engineer-in-charge or his representatives from time to time, the contractor providing all facilities for such instruction free of cost.

BHEL officers connected with the contract shall have the power at any time to inspect and examine any stores or materials intended to be used in or on the work, whether on the site or at any factory or workshop or other place where such stores or materials are being fabricated or manufactured or at any place the same are lying and the contractor shall give necessary facilities for such inspection and examination.

The Engineer-in-charge shall be entitled to have tests made of any stores or materials supplied by the contractor shall provide at his own expense all facilities which the Engineer-in-charge may require for this purpose. If at the discretion of the Engineer-in-charge an independent expert is employed to make any such tests his charges shall be borne by the contractor only if the tests disclosed that the said stores or materials are not in accordance with the provision of the contract.

Should the Engineer-in-charge consider at any time during the erection and commissioning on prior to the expiry of the Maintenance Period that the stores or materials provided by the contractor are unsound or of quality inferior to that contracted for, or otherwise not in accordance with the contract (in respect where the decision of the Engineer-in-charge shall be final and conclusive) the contractor shall on demand, in writing from the Engineer-in-charge specifying the stores or materials complained of, not with-standing that the same may have been inadvertently passed, certified that and paid forth with remove the stores or materials so specified and provide other and suitable stores or materials at his own expense, to the entire satisfaction of the Engineer-in-charge and in the event of his failing to do so within a period to be specified by the Engineer-in-charge, in his demand aforesaid, the Engineer-in-charge may replace within the other stores or materials complained of at the risk and expense in all respect of the contractor.

The liability of the contractor under this conditions, shall not extend beyond the maintenance period aforesaid except as regards stores or materials which the Engineer-in-charge shall have previously given notice to the contractor to replace (Maintenance period for any work under this organization will be six months from the date of actual completion of the particular work and handing over to BHEL).

### **14. INTERRUPTION TO THE WORKS**

While quoting the rates/prices the Contractor should take in to account the fact that due to the design or other stipulations at site, or the necessity to follow a particular sequence of overall construction operation, or non-supply of particular drawings, or the connected work or other reasons, interruptions

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Punam Mishra

Sr. Manager-SC&PV (Engg.)

Seal and sign of Bidder



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**(A Government of India Undertaking)**

Electronics Division

Mysore Road, Bangalore - 560 026

are likely to be encountered in a work of this nature and magnitude. No claims for such interruptions will be entertained on any account.

### **15. EXTENSION OF TIME OR PENALTY/LIQUIDATED DAMAGES**

Extension of time or penalty/liquidated damages as the case may be will be determined as stipulated in clause No. 2.7.9 of BHEL General Conditions of Contract 2019.

### **16. COMPLETION OF WORK AND MEASUREMENT**

- a) All work shall be carried out according to authorized dimensions and measurement will be restricted to those authorized dimension even though the Contractor may for convenience of this work exceed the authorized dimensions.
- b) All work shall be measured in accordance with the applicable standard method of measurements prescribed by the Indian Standard Institution (1200 latest edition) unless otherwise specified.
- c) The Contractor shall admit for technical inspection, works which are likely to be embedded or covered by other works and have the necessary measurement books and certificates to this effect duly signed by the Engineer before the works are covered.
- d) On completion of the work, the Contractor must submit to the Engineer the following documents for passing of works.
  - i) A copy of the working drawing showing there on all addition and alterations in the process of execution.
  - ii) A certificate for embedded and covered up works as in sub-para (C) above
- e) The authorized Contractors representative and a representative of the Employer shall jointly sign a certificate of handing over any completed work and date of signature of that certificate will be that the date from which the maintenance period of that unit will be reckoned.
- f) Notwithstanding the above, insurance cover has to be taken by the contractor for the full value of work as also for the duration of the contract period. 50% of the Security Deposit shall be released only on the total completion of the building and handing over to BHEL to their satisfaction. Remaining 50% of Security Deposit shall be released subject to the stipulation in BHEL after 6 months from the date of completion of site activity.

### **17. MAINTENANCE OF WORK**

The contractor will be responsible for the maintenance of works during the period of commissioning until the various items are taken over, and for a further period of six months, from the date of taking over.

If the contractor fails to maintain the building satisfactorily, it will be got done by other agency and cost towards such maintenance together with departmental charges will be recovered from his bills/dues.

### **18. RUNNING ACCOUNT PAYMENTS**

During execution of work, monthly payments of all works in place will be made on the basic measurements recorded in measurement sheet/book in respect of items executed but no claim

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on the account will be entertained, if for any reason payments are not so made. PRICE VARIATION clause not applicable.

## **19. MOBILIZATION ADVANCE/ADVANCE PAYMENT - NOT APPLICABLE**

## **20. INTEREST & RECOVERY - NOT APPLICABLE**

21. Statutory Deduction towards Income Tax will be made as per rules.

22. In respect of all labour directly or indirectly employed on the work by the Contractor, the Contractor shall comply with the provisions of the contract labour (Regulation and Abolition) Act 1970 or any amendment thereof and all legislations and rules of the State and or Central Government or other Authority, framed from time to time governing the protection of health, sanitary arrangements, wages, welfare and safety for labour employed on building and construction works. The rules and other statutory obligations with regard to fair wages, welfare and safety measures, maintenance of the register etc., will be deemed to be part of the contract.

23. The Contractor is required to take insurance for all workers employed on works towards payment for workmen compensation. The insurance has to be taken out within 15 days of the award of work and has to be produced at the time of signing agreement. Half (1/2%) shall be deducted for every bill if the contractor fails to produce a proof of having taken such an insurance to cover his workmen. However the contractor shall be fully responsible for all the consequences arising out of such default. This may also be read with relevant clauses of BHEL GCC 2019.

## **24. TIME OF COMPLETION**

The date of commencement of work shall be counted from the date of handing over the site to the contractor. It may be clearly understood that time is the essence of the contract and the entire work should be completed within the time imposed in the tender document letter of intent.

25. The Contractor has to comply with Building and Other Construction worker's Welfare Cess Act (1996) BOCW .

26. The management of BHEL shall be at liberty to terminate the contract by issuing a month's notice to the contractor without assigning any reason what so ever. As regards unsatisfactory performance or noncompliance with any of the terms & conditions of the contract by the contractor. The management of BHEL shall have the right to terminate the contractor forthwith without notice & rearrange the balance work through other agencies at the risk & cost of the contractor & under such circumstances, the Earnest Money Deposit/Security Deposit paid by the contractor shall stand forfeited.

## **27. SPECIFIC CONDITIONS OF TENDER**

- i) The successful bidder should open local office for Technical staff/Administrative group at Bangalore City for easy interactions/ monitoring of work at site./ Attend meetings at Bangalore city/site as and when instructed by BHEL.
- ii) Tenderers should not disclose any price bid details/discounts in the technical bids.

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**(A Government of India Undertaking)**

Electronics Division

Mysore Road, Bangalore - 560 026

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- iii) The successful bidder should construct site office / toilets for their workmen at site in consultation with Engineer-in-charge.

### **28. WORKMEN COMPENSATION POLICY**

The contractor is required to take Insurance for all the workers employed on the works towards payments for workmen compensation. The Insurance has to be taken out within 15 days of the award of work and has to be provided at the time of signing the agreement. Half percent (0.5%) of the amount shall be deducted from every bill if the contractor fails to produce a proof of having taken such an insurance to cover his workmen. However the contractor shall be fully responsible for the consequences arising out of such default.

### **29. LIST OF INDIAN STANDARD**

Following is the list of various Indian Standards, Relevant to the commissioning work

#### **A. ELECTRICAL WORK**

- I. IS:732 - 1989 Code of practice for electrical wiring installations.
- II. IS:8061 - 1976 Code of practice for design, installation and maintenance of service lines upto and including 650V
- III. IS: 11353- 1985 Guide for uniform system of marking and identification of conductors and apparatus terminals.
- IV. IS: 3043 - 1987 Code of practice for earthing
- V. IS:694 - 1990 PVC Insulated cables for working voltages upto and including 1100 V.

#### **B. SAFETY CODE**

- I.IS: 3043 - 1987 Code of practice for earthing
- II.IS: 5216(Part-1)-1982 Guide for safety procedures and practices in electrical work: General.

#### **C. FIRE FIGHTING CODES**

- I. IS 4736-1986 Galvanizing G.I. Pipes
- II. IS 2189-1962 Code of practice for Automatic Fire alarm system
- III. IS 732-1973 Code of practice for electrical wiring installation

These standards are indicative, any additional IS standard/specification required to be followed shall be adhered to by the contractor.

### **30. ADDITIONAL CLAUSES FOR GST:**

#### **I. BHEL GST Number of Nodal Agency:**

Nodal Unit Registered as Supplier of Goods/Services in GST: Telangana GSTIN of Nodal Unit: Will be intimated later after award of work.

- II. HSN (Harmonized System of Nomenclature) / SAC (Services Accounting Code) to be mandatorily mentioned in all quotations & invoices submitted.

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**(A Government of India Undertaking)**

Electronics Division

Mysore Road, Bangalore - 560 026

- III. Invoice submitted should be in the format as specified under GST Laws viz. all details as mentioned in Invoice Rules like GSTN registration number, invoice number, quantity, rate, value, taxes with nomenclature – CGST, SGST, IGST mentioned separately, HSN Code / SAC Code etc.
- IV. Payment of GST to vendors as applicable will be made only if it is matching with data uploaded by Vendors
- V. Vendors to give undertaking that GST as mentioned in the Invoice has been paid/will be paid either through cash or admissible input credit and also file the returns
- VI. For invoices paid on Reverse charge basis – that it is “payable on reverse charge basis” to be mentioned on the invoice.
- VII. With respect to supplies, vendor should intimate BHEL immediately on dispatch for parallel billing on customer.
- VIII. Vendor should get GST registration, if not available, in the state of Telangana immediately after placement of order.

### **31. List of Annexures Attached:**

Annexure No.	Description of Annexure
A	Certification of Work safety by Contractor during work
B	Acceptance Of Conditions Of Contract/ Specification/Scope Of Work
C	Certificate Of Declaration Confirming The Knowledge Of Site Condition
D	Certificate regarding ban/blacklisting of bidder
E	Form of Tender
F	Certificate by Chartered Accountant
G	EFT Form
H	Integrity pact Format
I	Safety Plan (For Information & Compliance during work)
J	BG Format for EMD



## **Bharat Heavy Electricals Limited**

**(A Government of India Undertaking)**

Electronics Division

Mysore Road, Bangalore - 560 026

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### **ANNEXURE A**

(To be made on Bidder's letter head)

Subject: Certification of Work safety by Contractor during work

This is to certify that, during the execution of the work as NIT undertaken by us, we shall be solely responsible for the Safety and health of our team consisting of site engineers, technicians and labour working at the site. Required statutory provisions governing Workmen safety and protection and accident compensation shall be our sole responsibility and entirely covered by us during the course of mobilization and execution of works.

Date:

Seal & Signature of the bidder



## **Bharat Heavy Electricals Limited**

**(A Government of India Undertaking)**

Electronics Division

Mysore Road, Bangalore - 560 026

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**ANNEXURE B**

(To be made on Bidder's letter head)

### **ACCEPTANCE OF CONDITIONS OF CONTRACT/ SPECIFICATION/SCOPE OF WORK**

It is hereby agreed by me/us that the BHEL General Conditions of Contract, Special conditions of contract, Scope cum Technical specification of work and their subsequent amendments/ Additions/deletions to clauses if any, and conditions pertaining the settlement of disputes by Arbitration form an integral part of the tender documents and that the tender submitted by me/ us is subject to the aforesaid BHEL Conditions of Contract/ Specification/Scope for the work given in NIT which has been read, understood and accepted by me/us.

Date:

Seal & Signature of the bidder



## **Bharat Heavy Electricals Limited**

**(A Government of India Undertaking)**

Electronics Division

Mysore Road, Bangalore - 560 026

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### **ANNEXURE C**

#### **CERTIFICATE OF DECLARATION CONFIRMING THE KNOWLEDGE OF SITE CONDITION**

I/We hereby declare and confirm that we have visited the project site under the subject given in NIT and acquired full knowledge and information about the site conditions, wage structure, industrial climate and total quantum of work involved. We further confirm that the above information is true and correct and we will not raise any claim of any nature due to lack of knowledge of site condition.

Date:

Seal & Signature of the bidder



## **Bharat Heavy Electricals Limited**

**(A Government of India Undertaking)**

Electronics Division

Mysore Road, Bangalore - 560 026

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**ANNEXURE D**

(To be made on Bidder's letter head)

**TO WHOM SO EVER IT MAY CONCERN**

This is to certify that our firm is not blacklisted / under hold from BHEL EDN Bangalore or banned by any unit/region/office of BHEL.

This is to certify that we / our firm is not guilty by a Court of Law in India for any offence involving fraud, dishonesty and moral turpitude

Date:

Seal & Signature of the bidder



## **Bharat Heavy Electricals Limited**

**(A Government of India Undertaking)**

Electronics Division

Mysore Road, Bangalore - 560 026

ANNEXURE E

### **FORM OF TENDER**

Having examined the invitation to bid, Instructions to Bidder, conditions of contract, Specifications, tender schedule, and other tender documents for the above work, we the undersigned, offer to construct, erect complete and maintain the whole of the said in conformity with the said bid documents on the terms and conditions and under the provisions set out or called for in the contract documents at the rates listed in the schedule of unit prices or else wherein the contract documents. We undertake if our bid is accepted, to commence the works from the date of issue of award/handing over the site and to complete and delivery the whole of the works comprised in the contract as per the time schedule agreed to the contract document.

We agree to abide by this bid for the period of three months from the date fixed for receiving the same and it shall remain binding upon us and may be accepted at any time before expiry of the period.

Until and unless a formal intimation /work order, together with your award thereof shall constitute a binding contract between us.

Date:

Seal & Signature of the bidder



# Bharat Heavy Electricals Limited

(A Government of India Undertaking)

Electronics Division

Mysore Road, Bangalore - 560 026

ANNEXURE F

## Certificate by Chartered Accountant on letter head

This is to Certify that M/S .....  
(hereinafter referred to as 'company') having its registered office at ..... is registered under MSMED Act 2006, (Entrepreneur Memorandum No (Part-II) ..... dtd: .....  
Category: ..... (Micro/Small)), (Copy enclosed).

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

1. **For Manufacturing Enterprises:** Investment in plant and machinery (i.e. original cost excluding land and building and the items specified by the Ministry of Small Scale Industries vide its notification No S.O.1722(E) dated October 5, 2006 :  
Rs. .... Lacs
2. **For Service Enterprises:** Investment in equipment (original cost excluding land and building and furniture, fittings and other items not directly related to the service rendered or as may be notified under the MSMED Act, 2006:  
Rs. .... Lacs

(Strike off whichever is not applicable)

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

Or

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

Date:

(Signature)

Name -

Membership number -

Seal of Chartered Accountant



# Bharat Heavy Electricals Limited

(A Government of India Undertaking)

Electronics Division

Mysore Road, Bangalore - 560 026

## ANNEXURE G

### Electronic Funds Transfer (EFT) OR Paylink Direct Credit Form

Please Fill up the form in **CAPITAL LETTERS** only.  
TYPE OF REQUEST(Tick one):  CREATE  CHANGE

BHEL Vendor / Supplier Code:

Company Name:

Permanent Account Number(PAN)

Address

City:

PINCODE

STATE

Contact Person(s)

Telephone No.:

Fax No.:

e-mail id:

1 Bank Name:

2 Bank Address:

3 Bank Telephone No.:

4 Bank Account No.:

5 Account Type: Savings/Cash Credit

6 9 Digit Code Number of Bank and branch  
appearing on MICR cheque issued by Bank

7 Bank swift Code(applicable for EFT only)

8 Bank IFSC code(applicable for RTGS)

9 Bank IFSC code(applicable for NEFT)

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

Date:

Authorised Signatory:

Designation:

Telephone NO. with STD Code

Company Seal

#### Bank Certificate

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

Date:

{.....}

Place:

Signature

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

Bharath Heavy Electricals Ltd.

Attn:

Electronics Division, Mysore Road,

BANGALORE - 560 026

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

NIT ISSUED BY:

Punam Mishra

Sr. Manager-SC&PV (Engg.)

Seal and sign of Bidder

**INTEGRITY PACT**

**Between**

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

**and**

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

**Preamble**

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

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

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

## **Section 1 – Commitments of the Principal**

- 1.1 The Principal commits itself to take all measures necessary to prevent corruption and to observe the following principles:-
  - 1.1.1 No employee of the Principal, personally or through family members, will in connection with the tender for, or the execution of a contract, demand, take a promise for or accept, for self or third person, any material or immaterial benefit which the person is not legally entitled to.
  - 1.1.2 The Principal will, during the tender process treat all Bidder(s) with equity and reason. The Principal will in particular, before and during the tender process, provide to all Bidder(s) the same information and will not provide to any Bidder(s) confidential / additional information through which the Bidder(s) could obtain an advantage in relation to the tender process or the contract execution.
  - 1.1.3 The Principal will exclude from the process all known prejudiced persons.
- 1.2 If the Principal obtains information on the conduct of any of its employees which is a penal offence under the Indian Penal Code 1860 and Prevention of Corruption Act 1988 or any other statutory penal enactment, or if there be a substantive suspicion in this regard, the Principal will inform its Vigilance Office and in addition can initiate disciplinary actions.

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

- 2.1 The Bidder(s)/ Contractor(s) commit himself to take all measures necessary to prevent corruption. He commits himself to observe the following principles during his participation in the tender process and during the contract execution.
  - 2.1.1 The Bidder(s)/ Contractor(s) will not, directly or through any other person or firm, offer, promise or give to the Principal or to any of the Principal's employees involved in the tender process or the execution of the contract or to any third person any material, immaterial or any other benefit which he / she is not legally entitled to, in

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

- 2.1.2 The Bidder(s)/ Contractor(s) will not enter with other Bidder(s) into any illegal or undisclosed agreement or understanding, whether formal or informal. This applies in particular to prices, specifications, certifications, subsidiary contracts, submission or non-submission of bids or any other actions to restrict competitiveness or to introduce cartelization in the bidding process.
- 2.1.3 The Bidder(s)/ Contractor(s) will not commit any penal offence under the relevant IPC/ PC Act; further the Bidder(s)/ Contractor(s) will not use improperly, for purposes of competition or personal gain, or pass on to others, any information or document provided by the Principal as part of the business relationship, regarding plans, technical proposals and business details, including information contained or transmitted electronically.
- 2.1.4 The Bidder(s)/ Contractor(s) will, when presenting his bid, disclose any and all payments he has made, and is committed to or intends to make to agents, brokers or any other intermediaries in connection with the award of the contract.

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

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

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

## **Section 4 – Compensation for Damages**

- 4.1 If the Principal has disqualified the Bidder(s) from the tender process prior to the award according to Section 3, the Principal is entitled to demand and recover the damages equivalent to Earnest Money Deposit/ Bid Security.
- 4.2 If the Principal has terminated the contract according to Section 3, or if the Principal is entitled to terminate the contract according to section 3, the Principal shall be entitled to demand and recover from the Contractor liquidated damages equivalent to 5% of the contract value or the amount equivalent to Security Deposit/Performance Bank Guarantee, whichever is higher.

## **Section 5 – Previous Transgression**

- 5.1 The Bidder declares that no previous transgressions occurred in the last 3 years with any other company in any country conforming to the anti-corruption approach or with any other Public Sector Enterprise in India that could justify his exclusion from the tender process.
- 5.2 If the Bidder makes incorrect statement on this subject, he can be disqualified from the tender process or the contract, if already awarded, can be terminated for such reason.

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

- 6.1 The Bidder(s)/ Contractor(s) undertake(s) to demand from his sub-contractors a commitment consistent with this Integrity Pact. This commitment shall be taken only from those sub-contractors whose contract value is more than 20% of Bidder's/ Contractor's contract value with the Principal.
- 6.2 The Principal will enter into agreements with identical conditions as this one with all Bidders and Contractors.
- 6.3 The Principal will disqualify from the tender process all bidders who do not sign this pact or violate its provisions.

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

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

## **Section 8 –Independent External Monitor(s)**

- 8.1 The Principal appoints competent and credible Independent External Monitor for this Pact. The task of the Monitor is to review independently and objectively, whether and to what extent the parties comply with the obligations under this agreement.
- 8.2 The Monitor is not subject to instructions by the representatives of the parties and performs his functions neutrally and independently. He reports to the CMD, BHEL.
- 8.3 The Bidder(s)/ Contractor(s) accepts that the Monitor has the right to access without restriction to all contract documentation of the Principal including that provided by the Bidder(s)/ Contractor(s). The Bidder(s)/ Contractor(s) will grant the monitor, upon his request and demonstration of a valid interest, unrestricted and unconditional access to his contract documentation. The same is applicable to Sub-contractor(s). The Monitor is under contractual obligation to treat the information and documents of the Bidder(s)/ Contractor(s) / Sub-contractor(s) with confidentiality.
- 8.4 The Principal will provide to the Monitor sufficient information about all meetings among the parties related to the contract provided such meetings could have an impact on the contractual relations between the Principal and the Contractor. The parties offer to the Monitor the option to participate in such meetings.
- 8.5 As soon as the Monitor notices, or believes to notice, a violation of this agreement, he will so inform the Management of the Principal and request the Management to discontinue or

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

- 8.6 The Monitor will submit a written report to the CMD, BHEL within 8 to 10 weeks from the date of reference or intimation to him by the Principal and, should the occasion arise, submit proposals for correcting problematic situations.
- 8.7 The CMD, BHEL shall decide the compensation to be paid to the Monitor and its terms and conditions.
- 8.8 If the Monitor has reported to the CMD, BHEL, a substantiated suspicion of an offence under relevant IPC / PC Act, and the CMD, BHEL has not, within reasonable time, taken visible action to proceed against such offence or reported it to the Vigilance Office, the Monitor may also transmit this information directly to the Central Vigilance Commissioner, Government of India.
- 8.9 The number of Independent External Monitor(s) shall be decided by the CMD, BHEL.
- 8.10 The word 'Monitor' would include both singular and plural.

### **Section 9 – Pact Duration**

- 9.1 This Pact begins when both parties have legally signed it. It expires for the Contractor 12 months after the last payment under the respective contract and for all other Bidders 6 months after the contract has been awarded.
- 9.2 If any claim is made / lodged during this time, the same shall be binding and continue to be valid despite the lapse of this pact as specified as above, unless it is discharged/ determined by the CMD, BHEL.

## **Section 10 – Other Provisions**

- 10.1 This agreement is subject to Indian Laws and jurisdiction shall be registered office of the Principal, i.e. New Delhi.
- 10.2 Changes and supplements as well as termination notices need to be made in writing. Side agreements have not been made.
- 10.3 If the Contractor is a partnership or a consortium, this agreement must be signed by all partners or consortium members.
- 10.4 Should one or several provisions of this agreement turn out to be invalid, the remainder of this agreement remains valid. In this case, the parties will strive to come to an agreement to their original intentions.
- 10.5 Only those bidders/ contractors who have entered into this agreement with the Principal would be competent to participate in the bidding. In other words, entering into this agreement would be a preliminary qualification.

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For & On behalf of the Principal  
(Office Seal)

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

Place-----  
Date-----

Witness  
Name and Address

Witness  
Name and Address

# SAFETY PLAN

PROJECT- 100 MW Floating Solar Project ,NTPC, Ramagundam

Doc ref. No. :BHE:NTPC RDM:HSE:01 dated 03.12.2019

Prepared by

PV Sys Engg and HSE Dept, BHEL EDN Bangalore

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# HEALTH SAFETY ENVIRONMENT POLICY



In BHEL, Health, Safety and Environment (HSE) responsibilities are driven by our commitment to protect our employees and people we work with, community and environment. BHEL believes in zero tolerance for unsafe work/non-conformance to safety and in minimizing environmental footprint associated with all its business activities. We commit to continually improve our HSE performance by:

- Developing safety and sustainability culture through active leadership and by ensuring availability of required resources.
- Ensuring compliance with applicable legislation, regulations and BHEL systems.
- Taking up activities for conservation of resources and adopting sound waste management by following Reduce/Recycle/Reuse approach.
- Continually identifying, assessing and managing environmental impacts and Occupational Health & Safety risks of all activities, products and services adopting approach based on elimination/substitution/reduction/control.
- Incorporating appropriate Occupational Health, Safety and Environment criteria into business decisions, design of products & systems and for selection of plants, technologies and services.
- Imparting appropriate structured training to all persons at workplace and promoting awareness amongst customers, contractors and suppliers on HSE issues.
- Reviewing periodically this policy and HSE Management Systems to ensure its relevance, appropriateness and effectiveness.
- Communicating this policy within BHEL and making it available to interested parties.

Atul Sobti  
Chairman & Managing Director

June 5, 2018

Creating  of tomorrow  
**BHARAT HEAVY ELECTRICALS LIMITED**

## CONTENTS

<b>Sr. No.</b>	<b>Description</b>
1.0	INTRODUCTION
2.0	APPLICATION
3.0	TERMINOLOGIES
4.1	ROLES AND RESPONSIBILITIES.
4.2	SAFETY OFFICER (SAFETY OFFICER)
4.3	ALL EMPLOYEES
5.0	SITE INCHARGE OF SUBCONTRACTOR
5.1	DEPLOYMENT OF TOOLS & PLANTS
5.2	DEPLOYMENT OF MANPOWER
5.3	PROVISION OF PPEs
5.4	PROVISION OF INFRASTRUCTURE
6.0	SAFETY TRAINING & AWARENESS
7.0	SAFETY COMMUNICATION
8.0	OPERATIONAL CONTROL
8.1	EXCAVATION SAFETY
9	WORK PERMIT
10	HOUSE KEEPING
11	WASTE MANAGEMENT
12	WARNINGS & SIGNS

13	EMERGENCY PREPAREDNESS
14	FIRE SAFETY PROCEDURE
15	CONTROL OF DOCUMENTS
16	SAFETY INSPECTION
17	MONTHLY SAFETY REVIEW MEETING
18	TYPICAL DETAILS OF FLOATING SOLAR POWER PLANT
19	ANNEXURES 1. Formats to be used at site 2. JSA (HIRAs) for PV floating system work, Tree felling and clearance work



## 1.0 INTRODUCTION

The purpose of this Safety Plan is to provide for the systematic identification, evaluation, prevention and control of general workplace hazards, specific job hazards, potential hazards and environmental impacts that may arise from foreseeable conditions during execution of the 100 MW Floating Solar Project.

This document shall be followed by Client's Sub-Contractors at all installation and servicing sites. In case customer specific documents are to be referred, the same will be followed in conjunction with this document.

## 2.0 APPLICATION

The document is applicable for execution of the 100 MW Floating Solar Project and it is expected that Client and Sub-contractor are committed to the following guidelines:

- Ensure that the Health and Safety of all persons at work site is not adversely affected by the work.
- Ensure protection of environment at the worksite.
- Ensure compliance at all times with the relevant statutory and contractual Safety requirements.
- Provide trained, experienced and competent personnel. Ensure medically fit personnel only are engaged at work.
- Provide and maintain plant, places and systems of work that are safe and without risk to health and the environment.
- Provide all personnel with adequate information, instruction, training and supervision.
- Effectively control, co-ordinate and monitor the activities of all personnel on the Project sites including contractors in respects of Safety.
- Establish effective communication on SAFETY matters with all relevant parties involved in the Project works.
- Ensure that all work planning takes into account all persons that may be affected by the work.
- Ensure fitness testing of all T&Ps. Lifting appliances like cranes, chain pulley blocks etc. are to be certified by competent authority.
- Ensure timely provision of resources to facilitate effective implementation of SAFETY requirements.
- Ensure continual improvements in SAFETY performance
- Ensure conservation of resources and reduction of wastage.
- Capture the data of all incidents including near misses, process deviation etc. Investigate and analyze the same to find out the root cause.
- Ensure timely implementation of correction, corrective action and preventive action.



## **3.0 TERMINOLOGIES**

### **INCIDENT**

Work- related event(s) in which an injury or ill health (regardless of severity) or fatality occurred, or could have occurred.

### **NEAR MISS**

An incident where no ill health, injury, damage or other loss occurs, but it had a potential to cause, is referred to as “Near-Miss incident”.

### **MAN-HOUR WORKED**

The total number of employee hours worked by all employees including subcontractors working in the premises. It includes managerial, supervisory, professional, technical, clerical and other workers including contract labors. Man-hours worked shall be calculated from the payroll or time clock recorded including overtime. When this is not feasible, the same shall be estimated by multiplying the total man-days worked for the period covered by the number of hours worked per day. The total number of workday for a period is the sum of the number of men at work on each day of period. If the daily hours vary from department to department separate estimate shall be made for each department and the result added together.

### **FIRST AID CASES**

First aids are not essentially all reportable cases, where the injured person is given medical treatment and discharged immediately for reporting on duty, without counting any lost time. Please refer Format 03 for requirement of items with respect to treatment for First Aid Cases.

### **LOST TIME INJURY**

Any work injury which renders the injured person unable to perform his regular job or an alternative restricted work assignment on the next scheduled work day after the day on which the injury occurred.

### **MEDICAL CASES**

Medical cases come under non-reportable cases, where owing to illness or other reason the employee was absent from work and seeks Medical treatment.

### **TYPE OF INCIDENT / ACCIDENT & THEIR REPORTING:**

The three categories of Incident / accident are as follows:

#### **Non-Reportable Cases:**



An accident, where the injured person is given medical help and discharged for work without counting any lost time.

#### **Reportable Cases:**

In this case the injured person is disabled for 48 hours or more and is not able to perform his duty.

#### **Injury Cases:**

These are covered under the heading of non-reportable cases. In these cases the accident caused injury to the person, but he still continues in his duty.

### **TOTAL REPORTABLE FREQUENCY RATE**

Frequency rate is the number of Reportable Lost Time Injury (LTI) per one Million Man hours worked. Mathematically, the formula read as:

$$\frac{\text{Number of Reportable LTI}}{\text{Total Man Hours Worked}} \times 1,000,000$$

### **SEVERITY RATE**

Severity rate is the Number of days lost due to Lost Time Injury (LTI) per one Million Man hours worked. Mathematically, the formula reads as:

$$\frac{\text{Days lost due to LTI}}{\text{Total Man Hours Worked}} \times 1,000,000$$

### **INCIDENCE RATE**

Incidence Rate is the Number of LTI per one thousand manpower deployed.

$$\frac{\text{Number of LTI} \times 1000}{\text{Average number of manpower deployed}}$$

**MANAGEMENT REPRESENTATIVE:** Representative from Project Head

**OCP:** Operation Control Procedures

**PPE:** Personal Protective Equipment



## 4.0 ROLES & RESPONSIBILITIES

### 4.1 SAFETY OFFICER

- Carry out safety inspection of Work Area, Work Method, Men, Machine & Material, and other tools and tackles. Record observations as per Format 01 on a weekly basis.
- Facilitate inclusion of safety elements into Work Method Statement.
- Highlight the requirements of safety through Tool-box / other meetings.
- Conduct investigation of all accident/dangerous occurrences & recommend appropriate safety measures.
- Advice & co-ordinate for implementation of SAFETY permit systems & OCPs. Convene SAFETY meeting & minute the proceedings for circulation & follow-up action.
- Plan procurement of PPE & Safety devices and inspect their healthiness.
- Facilitate administration of First-Aid
- Facilitate screening of workmen and safety induction.
- Conduct fire drill and facilitate emergency preparedness
- Design campaigns, competitions & other special emphasis programs to promote safety in the workplace.
- Notify site personnel for non-conformance to safety norms observed during site visits / site inspections.
- Recommend to Site In charge for immediate discontinuance of work until rectification, of such situations warranting immediate action in view of imminent danger to life or property or environment.
- To decline acceptance of such PPE / safety equipment that do not conform to specified requirements.
- Encourage raising Near Miss Report on safety along with, improvement initiatives on safety.

### 4.2 ALL EMPLOYEES

- To adopt safe working practices
- To take corrective action and preventive action in case any non-conformity is observed on product / process / system with respect to Occupational Health, Safety and Environment.
- To report all incidents including near miss to SAFETY officer or



SAFETY coordinator.

- In case any particular activity / work has extremely high consequential risk or high environmental impact, the employee shall bring it to the notice of Site In charge before starting the work.
- To ensure that the workers are engaged by the contractor for the job after undergoing induction training.
- To ensure that the persons engaged in his area, follow the safety rules like using appropriate PPEs.
- To get involved in exercises like Job Safety Analysis and Work Permit System.
- To engage licensed electricians for site electrical works.
- To report any incident including near misses or safety lapses immediately to safety officer/SAFETY coordinator
- To support/co-operate with audit team members as & when safety audits are carried out.
- To involve in investigation, if any incident occurs in his work area.
- To participate in safety promotional programmes'.
- To attend the safety committee meeting, if he is a member/invitee
- To ensure that only suitable Tackles & Plants and qualified persons are engaged.

#### **5.0 SUB-CONTRACTOR REPRESENTATIVE AT SITE**

- Shall fill-up agreement form for compliance to relevant SAFETY Plan for Site Operations.
- Shall ensure fulfillment of relevant safety requirements of 100 MW floating solar Project and practice very strictly in his area of work in consultation with his concerned engineer and the safety officer.
- Shall screen all workmen for health and competence requirement before engaging for the job and periodically thereafter as required.
- Shall not engage any employee below 18 years.
- Shall arrange for all necessary PPEs like safety helmets, belts, safety, shoes, face shield, high visibility vest, hand gloves etc. before starting the job. Shall ensure that no working men/women carry excessive weight more than stipulated in BOCW Rules and Regulations.
- Shall ensure that all Tackles & Plants engaged are tested for fitness



and have valid certificates from competent authorities.

- Shall adhere to the instructions laid down in Operation Control Procedures (OCPs Point No 8)
- Shall ensure that person working above 3.3 meter should use Safety Harness tied to a life line/stable structure.
- Shall ensure that materials are not thrown from height. Caution to be exercised to prevent fall of material from height.
- Shall report all incidents (Fatal/Major/Minor/Near Miss) to the Site engineer /SAFETY officer of the 100 MW floating solar Project.
- Shall ensure that adequate illumination is arranged during night work.
- Shall ensure that all personnel working under subcontractor are working safely and do not create any Hazard to self and to others.
- Shall ensure display of adequate signage/posters on HSE.
- Shall ensure that mobile phone is not used by workers while working.
- Shall ensure conductance of mock drill, induction training and training on the site.
- Shall ensure good housekeeping.
- Shall ensure adequate valid fire extinguishers are provided at the worksite.
- Shall adequate drinking water at work site.
- Shall ensure adequate emergency preparedness.

## 5.1 DEPLOYMENT OF TOOLS & PLANTS

- As a measure to ensure that machinery, equipment and tools being mobilized to the construction site are fit for purpose and are maintained in safe operating condition and complies with legislative and owner requirement, inspection shall be arranged by in-house competent authority for acceptance as applicable.
- The machinery and equipment to be employed for this purpose shall include but not limited to the following:
  - Mobile cranes.
  - Side Booms.
  - Forklifts.
  - Grinding machine.
  - Drilling machine.
  - Air compressors.
  - Welding machine.
  - Generator sets.
  - Dump Trucks, tractors.
  - JCBs, Excavators.



- Hand tools.
- Road Rollers
- Vibration Compactors
- Boring Machine
- Chipping Machines
- Hammer Machines
- Breakers

## 5.2 DEPLOYMENT OF MANPOWER

- As a measure to ensure that manpower being mobilized to the construction site is fit and competent for safe working, screening arrangement shall be made by the sub-contractors to fulfill contractual as well as legislative requirement.
- Examination of medical fitness shall be conducted through qualified medical professional for all workers to be deployed.

## 5.3 DEPLOYMENT OF PPEs

The following matrix recommends usage of minimum PPEs against the respective job. The PPEs shall conform to the relevant standards as listed in the reference under clause 3.0 and bear ISI mark. All the PPEs shall be periodically checked for its quality before issue. The users shall be advised to check the PPEs themselves for any defect before putting on. The defective ones shall be repaired/ replaced. The issuing agency shall maintain register for issue and receipt of PPEs. The Helmets shall have logo or name (abbreviation of agency name permitted) affixed or printed on the front. The body harnesses shall be serial numbered.

Sl. No	Type of work	PPEs (Subject to applicability of process only)
1	Concrete and asphalt mixing	Nose mask, hand glove, apron and gum boot
2	Welders/Grinders/ Gas cutters	Welding/face screen, apron, hand gloves. Helmet fitted with welding shield is preferred for welders
3	Stone/ concrete breakers	Safety goggles, hand gloves
4	Electrical Work	Rubber hand glove, Electrical Resistance shoes
5	Insulation Work	Hand gloves
6	Work at height	Double lanyard full body harness, Fall arrestor (specific cases)
7	Grit/Sand blasting	Blast suit, blast helmet, gloves
8	Painting	Plastic gloves, Respirator (for spray Painting)



Besides the PPEs mentioned above, the persons shall use helmet and safety shoe. The visitors shall be issued Helmet and any other PPEs as deemed appropriate for use in the area of work.

#### **Color Code for Helmets:**

1. Workmen: Yellow.
2. Safety staff: Green.
3. Engg, supervisor, visitor, site in charge : White.

### **MEDICAL FACILITIES**

#### **FIRST AID PROVIDER**

- Every injury shall be treated, recorded and reported.
- Refresher course on first aid shall be conducted as necessary.
- List of qualified first aiders and their contact numbers should be displayed at major locations.

#### **FIRST AID BOX**

- First aid facilities shall be provided and maintained.
- The first aid box shall be kept by first aider who shall always be readily available during the working hours of the work place. His name and contact number to be displayed on the box.
- The first aid box shall be distinctly marked with a Red Cross on white background.
- Details of contents of first aid box is given in **Format No.02**
- Monthly inspection of First Aid Box shall be carried out by the Site In charge as per **format no 02**.

#### **HEALTH CHECKUP**

The persons engaged at the site shall undergo health checkup as per the **format no 03** before induction.

- a. Height workers
- b. Drivers/crane operators/riggers
- c. Confined space workers
- d. Shot/sandblaster
- e. Welding and NDE personnel.

#### **PROVISION OF EMERGENCY VEHICLE**

In case of any emergency a vehicle shall be made available at



workplace on short notice to handle any emergency. This shall be by way of tying up with customer's medical centre /local hospitals/ sub-contractors by mutual aid agreement.

## 6.0 SAFETY TRAINING & AWARENESS

### SAFETY INDUCTION TRAINING

All persons entering into project site shall be given SAFETY induction training by the SAFETY officer of 100 MW floating solar Project.

In-house induction training subjects shall include but not limited to:

- Briefing of the Project .
- Safety objectives and targets.
- Site SAFETY rules.
- Site SAFETY hazards
- First aid facility.
- Emergency Contact No.
- Accident reporting.
- Fire prevention and emergency response.
- Proper safety wear & gear must be issued to all the workers being registered for the induction.
- They must arrive fully dressed in safety wear & gear to attend the induction.
- Any one failing to conform to this safety wear& gear requirement shall not qualify to attend.
- Each employee shall undergo safety induction training

### TOOL BOX TALK

- Tool Box talk shall be conducted by safety officer to work groups prior to the start of work. The agenda shall consist of the following:
  - Details of the job being intended for immediate execution.
  - The relevant hazards and risks involved in executing the job and their control and mitigating measures.
  - Specific site condition to be considered while executing the job like high temperature, humidity, unfavorable weather etc.
  - Recent non-compliances observed.
  - Appreciation of good work done by any person.
- Record of Tool box talk shall be maintained as per format no 06

### TRAINING ON HEIGHT WORK

Training on height work shall be imparted to all workers working at height by in- house/external faculty. The training shall include



following topics:

- Use of PPEs
- Use of fall arrester, life line.
- Safe climbing through monkey ladders.
- Inspection of PPEs.
- Medical fitness requirements.
- Mock drill on rescue at height.

Dos & Don'ts during height work.

### **SAFETY PROMOTION-SIGNAGE, POSTERS,**

#### **Display of SAFETY posters and banners.**

- Site shall arrange appropriate posters, banners, slogans in local/Hindi/,English languages at workplace

#### **Display of SAFETY signage**

- Appropriate SAFETY signage shall be displayed at the work area to aware workmen and passersby about the work going on and do's and don'ts to be followed.

### **SAFETY awareness program/SAFETY training program**

- Site will arrange SAFETY awareness program periodically on different topics including medical awareness for all personnel working at site.
- SAFETY officer shall arrange training program based on site condition

## **7.0 SAFETY COMMUNICATION**

### **MONTHLY SAFETY REPORTING**

- SAFETY information of Site shall be reported monthly through Monthly Site SAFETY report (MSR) as per format 04
- The period of reporting shall be 1st of each calendar month.

## **8.0 OPERATIONAL CONTROL**

### **8.1 EXCAVATION WORK SAFETY:**

- Avoid damage / personal injury during excavation work at sites.
- Ensure proper barricading by ribbon or Hard barricading of the excavated area.



- Proper side slopes of the excavation as per the type of soil should be maintained.
- Where side slopes cannot be provided due to space constraints before excavation, sheet piling must be done to prevent the collapse of earth.
- As soon as the job is completed, immediate back filling to be done.
- No personnel be allowed within the swing area of mechanical excavator when work is in progress.
- Proper lighting to be arranged when the excavation is carried out at night.
- Excavated earth to be dumped/ stored in a designated place only.
- Surplus earth to be transported and disposed in the authorized area.
- Site safety department to identify all possible hazard areas related to excavation work and ensure control.
- Use proper PPE's.
- Ensure adequate caution signs are displayed in the area of operation.

## **9..WORK PERMIT SYSTEM**

- The following activities shall come under Work Permit System
  - a. Height working of 3.3 metre and above
  - b. Excavation more than 4 meter depth
  - c. Heavy lifting by machinery
- “SAFETY Procedure for Work Permit System” shall be followed while implementing permit system.
- Permit applicant shall apply for work permit of particular work activity at particular location before starting of the work with Job Hazard Analysis.
- Permit signatory shall check that all the control measures necessary for the activity are in place and issue the permit to the permit holder.
- Permit holder shall implement and maintain all control measures during the period of permit  
He will close the permit after completion of the work. The closed permit shall be archived with SAFETY personnel of site.

## **10. HOUSEKEEPING**

- Proper housekeeping to be maintained at work place and the following are to be taken care of on daily basis.
- All surplus earth and debris are removed/disposed off from the working areas to identified locations.
- Unused/Surplus cables, steel items and steel scrap lying scattered at different places/elevation within the working areas are removed to identified locations.
- All wooden scrap, empty wooden cable drums and other combustible packing materials, shall be removed from workplace to identified locations. Sufficient waste bins shall be provided at



different work places for easy collection of scrap/waste. Scrap chute shall be installed to remove scrap from higher location.

- Access and egress (stair case, gangways, ladders etc.) path should be free from all scrap and other hindrances.
- Workmen shall be educated through tool box talk about the importance of housekeeping and encourage not to litter.
- Fabricated steel structures, pipes & piping materials shall be stacked properly.
- No parking of trucks/trolleys, cranes and trailers etc. shall be allowed in the camp, which may obstruct the traffic movement as well as below LT/HT power lines.
- Utmost care shall be taken to ensure over all cleanliness and proper upkeep of the working areas.

## **11. WASTE MANAGEMENT**

### **STORAGE AND COLLECTION**

- Different types of rubbish/waste should be collected and stored separately.
- Paper, oily rags, smoking material, flammable, metal pieces should be collected in separate bins with close fitting lids.
- Rubbish should not be left or allowed to accumulate on construction and other workplaces.
- Construction rubbish should not be burnt near working site.

### **SEGREGATION**

- Earmark the scrap area for different types of waste.
- Store wastes away from building.
- Oil spill absorbed by non-combustible absorbent should be kept in separate bin.
- Clinical and first aid waste stored and incinerated separately.

### **DISPOSAL**

- Sufficient containers and scrap disposal area should be allocated.
- All scrap bin and containers should be conveniently located.
- Provide self-closing containers for flammable/spontaneously combustible material.
- Keep drainage channels free from choking.
- Maintain a schedule for collection and disposal of waste.

## **12. WARNING AND SIGNS**

- Appropriate sign to be displayed at scrap storage area
- No toxic, corrosive or flammable substance to be discarded into public sewage system.
- Waste disposal shall be in accordance with best practice.



### **13.0 :EMERGENCY PREPAREDNESS AND RESPONSE**

- Emergency preparedness and response capability of site shall be developed as per project requirement.
- Availability of adequate number of first aid providers and fire fighters shall be ensured by sub-contractors
- Assembly point shall be earmarked and access to the same from different location shall be shown
- Fire exit shall be identified and pathway shall be clear for emergency escape in Stores area and office area.
- Appropriate type and number of fire extinguishers shall be deployed as per fire extinguisher deployment plan of BHEL and validity shall be ensured periodically through inspection
- First aid boxes shall be strategically placed at work places to cater to emergency needs.

### **14.0 : FIRE SAFETY PROCEDURE**

1. Site-in-charge / Safety Officer will make periodical review of the site Fire Protection, Prevention Preparedness, Site conditions and available fire protection equipment.
2. A mutual aid agreement with local Fire station for availability of Fire tender shall be made.
3. It is very imperative good contact with Local fire station for availability of Fire tender in case of emergencies, in addition to their own fire equipment.
4. Fire Protection, Prevention and Preparedness Inspections - The Contractor /Sub-Contractor will be required to make frequent fire prevention inspections of his work site and operating facilities. Deficiencies will be corrected at once.
5. Emergency telephone number to be displayed at all important places.

### **15. CONTROL OF DOCUMENTS**

All documents shall be controlled as per SAFETY Procedure for Document Control.

### **16.0 SAFETY INSPECTION**

Inspection on SAFETY for different activities being carried out at site shall be done to ensure compliance to safety requirements.

### **DAILY SAFETY CHECKS**

Both the Site Supervisors and SAFETY Supervisors are to conduct daily site safety inspection around work activities and premises to ensure that work methods and the sites are maintained to the acceptable standard.

### **INSPECTION OF PPE**

- PPEs shall be inspected by SAFETY officer at random once in a



week as per **Format no 07** for its compliance to standard and compliance to use and any adverse observation shall be recorded in the PPE register.

- The applicable PPEs for carrying out particular activities are listed below.
- The IS standard to be complied to, for different PPEs, is given as follows:

#### RELEVANT IS-CODES FOR PERSONAL PROTECTION

IS: 2925 – 1984	Industrial Safety Helmets.
IS: 4770 – 1968	Rubber gloves for electrical purposes.
IS: 5557 – 1969	Industrial and Safety rubber knee boots.
IS: 5983 – 1978	Eye protectors.
IS: 9167 – 1979	Ear protectors.
IS: 3521 – 1983	Industrial Safety Belts and Harness

#### INSPECTION OF Tools & Plants

- A master list of Tools & Plants shall be maintained by each subcontractor.
- All Tools & Plants being used at site shall be inspected by SAFETY officer once in a month as per **Format no 08** for its healthiness and maintenance.
- The Tools & Plants which require third party inspection shall be checked for its validity during inspection.
- The certificate of Tools & Plants shall be monitored as per Format no **09**

#### INSPECTION OF CRANES AND WINCHES

- Cranes and winches shall be inspected by the operator through a daily checklist for its safe condition (as provided by the equipment manufacturer) before first use of the day.
- Cranes and Winches shall be inspected by SAFETY officer once in a month as per **format no 10** for healthiness, maintenance and validity of third party inspection and SWL shall be displayed.
- The date of third party inspection and next due date shall be painted on cranes and winches.

#### INSPECTION ON HEIGHT WORKING (ONLY FOR CMCS AS APPLICABLE)

- Inspection on height working shall be conducted by SAFETY Coordinator of Construction agency before start of work to ensure safe working condition including provision of
  - Safety Harness
  - Fencing and barricading
  - Warning signage
  - Covering of opening
  - Proper scaffolding with access and egress.
  - Illumination
- Inspection on height working shall be conducted once in a week by SAFETY officer as per format no 11



- Height working shall not be allowed during adverse weather.

### INSPECTION ON ELECTRICAL INSTALLATION /APPLIANCES

- Ensure proper earthing in electrical installation
- Use ELCB at electrical booth.
- Electrical installation shall be properly covered at top where required
- Use appropriate PPEs while working
- Use portable electrical light < 24 V in confined space and potentially wet area.
- Monthly inspection shall be carried out as per format no 12

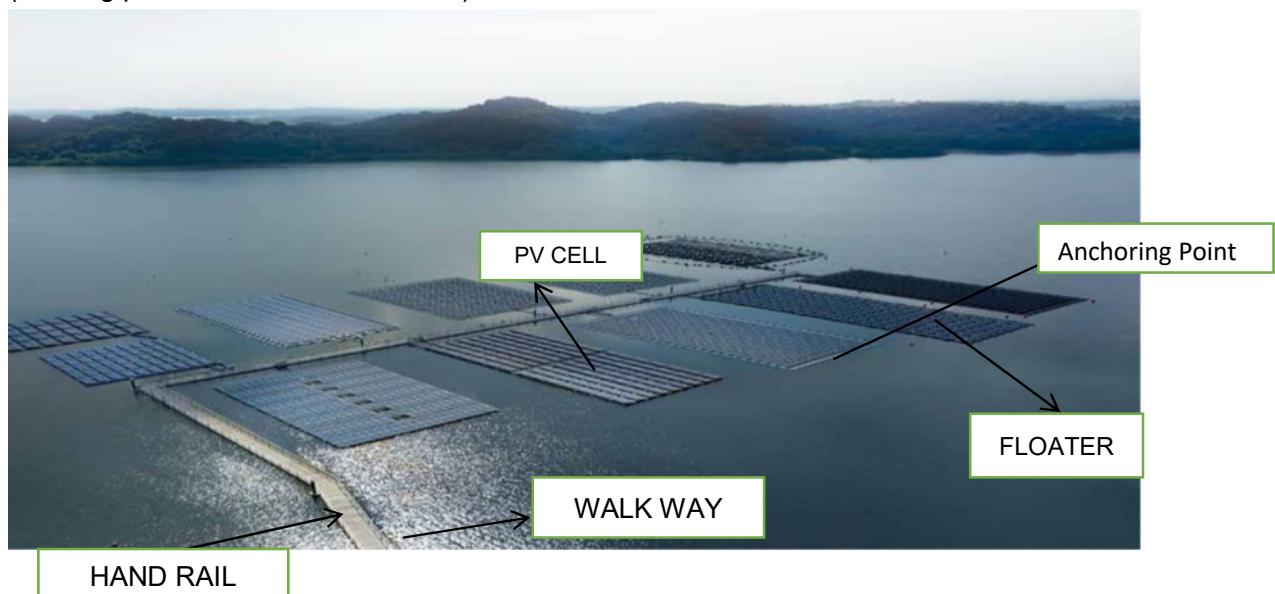
### 17. MONTHLY SAFETY REVIEW MEETING

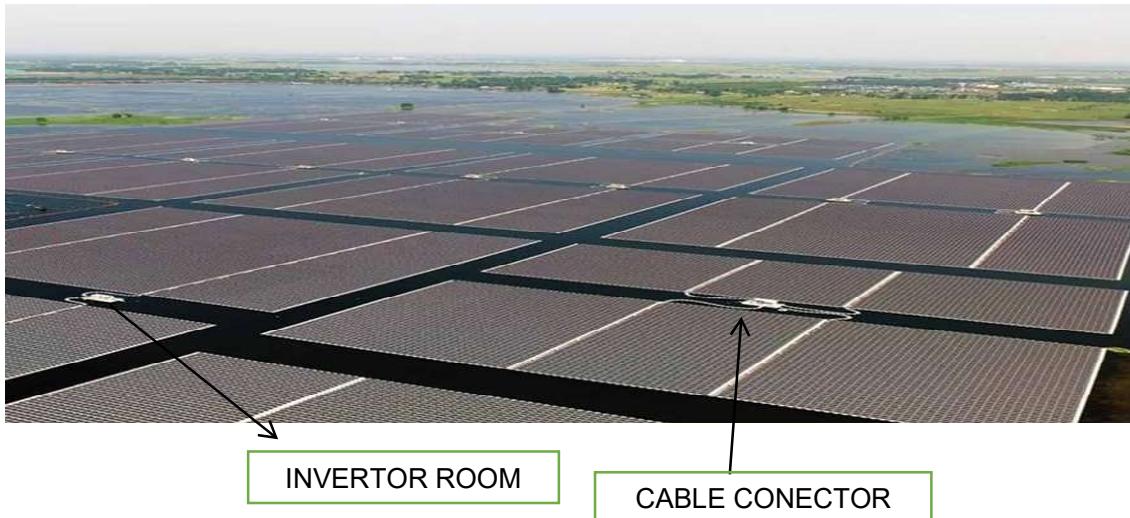
- Site shall hold SAFETY review meeting every month to discuss and resolve SAFETY issues of site and improve SAFETY performance. It will also discuss the incidents occurred since previous meeting its root cause and corrective action and preventive action.
- The meeting shall be chaired by Site In charge, convened by SAFETY coordinator and attended by all HOS, Site In charge of Subcontractors and SAFETY representative of Subcontractors.
- MOM on the discussion will be circulated to the concerned for implementation.

### 18.0 TYPICAL DEPICTION OF FLOATING SOLAR PV SYSTEM (FOR GENERAL REFERENCE)

#### FLOATING SOLAR POWER ERECTION SAFETY

(Floating platform Under construction)





(Typical View of completed Solar PV Floating platform)

#### **SYSTEM COMPONENTS:**

1. Solar PV modules for conversion of solar radiation to electrical energy/
2. Anchoring systems: Anchoring system refers to permanent under-water structure to secure floating platforms.
3. Pontoon: A pontoon is floatation device with enough buoyancy to float by itself as well as with a heavy load.
4. Floats: Multiple plastic hollow floats with effective buoyancy to self-weight ratio are combined over and over again, forming a giant pontoon. The floats are typically made of HDPE (high density polyethylene), known for its tensile strength, maintenance free property.
5. Mooring system: A mooring system usually refers to any permanent structure on the banks to which floats are secured.
6. Cables and connectors: Electricity is drawn from the solar array and transported to the land. Therefore, the power can be fed to the grid or stored in batteries.

#### **RISKS AND HAZARDS:**

1. Identified as per Job Risk Assessment exercise and HIRA Doc 1 and 2 attached.

#### **PRECAUTIONS:**

1. As mentioned in HIRA Doc 1 and 2.

#### **19.0 SITE RECORDING FORMATS**

HAZARD IDENTIFICATION AND RISK ASSESSMENT (HIRA) DOC.1	
<b>Job Task:</b> Erection of materials and over all site work	<b>Equipment #:</b> Hydra/Crane, Welding M/c,
<b>Project/Location:</b> 100 MW Floating Solar Project, NTPC, Ramagundam	<b>Analysis done by:</b> Roney Das, QUEST <b>Reviewed by:</b> BHEL EDN, Safety Dept
<b>PPE required:</b> Safety helmet, vest, shoes, hand gloves, etc. (IS standard)	<b>Date Initiated:</b>
<b>Emergency Plan:</b> Yes	<b>Revised date:</b>
<b>Tools used:</b> Crane, Chain pulleys, Sling, D-shackle, Bow shackle, Gas cutting set, Welding set.	<b>Chemicals used:</b> NO

Job activities/Work	Potential Hazards	Risk/Hazard Effect	Safety Precautions	PPE
<b>Structural materials and Equipment shifting and Liftin g</b>	<p>1. Pinching of leg/hands of workmen while handling Structural members.</p> <p>2. Swinging of load.</p> <p>3. Poor weather condition.</p> <p>4. Overloading of crane.</p> <p>5. Unauthorized operation of crane by helper.</p> <p>6. Failure of lifting tools and tackles due to use of damaged / under capacity tools and tackles.</p>	<p>1. Serious injuries.</p> <p>2. Property damage.</p> <p>3. Chances of Fatality</p>	<p>1. Pre work cautioning &amp; proper Permit must be followed before starting the work.</p> <p>2. Ensure that workmen keep their body parts away from pinching points.</p> <p>3. Ensure proper stacking of Structural members.</p> <p>4. While fit up work structural member must be secured safely.</p> <p>5. Qualified opeator, rigger and signalman should be assigned.</p> <p>6. Ensure use of tag lines at both ends to control the load.</p> <p>7. Use crane/Hydra within the capacity and do not over load.</p> <p>7a. Safe working load should be displayed on all matl handling eqpt.</p> <p>8. Avoid work in poor visibility / poor weather condition / Raining and in heavy wind.</p> <p>9. Affected area to be cordoned off and caution sign to be posted to avoid unauthorized entry.</p> <p>10. Ensure to use of certified and tested lifting tools and tackles with proper capacity, color code &amp;identification number.</p>	<p>Safety shoes, Safety Helmet, Safety goggles, Safety vest, Hand gloves.</p>

Job activities/Work	Potential Hazards	Risk/Hazard Effect	Safety Precautions	PPE
<b>Erections of structural materials with the help of crane&amp; rigging activity. (as applicable to CMCS building)</b>	1. Pinching points. 3. Failure of lifting tools and tackles due to use of damaged / under capacity tools and tackles. 4. Hit by load due to swinging.	1. Serious injuries. 2. Property Damage.	1. Ensure qualified Crane operator and competent Signal man/Riggers. 3. Ensure that workmen keep their hands / leg away from pinching points. Proper communication & co-ordination with coworker. 4. Ensure proper supervisoin. 5. Ensure to use of certified and tested lifting tools and tackles with proper capacity. 6. Softener or packing shall be provided in between slings and structural member. 7. While lifting ensure no one comes under suspended load. 7a. Safe working load should be displayed on all matl handling eqpt. 8. Ensure use of tag lines to control the load. 9. Lifting affected area to be cordoned off & caution sign to be posted to avoid unauthorized entry. 10. Daily Inspection checklist of crane/hydra shall be ensured by users.	Safety shoes, Safety Helmet, Safety goggles, Safety vest, Hand gloves. Full body harness.

Job activities/Work	Potential Hazards	Risk/Hazard Effect	Safety Precautions	PPE
<b>Erection/Dismantling Of Scaffolding (Only for CMCS area)</b>	1. Dropped objects 2. Slips, trips and falls 3. Striking against 4. Collapse and fall of scaffold structure	1. Serious injuries. 2. Property Damage.	1. Performing group shall conduct check of tool box relevant to the job before the work start 2. Use tools belt for containment of loose objects 3. Secure the tubes, planks and other objects when lifting/lowering 4. Barricade the work area and place sign boards 5. Do not climb with components 6. All scaffold platforms shall be secured/lashed 7. Ensure area is not congested. 8. Maintain safe distance from energized power lines and heat sources 9. Ensure that only authorized/certified personnel are engaged in erecting & dismantling scaffolding 10. Examine all scaffold components prior to use 11. Only essential personnel are allowed access to scaffold	Safety shoes, Safety Helmet, Safety goggles, Safety vest, Hand gloves, Full body harness

Job activities/Work	Potential Hazards	Risk/Hazard Effect	Safety Precautions	PPE
<b>Gas cutting and Welding work</b>	1. Fire and Explosion 2. Welding fumes 3. Fall of gas cylinders while transporting	1. Injury from cylinder fall 2. Burn injuries due to fire, spatters. 3. Eye injury to nearby workers 4. Property damage due to cylinder blast	1. Ensure flash back arrester /NRV on cylinder and torch side. 2. The combustible material shall be removed from site before starting the job. 3. No welding cable shall pass over the combustible materials/cylinders. 4. Provide fire extinguisher. 5. Check the leakage of cylinder with soap solution. 6. Hot work permit should be taken and Fire watch person should be identified & only authorized person allow to work. 7. Ensure appropriate safety goggles to all workers. 8. Provide suitable face shield for welders. 9. Use gas cylinders trolley for internal shifting of gas cylinders. 10. Ensure Fixing of the valve caps while shifting/storing the gas cylinders. 11. O2 and LPG Gas cylinders shall be stored separately chained and secured. 12. Ensure safe storage of diesel fuel if any.	Safety shoes, safety helmet, gloves, goggles. Face shield.
<b>Electrical work</b>	1. Electrical Shock 2. Fire	1. Injury 2. Property damage. 3. Fatality	1. Electric supply should be taken through ELCB of 30mA sensitivity. 2. All power cables should be protected from damage by improper laying. 3. All m/c and panel board should be protected against rain. 4. Proper Earthing shall be provided to all electrical equipment. 5. Ensure all portable power tools are tested and inspected by concern electrical engineer. 6. D.B Should not be overloaded.	Safety shoes, safety helmet, Rubber gloves, goggles.

Job activities/Work	Potential Hazards	Risk/Hazard Effect	Safety Precautions	PPE
<b>Removal Of Lifting Arrangement</b>	1. Fall of materials/objects from height.	1. Injuries 2. Property damage.	1. Trained and Authorized person only allow to perform the job. 2. All tools & tackles should be tightened by rope to prevent fall from height. 3. Safe lowering procedure should be ensured. 4 The area must be cordoned off. 5. Life line must be provided for anchoring safety harness.	Full body harness, Safety shoes, safety helmet, gloves, goggles
<b>Excavation Work by JCB/manually</b>	1. Fall of person 2. Soil collapse	1. Serious injuries.	1. Install cordon/warning tape around the excavated area. 2. No person allowed in during the excavation by JCB. 3. Work area clearance certificate and excavation permit must be taken before starting the work. 4. JCB inspection should be carried out before the job commencement	Safety shoes, safety helmet, goggles, hand gloves, vest.
<b>Civil work</b>	1. Slippery approach. 2. While work at height, fall hazard. 3. Electrical hazard for electric line/equipment's 4. Sharp edges of construction materials. 5. Chemical component of cement.	1. Slip trip fall 2. injuries Property damage. 3. Eye injuries, skin irritation	1. Preparation of proper approach with proper slope, steps, hand railing/ ropes. 2. Barricading /cordonning the area. 3. Display safety posters 4. Inspection of all hand tools before use. 5. Ensure proper working platform	Safety shoes, safety helmet, goggles, gloves, full body harness, nose masks.

Job activities/Work	Potential Hazards	Risk/Hazard Effect	Safety Precautions	PPE
<b>Work on Water body (NTPC reservoir)</b>	<ol style="list-style-type: none"> <li>1. Trip slip and fall hazard on floats</li> <li>2. Chance of fall into water</li> <li>3. Electrical hazard.</li> <li>4. Effect of extreme weather condition such as Sun burn and heat stress.</li> </ol>	<ol style="list-style-type: none"> <li>1. Physical fall shock - chance of injury or fatality.</li> <li>2. Fall from the work area in to the water resulting in suffocation or drowning.</li> <li>3. Chance of sun burn or sun stroke</li> </ol>	<ol style="list-style-type: none"> <li>1. Before start of work check all documents (such as work permit, TPI certificates of all tools and tackles and test certificates of life saving boat)</li> <li>2. Ensure all work men working in or very near to water to wear Life jackets</li> <li>3. Ensure availability of rescue boat in water with spare life jackets and floatation air tubes</li> <li>4. Make a proper approach into the water body with proper slope or steps if required</li> <li>5. In case of emergency, rescue team consisting of expert swimmers and above rescue boat to be always prepared.</li> <li>6. In case of underwater work such as diving related work, an expert for checking diving equipment prior to commencement of work. Also person shall be present for observing and monitoring diving activity during dive sessions.</li> <li>7. Arrangement to be in place to summon Ambulance on Call to site for emergency shifting of any injured person to the nearest hospital.</li> <li>8. Ensure drinking water to avoid de-hydration</li> <li>9. Ensure Wireless / mobile/ walky- talky arrangement between site to control room/office</li> <li>10. Ensure non-contamination of water body during the activities</li> </ol>	<p>Safety shoes, safety helmet, goggles, hand gloves, Reflective life jackets.</p> <p>Certified and compliant Diving gear to be used by divers if required</p> <p>One dedicated Rescue boat with life jackets</p>

	person	the day	
	Job Supervisor / Engineer	Safety Officer	

## HAZARD IDENTIFICATION AND RISK ASSESSMENT (HIRA) Doc 2

<b>Job Task:</b> Vegetation clearance at PV plant area	<b>Equipment #:</b> Hydra/Crane/JCB	
<b>Project/Location:</b> 100 MW Floating Solar Project, NTPC, Ramagundam	<b>Analysis done by:</b> Roney Das, QUEST	<b>Reviewed by:</b> BHEL
<b>PPE required:</b> Safety helmet, vest, shoes, hand gloves, goggles etc.	<b>Date Initiated:</b>	<b>Revised date:</b>
<b>Emergency Plan:</b> Yes		
<b>Tools used:</b> Hand operated Power saws, Cutting tools	<b>Chemicals used:</b> No	

Sequence of Job Steps	Potential Hazards	Risk/Hazard Effect	Safety Precautions	PPE
<b>Entry to Vegetation/ Undergrowth area (Area Survey)</b>	<p>1. Common Natural Hazard :</p> <p>A) Snake Bite, Insect bites like mosquito, Honey bee sting etc</p> <p>B) Falling branches, trees</p> <p>C) Fall, trip</p>	<p>1. Injuries</p> <p>2. Fatality</p> <p>3. Property damage</p>	<p>1. Before entry to the forest check for valid permit, and submit all documents of workers like medical fitness certificates, Group insurance, etc.</p> <p>2. Briefly discuss about the job and identify line and markings of area or path of work before commencing</p> <p>3. Organize for presence of a local person before start of work.</p> <p>4. Exercise caution while carrying out work and before commencement of works. Address the workers to be always careful.</p> <p>5. Work is allowed during day hours only</p> <p>6. Field First aid box along with required medical kit (incl. snake antidote, insect repellent cream) shall be available near the site</p>	<p>Safety knee height shoes (Gumboot)</p> <p>Safety Helmet,</p> <p>Safety goggles,</p> <p>Safety vest, Hand gloves, Full body protective apron</p> <p>, Nose mask</p>

Sequence of Job Steps	Potential Hazards	Risk/Hazard Effect	Safety Precautions	PPE
<b>Cutting and shifting of trees with the help of sawing machine, crane &amp; rigging activity.</b>	1. Pinching points. 2. Failure of lifting tools and tackles due to use of damaged / under capacity tools and tackles. 3. Failure of sawing machine. 4. Hit by load due to swinging. 5. Tree fall or collapse. 6. Electric shock 7. drowning due to sinking in swamp/ loose soil and falling in deep pits 8) Fall of logs during loading 9) Toppling of machinery due to loose soil 10) contact with Overhead live electric cable	1. Cut injuries 2. Serious injuries 3. Fatality 4. Property damage	1. Check Submit all TPI certificates and check for proper working of cutting machines 2. Ensure presence of qualified Signalman/Rigger. 3. Ensure that workmen keep their hands / leg away from pinching points. Proper communication & co-ordination with coworker. 4. Ensure proper supervision. 5. Ensure to use certified and tested lifting tools and tackles with proper capacity. 6. Safe working load should be displayed on all matl handling eqpt. 7. While lifting ensure no one comes under suspended load. 8. Ensure use of tag lines to control the load. 9. Lifting affected area to be cordon off & caution sign to be posted to avoid unauthorized entry. 10. Only authorized operator with valid license to operate the crane. 11. Daily Inspection checklist of crane/JCB/Cutting machine shall be ensured by users. 12. Stationary type Machinery shall be located in leveled platform and the same shall be ensured by the site engineer. 13. Ensure that soil bearing capacity is adequate to bear the load of machinery 14. Keep cutting tools sharp and in good condition. 15. Avoid work with oily hands. 16. Precautions for swamp/ loose soil / deep pits, etc.	Safety Knee height shoes(Gumboot), Safety Helmet, Safety goggles, Safety vest, Hand gloves, Reflective jacket, rain coat,

Sequence of Job Steps	Potential Hazards	Risk/Hazard Effect	Safety Precautions	PPE
<b>Housekeeping</b>	1. Chances of fire during friction 2. Slip Trip Fall	1. Injuries	1. Clean area properly 2. Not to dump bushes and trees in work area 3. Carry out stacking in designated area in orderly manner for further disposal. 4. Be aware of Fire fighting equipment locations	Safety shoes (Gumboots), safety Helmet, Vest, goggles, Hand gloves.

PROFORMA OF BANK GUARANTEE FOR EARNEST MONEY  
(On non -Judicial paper of appropriate value)

Bank Guarantee No. ....

Date: .....

To  
(Employer's Name and Address)  
.....

Dear Sirs,

In accordance with the terms and conditions of Invitation for Bids/Notice Inviting Tender No.....1(Tender Conditions), M/s. .... having its registered office at 2 (hereinafter referred to as the 'Tenderer'), is submitting its bid for the work of.....3 invited by .....4.(name of the Employer) through its Unit at .....(

The Tender Conditions provide that the Tenderer shall pay a sum of Rs..... as Earnest Money

Deposit in the form therein mentioned. The form of payment of Earnest Money Deposit includes Bank Guarantee executed by a Scheduled Bank.

In lieu of the stipulations contained in the aforesaid Tender Conditions that an irrevocable and unconditional Bank Guarantee against Earnest Money Deposit for an amount of .....5 .....

is required to be submitted by the Tenderer as a condition precedent for participation in the said Tender and the Tenderer having approached us for giving the said Guarantee,

we, the .....[Name & address of the Bank]

..... having our Registered Office at .....

.....(hereinafter referred to as the Bank) being the Guarantor under this Guarantee, hereby irrevocably and unconditionally undertake to forthwith and immediately pay to the Employer without any demur, merely on your first demand any sum or sums of Rs. 5

.....(in words Rupees.....) without any reservation, protest, and recourse and without the beneficiary needing to prove or demonstrate reasons for its such demand.

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

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

The payment so made by us under this Guarantee shall be a valid discharge of our liability for payment hereunder and the Tenderer shall have no claim against us for making such payment.

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

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

This Guarantee shall be irrevocable and shall remain in force upto and including

.....  
6 and

shall be extended from time to time for such period as may be desired by the Employer.

This Guarantee shall not be determined or affected by liquidation or winding up, dissolution or change of constitution or insolvency of the Tenderer but shall in all respects and for all purposes be binding and operative until payment of all money payable to the Employer in terms hereof. However, unless a demand or claim under this Guarantee is made on us in writing on or before the.....  
7 we shall

be discharged from all liabilities under this Guarantee.

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

Notwithstanding anything to the contrary contained hereinabove:

- a) The liability of the Bank under this Guarantee shall not exceed.....5.....
- b) This Guarantee shall be valid up to..... 6
- c) Unless the Bank is served a written claim or demand on or before \_\_\_\_\_7 all rights under this guarantee shall be forfeited and the Bank shall be relieved and discharged from all liabilities under this guarantee irrespective of whether or not the original bank guarantee is returned to the Bank

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

For and on behalf of

(Name of the Bank)

Date.....

Place of Issue.....

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**TECHNICAL SPECIFICATION:  
SUPPLY OF BOS ITEMS AND I&C OF 100MW(AC)  
FLOATING SOLAR PV POWER PLANT FOR NTPC AT  
RAMAGUNDAM THERMAL POWER PLANT**

PS-439-1332

Rev No: 00

PAGE : 1 OF 23

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**Technical specification  
for  
Supply of Balance Of System items, Installation & Commissioning  
of**

**100MW (AC) Floating Solar Photovoltaic Grid-connected Power plant  
(Excluding Installation of floating SPV module array with SCB, ESE LA's  
and associated earthing) for NTPC at  
Ramagundam Thermal Power Plant, Telengana**

Revision details: Rev:00	Prepared  Vipindas C P	Approved:  M Sreenath	Date:  10.03.2020
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PS-439-1332

Rev No: 00

PAGE : 2 OF 23

1.0	Introduction
1.1	Overall project outline of 100MW (AC) Floating solar photovoltaic power plant
1.2	Scope of this tender specification
1.3	Enclosures to this tender specification (Tender purpose only)
1.4	Location / address of power plant
2.0	Bidder's scope of supply and works
3.0	BHEL scope of Supplies (I&C in bidder scope)
4.0	List of documents to be submitted along with the technical bid
5.0	Technical specification for supply , installation and commissioning
5.1	Electrical power for I&C works and Bore-well for CMCS
5.2	Construction of temporary yards for safe storage of bidder supplied items
5.3	Movement of items received at site:
5.4	Laying and termination of 1.1kV, 1CX400 sq.mm XLPE Al Un-armoured cable from SCB to PCU through cable tray
5.5	Erection of Equipment on Inverter Platform (IP) and Local Pooling Switchgear Floating Platform (LPSFP)
5.6	Earthing of Equipment on Inverter Platform (IP) and Local Pooling Switchgear Floating Platform (LPSFP)
5.7	Laying and Termination of 1Cx400sq.mm LT AC power cables at PCU and Inverter Transformer
5.8	Laying and termination of 33KV(E), 1CX150 sq.mm XLPE Al cable from Inverter transformer to HT panel and to local pooling switchgear floating platform
5.9	Laying and termination of 33KV(E), 1CX630 sq.mm XLPE Al cable from local pooling switchgear floating platform (LPSFP) to reservoir embankment
5.10	Laying and termination of 33KV(E), 1CX630 sq.mm XLPE Al cable from reservoir embankment to IC-OG panels and to indoor switchgear room
5.11	Identification marking of cables using cable tags
5.12	Installation of electrical panels in CMCS room
5.13	Design, Supply, Laying and installation of Control / data / instrumentation / Aux power cables for IP, LPSFP, CMCS, IC-OG panels and indoor switchgear panels
5.14	Erection of 33kV transformer
5.15	Specification of Earthing system: As per attached Annexure
5.16	Laying and termination of 33KV(E), 3CX240 sq.mm XLPE Al cable from Inverter transformer and Aux transformer to HT panel
5.17	Laying and termination of 33KV(E), 2 runs of 3CX240 sq.mm XLPE Al cable from HT panel to outdoor switchyard
5.18	Identification marking of cables using cable tags
5.19	Installation of electrical panels in main control room
5.20	Installation of electrical panels in outdoor switchyard small control room
5.21	Auxiliary AC/DC power supply system
5.22	Design, supply, installation of security room with electrical fittings
5.23	Supply and installation of Weather monitoring system



**TECHNICAL SPECIFICATION:  
SUPPLY OF BOS ITEMS AND I&C OF 100MW(AC)  
FLOATING SOLAR PV POWER PLANT FOR NTPC AT  
RAMAGUNDAM THERMAL POWER PLANT**

PS-439-1332

Rev No: 00

PAGE : 3 OF 23

	5.24	Installation and commissioning of SCADA and Telemetry systems
	5.25	Earthing system for CMCS room
	5.26	Identification marking of electrical items using painting
	5.27	Cable markers and cables tags
	5.28	Display boards and sign boards
	5.29	Electrical insulation mat
	5.30	Supply and Installation Miscellaneous Items for CMCS Room
	5.31	Tool kits and instruments :
	5.32	PRE-COMMISSIONING AND COMMISSIONING FACILITIES
	5.33	Spares
6.0		General conditions applicable during supply, installation and commissioning phase
7.0		Documents to be submitted for BHEL/NTPC approval during detailed engineering



## 1.0 Introduction

### 1.1 Overall project outline of 100MW (AC) Floating solar photovoltaic power plant

Bharat Heavy Electricals Limited (BHEL), Electronics Division, Bangalore is setting up a 100MW (AC) Floating solar photovoltaic (SPV) power plant for NTPC at Ramagundam Thermal Power Plant at Telengana.

The supply and installation of all floatation devices for forming floating islands, installation of SPV modules, String Combiner Box(SCB), ESE LA's for solar array, series cabling of modules, cable termination upto SCB and solar array earthing are in the scope of BHEL.

After forming floating solar PV Island, the DC power cables from SCBs are routed through floaters upto PCU placed on an independent floating platform. The output power from PCU is fed to an 2.7MVA hermetically sealed KNAN transformer. A stand-alone 33KV HT breaker shall be placed near to the transformer. 2.5MW(AC) power at 33KV level is combined at Local Pooling Switchgear Floating Platform(LPSFP) where 10 in 1 out breaker panels are mounted. Total 4 nos of 25MW(AC) LPSFP shall be available in entire 100MW(AC) floating project. 3 Runs of 1CX630 sq.mm XLPE Al cable shall be route from each LPFSP through independent cable floaters upto the reservoir embankment on the north side and through underground upto the final evacuation point. 4 Nos of outdoor IC-OG HT switchgear panels along with metering cubicles shall be placed near to NTPC's switchgear room. The output power from each 2 nos of IC-OG panels are connected to 1 No.(50MW) indoor HT switchgear panel at bus section A and bus section F respectively.

The scope of this contract is envisaged to have several other infrastructural support systems such as UPS, plant illumination system, fire alarm system, Weather Monitoring System etc.

### 1.2 Scope of this tender specification

Bidder scope includes supply, installation, testing and commissioning of identified activities of the 100MW (AC) floating solar photovoltaic power plant.

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

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

### 1.3 Enclosures to this tender specification (Tender purpose only)

1	AC single line diagram of overall Solar PV power plant
2	Tentative array layout with SCB locations
3	Tentative layout of Inverter Floating Platform (IFP) and Local Pooling Switchgear Floating Platform (LPSFP)
4	Tentative layout of CMCS
5	Tentative layout of IC-OG and metering panel
6	Cable installation methodology
7	UPS with Ni-Cd battery bank specification
8	Weather Monitoring System (WMS)
9	Fire Fighting & Alarm System
10	Earthing system specification



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RAMAGUNDAM THERMAL POWER PLANT**

PS-439-1332

Rev No: 00

PAGE : 5 OF 23

11	Illumination system specification
12	NTPC approved vendor list
13	Auxiliary Transformer specification
14	Wall mounted LT switchgear specification (For CMCS)
15	Safety manual
16	Typical arrangement of Hume pipes on bund

#### 1.4 Location/ address of power plant:

100MW (AC) Floating Solar Photovoltaic Power Plant,  
NTPC Ramagundam Thermal Power Plant  
Peddapelli (Dist),  
Telangana

#### 2.0 Bidder's scope of supply and works

The table below briefly indicates the scope of supply and works for the bidder, as briefly outlined.

#	<b>Bidder scope of supply and works (as briefly outlined)</b>	<b>Qty</b>
1	Supply of FRP/Aluminium ladder type cable tray with cover and supporting arrangement consisting of mounting bar and clamp with SS 304 hardware for clamping with HDPE floaters – 300mm wide	12.7 Km
2	Supply of FRP/Aluminium ladder type cable tray with cover and supporting arrangement consisting of mounting bar and clamp with SS 304 hardware for clamping with HDPE floaters – 600mm wide	7.7 Km
3	Supply of double compression weatherproof metallic cable gland, bi-metallic strip or washer, SS304 hardware for 400 sq.mm cable- For PCU DC & AC side, Transformer LV side	3550 set
4	Supply of double compression weatherproof metallic cable gland for 33KV(E), 1CX150 sq.mm cable	480 Nos
5	Supply of double compression weatherproof metallic cable gland for 33KV(E), 1CX630 sq.mm cable	75 Nos
6	Supply of 30KVA, 380V/ 415V, dYN11 Dry Type transformer with IP 54 or higher rated outdoor enclosure(Corrosion resistant) with stand and accessories (Including lugs and glands for input and output side cables at both ends)	1 Set
7	Supply of 1.1KV, 3.5CX25 sq.mm XLPE aluminium armoured cable – From Aux Transformer to CMCS and PCU to Aux transformer	1500 meter
8	63 mm, 6kg/sq.cm HDPE pipe for 1.1kV, 3.5CX25 sq.mm cable	200 m
9	Supply of Hume pipes (NP 2 or above, dia 300mm) for HT cable crossing over the reservoir bund	32 m
10	Supply of outdoor ladder type cable tray (Aluminium / FRP) with mounting arrangements for HT cables on sloping sides of the reservoir bund	100 m
11	Supply of trefoil clamps (Non corrosive) for entire HT cables laying	1 set
12	Supply of indoor cable termination kit for 33KV(E),1CX150 sq.mm cable	480 Nos



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RAMAGUNDAM THERMAL POWER PLANT**

PS-439-1332

Rev No: 00

PAGE : 6 OF 23

13	Supply of indoor cable termination kit for 33KV(E), 1CX630 sq.mm	75 Nos
14	Supply of outdoor straight through joint kits for 33KV(E), 1CX150 sq.mm cable	25 Nos
15	Supply of outdoor straight through joint kits for 33KV(E), 1CX630 sq.mm cable	60 Nos
16	Supply of wall mounted LT switchgear for CMCS (With energy meter)	1 No
17	Supply of UPS systems (5 KVA), with 1 hour backup, UPSDB and Ni-Cd type battery bank (Comprising of 2 x100% redundancy for Battery and Charger)	5 set
18	Supply of UPS systems (3 KVA), with 30 mins backup, UPSDB and Ni-Cd type battery bank (Comprising of 2 x100% redundancy for Battery and Charger)	37 sets
19	Outdoor IP54 or higher enclosure for housing UPS and battery bank at final evacuation point (IC-OG panels)	1 No
20	Supply of weather monitoring system (WMS)	1 set
21	Supply of furniture for CMCS room	1 set
22	Supply of fire-fighting and alarm system for CMCS	1 Set
23	Supply of outdoor fire-fighting system for IFP & LPSFP	40 sets
24	Supply of earthing system for inverter platform (Below water- Including hardware, bare down conductor as per standards, earthing rod etc)	36 set
25	Supply of earthing system for Local Pooling Switchgear Floating Platform (LPSFP) (Below water- Including hardware, bare down conductor as per standards, earthing rod etc)	4 set
26	Supply of earthing system for IC-OG panels as per Annexure "Earthing system specification"	1 set
27	Supply of earthing system for CMCS as per Annexure "Earthing system specification"	1 set
28	Supply of control, instrumentation and aux power cable for connecting 40 Nos of PCUs, 40 Nos of inverter Transformer, 90 Nos of HT panels, 42 Nos of UPS, 42 Nos of SCADA panel, 1 No WMS, 40 Nos of wireless transmitter system from SCADA panel on floating platform, 1 set of wireless receiver system at CMCS, 1 No Fire Alarm system at CMCS etc.	1 set (as required)
29	Supply of wireless receiver support lattice tower structure near to CMCS building- Max height 20m with approx. tonnage 2Tonnes along with foundations.	1 No
30	Supply of LED outdoor lighting system with 3 m pole, JB and fixtures	82 no.s
31	Supply of Emergency lamps and associated cabling with conduits for CMCS (to be connected with UPS)	4 no.s
32	Supply of lightning arrester system with earthing arrangement for CMCS building as per IS/IEC 62305	1 set
33	Supply of Pre-fabricated security cabin – Dimensions 3mX3mX2.4m(H)-minimum	1 No
34	Supply of air conditioners for CMCS building- Capacity 1.5 Ton	2 Nos
35	Supply of Water supply system with bore-well having submersible pump set, starter with protections (both of reputed make). Bore-well shall be with casing and filters for bore piping with valves etc. upto water storage tank located on top of CMCS building. Bore well shall be located adjacent to CMCS. Depth shall be such as to ensure permanent supply of clean water and may be decided as per Hydrological investigation	1 set
36	Supply of miscellaneous items such as cable tags, cable ties, cable ferrules, cable route markers, hoarding board, sign boards, danger boards, display boards, plant	1 set (as required)



**TECHNICAL SPECIFICATION:  
SUPPLY OF BOS ITEMS AND I&C OF 100MW(AC)  
FLOATING SOLAR PV POWER PLANT FOR NTPC AT  
RAMAGUNDAM THERMAL POWER PLANT**

PS-439-1332

Rev No: 00

PAGE : 7 OF 23

	Layout boards, electrical insulation mat, tool kits, first aid box, measuring instruments, items for remote connectivity of SCADA excluding FO cable, etc.	
37	Supply of ABT meter (To be mounted on BHEL supplied HT panels) make as per approved TRANSCO/SLDC with valid calibration certificates	12 Nos
38	Supply of spare items	1 set
<b><i>List of Works (I&amp;C activities)</i></b>		
1	<b>I&amp;C:</b> Laying and termination of 2RX1CX400 sq.mm XLPE AL DC power cables from 14 Nos of SCBs to PCU through covered cable trays (1AU = 2.5MWac block)	40 AU
2	<b>I&amp;C:</b> Transport of equipment from BHEL store to floating platform casting location, Placement and proper grouting of PCU, Transformer, HT panel, Electrical equipment enclosure (for housing SCADA panel with wireless transmitter and UPS with battery bank) on floating platform when the platform is casted near to the shore and towing the platform with equipment to the pre-defined location as per the instructions by the OEM of floating platform. Supply of platform, anchoring and mooring of platform is in BHEL scope. Bidder has to hire motor boats, barge mounted or land based heavy duty cranes, experienced rigging crew etc for this activity. ( 1AU = Works related to 1 platform)	40 AU
3	<b>I&amp;C :</b> Launching ramp: Construction of temporary platform cum ramp of approximate dimensions of 12 m x 5 m at edge of reservoir at location given by BHEL to enable loading and mounting of heavy electrical equipment from land onto Floating equipment platforms. Deepening of water depth at platform area upto 3 meters along ramp and excavation for approximately 150 m long approach way in water from deep end to ramp for enabling approach of floating platforms upto ramp and return. Platform shall be of RCC construction with ramp on land side for enabling movement of cranes onto platform.	1 AU
4	<b>I&amp;C:</b> Laying and termination of 30RX1Cx400sqmm LT power cable from PCU to transformer (Approx distance 3 m) ( 1AU = Works on 1 platform)	40 AU
5	<b>I&amp;C:</b> Laying and termination of 3RX1Cx150sqmm HT power cable from transformer to stand alone HT panel (Approx distance 3 m) ( 1AU = Works on 1 platform)	40 AU
6	<b>I&amp;C:</b> Erection of 30KVA Aux dry type transformer in one of the inverter floating platform, cabling and termination of aux power cables upto CMCS room (Approx distance 1.5Km) through HDPE pipes, floaters and underground trenches as per site requirement	1 AU
7	<b>I&amp;C:</b> Under water Earthing of electrical equipment on IFP & LPSFP as per standards (1AU = Earthing of equipment on 1 floating platform like, PCU, Transformer, HT panel, SCADA, UPS) ( 1AU = Works related to 1 platform)	40 AU
8	<b>I&amp;C:</b> Laying and termination of 3RX1Cx150sqmm HT power cable from stand-alone HT panel to LPSFP through cable floaters. HT cable floater installation as per the	40 AU



**TECHNICAL SPECIFICATION:  
SUPPLY OF BOS ITEMS AND I&C OF 100MW(AC)  
FLOATING SOLAR PV POWER PLANT FOR NTPC AT  
RAMAGUNDAM THERMAL POWER PLANT**

PS-439-1332

Rev No: 00

PAGE : 8 OF 23

	instructions of OEM is in bidder scope. Necessary clamps and fixing arrangements shall be supplied and installed by the bidder. Cable floaters supply is in BHEL scope. ( 1AU = Works related to 1 IF to LPSFP)	
9	<b>I&amp;C:</b> Laying and termination of 3RX1CX630 sq.mm HT power cable from LPSFP to reservoir bund through cable floaters. HT cable floater installation as per the instructions of OEM is in bidder scope. Necessary clamps and fixing arrangements for cables on HDPE floaters shall be supplied and installed by the bidder. Required tying arrangement in consultation with floater OEM for arresting movement of cable floaters is also in bidder scope. Cable floaters supply is in BHEL scope. ( 1AU = Laying of 1 trefoil run for 1KM)	10 AU
10	<b>I&amp;C:</b> Laying and termination of 3RX1CX630 sq.mm HT power cable from reservoir bund (crossing bund using trays and hume pipes ) to final evacuation point at NTPC switchyard via IC-OG and metering panels near to final evacuation point through underground cable trench. 2 trefoils shall be routed with a Center to center gap of 400mm. Similar 2 nearby trenches of gap min 1000mm for 4 Nos of 25MW feeders. ( 1AU = Laying of cables through 2 trenches for 1KM)	2 AU
11	<b>I&amp;C:</b> Erection and earthing of 8 Nos of outdoor HT panels (including fixing of ABT meters) near to evacuation point and 2 nos of indoor panels with adapter panels inside switchgear section B & F. All activities required for bus bar extension using adapter panel is in the scope of bidder, Supply of HT panels is in BHEL's scope.	1 AU
12	<b>I&amp;C:</b> Erection and earthing of electrical equipment at CMCS: SCADA and telemetry panels, UPS with battery bank, fire alarm system, A/C, WMS system, LA and wireless receiver system with RCC foundation near to CMCS building etc	1 AU
13	<b>I&amp;C:</b> Laying and termination of control/data/instrumentation/aux power cable inside CMCS room, WMS system on top of CMCS room and wireless receiver mast near to CMCS room	1 AU
14	<b>I&amp;C:</b> Laying and termination of OFC cable from CMCS to OWS at final evacuation point (along with the HT cables). 1AU= 1Km OFC cable laying including splicing termination etc.	3.5 AU
15	<b>I&amp;C:</b> Plant lighting system including outdoor cable laying, cable terminations at poles / lights as well as DB boards of inverter platforms. (1 AU= for 1 LED fixture)	82 AU
16	<b>I&amp;C:</b> Emergency lighting system including cable laying, cable terminations at CMCS. (1 AU= for 1 LED fixture)	4 AU
17	<b>I&amp;C:</b> Miscellaneous and safety items such as cable tags, cable markers, hoarding board, sign boards, danger boards, display boards, electrical insulation mat, air conditioners, office furniture, fire extinguishers, fire alarm system, weather monitoring system, items for remote connectivity of SCADA, identification markings using painting etc	1 AU
18	<b>I&amp;C:</b> Pre-commissioning inspections/ checks/tests, MRT tests, coordination/liaison with state /central departments/CEIG etc for necessary approvals/clearances for commissioning, synchronization with grid/ plant commissioning.	1 AU
19	<b>I&amp;C:</b> Liasoning with railways and carrying out laying / tunneling works for 4 sets of 33KV(E), 3RX1CX630 sq.mm HT cable crossing below the railway line (If required). Presently cable crossing through existing hume pipes are considered. Hence this line item may be operated only if any objection from railways to use the existing hume pipes.	1 AU



**TECHNICAL SPECIFICATION:  
SUPPLY OF BOS ITEMS AND I&C OF 100MW(AC)  
FLOATING SOLAR PV POWER PLANT FOR NTPC AT  
RAMAGUNDAM THERMAL POWER PLANT**

PS-439-1332

Rev No: 00

PAGE : 9 OF 23

20	Deputation of Safety supervisor for duration of I&C ( 1 AU = 1 Month )	6 AU
21	Provision of emergency vehicle/Ambulance on standby for duration of I&C ( 1 AU = 1 Month )	6 AU

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

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

1	Supply of 1.1 kV, 1C x 400sq mm, Al, XLPE, Un-armoured cable as per IS: 7098 (from SCB to PCU and PCU to transformer)	~160KM
2	Supply of Inverter platform and Local Pooling Switchgear Floating Platform	40 Nos
3	Supply of containerized power conditioning units (PCUs) of 2500 kW with Aux transformer and ACDB	40 Nos
4	Supply of electrical panel enclosure for SCADA and UPS with battery bank- 2200mm (L) X 1500mm (D) X 2000mm (H).	40 Nos
5	Supply of inverter transformer 2.7MVA, 33KV/380V, Hermetically sealed KNAN	40 Nos
6	Supply of 33kV HT panels	90 Nos
7	Supply of SCADA system including PLC panels, computers, software systems	1 Set
8	Construction of RCC CMCS room and construction of IC-OG panel platform	1 set
10	33KV(E), 1CX150 sq.mm XLPE AL armoured cable (Inv Platform to LPSFP)	60 Km
11	33KV(E), 1CX630 sq.mm XLPE AL armoured cable (LPSFP to final evacuation point)	60 Km
12	OFC cable	4 Km
13	SCADA-wireless transmitter and receiver equipment	1 set

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

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

### **5.0 Technical specification for supply, installation and commissioning**

#	<b>BHEL purchase specification</b>
5.1	<b>Electrical power for I&amp;C works and Bore-well for CMCS</b> Power for I&C works shall be arranged by the bidder. One number bore-well shall be dug near to CMCS. All associated pumps and electrical wiring shall be under bidder scope. Water connection upto Sintex type storage tank on top of RCC building is in bidder scope. Syntex tank will be supplied by BHEL.
5.2	<b>Construction of temporary yards for safe storage of bidder supplied items</b> a) Bidder shall, at a suitable location at the site, as decided based on discussions with BHEL site engineer, construct temporary yards for safe storage of bidder supplied items.



**TECHNICAL SPECIFICATION:  
SUPPLY OF BOS ITEMS AND I&C OF 100MW(AC)  
FLOATING SOLAR PV POWER PLANT FOR NTPC AT  
RAMAGUNDAM THERMAL POWER PLANT**

PS-439-1332

Rev No: 00

PAGE : 10 OF 23

	<p>b) Area of all storage yards/sheds shall be selected based on sizes of items. Bidder shall, at the time of starting their activities at site, submit drawings/ sketches/ dimensions etc to obtain approval from BHEL.</p> <p>c) Safety and security of all the items shall be within bidder scope. Accordingly, bidder shall ensure adequate security watch and ward for these items round the clock.</p>
<b>5.3</b>	<p><b>Movement of items received at site:</b></p> <p>a) Arrangements shall be made by bidder for movement of the stored items (those item's installations are in bidder scope) from interim storage yards to the exact construction locations within the project site.</p> <p>b) Bidder shall maintain proper documentation / compilation of all the records related to shipping (invoices, LRs, delivery challans, material receipt certificates etc.) and shall take approval from BHEL site engineer for every consignment. The documents shall be suitably preserved for further handing over to BHEL.</p> <p>c) Registers shall be maintained for the yard to keep track of incoming/outgoing items. Safety of items at the work spot/s shall be in bidder scope. Accordingly, suitable watch and ward shall be deployed on round-the-clock basis.</p>
<b>5.4</b>	<p><b>Laying and termination of 1.1kV, 1CX400 sq.mm XLPE AI Un-armoured cable from SCB to PCU through cable trays</b></p> <p>(1) 2 Runs per SCB of 1.1kV, 1CX400 sq.mm cable through ladder type cable tray with cover, shall be connected from SCB to PCU through walkway cable floaters. The cable termination at SCB side by using BHEL supplied hardware and cable termination at PCU side with bidder supplied, gland, lugs and hardware is in bidder scope.</p> <p>(2) The laying of cable shall be done without overlapping each other and routing neatly through cable trays using cable ties, supporting arrangement consisting of mounting bar and clamp with SS 304 hardware for clamping the tray(300/ 600mm wide) with HDPE floaters</p> <p>(3) Bidder shall carry out drilling of holes in cable gland plates of the container and PCUs for the positive and negative DC inputs of 1Cx400 cable for 40 nos of PCUs. Gas cutting method is strictly not allowed. Bidder shall organize hole-saw cutters of appropriate size for this purpose. All necessary drilling machines / tools etc. shall be made available at site.</p> <p>(4) Prior to termination, each cable shall be checked for continuity and meggered. In case any cable found defective, bidder shall implement suitable corrective action such as cable jointing, replacement/re-laying of cable etc. as applicable.</p> <p>(5) Bidder shall carry out glanding of the cables following which the glands shall be fitted to the respective holes of gland plates.</p> <p>(6) Bidder shall carry out the cable terminations for positive and negative inputs that include tasks such as unsleaving, crimping, connecting to the tinned copper bus bars, tightening using torque wrench etc. Proper labelling/tagging is to be planned and fixed on cables.</p> <p>(7) Bidder shall arrange torque wrench of appropriate range. Torque setting shall be as per the bolt size and property class. For the setting, approval shall be obtained from BHEL site engineer.</p> <p>(8) Bidder shall submit details of cable glands/lugs/ties/hardware (Make, part number, size, quantity etc.) Glands shall be of COMET or 3D make. Other than these makes shall not be accepted.</p> <p>(9) Cable lugs shall be of Dowell or COMET or 3D make. Other than these makes shall not be accepted.</p> <p>(10) All necessary tools such as pliers, strippers, crimping tool etc shall be within bidder scope.</p>
<b>5.5</b>	<p><b>Erection of Equipment on Inverter Platform (IP) and Local Pooling Switchgear Floating Platform (LPSFP)</b></p> <p>(1) Ferro cement based IP &amp; LPSFP will be casted by BHEL near to the launching pad on southern side.</p>



	<p>(2) Bidder shall place the equipment on cured floater as per the equipment layout in line with the instruction of BHEL/OEM representative at site.</p> <p>(3) Necessary heavy duty cranes, boats, barge mounted handling equipment etc for the successful installation of equipment are in bidder scope.</p> <p>(4) All equipment on IP and LPSFP shall be grouted properly by welding or nut bolt arrangement as per site requirements. Stand for PCU on IP and HT panels on LPSFP will be supplied by BHEL. Transformer, Electrical equipment enclosure for SCADA and UPS with battery bank, stand-alone HT panel on IP shall be place directly on ferro cement platform without any stands. SCADA transmitter antenna shall be installed on top of enclosure using suitable arrangements.</p> <p>(5) Necessary drilling, cutting and welding works if required for equipment placement on platform/stand shall be in bidder scope.</p> <p>(6) SS 304 hardware of equipment placement if required is also in bidder scope.</p> <p>(7) Repair cost of ferro cement floater due to mishandling of equipment and floater will be in bidder scope. Adequate care shall be taken during placement of equipment.</p> <p>(8) After installation of equipment on IP and LPSFP, the entire floating platform shall be taken to the designated locations as per array layout.</p> <p>(9) <b>Anchoring and mooring of IP and LPSFP is in the scope of BHEL.</b></p> <p>(10) Launching ramp: Construction of temporary platform cum ramp of approximate dimensions of 12 m x 5 m at edge of reservoir at location given by BHEL to enable loading and mounting of heavy electrical equipment from land onto Floating equipment platforms. Deepening of water depth at platform area upto 3 meters along ramp and excavation for approximately 150 m long approach way in water from deep end to ramp for enabling approach of floating platforms upto ramp and return. Platform shall be of RCC construction with ramp on land side for enabling movement of cranes onto platform.</p>
<b>5.6</b>	<p><b>Earthing of Equipment on Inverter Platform (IP) and Local Pooling Switchgear Floating Platform (LPSFP)</b></p> <p>Please refer Annexure- “<b>Earthing system</b>” for general understanding.</p> <p>(1) All equipment body earthing shall be done at two discrete locations. Platform handrail also shall be connected to body earthing.</p> <p>(2) Transformer shield shall be earthed</p> <p>(3) SCADA shall be earthed separately.</p> <p>(4) Bare conductor of adequate size shall be used as down conductor for earthing. Approx depth of water is 6 m to 12m. Sufficient loops of conductor shall be kept extra to incorporate water level variations. Bidder has to submit detailed earthing design with calculations for BHEL/NTPC approval.</p>
<b>5.7</b>	<p><b>Laying and Termination of 1Cx400sq.mm LT AC power cables at PCU and Inverter Transformer</b></p> <p>a) LT Cables 10 runs of 1C x 400 sqmm per phase shall be neatly laid between AC side of the PCU and the LT side of the Inverter transformer as per “Cable installation methodology” defined in this specification.</p> <p>b) Bidder scope includes removal of sleeve at the cable end, crimping with suitable cable lug of appropriate type/size and connecting the lugged end to the tinned copper bus bar within the PCU and Transformer. Cables shall enter the PCU and Transformer through the metallic cable glands.</p> <p>c) Cable lug make shall be Dowell, COMET or 3D. Other than these makes shall not be accepted.</p> <p>d) Cable gland metallic type shall be of COMET or 3D make. Other than these makes shall not be accepted.</p>



**TECHNICAL SPECIFICATION:  
SUPPLY OF BOS ITEMS AND I&C OF 100MW(AC)  
FLOATING SOLAR PV POWER PLANT FOR NTPC AT  
RAMAGUNDAM THERMAL POWER PLANT**

PS-439-1332

Rev No: 00

PAGE : 12 OF 23

	e) Quantity of lug and hardware shall also include contingency requirements arising out of shortage due to various reasons (damage, theft etc.) during installation. All necessary tools such as pliers, strippers, crimping tool etc. shall be within bidder scope
5.8	<b>Laying and termination of 33KV(E), 1CX150 sq.mm XLPE AI cable from Inverter transformer to HT panel and to local pooling switchgear floating platform</b>  a) Laying and termination of 3 run 33KV(E),1CX150 sq.mm XLPE AI armoured cable from HV side of the inverter transformer to HT panels mounted near to it (approx. 3m) on the inverter platform shall be in bidder scope. Rear side cable glanding in HT panel shall be done with care to avoid stress on cable and equipment. Cable support shall be used if required as per site requirement. b) Laying and termination of 3 run 33KV (E),1CX150 sq.mm XLPE AI armoured cables from each inverter platform (IF) to Local Pooling Switchgear Floating Platform (LPSFP) shall be in vendor scope. Corrosion resistant tre-foil clamps shall be used at particular intervals as per standards. c) Cable shall be neatly routed <b>using floaters</b> supplied by BHEL. All necessary cable support/hardware used for cable laying is in the scope of bidder. Installation of floater for cable routing is in bidder scope. Floaters shall be used at pre-designed intervals with hardware for clamping it to cables. Bidder has to ensure that HT cable is not touching water at any locations throughout the route. Required tying arrangement in consultation with floater OEM for arresting movement of cable floaters is also in bidder scope. Cable floaters supply is in BHEL scope. d) Cable shall be laid with sufficient bends and turns to accommodate the lateral movement of floating platforms due to wind. e) Cable route using floater shall be done as per the layout drawing attached and BHEL site representative instructions. <b>Bidder has to ensure that after cable routing, necessary access clearance shall be available to all the IF and LPSFP for motor boats and movement of IF/LPSFP itself in case of breakdown maintenance.</b> f) Cable glands, cable lugs, 33kV HT cable termination kits (indoor/ outdoor types as applicable), bolts, nuts, washers etc. shall be in bidder scope of supply. Cable glands make shall be COMET or 3D. Cable lugs make shall be Dowell or COMET or 3D. Other than these makes shall not be accepted. HT termination and joint kits (indoor/ outdoor as applicable) shall be Raychem or 3M make/ NTPC approved make. HT termination shall be carried out by certified jointers. Credentials / certification of experience from Raychem or 3M for the proposed jointers shall be submitted for BHEL/NTPC approval during detailed engineering
5.9	<b>Laying and termination of 33KV(E), 1CX630 sq.mm XLPE AI cable from local pooling switchgear floating platform (LPSFP) to reservoir embankment</b>  a) Laying and termination of 3 run 33KV (E),1CX630 sq.mm XLPE AI armoured cables from 4 nos of 25MW Local Pooling Switchgear Floating Platform (LPSFP) to reservoir embankment on north side shall be in bidder scope. Corrosion resistant tre-foil clamps shall be used at particular intervals as per standards. b) Cable shall be neatly routed <b>using floaters</b> supplied by BHEL. All necessary cable support/hardware used for cable laying is in the scope of bidder. Installation of floater for cable routing is in bidder scope. Floaters shall be used at pre-designed intervals with hardware for clamping it to cables. Bidder has to ensure that HT cable is not touching water at any locations throughout the route.



	<p>c) Cable shall be laid with sufficient bends and turns to accommodate the relative movement of floating platforms with respect to embankment due to wind and water level variations.</p> <p>d) Cable route using floater shall be done as per the layout drawing attached and BHEL site representative instructions. <b>Bidder has to ensure that after cable routing, necessary access clearance shall be available to all the IF and LPSFP for motor boats and movement of IF/LPSFP itself in case of breakdown maintenance.</b></p> <p>e) FRP/HDPE/Treated Wood slotted supports to be provided from Float end to the entry of Hume pipe on the reservoir embankment.</p> <p>f) Cable glands, cable lugs, 33kV HT cable termination kits (indoor/ outdoor types as applicable), bolts, nuts, washers etc. shall be in bidder scope of supply. Cable glands make shall be COMET or 3D. Cable lugs make shall be Dowell or COMET or 3D. Other than these makes shall not be accepted.</p> <p>HT termination and joint kits (indoor/ outdoor as applicable) shall be Raychem or 3M make/ NTPC approved make. HT termination shall be carried out by certified jointers. Credentials / certification of experience from Raychem or 3M for the proposed jointers shall be submitted for BHEL/NTPC approval during detailed engineering</p>
<b>5.10</b>	<p><b>Laying and termination of 33KV(E), 1CX630 sq.mm XLPE AI cable from reservoir embankment to IC-OG panels and to indoor switchgear room</b></p> <p>a) Cables from floaters shall be routed through trays and hume pipes while crossing the bund. Hume pipes laid on the top of bund road with layer of RCC cover with suitable ramp on either side to allow vehicle movement. Refer typical sketch attached.</p> <p>b) Ladder type cable trays on either side of embankment upto hume pipe opening shall be fixed for cable laying, as per site conditions without damaging of bund.</p> <p>c) Laying and termination of 4 nos of trefoils of 33KV (E),1CX630 sq.mm XLPE AI armoured cables from reservoir embankment to IC-OG panels and to indoor switchgear room through underground trench as per standards shall be in bidder scope. Digging trench as per specification is also in bidder scope. Trefoil clamps shall be used at particular intervals as per standards.</p> <p>d) Minimum depth of underground trench shall be 1050mm.</p> <p>e) Two separate trenches of atleast 1000mm clearance shall be used for laying total 4 trefoils of HT cables. In each trench, 2 trefoils with center to center distance of 400mm shall be laid.</p> <p>f) Cable crossing under railway track through existing hume pipes is in bidder scope. Necessary brick works/ framework to protect cable shall be done at entry and exit points of 2 nos of hume pipes, without blocking flow of water. Design of brick work/frame work shall be finalized during detailed Engineering.</p> <p>g) Spacers shall be used inside the hume pipe to maintain 400mm clearance between the trefoils and to allow natural water flow through hume pipes during rainy seasons.</p> <p>h) Refer Annexure- "Cable installation methodology" for more details.</p> <p>i) 4 Nos of trefoil cable shall be terminated at IC-OG panels near to evacuation switchgear room. The cable from IC-OG panel shall be connected to metering cubicle. Output cable from metering cubicle shall be terminated at indoor switchgear at bus section B &amp; F.</p> <p>j) Erection of 8 Nos of outdoor HT panels (including fixing of ABT meters) near to evacuation point and 2 nos of indoor panels with adapter panels inside switchgear section B &amp; F. All activities required for bus bar extension using adapter panel is in the scope of bidder, Supply of HT panels is in BHEL's scope.</p> <p>k) Cable glands, cable lugs, 33kV HT cable termination kits (indoor/ outdoor types as applicable), bolts, nuts, washers etc. shall be in bidder scope of supply. Cable glands make shall be COMET or 3D. Cable lugs make shall be Dowell or COMET or 3D. Other than these makes shall not be accepted.</p> <p>l) HT termination and joint kits (indoor/ outdoor as applicable) shall be Raychem or 3M make/ NTPC approved make. HT termination shall be carried out by certified jointers. Credentials</p>



	<p>/ certification of experience from Raychem or 3M for the proposed jointers shall be submitted for BHEL/NTPC approval during detailed engineering.</p> <p>m) Proper HT cable route marker shall be used in regular intervals as approved by BHEL/NTPC</p>
<b>5.11</b>	<p><b>Identification marking of cables using cable tags</b></p> <p>1) Cable tags shall be provided on all power cables at both ends just before entering the equipment enclosure.</p> <p>2) Cable tags shall be of rectangular shape.</p> <p>3) Cable tag shall be of 2mm thick aluminum with number punched (embossed) on it and securely attached to the cable by not less than two turns of 20 SWG GI wire conforming to IS:280.</p> <p>4) Bidder shall submit the technical details of cable tags, ID numbering scheme for BHEL/ NTPC approval during detailed engineering.</p>
<b>5.12</b>	<p><b>Installation of electrical panels in CMCS room</b></p> <p>Bidder shall organize necessary resources such as labour, cranes, hydra, forklifts, transportation trucks / trolleys and other accessories for movements and positioning of the equipment as below</p> <p>(a) LT SWITCHGEAR main panel: 1 No</p> <p>(b) SCADA panel: 1 set</p> <p>(c) HMI SCADA control desk with PCs and accessories: 1 set</p> <p>(d) UPS with battery bank – 2 Set.</p> <p>(e) 20 m tall lattice structure (tower with foundations) for wireless receiver near to CMCS room.</p> <p>(f) Fire alarm system</p> <p>(g) Emergency lighting system</p>
<b>5.13</b>	<p><b>Design, Supply, Laying and installation of Control / data / instrumentation / Aux power cables for IP, LPSFP, CMCS, IC-OG panels and indoor switchgear panels</b></p> <p>(1) All aux. cables shall be in bidder scope of supply. Selection of cable type and its sizing shall be as per applicable standards and design calculations.</p> <p>(2) Cable glands, cable lugs, bolts, nuts, washers etc. shall be in bidder scope of supply. Cable glands make shall be COMET or 3D.</p> <p>(3) For marshalling box of transformer/ UPS/ SCADA/ DB boards, single compression nickel plated brass glands shall be provided by bidder.</p> <p>(4) All cables other than those listed under section “BHEL scope” of this specification shall be in bidder scope of supply.</p> <p>(5) Lengths of all aux. cables shall be assessed by bidder based on indicative layouts enclosed with the tender.</p> <p>(6) All the cable installation accessories such as cable trays, cable conduits, cable glands, cable lugs, ferrules, cable ties, bolts, nuts, washers etc. shall be in bidder scope of supply. Cable laying and cable terminations shall be in bidder scope. All necessary resources such as labour, tools and accessories required to carry out laying and termination works etc. shall be in bidder scope.</p> <p>(7) All the other cables such as (i) control cables from inverter transformer marshalling boxes to relay circuits in VCB panels (transformer trip signals), (ii) control cables from inverter transformer marshalling boxes to SCADA (transformer alarm signals), (iii) control cables from SCADA panels to relay circuits in VCB panels (VCB on/off status, VCB close/open command signals), (iv) instrumentation cables from inverter transformer marshalling boxes to SCADA panels (4-20mA signals, WTI/OTI values) shall be in bidder scope of supply.</p>



**TECHNICAL SPECIFICATION:  
SUPPLY OF BOS ITEMS AND I&C OF 100MW(AC)  
FLOATING SOLAR PV POWER PLANT FOR NTPC AT  
RAMAGUNDAM THERMAL POWER PLANT**

PS-439-1332

Rev No: 00

PAGE : 15 OF 23

	<p>(8) Cable laying and cable terminations shall be in bidder scope. Design calculations for cable selection together with GTP/datasheet particulars shall be submitted for BHEL/ NTPC approval. Number of cores, length requirements shall be appropriately assessed by the bidder.</p> <p>(9) Bidder shall lay and terminate the <b>RS485 cables</b> to SCADA from (a) MFM meters of LT SWITCHGEAR panel, (b) Weather monitoring station (c) Wireless receiver installed near to CMCS etc.</p> <p>(10) Bidder shall lay and terminate the Ethernet cables to SCADA from (a) PCUs, (b) numerical relays of VCB panels.</p> <p>(11) All necessary resources such as labour, tools and accessories required to carry out laying and termination works etc shall be within scope of bidder.</p> <p>(12) All applicable/ relevant clauses under "<b>Cable installation methodology</b>" sections of this specification shall be adopted for all aspects of these cables such as technical specifications (ratings, sizes, calculations etc), cable selection, tests on cables, cable installation, cable accessories etc.</p> <p>Note: Make shall be as per Annexure "NTPC vendor list".</p>
<b>5.14</b>	<p><b>I&amp;C of 33kV transformer</b></p> <p>(1) Bidder shall erect the transformers on Ferro-cement platform as mentioned earlier in this specification. Bidder scope of I&amp;C of transformers shall include:</p> <ol style="list-style-type: none"><li>Movement of transformers from storage yard and placement on platform.</li><li>Assembly of transformer parts.</li><li>Cable laying and terminations at LV/HV/Marshalling boxes of transformers.</li><li>All activities applicable to oil filling and filtration including measurement of oil BDV and PPM in NABL accredited laboratory. Particularly for inverter transformers, filtration of oil shall be carried out to such an extent as to obtain the desired BDV (&gt;60 kV) and PPM (&lt; 15ppm) values.</li><li>1 no. of Nitrogen gas filling apparatus with cylinder, for sealing transformer oil (natural ester oil) drums shall be supplied.</li><li>Testing of transformers as per "<b>pre-commissioning checks</b>" .</li></ol> <p>(2) Bidder shall provide applicable earthing connections to transformers.</p> <p>(3) All other items (if any, other than the above) that are required to meet the technical requirements of transformer as per applicable standards / electricity rules shall be incorporated by the bidder.</p>
<b>5.15</b>	<p><b>Specification of Earthing system: As per attached Annexure</b></p>
<b>5.16</b>	<p><b>Specification of Firefighting and alarm system : As per attached Annexure</b></p>
<b>5.17</b>	<p><b>Specification of cable installation methodology: As per attached Annexure</b></p>
<b>5.18</b>	<p><b>Specification of UPS with battery bank: As per attached Annexure</b></p>
<b>5.19</b>	<p><b>Specification of Auxiliary Transformer: As per attached Annexure</b></p>
<b>5.20</b>	<p><b>Specification of illumination system: As per attached Annexure</b></p>
<b>5.21</b>	<p><b>Auxiliary AC/DC power supply system</b></p> <p>Bidder shall establish an auxiliary AC/DC supply system:</p> <ol style="list-style-type: none"><li>For CMCS <b>AC/DC</b> power requirement: - <b>30 KVA</b> Dry type Auxiliary Transformer shall be installed on nearest inverter floating platform (Approx distance 1.3 Km) and laying aux power cable from floating platform to CMCS through floaters and underground trench as per site requirement shall be in the scope of bidder. Aux cable shall be terminated on wall mounted LT switchgear panel supplied and installed by the bidder in CMCS room.</li></ol>



**TECHNICAL SPECIFICATION:  
SUPPLY OF BOS ITEMS AND I&C OF 100MW(AC)  
FLOATING SOLAR PV POWER PLANT FOR NTPC AT  
RAMAGUNDAM THERMAL POWER PLANT**

PS-439-1332

Rev No: 00

PAGE : 16 OF 23

	<p>Refer Annexure "LT switchgear".</p> <p>Supply of UPS systems (5 KVA), with 1 hour backup, UPSDB and Ni-Cd type battery bank (Comprising of 2 x100% redundancy for Battery and Charger) is in the scope of bidder. Please refer Annexure for technical details. SCADA and emergency lighting system shall be connected to UPSDB.</p> <p>b. For IP and LPSFP <b>AC/DC</b> power requirement: - Each BHEL supplied containerized 2.5MW PCU consists of 1 No 15KVA dry type aux transformer and ACDB with 4 to 6 feeders. Bidder shall connect the aux requirements of IP and LPSFP from the ACDB feeders. Supply and installation of aux power cables is in bidder scope.</p> <ul style="list-style-type: none"><li>• For IP:- Supply of UPS systems (3 KVA),with 30 mins backup, UPSDB and Ni-Cd type battery bank (Comprising of 2 x100% redundancy for Battery and Charger) is in the scope of bidder.</li><li>• For LPSFP:- Supply of UPS systems (5 KVA), with 1 hour backup, UPSDB and Ni-Cd type battery bank (Comprising of 2 x100% redundancy for Battery and Charger) is in the scope of bidder. Please refer Annexure for technical details. Bidder shall erect and grout the UPS system inside BHEL supplied enclosure near to the PCU container. The UPS and battery bank shall be compact enough to install inside the enclosure. Cable laying, glanding and termination of DC aux cable shall be in bidder scope.</li></ul> <p>c. For IC-OG outdoor HT switchgear panels near to evacuation point: - Supply of UPS systems (3 KVA),with 30 mins backup, UPSDB and Ni-Cd type battery bank (Comprising of 2 x100% redundancy for Battery and Charger) is in the scope of bidder. This system shall be installed inside IP54 or higher rated metallic enclosure. The enclosure details shall be submitted to BHEL for approval. The aux AC power shall be tapped from nearest NTPC switchgear room. Cable laying, glanding and termination of aux cable shall be in bidder scope</p> <p>Following DB boards for application in CMCS and electrical equipment enclosure shall be in bidder scope of supply, installation and commissioning:</p> <ol style="list-style-type: none"><li>1. UPS DB for 230V AC UPS supply to SCADA, weather monitoring system, fire alarm system, emergency loads - 1 Set</li><li>2. Above DB boards shall also provide for any other feeders, if necessary, to meet functional requirements. In addition, at least two spare feeders shall be provided in each of the above DB boards. Further, any extra DB boards to meet functional requirements of Aux AC/DC system shall be provided by the bidder.</li><li>3. Above DBs shall be of reputed make such as Legrand, Siemens, Schneider or any other reputed make as approved by BHEL/NTPC.</li><li>4. DB boards shall be provided with incoming/ outgoing MCB as applicable (based on rating requirements) with spare feeders as shall be approved by BHEL/NTPC.</li><li>5. Installation of all the above items including all necessary cables, cable terminations/ installation shall be in bidder scope.</li><li>6. Constructional features of the connections shall be as per specification "<b>LT switchgear</b>".</li><li>7. LT switchgear component of reputed make such as L&amp;T, Siemens, ABB, Schneider or any other NTPC approved makes are only accepted.</li></ol> <p>(a) <b>LT SWITCHGEAR wall-mounted panel for CMCS: 1 No</b> (fed by 3ph, 4-wire 415V auxiliary transformer supply) distributes the AC power to various utility applications in main control room. The panel shall be supplied, installed and commissioned in CMCS by the bidder.</p> <p>Constructional features of the panel shall be as per specification "<b>LT switchgear</b>"</p>
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	<p>Make shall be as per “NTPC vendor list”.</p> <p>MFM meter with RS485 communication feature to facilitate SCADA connection shall be provided in LT SWITCHGEAR.</p>
<b>5.22</b>	<p><b>Design, supply, installation of security room with electrical fittings</b></p> <p>Bidder shall provide prefabricated Security Cabin of size 3 meter x 3 meter X 2.4 meter at the main entrance gate, keeping in view the safety and security of the power plant. Minimum 1 lamp, 1 fan, 1 socket shall be provided.</p>
<b>5.23</b>	<p><b>Supply and installation of Weather monitoring system at CMCS</b></p> <p><b>As per attached Annexure “Weather monitoring system”</b></p>
<b>5.24</b>	<p><b>Installation and commissioning of SCADA and Telemetry systems</b></p> <p>(1) SCADA system, supply of which shall be in BHEL scope, comprises of data station panels and PC based control desks with software to collect, store, process and report the data parameters of power plant and also to control the operations of the power plant by integrating the various equipment at the segments as follows:</p> <ul style="list-style-type: none"><li>(a) SCADA panels placed on the floating inverter platforms.</li><li>(b) Power conditioning units (40 Nos): DC input / AC output parameters of inverters, grid data, fault status and events logged, etc.</li><li>(c) Inverter transformers (40 Nos): Alarm/Trip signals, WTI/OTI temperature values. Signals will be confirmed during detailed engineering.</li><li>(d) 33kV VCB breaker panels (as per SLD): status of VCB breakers, status of protection relays of transformers, oil / winding temperatures, AC parameters.</li><li>(e) Fire alarm system at main control room: status signals</li><li>(f) Weather monitoring equipment</li></ul> <p>(2) <b>BHEL scope of SCADA:</b></p> <ul style="list-style-type: none"><li>(a) Data station panels with necessary data loggers / PLCs and other accessories such as power supply etc to integrate the data signals.</li><li>(b) Desktop PCs (HMI control desks) provided with necessary software packages and remote monitoring features.</li><li>(c) Supply of SCADA related communication/ data / LAN cables as brought out in other clauses of this specification.</li></ul> <p>(3) <b>Bidder scope of supply and installation of SCADA system:</b></p> <ul style="list-style-type: none"><li>(a) Bidder shall install the BHEL supplied SCADA system in the air-conditioned SCADA room in CMCS.</li><li>(b) Cable laying/ terminations of all SCADA cables at respective panels / equipments shall be in bidder scope of supply. <b>SCADA communication (OFC) cable laying from plant CMCS to switch yard panel room and to switchyard room is also in bidder scope (length is 3.5 Kms approx.).</b> BHEL will provide the necessary cabling schedule during detailed engineering.</li></ul>
<b>5.25</b>	<p><b>Earthing system for CMCS room</b></p>



	<b>As per attached Annexure “Earthing system”</b>																															
<b>5.26</b>	<b>Identification marking of electrical items using painting</b> Following items shall be identified by way of artistic painting in black letters with yellow background. For danger symbol/text, white letters in red background. Identification number/text to be painted shall be submitted for BHEL/NTPC approval during detailed engineering for the following. (1) String Combiner boxes: 560 Nos (2) Size/ source/ destination of DC cable 1Cx400 with arrow mark (power flow direction) to be painted on SCBs and PCUs (3) PCUs front side: PCU ID number (1 to 40) with rating 2500kW, AC chamber/ DC chamber, Danger text/symbol. (4) PCUs DC chamber back side: SCB ID numbers, cable size (1Cx400 +,-) with upward arrow mark, danger text/symbol (5) PCUs AC chamber back side: Inv Trnfmr ID, cable size (10Rx1Cx400 / ph) with downward arrow mark, danger text/symbol (6) Same way as above, the corresponding panel ID with rating, cable destination with arrow mark in power flow direction, danger text/symbol shall be painted for all VCB panels, Inverter transformers (HV and LV sides). (7) For UPS/ SCADA/ ABT metering panels, all DB boards/ fire alarm panels, ID number shall be painted. Cable size/ destination/ arrow marks not required to be painted as cable tags shall be adequate. (8) For earth chambers of CMCS room ID number shall be painted. (9) All switchboards shall be painted with ID number.																															
<b>5.27</b>	<b>Cable markers and cables tags</b> (1) Cable markers and joint markers for underground cables and cables on floaters shall be provided along the route of the cables as per section “ <b>Cable installation methodology</b> ” of this specification. (2) Cable tags shall be provided at either of the cable (at the entry point to the panel / equipment to which it is connected / terminated) shall be provided as per section “ <b>Cable installation methodology</b> ” of this specification. (3) Bidder shall submit the respective schemes of marking and tagging for BHEL/NTPC approval during detailed engineering.																															
<b>5.28</b>	<b>Display boards and sign boards</b> <table border="1"><thead><tr><th>SI. No</th><th>Description</th><th>Qty</th></tr></thead><tbody><tr><td>1</td><td>IP &amp; LPSFP number board on top of container (Shall be visible from long distance)</td><td>44 Nos</td></tr><tr><td>2</td><td>Boat route markers for accessing IP &amp; LPSFP</td><td>As required</td></tr><tr><td>3</td><td>Board displaying instruction chart for restoration from Electric Shock</td><td>1 No</td></tr><tr><td>4</td><td>Board displaying instruction chart for artificial respiration</td><td>1 No</td></tr><tr><td>5</td><td>Board displaying dos and don'ts.</td><td>1 No</td></tr><tr><td>6</td><td>Board displaying fire extinguishers details and operations</td><td>1 No</td></tr><tr><td>7</td><td>“No smoking” board</td><td>3 Nos</td></tr><tr><td>8</td><td>Danger boards: 33000V with danger symbol in Hindi, Telugu and English</td><td>As required</td></tr><tr><td>9</td><td>Identification boards, of suitable sizes, within and outside control room such as Main control room, Store room, Gents toilet, Ladies toilet, SCADA room, Battery room etc. BHEL will provide list.</td><td>As required</td></tr></tbody></table>	SI. No	Description	Qty	1	IP & LPSFP number board on top of container (Shall be visible from long distance)	44 Nos	2	Boat route markers for accessing IP & LPSFP	As required	3	Board displaying instruction chart for restoration from Electric Shock	1 No	4	Board displaying instruction chart for artificial respiration	1 No	5	Board displaying dos and don'ts.	1 No	6	Board displaying fire extinguishers details and operations	1 No	7	“No smoking” board	3 Nos	8	Danger boards: 33000V with danger symbol in Hindi, Telugu and English	As required	9	Identification boards, of suitable sizes, within and outside control room such as Main control room, Store room, Gents toilet, Ladies toilet, SCADA room, Battery room etc. BHEL will provide list.	As required	
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	<p>Note: In addition to the above, requirement of hoarding board as well as direction board for the overall power plant shall be fabricated in consultation with BHEL/NTPC and installed at a suitable location near the main entrance gate of the plant.</p>
<b>5.29</b>	<p><b>Electrical insulation mat</b></p> <p>(1) Bidder shall supply electrical insulating mats as follows:</p> <ul style="list-style-type: none"><li>(a) Reputed make as shall be approved by BHEL/ NTPC</li><li>(b) As per IS: 15652:2006</li><li>(c) Class B</li><li>(d) Thickness 2.5 mm minimum</li><li>(e) Size = 2m x 1m minimum, exact size shall be as approved by BHEL/NTPC during detailed engineering.</li><li>(f) Colour: to be approved by BHEL/NTPC</li><li>(g) Max use voltage = 33 kV</li><li>(h) Marking of IS standard on the mat</li></ul> <p>(2) Test certificate shall be provided by bidder</p> <p>(3) Bidder shall lay the mats in front of all the electrical panels viz. PCUs, VCB panels, LT SWITCHGEAR panels, SCADA panels, UPS panels, FCBC battery charger, battery banks etc.</p>
<b>5.30</b>	<p><b>Supply and Installation Miscellaneous Items for CMCS Room</b></p> <p>(1) Split Air conditioner of 1.5 tonne (2 Nos) of split type for SCADA room of Voltas/ Hitachi/ Samsung/LG make.</p> <p>(2) Furniture for SCADA room as below</p> <ul style="list-style-type: none"><li>• Control desk for OWS and EWS – 2 No (one for CMCS and one at evacuation point)</li><li>• Chair, industry standard, revolving type, with wheels, arm rest, provisions for adjustment of height (hydraulic/ gas lift): 4 Nos</li><li>• Storage almirah: 1 No</li><li>• Storing rack (slotted metal frame) 1 no. in store room.</li><li>• Arm-rests in one piece shall be of poly-urethane and twin wheel castor of glass filled nylon.</li><li>• One Printer Table made of Laminated Wood or Heavy Duty MDF shall be provided for printer.</li><li>• All the furniture shall be of reputed make (Godrej or Equivalent).</li></ul>
<b>5.31</b>	<p><b>Tool kits and instruments :</b></p> <p>The bidder shall keep ready stock of tools, tackles and essential spares that will be needed for the day-to-day maintenance of the solar PV system. This shall include but not be limited to the following:</p> <ul style="list-style-type: none"><li>• Screw driver and / or Allen key suitable for the connectors, power distribution blocks, Circuit breaker terminals and surge arrestor terminals.</li><li>• Digital multimeter- 2 Nos</li><li>• AC/DC clamp meter – 2 Nos</li><li>• Meggering kit (5 KV) – 1 No.</li><li>• Cable crimping tool – 1 no. 2.5/4/6/10 sq.mm and 1 no. 240-630 sq.mm (hydraulic type)</li><li>• Rechargeable LED type water proof Flash lights – 5 nos.</li></ul>



- Discharge rods for 33KV – 1 no.
- 33 KV safety gloves – 5 no.s
- Vacuum cleaner cum blower – 1 no.

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

**5.32 PRE-COMMISSIONING AND COMMISSIONING FACILITIES**

- a) The Vendor upon completion of installation of equipment and systems, shall conduct pre-commissioning and commissioning activities, to make the equipment/systems ready for safe, reliable and efficient operation on sustained basis.
- b) During commissioning the Vendor shall carry out system checking and reliability trials on various parts of the facilities. All pre-commissioning/commissioning activities considered essential for such readiness of the equipment/systems including those mutually agreed and included in the Vendor's quality assurance plan as well as those indicated in clauses elsewhere in the technical specifications shall be performed by the vendor.
- c) The pre-commissioning and commissioning activities of the equipment/systems furnished and installed by the vendor shall be the responsibility of the Vendor. The Vendor shall provide, in addition, temporary instrumentation and other measuring devices, test instruments, calibrating devices etc. and labor required for successful performance of these operations. If it is anticipated that the above test may prolong for a long time, the Vendor's workmen required for the above test shall always be present at site during such operations.

**All erection & commissioning checks shall be as per manufacturer's manual on mutually agreed terms**

- a) As soon as the facilities or part thereof has been completed operationally and structurally and before start-up, each item of the equipment and systems forming part of facilities shall be thoroughly cleaned and then inspected jointly by the Employer and the Vendor for correctness of and completeness of facility or part thereof and acceptability for initial pre-commissioning tests, commissioning and start-up at Site. The list of pre-commissioning tests to be performed shall be as mutually agreed and included in the Vendor's quality assurance plan as well as those included elsewhere in the Technical Specifications.
- b) The Vendor's pre-commissioning/ commissioning/start-up engineers, specially identified as far as possible, shall be responsible for carrying out all the pre-commissioning tests at Site. On completion of inspection, checking and after the pre-commissioning tests are satisfactorily over, the commissioning of the complete facilities shall be commenced during which period the complete facilities, equipment shall be operated integral with subsystems and supporting equipment as a complete plant.
- c) The time consumed in the inspection and checking of the units shall be considered as a part of the erection and installation period.
- d) The check outs during the pre - commissioning period should be programmed to follow the construction completion schedule. Each equipment/system, as it is completed in construction and turned over for commissioning (start-up), should be checked out and cleaned. The checking and inspection of individual systems should then follow a prescribed commissioning documentation [SCL (Standard Check List) / TS (Testing Schedule) / CS (Commissioning Schedule)] to be furnished by the manufacturer/supplier.

The Vendor shall conduct vibration testing to determine the 'base line' of performance of all plant rotating equipment. These tests shall be conducted when the equipment is running at the base load, peak load as well as lowest sustained operating condition as far as practicable



**5.33 Spares**

- 1) Auxiliary Transformer spare components
- 2) 33kV(E) indoor termination kit for 1Cx150 cable: 3 Nos
- 3) 33kV(E) indoor termination kit for 1Cx630 cable: 3 Nos
- 4) 33KV(E) straight through joint kit for 1Cx150 cable: 3 Nos
- 5) 33KV(E) straight through joint kit for 1Cx630 cable: 3 Nos
- 6) Semiconductor fuse: 5% of total population of respective items
- 7) AC Fuse of rating more than 10 Amp: 25 Nos of each type
- 8) MCCB, MCB of all types: 1 no of each type
- 9) Surge protection devices/ MOV: 5% of total population of respective items

**Notes:**

- (a) In case quantity arrived based on percentage is a decimal figure, it shall be rounded off to next higher integer.
- (b) Bidders shall supply the above mentioned item as applicable in their scope.

**6.0 General conditions applicable during supply, installation and commissioning phase**

6.1	Bidder shall arrange sufficient water safety equipments for floater installation like, safety vests, nylone ropes, buoys, inflatable rafts etc. Temporary power supply for I&C work shall be taken through LT Panel boards having ELCBs, fuses and duly earthed.
6.2	Bidder to source items as per NTPC approved vendor list as applicable.
6.3	All machinery such as cranes, hydra, JCBs, forklifts, transport trucks, trolleys etc necessary for movement and installation of materials / panels / equipment etc shall be organized by the bidder.
6.4	All necessary tools and tackles such as crimping tool ( <b>including heavy duty tools for crimping copper/ aluminium cables up to 630 sq-mm</b> ), screw driver set, power screw drivers, cutting pliers, nose pliers, spanner sets, adjustable spanners, hole-saw cutter set, bending tools, torque wrenches, hack saw blades, pipe wrenches, flat / round files, HV termination tools, drilling machines, welding machines, concrete mixers, steel bar bending tools / templates/ shuttering materials for RCC works, spade, shovel, hammer etc shall be organized by the bidder.
6.5	All necessary measuring instruments such as digital multimeters, measuring tapes, vernier calipers, electrical testers, digital meggers (1kV, 2.5kV, 5kV), earth resistance meters, clamp meters, transformer oil BDV kit, relay testing kit (secondary injection), primary injection kit, infrared thermal imaging handheld temperature meter etc. All these instruments shall possess valid calibration certificate issued from approved NABL laboratory.
6.6	Bidder shall make their own arrangements for necessary food, drinking water and accommodation for their labour and employees posted at the site. Similarly, food and drinking water required at the site, during the construction operations, shall also be in scope of bidder.
6.7	Bidder shall organize all necessary steps to meet statutory requirements such as labour license, PF, ESI etc and also ensure compliance with relevant acts such as minimum wages act, income tax act, employee insurance act etc for their labour deployed at site.
6.8	Bidder shall maintain updated labour register, with name, age, qualification, salary, attendance details etc. at the site.
6.9	Bidder shall use danger boards, wherever required, to ensure safety of the persons during the work at site.



**TECHNICAL SPECIFICATION:  
SUPPLY OF BOS ITEMS AND I&C OF 100MW(AC)  
FLOATING SOLAR PV POWER PLANT FOR NTPC AT  
RAMAGUNDAM THERMAL POWER PLANT**

PS-439-1332

Rev No: 00

PAGE : 22 OF 23

6.10	Bidder shall adhere to all necessary safety norms such as use of helmet, goggles, hand gloves, gumboots, aprons etc. It is the ultimate responsibility of the bidder in all respect to prevent accidents at the site and safeguard their labour from accidents.
6.11	Bidder shall, at the completion of every work, clear off the debris, which resulted out of the work. In case of excavation work such as cable trench etc, bidder shall finish the land neatly with necessary leveling, rolling etc.
6.12	Bidder shall carry out the work without causing inconvenience to other contract groups at the site. In case of conflicts with other groups, bidder shall ensure that the matter is resolved at once amicably so that the progress of work is not affected.
6.13	Any damages on the building, structures etc. attributable to the acts of labour / employees of bidder shall be rectified and made good by the bidder at their own cost.
6.14	No child labour shall be employed for execution of the present contract.
6.15	Any miscellaneous materials, which are found essential for technical completion of the contract but not mentioned explicitly in this specification, shall be deemed to be included in the specification. Accordingly, such materials shall be included by the bidder as part of the offer.
6.16	<b>Special instruction for earthing:</b> In compliance with Rule 33 and 61 of Indian Electricity Rules, 1956 (as amended up to date), all non-current carrying metal parts shall be earthed with two separate and distinct earth continuity conductors to an efficient earth electrode. Accordingly, all cases such as cable support structures, cable ladders, cable trays (control room) etc. shall be earthed.
6.17	BHEL/NTPC shall witness routine/ acceptance/ type tests performed at manufacturer works for the items supplied by bidder. Bidder shall accordingly provide inspection call to BHEL with submission of quality assurance plan in advance. For the items bought out from dealers, test certificates, as per relevant IS / IEC standards, as issued by manufacturer shall be submitted to BHEL. However, prior approval shall be obtained from BHEL/NTPC for procurement of the item from dealers.
6.18	<b>Field Quality Plan / Quality control system (if applicable)</b> Bidder shall set up a field quality control laboratory with full set up to facilitate testing of all construction materials in accordance with FQP (Field quality control plan) as approved by BHEL/NTPC. Bidder shall deploy a well experienced quality control engineer to monitor all QC activities at site as per approved FQP. Specifically, with reference to civil works, bidder shall submit all concrete mix designs and bituminous mix designs for BHEL/NTPC approval before starting of the work. All the third party testing should be conducted in NABL approved laboratories only. Bidder shall submit the FQP for the civil construction works before starting of the works for approval of BHEL/NTPC.
6.19	Any deviations shall be discussed with BHEL/NTPC site engineers and implementation shall be taken up only after approval from BHEL /NTPC.
6.20	Bidder shall submit periodic status report, on daily as well as weekly consolidated basis, to BHEL on the progress of the contract.
6.21	Bidder shall, as and when required by BHEL/NTPC, participate in the review meetings conducted by BHEL/NTPC at project site, BHEL-EDN (Bangalore), BHEL-Corporate office (New Delhi), NTPC office (Kolkata) etc.
6.22	<b>General Guidelines</b> a) <b>All civil structures shall be complied for “C4” category Corrosive Environment.</b> b) Any civil or electrical work which is not mentioned or included in this tender document but necessary for functional requirements of the plant shall be carried out by bidder. c) Bidder shall prepare all designs / drawings based on the specifications given in the tender and in light of relevant BIS/IS/ equivalent standard. d) Bidder shall provide type test reports and datasheet/ GTP for all equipments covered under bidder scope of supply.



**TECHNICAL SPECIFICATION:  
SUPPLY OF BOS ITEMS AND I&C OF 100MW(AC)  
FLOATING SOLAR PV POWER PLANT FOR NTPC AT  
RAMAGUNDAM THERMAL POWER PLANT**

PS-439-1332

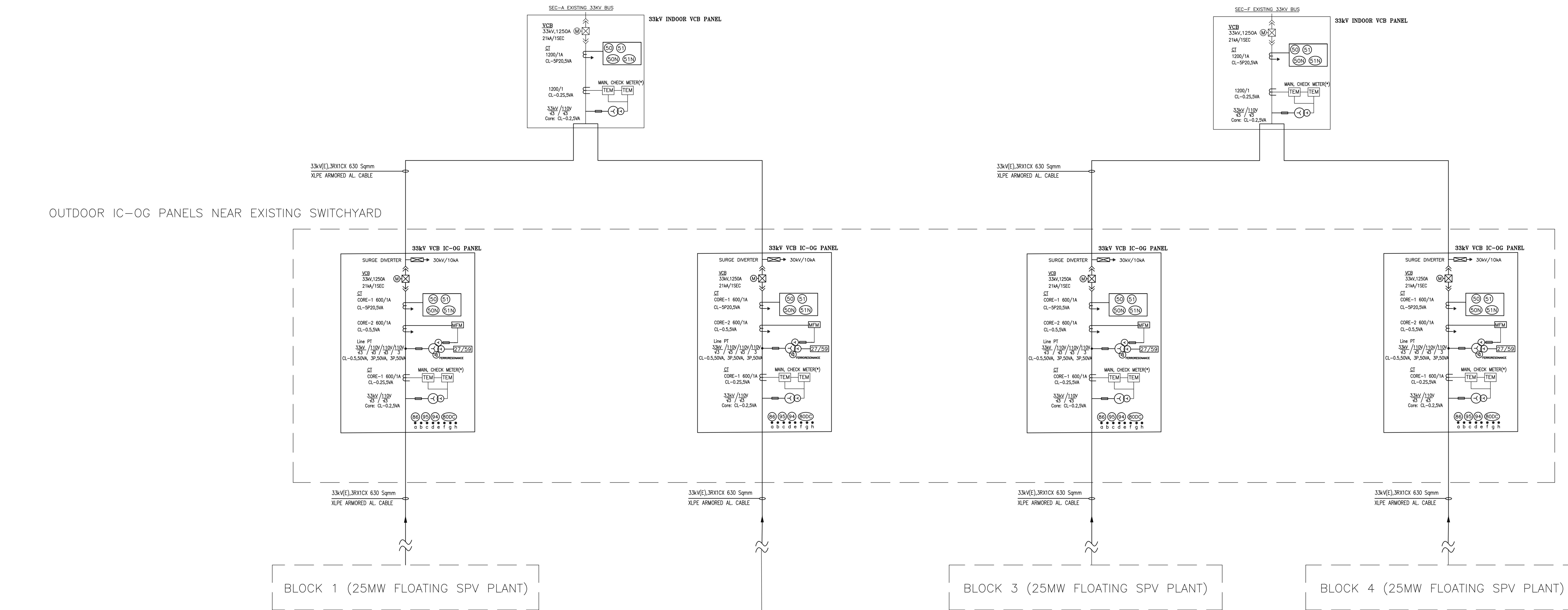
Rev No: 00

PAGE : 23 OF 23

	<p>e) BHEL reserves right to modify the design at any stage to meet local site conditions / project requirements.</p> <p>f) All work shall be carried out in accordance with the latest edition of the Indian Electricity Act and rules formed thereunder and as amended from time to time.</p>
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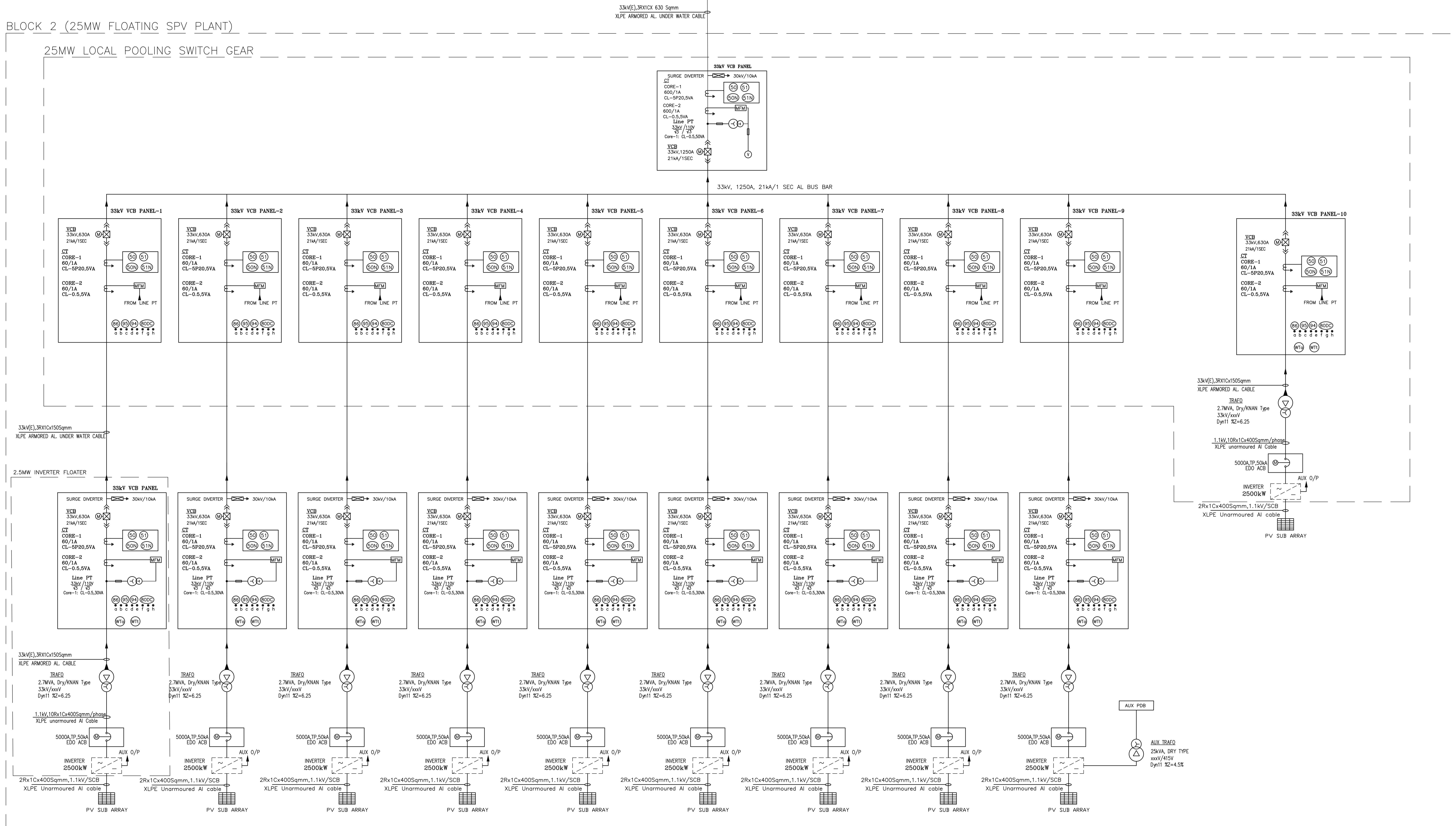
## **7.0 Documents to be submitted for BHEL/NTPC approval during detailed engineering**

7.1	BHEL / NTPC approval shall be obtained for the following technical documents, which shall be submitted to BHEL in phased manner based on priority sequence of activities during detailed engineering (after receipt of order from BHEL).
7.2	Name of vendor/ make, model number/ part number, specification/ sizes/ dimensions/ drawings/ datasheets shall be submitted for approval to BHEL / NTPC for the items which cases vendors name is not mentioned.
7.3	Design calculations/ general arrangement drawings/ single line diagrams/ GTP particulars/ datasheets/ schemes/ layouts/ bill of materials etc., as applicable of bidder supplied items shall be submitted.
7.4	Manufacturing Quality Plans for all the bidder supplied items
7.5	Field quality plan for the field work: civil works, electrical works
7.6	Detailed activity-time chart for project implementation
7.7	Detailed manpower deployment schedule
7.8	Operation and maintenance manuals of bidder supplied items.



## LEGEND DETAILS

NO.	SYMBOL	DESCRIPTION
1		INVERTER DUTY TRANSFORMER
2		<u>VCB</u> 33kV, 630/1250A 21kA/1SEC
3		SURGE DIVERTER, 33kV/10kA
4	(86)	MASTER TRIP RELAY
5	(95) (195) (295)	TRIP CIRCUIT SUPERVISION RELAY
6	(94)	ANTI PUMPING RELAY
7	(WTa)	WINDING TEMPERATURE ALARM
8	(WTt)	WINDING TEMPERATURE TRIP
9	⊗ a	VCB ON
10	⊗ b	VCB OFF
11	⊗ c	SPRING CHARGE
12	⊗ d	AUTO TRIP
13	⊗ e	TRIP CIRCUIT HEALTHY
14	⊗ f	SERVICE POSITION
15	⊗ g	TEST POSITION
16	⊗ h	DC FAILURE
17	(50)	INST OVER CURRENT RELAY
18	(51)	IDMT OVER CURRENT RELAY
19	(50N)	NEUTRAL INSTANTANEOUS OVER CURRENT RELAY
20	(51N)	IDMT EARTH FAULT RELAY
21	[MFM]	MULTI FUNCTION METER
22		CURRENT TRANSFORMER
23	(27)	UNDER VOLTAGE RELAY
24	(59)	OVER VOLTAGE RELAY
25		POTENTIAL TRANSFORMER
26		FUSE
27	50G/51G	CBCT
28	[TEM]	TARIFF ENERGY METER
29	(80DC)	DC FAILURE INDICATION
30	(49)	WINDING TEMP INDICATOR AND OIL TEMP INDICATOR



NOTE: 1) \* MAIN & CHECK METERS IN SEPARATE METERING CUBICLE, WHEREAS METERING CT AND PT SHALL BE INSTALLED IN VCB PANEL.

2) TOTAL 12 Nos OF TEMs ARE CONSIDERED AS PER NIT REQUIREMENT

3) AUX POWER FOR 4 Nos OF OUTDOOR IC-OC PANELS AND 2 Nos OF INDOOR HT PANELS NEAR TO EXISTING SWITCHGEAR ROOM WILL BE PROVIDED BY NTPC.

4) DRY TYPE AUX TRANSFORMER WILL BE PLACED IN ONE OF THE INV FLOATER PLATFORM NEAR TO CMCS AND CABLE WILL BE TAKEN TO AUX PDB INSTALLED IN CMCS



**DEVELOPMENT OF 100 MW (AC) FLOATING SOLAR PHOTOVOLTAIC PLANT  
AT NTPC RAMAGUNDAM SUPER THERMAL POWER PLANT**



**TITLE OF THE DRAWING:** Overall Solar Block Layout

**DOCUMENT NO:** 5747-004-PVE-F-001


SL.NO	CONTENTS
1	There is a slight discrepancy between the Bathymetry Study done by BHEL and the Bathymetry report provided by NTPC and hence to be on the safer side we have made the Array layout considering the worst conditions so that the Floatation Platform will perennially rest on water. There are very few isolated earth dunes in the reservoir area , they shall be dredged and removed before the commencement of Anchoring and Mooring works.
2	Compliance to Customer Comments provided.

2	17.01.2020	FOR APPROVAL			
1	31.12.19	FOR APPROVAL			
0	16.12.19	FOR APPROVAL	BHEL-EDN-BLR	Punam Mishra	M SREENATH
REV NO.	DATE	STATUS	INITIALS	INITIALS	INITIALS
PROJECT:			PREPARED BY	CHECKED BY	APPROVED BY
DEVELOPMENT OF 100 MW (AC) FLOATING SPV PLANT AT NTPC RAMAGUNDAM SUPER THERMAL POWER PLANT			5747-004-PVE-F-001		17.01.2020
					PAGE - 1

**Compliance Sheet**

Sl.no	Customer Comments	BHEL Reply Dt 16.12.19	Customer Comments Dt 19.12.19	BHEL Reply Dt 31.12.19	Customer Comments Dt 08.01.2020	BHEL Reply Dt 17.01.2020
1	Some part of Array no 1,6,14 ,15 ,16 &11 will get dried up during minimum draw down period.The location of the same need to be shifted to avoid this.	All the Arrays have been populated so as to remain perennially in water.	CMCS May be located on the reservoir side( not exactly here). O&M,safety , accessibility etc has to be considered for locating CMCS building)	CMCS is relocated and revised location shown in Array layout.	Location of CMCS may be reviewed considering the proximity to bund, availability of access, Foundation and Civil works , availability of drinking water and layout of sewerage system.Locating the Control room shall be confirmed latter after discussion with Site.	Agreed.
2	4 nos pooling Switchgear/Inverter Platform (25 MW) will have to accommodate Switchgear of approx 25m in length in addition to inverter and transformer. Accordingly they may be located along the reservoir periphery (Land).	4 nos of Pooling Switchgear are shown in the Array layout in the reservoir itself considering cable routing optimization.	Cable crossing across the Dam/Bund at this location may be difficult considering the steep slope and anchoring difficulties. BHEL to inspect the same and take necessary clearance from NTPC Ramagundam.	Necessary clearances will be taken from NTPC.	Access for the floating Platforms has to be indicated considering erection and O&M.	Access of all floating platforms indicated in the layout.
3	Route for accessing the floating system/floating Platform during Erection and O&M required draft for Boat/Floating Platform has to be maintained for Erection and O&M at MDDL (162.3)	Complied.	Explore the possibility of placing 25MW pooling switchgear on land for easy installation and optimum O&M.	Location of 25MW pooling switchgear shown . However it is located on water. Option of placing the same on land was explored ,however does not fit in the overall system design as the floating HT cables shall obstruct the access to inverter platforms.	It is assumed that the entire floating platform will be towed to the shore incase of any repair to Inverter . Transformer ,Switch gear etc. Accordingly the route of any repair to Inverter ,Transformer ,Switch gear etc. Accordingly the route with necessary clearances may be mentioned.	Yes the assumption is correct and the entire floating platform will be towed to the shore in case of any repair to Inverter. Route to take the Entire Floating Platform to the shore is indicated in the layout and minimum 20 mts clearance is provided for movement of Equipment Floater Platform.
4	HT Cable routing to be marked .Routing has to be optimized to allow access to all floating blocks during erection and O&M Stage.	Shall be submitted later.	The complete floating system shall have at least 400mm floating corridor along the periphery comprising of module floaters and /or walkway floater to prevent water splash. Location of SCB to be shown.	Complied. Location of SCB shown in the detailed 2.5MW Block of M/s Prabh Dayal.	2 Nos of Launching platforms for each vendor may be provided.	Complied. Location of same will be decided as per the water level during the erection time.
5	Location Switchgear room, CMCS and other major installations to be marked.	CMCS shown in Array layout and switchgear platform is near existing Switchgear Room.	1. Cable Routing to be marked. The accessibility of individual floating blocks can be ascertained after cable routing only. 2. Array layout of the two typical blocks has to be shown. 3. Location of launching platform and O&M access platform has to be marked.	1.Cable Routing is marked . 2.Detailed Layout of both the Typical blocks attached. 3. Location of launching platform is subject to change - depending upon the reservoir level. However one fixed location shown.	Indicate the layout (cabling arrangement on the bund.)	Cable route shall be finalized at site.
6	Location of Inverter platforms may be ascertained for ease and shadow analysis .	The inverter platforms are placed such as not to cast any shadow on the PV-Module Array.	1. Size and dimension of floating blocks with details shall be provided in layout drawing. 2. Distance between each individual block shall also be marked in the drawing. 3. Details of plant ,panels , equipment shall be provided in tabular form.		Enclose site clearance for the cable route.	
7	Location and no of Anchors shall be based on the design.	Complied.			Anchoring Points has to be connected by Floater on all three sides for better load distribution and system rigidity.	Details of Anchoring points shall be submitted through different Mdl of Design of Floatation system.
8	Mark the location of Launching platforms for erection of Floating system and Floating Platform for Inverter and Transformer.	Platforms shall be launched from the southern side of reservoir , exact locations will be finalized later.			Anchoring location to be marked.	
					Cable layout has to be marked.	Marked and attached.
					Necessary walkway width has to be proved after providing for cables.	There is a 400mm walkway all around the 2.5MW Block. There is no cable running on this periphery float.

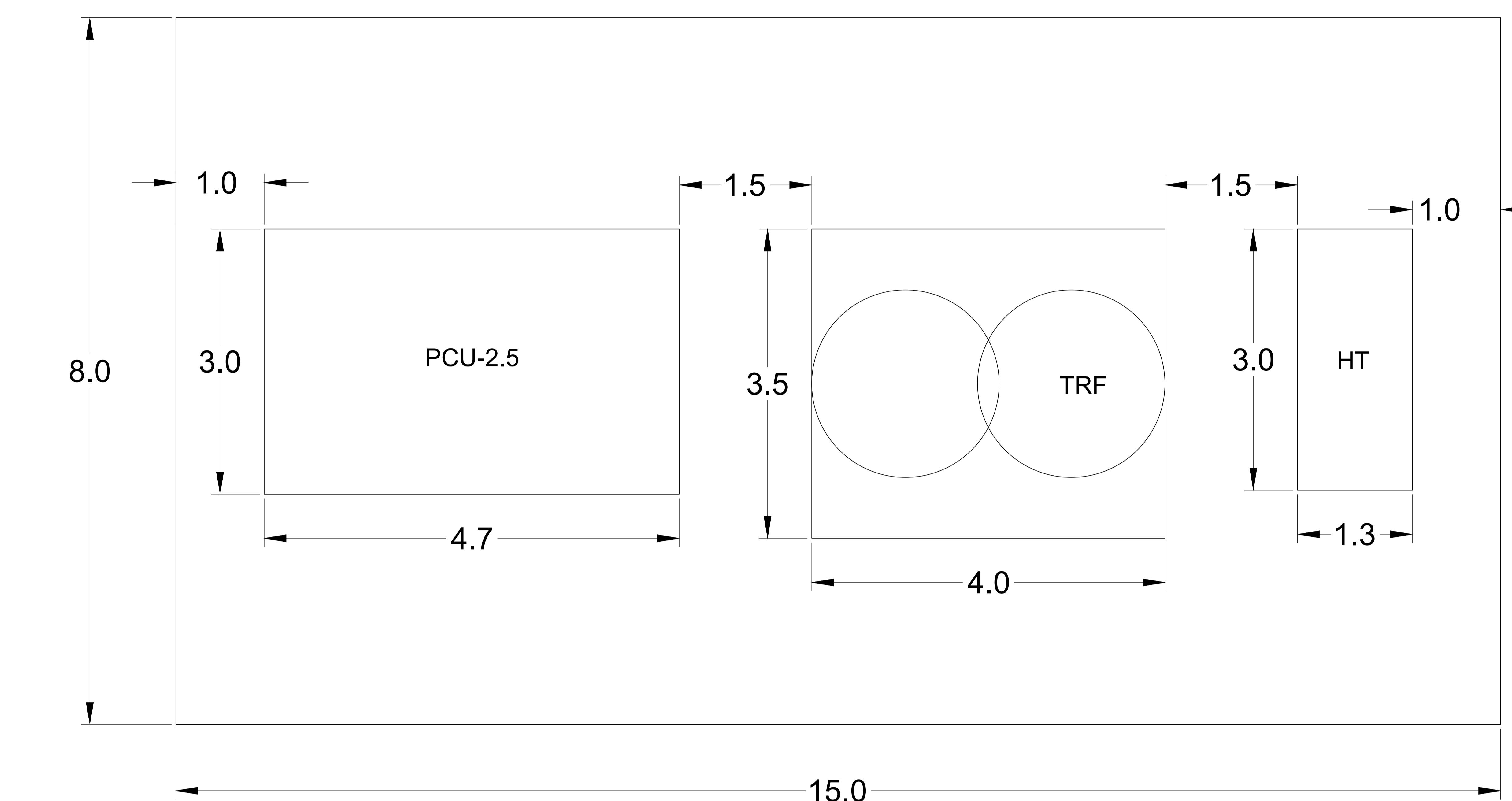




**Actual Layout**

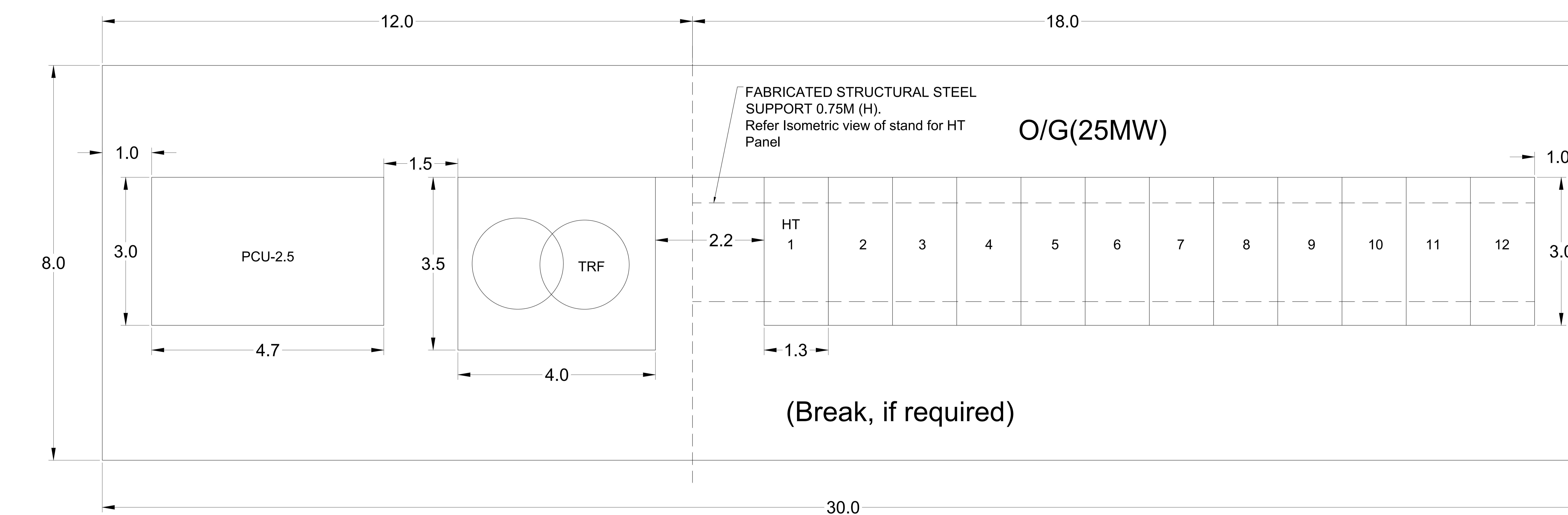
# Inverter Floater Platform (IFP)

-Qty:36Nos



# Local Pooling Switcher Floater Platform (LPSFP)

-Qty:4 Nos



**NOTE:**  
 1. TRANSFORMER WEIGHT -9T  
 2. PCU WEIGHT -6T  
 3. HT PANEL WEIGHT-2T  
 4. TRANSFORMER HEIGHT -3.5M  
 5. PCU HEIGHT -3.5M  
 6. HT HEIGHT -2.8M

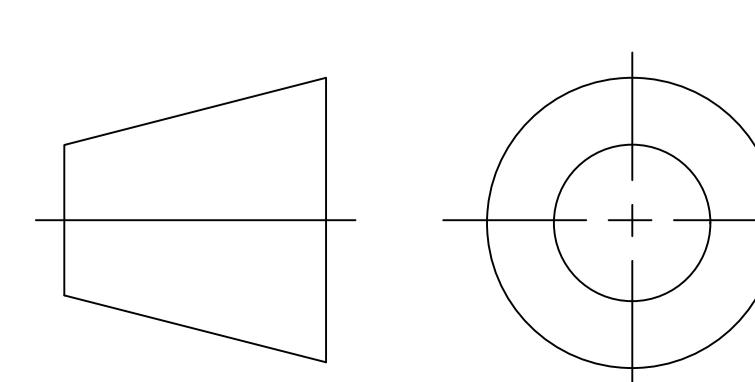
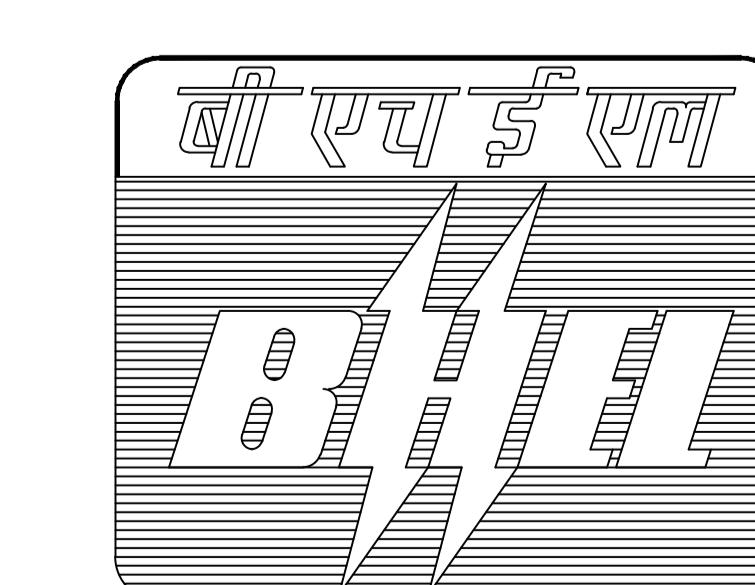
PROJECT: 100MW (AC) FSPV  
 CUSTOMER: NTPC, RAMAGUNDAM

BHARAT HEAVY ELECTRICALS LIMITED.  
 ELECTRONICS DIVISION, BANGALORE

TITLE: FLOATING PLATFORM FOR ELECTRICAL EQUIPMENT  
 EQUIPMENT LAYOUT (TENTATIVE)

No. OF  
SHEETS  
SHEET  
No.  
REV

02



All Dimension in Meter

BHEL DRG. No.





DEVELOPMENT OF 100 MW FLOATING SOLAR PHOTOVOLTAIC PLANT  
AT NTPC RAMAGUNDAM



TITLE OF THE DRAWING: CMCS-ARCHITECTURAL PLAN, ELEVATIONS, SECTION & FINISHING

DOCUMENT NO: 5747-004-PVC-F-050

SL.NO CONTENTS

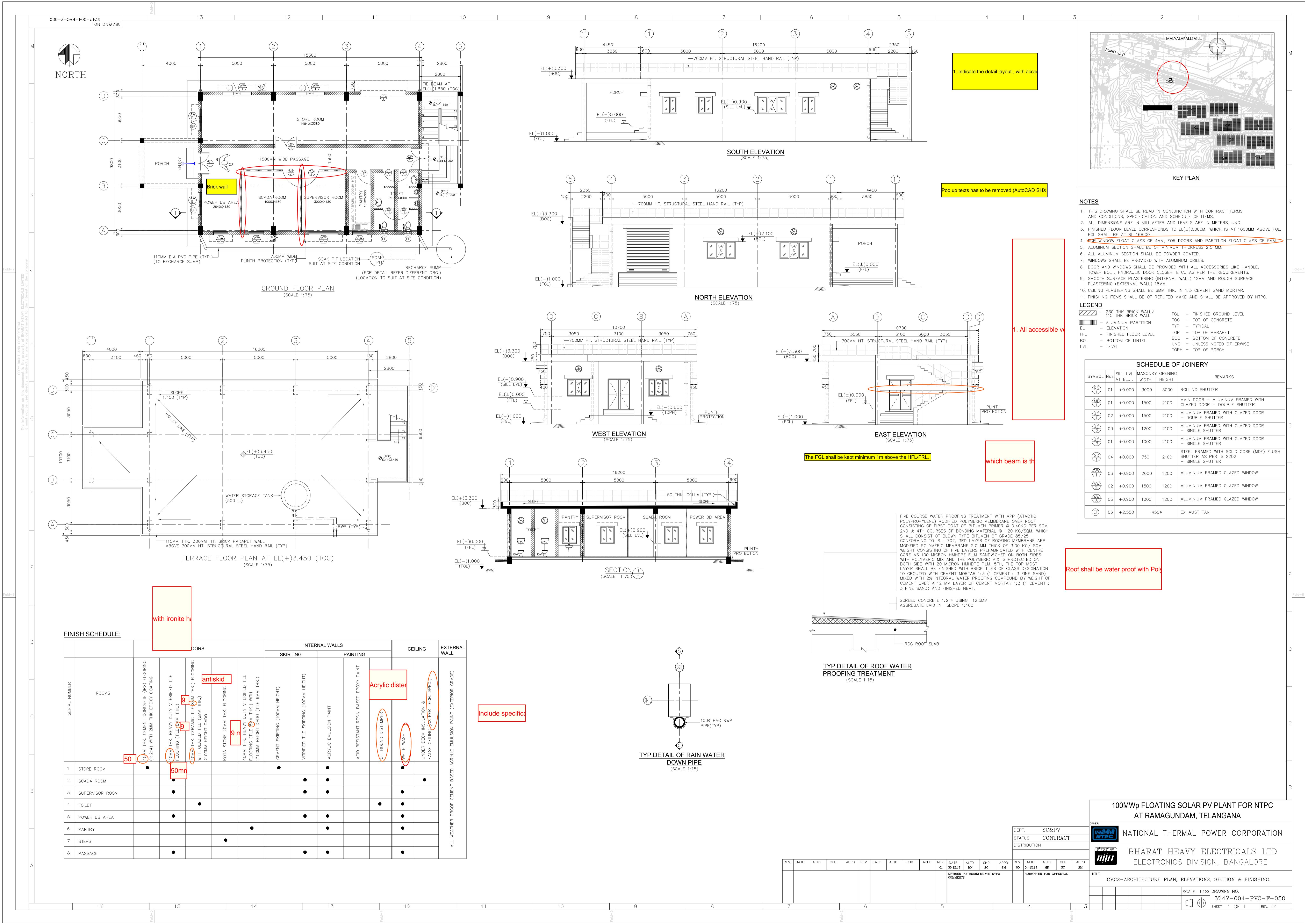
1 CMCS-ARCHITECTURAL PLAN, ELEVATIONS, SECTION & FINISHING

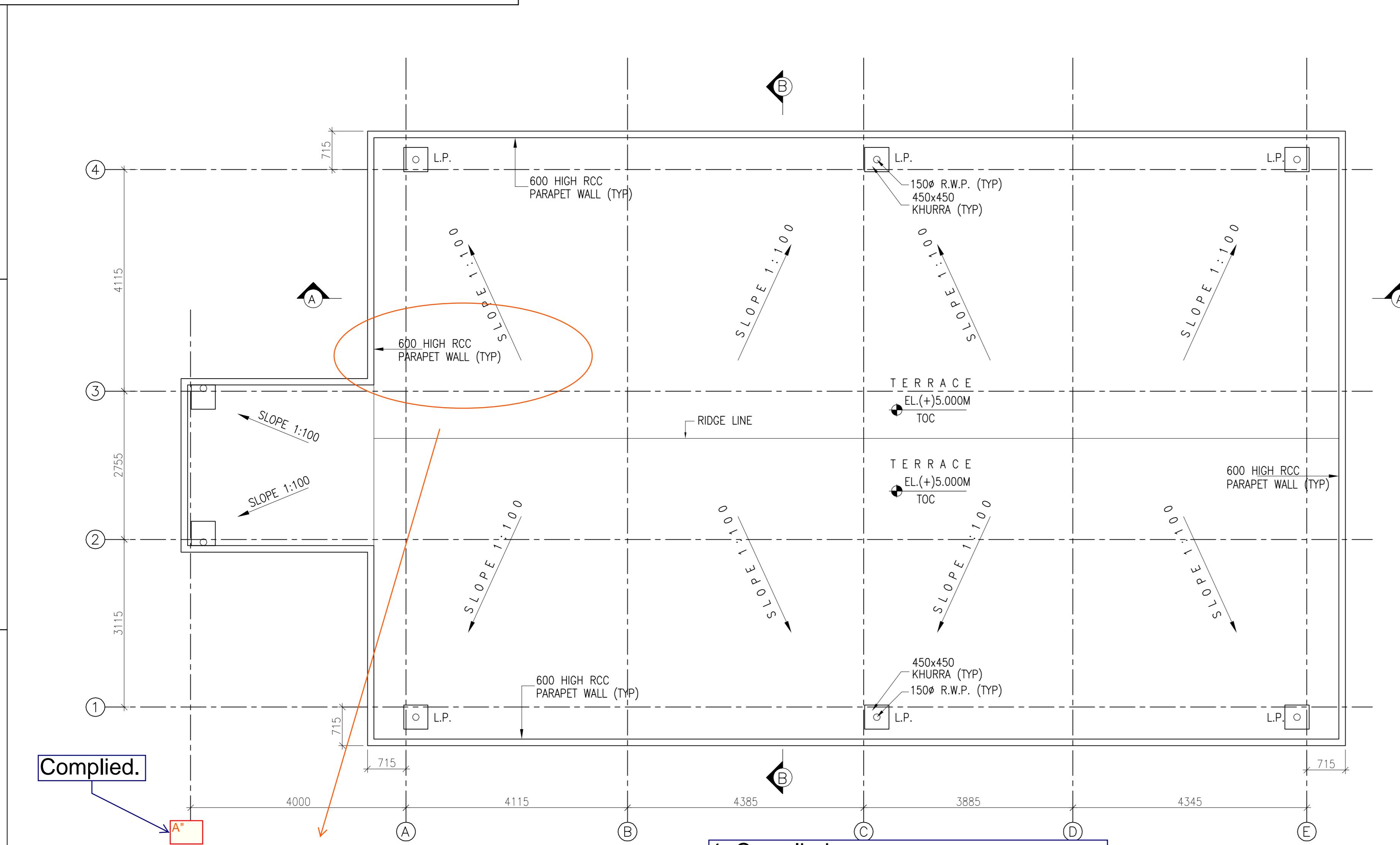
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REV NO.	DATE	STATUS	INITIALS	INITIALS	INITIALS
PROJECT:			PREPARED BY	CHECKED BY	APPROVED BY
DEVELOPMENT OF 100 MW (AC) FLOATING SPV PLANT AT NTPC RAMAGUNDAM SUPER THERMAL POWER PLANT			5747-004-PVC-F-050		04.12.2019
					PAGE - 1

Signature Not Verified

Digitally signed  
by P RAJKUMAR  
Date: 2020.01.06  
15:22:48 IST  
Reason: CAT II  
Location:  
NTPCEOC

P. Rajkumar

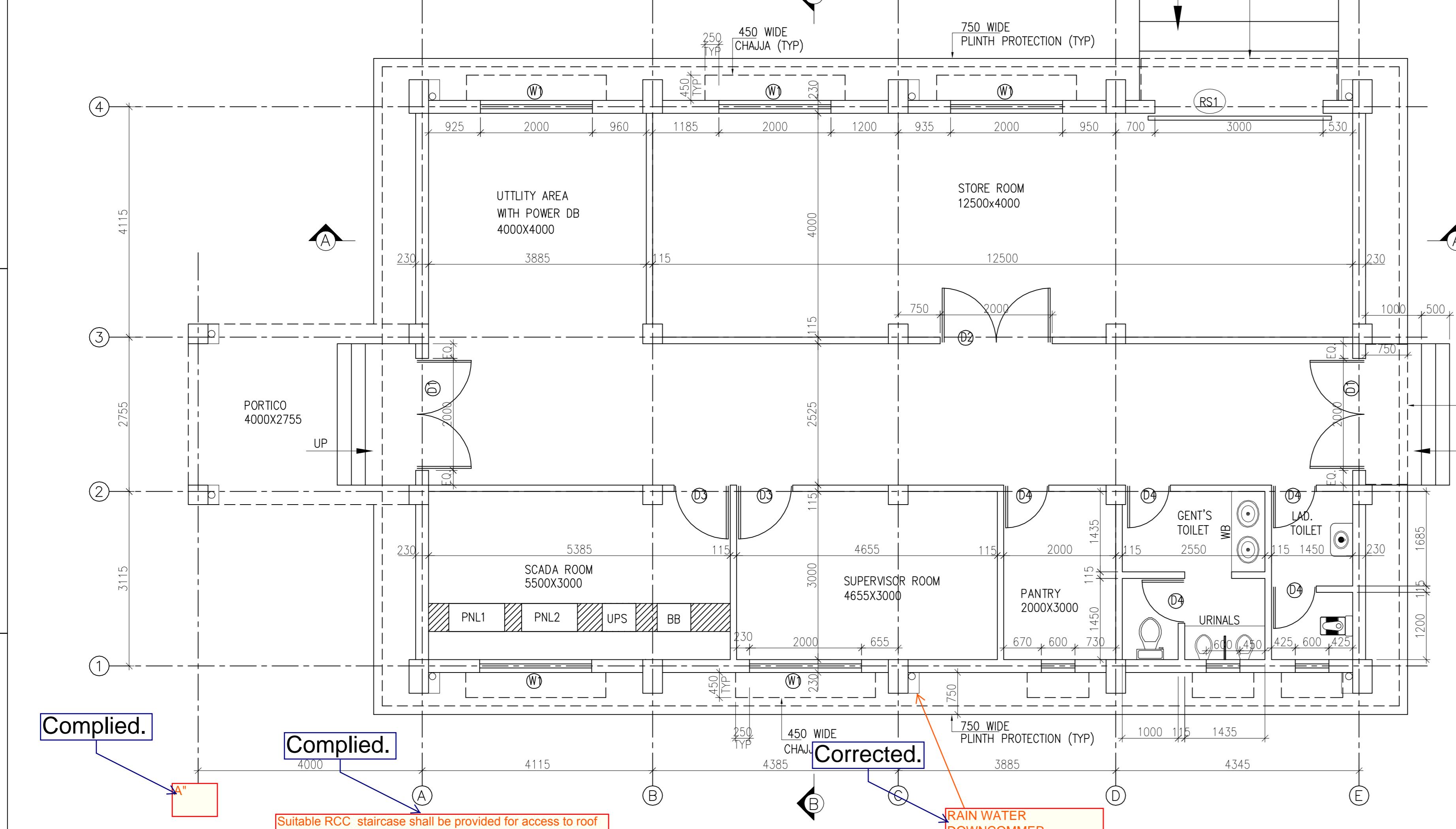




Complied.

1. Height of parapet wall shall be minimum 300 mm above top of roof level. Structural steel hand railings of minimum 700mm height shall also be provided over the parapet wall as per tech Specification refer clause no 2.1.3 of chapter D2 of civil works.  
2. As per technical specifications bidder shall also provide rain water harvesting system consisting of ground water recharge pits for CMCS building roof. Kindly incorporate the same in design

1. Complied.  
2. Complied, detail will be provided in the plumbing detail drawing.



Complied.

Complied.

Suitable RCC staircase shall be provided for access to roof of the CMCS building.

Corrected.  
RAIN WATER DOWNCOMMER ENCASEMENT??

Water supply scheme indicating source has to be marked/Shown.

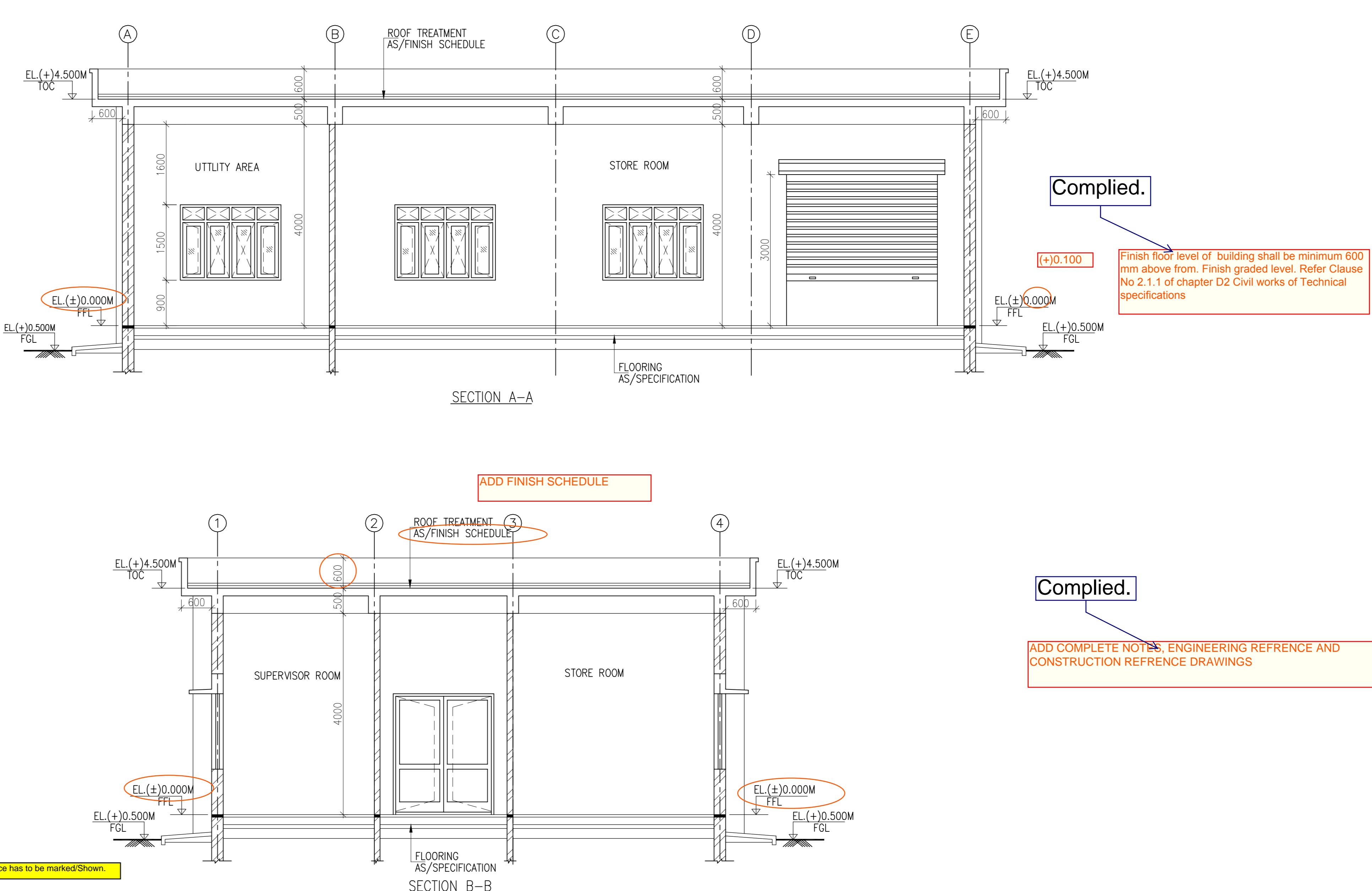
Main door is provided with porch. As per clause no 2.1.5, all other door shall be provided with 450mm wide.

Projections over main entrance door to the control room where the projection shall be 1500 mm as per clause no 2.1.5 of chapter D2 Civil works of Technical specifications

**FOR MECHANICAL APPROVAL ONLY**

Septic tank and soak pit detail is covered in different drawing.

Indicate location of packaged sewage treatment plant/septic with soak pit for CMCS assuming that a total of 15 people shall use the facility.



Complied.

INCLUDE KEY PLAN INDICATING LOCATION OF THE CMCS BUILDING

Complied.  
Finish floor level of building shall be minimum 600 mm above from Finish graded level. Refer Clause No 2.1.1 of chapter D2 Civil works of Technical specifications

Complied.  
ADD COMPLETE NOTES, ENGINEERING REFERENCE AND CONSTRUCTION REFERENCE DRAWINGS

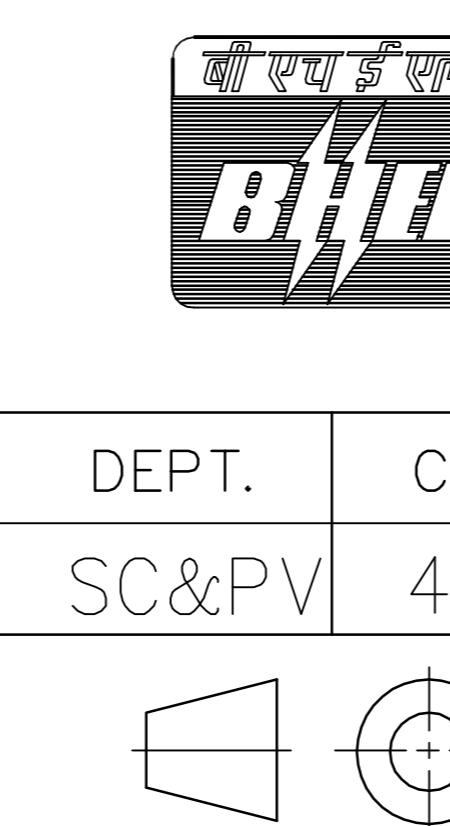
PROJECT : 100MV FLOATING SOLAR PV PROJECT  
CUSTOMER : NTPC RAMAGUNDAM

BHARAT HEAVY ELECTRICALS LIMITED.  
ELECTRONICS DIVISION, BANGALORE  
TITLE: CENTRAL MONITORING & CONTROL STATION  
ARCHITECTURAL DRAWING

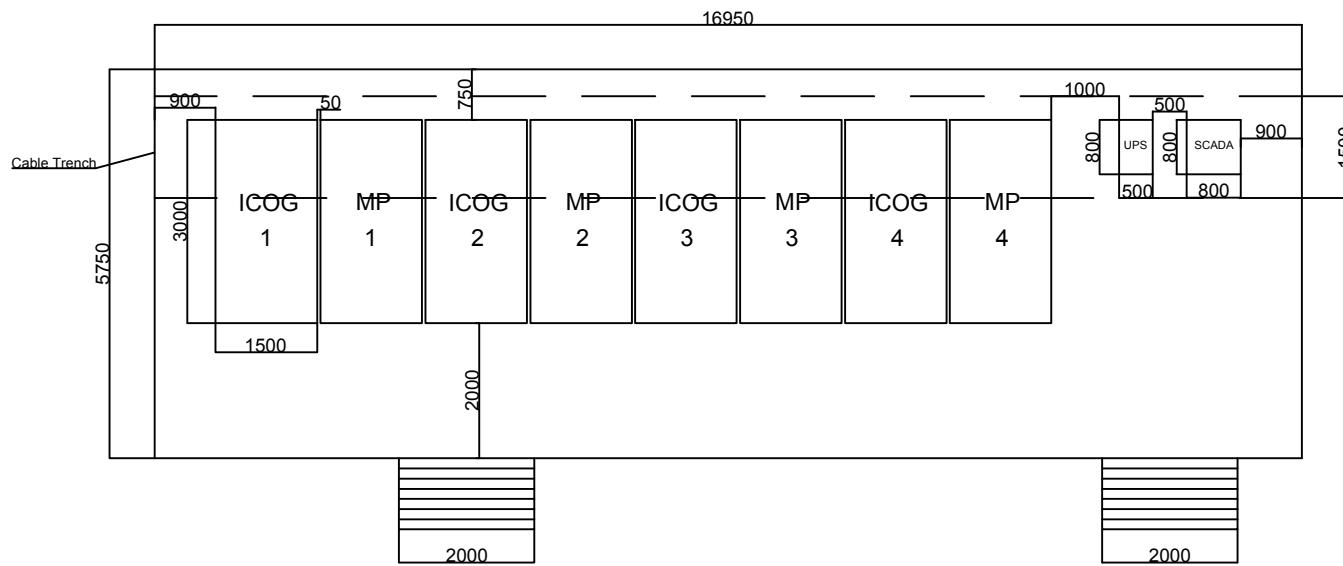
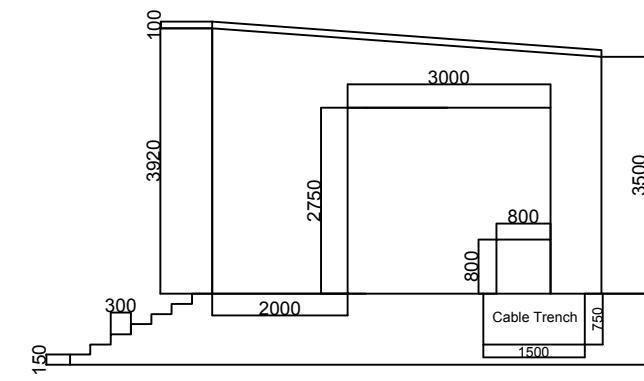
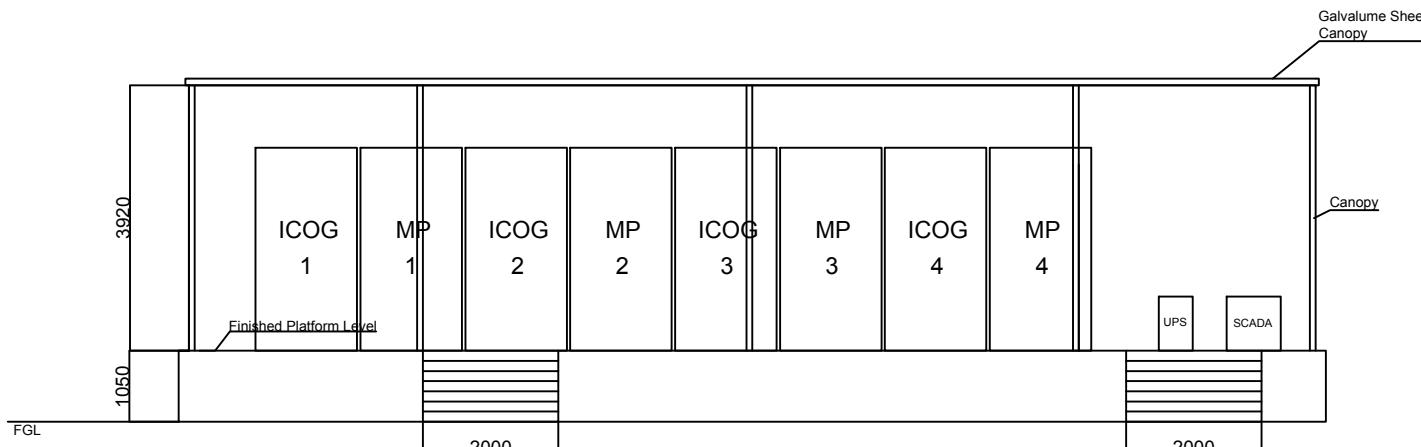
No. OF SHEETS 02  
SHEET No. 01  
REV 00

REV.	DATE	ALTERED CHECKED APPROVED	REV.	DATE	ALTERED CHECKED APPROVED	DRAWN	NAME PM	SIGN	DATE 04-12-19	DEPT.	CODE
						CHECKED	VCP		04-12-19		
						APPROVED	SM		04-12-19		
DISTRIBUTION OF PRINTS											
										SC&PV	439

1	2	3	4
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# HT SWGR PLATFORM AT 100MW NTPC RAMAGUDAM FLOATING SPV-SWITCH YARD



CLAUSE NO.	TECHNICAL SPECIFICATIONS	NTPC																								
1.0	<p style="text-align: center;"><b>C-6 CABLE INSTALLATION METHODOLOGY</b></p> <p><b>CODES &amp; STANDARDS</b></p> <p>All standards, specifications and codes of practice referred to herein shall be the latest editions including all applicable official amendments and revisions as on date of opening of bid. In case of conflict between this specification and those (IS codes, standards, etc.) referred to herein, the former shall prevail. All work shall be carried out as per the following standards/ codes as applicable.</p> <table> <tbody> <tr> <td>IS:513</td><td>Cold rolled low carbon steel sheets and strips.</td></tr> <tr> <td>IS:802</td><td>Code of practice for the use of Structural Steel in Overhead Transmission Line Towers.</td></tr> <tr> <td>IS:1079</td><td>Hot Rolled carbon steel sheet &amp; strips</td></tr> <tr> <td>IS:1239</td><td>Mild steel tubes, tubulars and other wrought steel fittings</td></tr> <tr> <td>IS:1255</td><td>Code of practice for installation and maintenance of power cables upto and including 33 KV rating</td></tr> <tr> <td>IS:1367 Part-13</td><td>Technical supply conditions for threaded Steel fasteners. (Hot dip galvanized coatings on threaded fasteners).</td></tr> <tr> <td>IS:2147</td><td>Degree of protection provided by enclosures for low voltage switchgear and control gear</td></tr> <tr> <td>IS:2309</td><td>Code of Practice for the protection of building and allied structures against lightning.</td></tr> <tr> <td>IS:2629</td><td>Recommended practice for hot dip galvanising of iron &amp; steel</td></tr> <tr> <td>IS:2633</td><td>Method for testing uniformity of coating on zinc coated articles.</td></tr> <tr> <td>IS:3043</td><td>Code of practice for Earthing</td></tr> <tr> <td>IS:3063</td><td>Fasteners single coil rectangular section spring washers.</td></tr> </tbody> </table>	IS:513	Cold rolled low carbon steel sheets and strips.	IS:802	Code of practice for the use of Structural Steel in Overhead Transmission Line Towers.	IS:1079	Hot Rolled carbon steel sheet & strips	IS:1239	Mild steel tubes, tubulars and other wrought steel fittings	IS:1255	Code of practice for installation and maintenance of power cables upto and including 33 KV rating	IS:1367 Part-13	Technical supply conditions for threaded Steel fasteners. (Hot dip galvanized coatings on threaded fasteners).	IS:2147	Degree of protection provided by enclosures for low voltage switchgear and control gear	IS:2309	Code of Practice for the protection of building and allied structures against lightning.	IS:2629	Recommended practice for hot dip galvanising of iron & steel	IS:2633	Method for testing uniformity of coating on zinc coated articles.	IS:3043	Code of practice for Earthing	IS:3063	Fasteners single coil rectangular section spring washers.	
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CLAUSE NO.	TECHNICAL SPECIFICATIONS	एनटीपीसी NTPC
	<p>IS:6745 Methods for determination of mass of zinc coating on zinc coated iron &amp; steel articles.</p> <p>IS:8308 Compression type tubular in- line connectors for aluminium conductors of insulated cables</p> <p>IS:8309 Compression type tubular terminal ends for aluminium conductors of insulated cables.</p> <p>IS:9537 Conduits for electrical installation.</p> <p>IS:9595 Metal - arc welding of carbon and carbon manganese steels - recommendations.</p> <p>IS:13573 Joints and terminations for polymeric cables for working voltages from 6.6kv upto and including 33kv performance requirements and type tests.</p> <p>BS:476 Fire tests on building materials and structures</p> <p>IEEE:80 IEEE guide for safety in AC substation grounding</p> <p>IEEE:142 Grounding of Industrial &amp; commercial power systems</p> <p>DIN 46267 (Part-II) Non tension proof compression joints for Aluminium conductors.</p> <p>DIN 46329 Cable lugs for compression connections, ring type ,for Aluminium conductors</p> <p>VDE 0278 Tests on cable terminations and straight through joints</p> <p>BS:6121 Specification for mechanical Cable glands for elastomers and plastic insulated cables.</p> <p>Indian Electricity Act.</p> <p>Indian Electricity Rules.</p> <p>Equipment complying with other internationally accepted standards such as IEC, BS, DIN, USA, VDE, NEMA etc. will also be considered if they ensure performance and constructional features equivalent or superior to</p>	

CLAUSE NO.	TECHNICAL SPECIFICATIONS	
<p><b>2.0</b></p>	<p>standards listed above. In such a case, the Bidder shall clearly indicate the standard(s) adopted, furnish a copy in English of the latest revision of the standards along with copies of all official amendments and revisions in force as on date of opening of bid and shall clearly bring out the salient features for comparison.</p> <p><b>DESIGN AND CONSTRUCTIONAL FEATURE</b></p> <p><b>Inter Plant Cabling</b></p> <p>Interplant cabling for main routes shall be laid in Cable trenches/cable trays/buried/duct banks. In case of Duct banks, pull-pits shall be filled with sand and provided with a PCC covering. All buried cables shall be armoured</p> <p><b>Cable Sizing Conditions</b>  <b>All cables shall be suitably derated as per the laying conditions for carrying the required load current and fault current. For derating, the ambient temperature for directly buried cables shall be taken as 35° C and 45° C for cables laid in air.</b></p> <p><b>All XLPE cables shall be rated at 90° C conductor temperature for AC Voltage drop calculation and 80° C for DC Voltage calculation. However, for Voltage drop calculation in DC Cable, actual conductor temperature as per loading can be used.</b></p> <p><b>Trenches</b></p> <p>PCC flooring of built up trenches shall be sloped for effective drainage with sump pits and sump pumps.</p> <p><b>General</b></p> <p>The cable slits to be used for motor/equipment power/control supply shall be sand filled &amp; covered with PCC after cabling.</p> <p>Sizing criteria, derating factors for the cables shall be met as per respective chapters. However for the power cables, the minimum conductor size shall be 6 sq.mm. for aluminium conductor and 2.5 sq.mm. for copper conductor cable.</p> <p>Conscious exceptions to the above guidelines may be accepted under special conditions but suitable measures should be taken at such location to:</p>	

CLAUSE NO.	TECHNICAL SPECIFICATIONS
3.0	<ul style="list-style-type: none"> <li>• Meet all safety requirements</li> <li>• Safeguard against fire hazards, mechanical damage, flooding of water, oil accumulation, electrical faults/interferences, etc</li> </ul> <p><b>EQUIPMENT DESCRIPTION</b></p> <p><b>Cable trays, Fittings &amp; Accessories</b></p> <p>Cable trays shall be ladder/perforated type as specified complete with matching fittings (like brackets, elbows, bends, reducers, tees, crosses, etc.) accessories (like side coupler plates, etc. and hardware (like bolts, nuts, washers, G.I. strap, hook etc.) as required. Cable tray shall be ladder type for power &amp; control cables and perforated for instrumentation cables.</p> <p>Cable trays, fittings and accessories shall be fabricated out of rolled mild steel sheets free from flaws such as laminations, rolling marks, pitting etc. These (including hardware) shall be hot dip galvanized as per relevant IS.</p> <p>Cable trays shall have standard width of 150 mm, 300 mm &amp; 600 mm and standard lengths of 2.5 metre. Thickness of mild steel sheets used for fabrication of cable trays and fittings shall be 2 mm. The thickness of side coupler plates shall be 3 mm.</p> <p>Cable troughs shall be required for branching out few cables from main cable route. These shall be U-shaped, fabricated of mild steel sheets of thickness 2 mm and shall be hot dip galvanised as per relevant IS. Troughs shall be standard width of 50 mm &amp; 75 mm with depth of 25 mm</p> <p><b>Support System for Cable Trays</b></p> <p>Cable tray support system shall be pre-fabricated similar or equivalent to "Unistrut make".</p> <p>Support system for cable trays shall essentially comprise of the two components i.e. main support channel and cantilever arms. The main support channel shall be of two types : (i) C1:- having provision of supporting cable trays on one side and (ii) C2:-having provision of supporting cable trays on both sides. The support system shall be the type described hereunder:</p> <p>a. Cable supporting steel work for cable racks/cables shall comprise of various channel sections, cantilever arms, various brackets, clamps, floor plates, all hardwares such as lock washers, hexagon</p>

CLAUSE NO.	TECHNICAL SPECIFICATIONS	 નાન્દીપાંડી NTPC
	<p>nuts, hexagon head bolt, support hooks, stud nuts, hexagon head screw, channel nut, channel nut with springs, fixing studs, etc.</p> <p>b. The system shall be designed such that it allows easy assembly at site by using bolting. All cable supporting steel work, hardwares fittings and accessories shall be prefabricated factory galvanised.</p> <p>c. The main support and cantilever arms shall be fixed at site using necessary brackets, clamps, fittings, bolts, nuts and other hardware etc. to form various arrangements required to support the cable trays. Welding of the components shall not be allowed. However, welding of the bracket (to which the main support channel is bolted) to the overhead beams, structural steel, insert plates or reinforcement bars will be permitted. Any cutting or welding of the galvansied surface shall be brushed and red lead primer, oil primer &amp; aluminium paint shall be applied</p> <p>d. All steel components, accessories, fittings and hardware shall be hot dip galvanised after completing welding, cutting, drill ing and other machining operation.</p> <p>e. Support system shall be able to withstand</p> <ul style="list-style-type: none"> <li>• weight of the cable trays</li> <li>• weight of the cables (75 Kg/Metre run of each cable tray)</li> <li>• Concentrated load of 75 Kg between every support span.</li> <li>• Factor of safety of minimum 1.5 shall be considered.</li> </ul> <p><b>Pipes, Fittings &amp; Accessories</b></p> <p>Pipes offered shall be complete with fittings and accessories (like tees, elbows, bends, check nuts, bushings, reducers, enlargers, coupling caps, nipples etc.) The size of the pipe shall be selected on the basis of maximum 40% fill criteria</p> <p>GI Pipes shall be of medium duty as per IS:1239</p> <p>Duct banks shall be High Density PE pipes encased in PCC (10% spare of each size, subject to minimum one) with suitable water-proof manholes.</p> <p>Hume pipes shall be NP3 type as per IS 458</p> <p><b>Junction Boxes</b></p>	

CLAUSE NO.	TECHNICAL SPECIFICATIONS	 <b>નાન્દીપાંડી</b> <b>NTPC</b>	
	<p>Junction Boxes with IP:55 degree of protection, shall comprise of a case with hinged door constructed from cold rolled sheet steel of thickness 2mm. Top of the boxes shall be arranged to slope towards rear of the box. Gland plate shall be 3mm thick sheet steel with neoprene/synthetic rubber gaskets. All junction boxes shall be of adequate strength and rigidity, hot dip galvanised as per relevant IS, and suitable for mounting on wall, columns, structures etc. The boxes shall include brackets, bolts, nuts, screws M8 earthing stud etc. required for installation.</p> <p>Terminal blocks shall be 1100V grade, 10Amps rated, made up of unbreakable polyamide 6.6 grade. The terminals shall be screw type or screw-less (spring loaded) / cage clamp type with lugs. Marking on terminal strips shall correspond to the terminal numbering in wiring diagrams. All metal parts shall be of non-ferrous material. In case of screw type terminals the screw shall be captive, preferably with screw locking design. All terminal blocks shall be suitable for terminating on each side two (2) nos. stranded copper conductors of size upto 2.5 sq mm each. All internal wiring shall be of minimum 1.5 sq. mm cu. Conductor PVC wire.</p> <p><b>Terminations &amp; Straight Through Joints</b></p> <p>Termination and jointing kits for 33kV, 11kV, 6.6 kV and 3.3 kV grade XLPE insulated cables shall be of proven design and make which have already been extensively used and type tested. Termination kits and jointing kits shall be pre-moulded type, taped type or heat shrinkable type. 33kV, 11kV and 6.6 kV grade joints and terminations shall be type tested as per IS:13573. 3.3kV grade joints and terminations shall be type tested as per VDE0278. Critical components used in cable accessories shall be of tested and proven quality as per relevant product specification/ESI specification. Kit contents shall be supplied from the same source as were used for type testing. The kit shall be complete with the aluminium solderless crimping type cable lugs &amp; ferrule as per DIN standard.</p> <p>Straight through joint and termination shall be capable of withstanding the fault level for the system.</p> <p>1.1KV grade Straight Through Joint shall be of proven design.</p> <p><b>Cable glands</b></p> <p>Cable shall be terminated using double compression type cable glands. Cable glands shall conform to BS:6121 and be of robust construction capable of clamping cable and cable armour (for armoured cables) firmly without injury to insulation. Cable glands shall be made of heavy duty</p>		

CLAUSE NO.	TECHNICAL SPECIFICATIONS	
	<p>brass machine finished and nickel chrome plated. Thickness of plating shall not be less than 10 micron. All washers and hardware shall also be made of brass with nickel chrome plating. Rubber components shall be of neoprene or better synthetic material and of tested quality. Cable glands shall be suitable for the sizes of cable supplied/erected.</p> <p><b>Cable lugs/ferrules</b></p> <p>Cable lugs/ferrules for power cables shall be tinned copper solderless crimping type suitable for aluminium compacted conductor cables. Cable lugs and ferrules for control cables shall be tinned copper type. The cable lugs for control cables shall be provided with insulating sleeve and shall suit the type of terminals provided on the equipments. Cable lugs and ferrule shall conform to relevant standard</p> <p><b>Trefoil clamps</b></p> <p>Trefoil clamps for single core cables shall be pressure die cast aluminum or fibre glass or nylon and shall include necessary fixing accessories like G.I. nuts, bolts, washers, etc. Trefoil clamps shall have adequate mechanical strength to withstand the forces generated by the peak value of maximum system short circuit current.</p> <p><b>Cable Clamps &amp; Straps</b></p> <p>The cable clamps required to clamp multicore cables on vertical run shall be made up of Aluminium strip of 25x3 mm size. For clamping the multicore cables, self-locking, de-interlocking type nylon clamps/straps shall be used. The clamps/straps shall have sufficient strength and shall not get affected by direct exposure to sun rays and outdoor environment</p> <p><b>Receptacles</b></p> <p>Receptacles boxes shall be fabricated out of MS sheet of 2mm thickness and hot dipped galvanised or of die-cast aluminium alloy of thickness not less than 2.5 mm. The boxes shall be provided with two nos. earthing terminals, gasket to achieve IP55 degree of protection, terminal blocks for loop-in loop-out for cable of specified sizes, mounting brackets suitable for surface mounting on wall/column/structure, gland plate etc. The ON-OFF switch shall be rotary type heavy duty, double break, AC23 category, suitable for AC supply. Plug and Socket shall be shrouded Die-cast aluminium. Socket shall be provided with lid safety cover. Robust mechanical interlock shall be provided such that the switch can be put ON only when the plug is fully engaged and plug can be withdrawn only when</p>	

CLAUSE NO.	TECHNICAL SPECIFICATIONS		
4.0	<p>the switch is in OFF position. Also cover can be opened only when the switch is in OFF position. Wiring shall be carried out with 1100 V grade PVC insulated stranded aluminium/copper wire of adequate size. The Terminal blocks shall be of 1100 V grade. The Terminal blocks shall be of 1100 V grade made up of unbreakable polyimide 6.6 grade with adequate current rating and size. The welding receptacles shall be provided with inbuilt ELCB rated for suitable mA sensitivity.</p> <p><b>Galvanising</b></p> <p>Galvanising of steel components and accessories shall conform to IS:2629 , IS4759 &amp; IS:2633. Additionally galvanising shall be uniform, clean smooth, continuous and free from acid spots.</p> <p>The amount of zinc deposit over threaded portion of bolts, nuts, screws and washers shall be as per IS:1367 . The removal of extra zinc on threaded portion of components shall be carefully done to ensure that the threads shall have the required zinc coating on them as specified</p> <p><b>Welding</b></p> <p>The welding shall be carried out in accordance with IS:9595. All welding procedures and welders qualification shall also be followed strictly in line with IS:9595</p> <p><b>INSTALLATION</b></p> <p><b>Cable tray and Support System Installation</b></p> <p>Cables shall run in cable trays mounted horizontally or vertically on cable tray support system which in turn shall be supported from floor, ceiling, overhead structures, trestles, pipe racks, trenches or other building structures.</p> <p>Horizontally running cable trays shall be clamped by bolting to cantilever arms and vertically running cable trays shall be bolted to main support channel by suitable bracket/clamps on both top and bottom side rails at an interval of 2000 mm in general. For vertical cable risers/shafts cable trays shall be supported at an interval of 1000mm in general. Fixing of cable trays to cantilever arms or main support channel by welding shall not be accepted. Cable tray installation shall generally be carried out as per the approved guidelines/ drawings. Vendor shall design the support system along with tray, spacing etc in line with relevant standard.</p>	C-6	PAGE 100

CLAUSE NO.	TECHNICAL SPECIFICATIONS	 <b>નાન્દીપાંડી</b> <b>NTPC</b>	
	<p>The cantilever arms shall be positioned on the main support channel with a minimum vertical spacing of 300 mm unless otherwise indicated.</p> <p>The contractor shall fix the brackets/ clamps/ insert plates using anchor fasteners. Minimum size of anchor fasteners shall be M 8 X 50 and material shall be stainless steel grade 316 or better. Anchor fastener shall be fixed as recommended by manufacturer and as approved by site engineer. For brick wall suitable anchor fasteners shall be used as per the recommendations of manufacturer. Make of anchor fasteners subject to QA approval.</p> <p>All cable way sections shall have identification, designations as per cable way layout drawings and painted/stenciled at each end of cable way and where there is a branch connection to another cable way. Minimum height of letter shall be not less than 75 mm. For long lengths of trays, the identification shall be painted at every 10 meter. Risers shall additionally be painted/stenciled with identification numbers at every floor.</p> <p>In certain cases it may be necessary to site fabricate portions of trays, supports and other non standard bends where the normal prefabricated trays, supports and accessories may not be suitable. Fabricated sections of trays, supports and accessories to make the installation complete at site shall be neat in appearance and shall match with the prefabricated sections in the dimensions. They shall be applied with one coat of red lead primer, one coat of oil primer followed by two finishing coats of aluminium paint.</p> <p><b>Conduits/Pipes/Ducts Installation</b></p> <p>The Contractor shall ensure for properly embedding conduit pipe sleeves wherever necessary for cabling work. All openings in the floor/ roof/ wall/ cable tunnel/ cable trenches made for conduit installation shall be sealed and made water proof by the Contractor <b>either with any proven fire sealing system rated for one hour or</b> Modular multi-diameter cable sealing system consisting of frames, blocks, Compression wedge and its accessories. <b>The Cable sealing system should have been tested for fire insulation for min. 1 hr as per BS 476 and shall also provide water sealing. System shall be anti- rodent and anti- termite.</b></p> <p>GI pull wire of adequate size shall be laid in all conduits before installation. Metallic conduit runs at termination shall have two lock nuts wherever required for junction boxes etc.</p>		

CLAUSE NO.	TECHNICAL SPECIFICATIONS												
	<p>Conduit runs/sleeves shall be provided with PVC bushings having round edge at each end. All conduits/pipes shall have their ends closed by caps until cables are pulled. After cables are pulled, the ends of conduits/pipes shall be sealed with Glass wool/Cement Mortar/Putty to prevent entrance of moisture and foreign material</p> <p>Exposed conduit/pipe shall be adequately supported by racks, clamps, straps or by other approved means. Conduits /pipe support shall be installed square and true to line and grade with an average spacing between the supports as given below, unless specified otherwise</p> <table> <thead> <tr> <th><b>Conduit /pipe size (dia).</b></th><th><b>Spacing</b></th></tr> </thead> <tbody> <tr> <td>Upto 40 mm</td><td>1 M</td></tr> <tr> <td>50 mm</td><td>2.0 M</td></tr> <tr> <td>65-85 mm</td><td>2.5 M</td></tr> <tr> <td>100 mm and above</td><td>3.0 M</td></tr> </tbody> </table> <p>For bending of conduits, bending machine shall be arranged at site by the contractor to facilitate cold bending. The bends formed shall be smooth.</p> <p><b>Junction Boxes Installation</b></p> <p>Junction boxes shall be mounted at a height of 1200mm above floor level or as specified in the drawings and shall be adequately supported/mounted on masonry wall by means of anchor fasteners/expandable bolts or shall be mounted on an angle, plate or other structural supports fixed to floor, wall, ceiling or equipment foundations.</p> <p><b>Cable Installation</b></p> <p>Cable installation shall be carried out as per IS:1255 and other applicable standards.</p> <p>For Cable unloading, pulling etc following guidelines shall be followed in general :</p> <ul style="list-style-type: none"> <li>• Cable drums shall be unloaded, handled and stored in an approved manner on hard and well drained surface so that they may not sink. In no case shall be drum be stored flat i.e. with flange horizontal. Rolling of drums shall be avoided as far as possible. For short distances, the</li> </ul>	<b>Conduit /pipe size (dia).</b>	<b>Spacing</b>	Upto 40 mm	1 M	50 mm	2.0 M	65-85 mm	2.5 M	100 mm and above	3.0 M		
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CLAUSE NO.	TECHNICAL SPECIFICATIONS	
	<p>drums may be rolled provided they are rolled slowly and in proper direction as marked on the drum. In absence of any indication, the drums may be rolled in the same direction as it was rolled during taking up the cables. For unreeling the cable, the drum shall be mounted on suitable jacks or on cable wheels and shall be rolled slowly so that cable comes out over the drum and not from below. All possible care shall be taken during unreeling and laying to avoid damage due to twist, kink or sharp bends. Cable ends shall be provided with sealed plastic caps to prevent damage and ingress of moisture.</p> <ul style="list-style-type: none"> <li>While laying cable, ground rollers shall be used at every 2 meter interval to avoid cable touching ground. The cables shall be pushed over the rollers by a gang of people positioned in between the rollers. Cables shall not be pulled from the end without having intermediate pushing arrangements. Pulling tension shall not exceed the values recommended by cable manufacturer. Selection of cable drums for each run shall be so planned so as to avoid using straight through joints. Care should be taken while laying the cables so as to avoid damage to cables. If any particular cable is damaged, the same shall be repaired or changed to the satisfaction of Project Manager.</li> </ul> <p>Cables shall be laid on cable trays strictly in line with cable schedule</p> <p>Power and control cables shall be laid on separate tiers in line with approved guidelines/drawings. The laying of different voltage grade cables shall be on different tiers according to the voltage grade of the cables. In horizontal tray stacks, H.T. cables shall be laid on topmost tier and cables of subsequent lower voltage grades on lower tiers of trays. Single core cable in trefoil formation shall be laid with a distance of four times the diameter of cable between trefoil center lines and clamped at every two meter. All multi core cables shall be laid in touching formation. Power and control cables shall be secured fixed to trays/support with self-locking type nylon cable straps with de-interlocking facilities. For horizontal trays arrangements, multi core power cables and control cables shall be secured at every five meter interval. For vertical tray arrangement, individual multi core power cables and control cables shall be secured at every one meter by nylon cable strap. After completion of cable laying work in the particular vertical tray, all the control cables shall be binded to trays/supports by aluminium strips at every five meter interval and at every bend.</p> <p>Bending radii for cables shall be as per manufacturer's recommendations and IS: 1255.</p>	

CLAUSE NO.	TECHNICAL SPECIFICATIONS					
	<p>Where cables cross roads/rail tracks, the cables shall be laid in hume pipe/ HDPE pipe.</p> <p>No joints shall be allowed in trip circuits, protection circuits and CT/PT circuits. Also joints in critical equipment in main plant area shall not be permitted. Vendor shall identify and accordingly procure the cable drum length.</p> <p>In each cable run some extra length shall be kept at suitable point to enable one LT/two HT straight through joints to made, should the cable develop fault at a later stage. Control cable termination inside equipment enclosure shall have sufficient lengths so that shifting of termination in terminal blocks can be done without requiring any splicing.</p> <p>Wherever few cables are branching out from main trunk route troughs shall be used.</p> <p>Wind loading shall be considered for designing support as well Cable trays wherever required.</p> <p>Where there is a considerable risk of steam, hot oil or mechanical damage cable routes shall be protected by barriers or enclosures.</p> <p>The installation work shall be carried out in a neat workman like manner &amp; areas of work shall be cleaned of all scraps, water, etc. after the completion of work in each area every day. Contractor shall replace RCC/Steel trench covers after the Installation work in that particular area is completed or when further work is not likely to be taken up for some time.</p> <p><b>Separation</b></p> <p>At least 300mm clearance shall be provided between:</p> <ul style="list-style-type: none"> <li>- HT power &amp; LT power cables,</li> <li>- LT power &amp; LT control/instrumentation cables,</li> </ul> <p>Minimum number of spare cores required to be left for interconnection in control cables shall be as follows:</p> <table style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 50%;">No. of cores in cable</td> <td style="width: 50%;">No. of spare cores</td> </tr> <tr> <td style="text-align: center;">2C,3C</td> <td style="text-align: center;">NIL</td> </tr> </table>	No. of cores in cable	No. of spare cores	2C,3C	NIL	
No. of cores in cable	No. of spare cores					
2C,3C	NIL					
DEVELOPMENT OF 100 MW FLOATING SOLAR PV PROJECT AT NTPC RAMAGUNDAM IN TELANGANA	TECHNICAL SPECIFICATION BID DOC. NO:RE-CS-5747-004-9	C-6	PAGE 104			

CLAUSE NO.	TECHNICAL SPECIFICATIONS		
	<p>5C 1</p> <p>7C-10C 2</p> <p>14C and above 3</p> <p><b>Directly Buried Cables</b></p> <ul style="list-style-type: none"> <li>• Cable trenches shall be constructed for directly buried cables. Construction of cable trench for cables shall include excavation, preparation of sieved sand bedding, riddled soil cover, supply and installation of brick or concrete protective covers, back filling and compacting, supply and installation of route markers and joint markers. Laying of cables and providing protective covering shall be as per IS:1255.</li> <li>• RCC cable route and RCC joint markers shall be provided wherever required. The voltage grade of the higher voltage cables in route shall be engraved on the marker. Location of underground cable joints shall be indicated with cable marker with an additional inscription "Cable Joint". The marker shall project 150 mm above ground and shall be spaced at an interval of 30 meters and at every change in direction. They shall be located on both sides of road crossings and drain crossings. Top of cable marker/joint marker shall be sloped to avoid accumulation of water/dust on marker.</li> </ul> <p>Cable tags shall be provided on all cables at each end (just before entering the equipment enclosure), on both sides of a wall or floor crossing, on each duct/conduit entry, and at every 20 meters in cable tray/trench runs. Cable tags shall also be provided inside the switchgear, motor control centers, control and relay panels etc. where a number of cables enter together through a gland plate. Cable tag shall be of rectangular shape for power cables and control cables. Cable tag shall be of 2 mm thick aluminum with number punched on it and securely attached to the cable by not less than two turns of 20 SWG GI wire conforming to IS:280. Alternatively, the Contractor may also provide cable tags made of nylon, cable marking ties with cable number heat stamped on the cable tags</p> <p>While crossing the floors, unarmoured cables shall be protected in conduits upto a height of 500 mm from floor level if not laid in tray.</p> <p><b>Cable Terminations &amp; Connections</b></p> <p>The termination and connection of cables shall be done strictly in accordance with cable termination kit manufacturer" instructions, drawings</p>		

CLAUSE NO.	TECHNICAL SPECIFICATIONS		
	<p>and/or as directed by Project Manager. Cable jointer shall be qualified to carryout satisfactory cable jointing/termination. Contractor shall furnish for review documentary evidence/experience reports of the jointers to be deployed at site.</p> <p>Work shall include all clamps, fittings etc. and clamping, fitting, fixing, plumbing, soldering, drilling, cutting, taping, preparation of cable end, crimping of lug, insulated sleeving over control cable lugs, heat shrinking (where applicable), connecting to cable terminal, shorting and grounding as required to complete the job to the satisfaction of the Project Manager.</p> <p>The equipment will be generally provided with undrilled gland plates for cables/conduit entry. The Contractor shall be responsible for punching of gland plates, painting and touching up. Holes shall not be made by gas cutting. The holes shall be true in shape. All cable entry points shall be sealed and made vermin and dust proof. Unused openings shall be effectively sealed by 2mm thick aluminium sheets.</p> <p>Control cable cores entering control panel/switchgear/MCC/misellaneous panels shall be neatly bunched, clamped and tied with self-locking type nylon cable ties with de interlocking facility to keep them in position.</p> <p>All the cores of the control cable to be terminated shall have identification by providing ferrules at either end of the core, each ferrule shall be indelible, printed single tube ferrule and shall include the complete wire number and TB number as per the drawings. The ferrule shall fit tightly on the core. Spare cores shall have similar ferrules with suffix sp1, sp2, ---etc along with cable numbers and coiled up after end sealing.</p> <p>All cable terminations shall be appropriately tightened to ensure secure and reliable connections</p>		
DEVELOPMENT OF 100 MW FLOATING SOLAR PV PROJECT AT NTPC RAMAGUNDAM IN TELANGANA	TECHNICAL SPECIFICATION BID DOC. NO:RE-CS-5747-004-9	C-6	PAGE 106



## PURCHASE SPECIFICATION

### UPS WITH Ni-Cd BATTERY BANK

PS-439-UPS

REV NO: 00

PAGE : 1 OF 7

#### 1.0 Introduction

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

#### 2.0 Scope of supply

Sl. No	Item Description	Qty
1	Supply of UPS systems (5 KVA), with 1 hour backup, UPSDB and Ni-Cd type battery bank (Comprising of 2 x100% redundancy for Battery and Charger)	5 set
2	Supply of UPS systems (3 KVA), with 30 mins backup, UPSDB and Ni-Cd type battery bank (Comprising of 2 x100% redundancy for Battery and Charger)	37 sets

**Note: Make as per Annexure “NTPC vendor list”.**

The bidder shall select the model with lowest foot print to place the equipment inside the enclosure on floating platform. **Maximum allowable footprint for UPS (For 2X100%) shall be 300mmX600mm and for battery bank shall be 400mmX600mm.** Multi-tier arrangement of UPS and battery bank is also acceptable.

#### 3.0 Technical specifications

The UPS system shall meet the following minimum specifications.

1.0	Type	1. UPS System - 5KVA along with Ni-Cd Battery bank 2. UPS System - 3KVA along with Ni-Cd Battery bank
2.0	Configuration	UPS system shall have <b>2x100% configuration</b> , at a time one inverter shall be in service. On failure of any UPS, its load shall automatically get transferred to the other healthy UPS. Suitable auto changeover logic shall be provided. The minimum capacity of the UPS at load factor of 0.8 lagging inclusive of 10% design margin at 50 deg C. The UPS shall have an overload capacity of 125 % rated capacity for 10 minutes and 150 % rated capacity for 10 seconds. The overall efficiency of UPS shall be at least 80% on full load. The UPS system shall be capable of operating without D.C. battery in circuit under all conditions of load and the performance of various components of UPS like inverter, charger, static switch etc. shall be guaranteed without the battery in circuit.
3.0	Charger	The chargers shall be self-regulating, solid state silicon controlled, full wave rectifier type designed for single and parallel operation with battery and shall have automatic voltage regulators for close voltage stability even when AC supply voltage fluctuates, effective current limiting features and filters to minimise harmonics. The charger should be capable to fully charge the required batteries as well as supply the full rated load. Furthermore, the charger should be able to re-charge the fully discharged battery within 8 hours. The charger shall be current limited for charger circuit protection and protection of battery from overcharge shall also be provided. The current limit shall be continuously adjustable. The chargers shall have a slow walk-in circuit. Charger design shall ensure that there is no component failure due to fluctuations of input supply or loss of supply and restoration. The charger shall be design for input supply voltage variation of $\pm 10\%$ and



## PURCHASE SPECIFICATION

### UPS WITH Ni-Cd BATTERY BANK

PS-439-UPS

REV NO: 00

PAGE : 2 OF 7

frequency variation of  $\pm 5\%$ .

Battery Chargers shall have a selector switch for selecting the battery charging mode i.e. whether Trickle or Boost charging.

All Battery Chargers shall be provided with facility for both automatic and manual control of output voltage and current. A selector switch shall be provided for selecting the mode of output voltage/current control, whether automatic or manual. Means shall be provided to avoid current/voltage surges of harmful magnitude/nature which may arise during changeover from Auto to Manual mode or vice-versa under normal operating condition.

Soft start feature shall be provided to build up the voltage to the set value slowly. The chargers shall have load limiters which shall cause, when the voltage control is in automatic mode, a gradual lowering of the output voltage when the DC load current exceeds the load limiter setting of the Charger. The load limiter characteristic shall be such that any sustained overload or short circuit in DC system shall neither damage the Charger nor shall it cause blowing of any of the charger fuses. The Charger shall not trip on overload or external short circuit. After clearance of fault, the Charger voltage shall build up automatically when working in automatic mode.

When on automatic control mode during Trickle charging, the Charger output voltage shall remain within  $+/-1\%$  of the set value for AC input voltage variation of  $+/-10\%$ , frequency variation of  $+3/-5\%$ , a combined voltage and frequency (absolute sum) variation of 10% and a continuous DC load variation from zero to full load. Uniform and step-less adjustments of voltage setting (in both manual and automatic modes) shall be provided on the front of the Charger panel covering the entire Trickle charging output range specified & shall be capable of matching the float voltage correction recommendations (w.r.t. temperature) as suggested by the respective battery manufacturer. Step-less adjustment of the load limiter setting shall also be possible from 80% to 100% of the rated output current for Trickle charging mode.

During Boost charging, the Battery Chargers shall operate on constant current mode (When automatic regulator is in service). It shall be possible to adjust the Boost charging current continuously over a range of 50 to 100% of the rated output current for Boost charging mode. The charger output voltage shall automatically go on rising, when it is operating on boost mode, as the battery charges up. For limiting the output voltage of the charger, a potentiometer shall be provided on the front of the panel, whereby it shall be possible to set the upper limit of this voltage anywhere in the output range specified for boost charging mode. All voltage and current setting potentiometers shall be Vernier type.

Energizing the Charger with fully charged battery connected plus 10% load shall not result in output voltage greater than 110% of the voltage setting. Time taken to stabilize, to within the specified limits as mentioned elsewhere, shall be less than fifteen seconds.



## PURCHASE SPECIFICATION

### UPS WITH Ni-Cd BATTERY BANK

PS-439-UPS

REV NO: 00

PAGE : 3 OF 7

Momentary output voltage of the Charger, without the Battery connected shall be within 94% to 106% of the voltage setting during sudden load Change from 100% to 20% of full load or vice-versa. Output voltage shall return to, and remain, within the limits specified as mentioned elsewhere in less than 2 seconds after the above mentioned change.

Suitable filter circuits shall be provided in all the Chargers to limit the ripple content (peak to peak) in the output voltage to 1% irrespective of the DC load, even when they are not connected to a battery.

The DC System shall be ungrounded and float with respect to the ground potential when healthy. An earth fault relay shall be provided by the bidder in the DC distribution board for remote annunciation.

Digital Outputs shall be configured for connection to the SCADA for realtime charger status updation. Outputs like charger output current, output voltage, float/boost mode, etc may be configured to provide the update to SCADA.

The Battery Chargers as well as their automatic regulators shall be of static type. The Chargers shall be designed to operate, as mentioned above, at an ambient air temperature of 50°C.

Battery chargers shall be capable of continuous operation at the respective rated load in Trickle mode i.e. Trickle charging the associated DC Nickel-Cadmium Batteries while supplying the D.C. loads. The Batteries shall be Trickle charged at 1.4 to 1.42 Volts per cell. All chargers shall be capable of Boost Charging the associated D.C. Battery at 1.54 to 1.7 Volts per cell at the desired rate.

All Battery Chargers shall have an AC contactor on the input side. It shall be of air break type and suitable for continuous duty. A thermal overload relay incorporating a distinct single phasing protection (using differential movement of bimetal strips) shall also be provided for the AC input. The relay shall trip the above contactor.

The rectifier assembly shall be full wave bridge type and designed to meet the duty as required by the respective Charger.

Digital or analog indicating instruments shall indicate DC current, DC voltage & AC voltage.

The Chargers shall be indoor, floor mounted, self-supporting sheet metal enclosed cubicle type. The Contractor shall supply all necessary base frames, anchor bolts and hardware. The Charger shall be fabricated using cold rolled sheet steel shall not be less than 1.6 mm and shall have folded type of construction. The panel frame shall be fabricated using cold rolled sheet steel of thickness not less than 2.0 mm. Removable undrilled gland plates of at least 3.0 mm sheet steel and lugs for all cables shall be supplied by the Contractor. The Charger shall be tropicalized and vermin proof. Ventilation louvers shall be backed with fine brass wire mesh. All doors and covers shall be fitted with synthetic rubber gaskets. The



## PURCHASE SPECIFICATION

### UPS WITH Ni-Cd BATTERY BANK

PS-439-UPS

REV NO: 00

PAGE : 4 OF 7

		<p>Chargers shall have hinged double leaf doors provided on front and/or backside for adequate access to the Charger internals. All the Charger cubicle doors shall be properly earthed.</p> <p>Treatment as per IS: 6005. Two coats of lead oxide primer followed by powder painting with final shade of RAL9002 for complete panel except end covers &amp; RAL 5012 for end covers.</p> <p>All acceptance and routine tests as per the manufacture recommendations and relevant standards shall be carried out.</p> <p>The cabinets shall be IP-42 protection class for indoor application and IP65 for outdoor application.</p> <p>The Contractor shall also carry out the site tests on battery charger systems required to be conducted as a standard practice of the UPS manufacture or deemed necessary by the Employer and mutually agreed between the Contractor and the Employer.</p>
4.0	<b>Battery</b>	<p><b>BATTERY: NICKEL-CADMIUM BATTERY</b></p> <p>Ni-Cd vented type, pocket plate high discharge battery of adequate capacity to meet the requirement of UPS, generally conforming to IS-10918.</p> <p><b>BATTERY PARAMETERS</b></p> <ul style="list-style-type: none"><li>a) Battery Voltage : To be decide during Detail Engineering</li><li>b) No. of Cells : To be decide during Detail Engineering</li><li>c) Battery type : Nickel-Cadmium</li><li>d) Nominal discharge voltage per Cell: 1.2 V</li><li>e) Float voltage : 1.42V/Cell</li></ul> <p>Batteries should be suitable for continuous operation for the maximum ambient temperature as defined in technical parameters.</p> <p><b>CODES AND STANDARDS</b></p> <p>All standards, specifications and codes of practice referred to herein, shall be the latest editions including all applicable official amendments and revisions as on date of opening of techno-commercial bid. In case of conflict between this specification and those (IS codes, Standards etc.) referred to herein, the former shall prevail. All works shall be carried out as per the following standards and codes:</p> <p>IEC 60623/ IS 10918: Specification for vented type Nickel Cadmium Batteries.</p> <p>IS 106 : Quality tolerances for water for storage batteries</p> <p>IEC 60993 : Electrolyte for vented Nickel-Cadmium cells</p> <p>Indian electricity rules</p> <p>Indian electricity acts</p> <p>Equipment complying with other internationally accepted standards such as IEC., BS, VDE etc. will also be considered if they ensure performance and constructional features equivalent or superior to standards listed above. In such a case, the Bidder shall clearly indicate the standard(s) adopted,</p>



## PURCHASE SPECIFICATION

### UPS WITH Ni-Cd BATTERY BANK

PS-439-UPS

REV NO: 00

PAGE : 5 OF 7

furnish a copy in English of the latest revision of the standards along with copies of all official amendments and revisions in force as on date of opening of techno-commercial bid and shall clearly bring out the salient features for comparison.

DC Batteries shall be stationary Nickel Cadmium Pocket plate type conforming to IS:10918. The batteries shall be high/medium discharge performance type suitable for the backup time as specified. For the purpose of design an ambient temperature of 50 deg.C and relative humidity of 85% shall be considered.

DC batteries shall be suitable for standby duty. The batteries shall normally be permanently connected to the load in parallel with a charge and shall supply the load during emergency conditions when AC supplies are lost. Batteries shall be suitable for a long life under continuous float operations and occasional discharges. The batteries shall be boost charged at about 1.54 to 1.7 volts per cell maximum and float charged at about 1.42 V/cell.

#### **Sizing**

- a) Environmental temperature 0 to 50 degC.
- b) Power factor of load - 0.8
- c) Adequate I<sub>2</sub> t capability to clear fault in the maximum rated branch circuit.
- d) UPS shall be capable to operate without DC battery in circuit and under all conditions of load.
- e) In case of failure of a charger / input power, other charger whose input supply is healthy shall be capable to charge the battery and as well supply input power to inverter. No discharge of battery is allowed.
- f) Inrush current

#### **Construction Features:**

##### **a) Containers**

Containers shall be made of polypropylene plastic material. Containers shall be robust, heat resistance, leak proof, non-absorbent, alkali resistant, non-bulging type and free from flaws, such as wrinkles, cracks, blisters, pin holes etc. Electrolyte level lines shall be marked on container in case of translucent containers.

##### **b) Vent Plugs**

Vent plugs shall be provided in each cells. They shall be anti-splash type, having more than one exit hole shall allow the gases to escape freely but shall prevent alkali from coming out. The design shall be such that the water loss due to evaporation is kept to minimum. In addition, the ventilator shall be easily removed for topping up the cells and of such dimensions that the syringe type hydrometer can be inserted into the vent to take electrolyte samples.

##### **c) Plates**

The plates shall be designed for maximum durability during all service conditions including high rate of discharge and rapid fluctuations of load. The construction of plates shall conform to latest revisions of IS:10918. The separators shall maintain the electrical insulation between the plates and shall allow the electrolyte to flow freely. Separators should be suitable for



## PURCHASE SPECIFICATION

### UPS WITH Ni-Cd BATTERY BANK

PS-439-UPS

REV NO: 00

PAGE : 6 OF 7

		<p>continuous immersion in the electrolyte without distortion. The positive and negative terminal posts shall be clearly marked.</p> <p><b>d) Sediment Space</b> Sufficient sediment space shall be provided so that cells will not have to be cleaned during normal life and prevent shorts within the cells.</p> <p><b>e) Electrolyte</b> The electrolyte shall be prepared from battery grade potassium hydroxide conforming to IEC 60993. The cells can be shipped either in charged condition or in dry condition. Necessary electrolyte for make-up shall be supplied separately.</p> <p><b>f) Connectors and Fasteners</b> Nickel plated copper connectors shall be used for connecting adjacent cells and PVC insulated flexible copper cables shall be used for inter-row / inter-tier / inter-bank connections. Bolts, nuts and washers shall be Stainless Steel / Nickel coated steel to prevent corrosion. The thickness of Nickel coating of connectors should be not less than 0.02 mm. All the terminals and cells inter-connectors shall be fully insulated or have insulation shrouds.</p> <p><b>g) Battery racks</b> Mild steel racks for all the batteries shall be provided. They shall be free standing type mounted on porcelain/hard rubber/PVC pads insulators/High impact plastic insulators. Batteries shall preferably be located in the single tier arrangement. However, batteries having a complete cell weight of lower than 50 Kg could be located in the double tier arrangement. The batteries racks and supports for cable termination shall be coated with three (3) coats of anti-alkali paint of approved shade. Name plates, resistant to alkali, for each cell shall be attached on to the necessary racks. The bottom tier of the stand shall not be less than 150 mm above the floor.</p> <p><b>h) Test</b> The Contractor shall submit for Owner's approval the reports of all the type tests carried out as per latest IS-1146(for all applicable tests for containers) / IS-10918 (for NI-CD batteries). The complete type test reports shall be for any rating of battery in a particular group, based on plate dimensions being manufactured by supplier. Routine and Acceptance tests shall be as per Quality Assurance &amp; Inspection table of battery.</p>
5.0	<b>Inverter</b>	<p>The UPS inverter shall be of continuous duty, solid state type using proven Pulse Width Modulation (PWM)/Quasi square wave/step wave technique. Ferro-resonant types Inverters are not acceptable. The nominal voltage output shall be 230 Volts single phase ,50 Hz. The inverter equipment shall include all necessary circuitry and devices to conform to requirements like voltage regulation, current limiting, wave shaping, transient recovery, etc. The total harmonic content shall be 5% maximum and content of any single harmonic shall be 3% maximum. The bidder shall provide status, common alarm and trip DI (soft or hard) signal to SCADA.</p> <p>For UPS capacity 5 kVA or more, in addition to indications/display on UPS panel, important alarms along with important analog signal shall also be provided for use in SCADA. For UPS capacity less than 5 kVA bidder shall provide status, common alarm and trip DI (soft or hard) signal to SCADA.</p>
6.0	<b>Efficiency</b>	a) 100% Full load- 80%



## PURCHASE SPECIFICATION

### UPS WITH Ni-Cd BATTERY BANK

PS-439-UPS

REV NO: 00

PAGE : 7 OF 7

7.0	<b>Synchronization limit</b>	Between inverter & standby AC source shall be within 47 Hz to 53 Hz field adjustable. Inverter shall remain synchronized with the AC mains.
8.0	<b>Inverter protection</b>	Overload, short circuit and 100% loss of load.
9.0	<b>Load sharing</b>	At a time one inverter from UPS shall be in service. On failure of any UPS, its load shall automatically get transferred to the other healthy UPS without any degradation of the UPS power quality. Suitable auto changeover logic shall be provided. Power shall be transferred to the standby AC power without a break in synchronization if within limit in case of failure of both inverters. Asynchronous transfer to standby AC source in case inverters are being out of synchronism limit with AC mains.
10.0	<b>Static switch</b>	To transfer UPS loads automatically without any break from faulty inverter to standby AC source. Manual bypass switch shall be employed for isolating the UPS during maintenance.
11.0	<b>Enclosure</b>	Individual enclosure shall be ventilated switchboard type fabricated from not less than 1.6-mm thick sheet steel. Enclosures shall be furnished with concealed hinges. Front and rear doors shall be designed to permit easy access to all components for maintenance or replacement. The enclosures shall be reinforced with formed steel members as required to form a rigid self-supporting structure. Doors shall have three point latches. Adequate ventilating louvers and enclosure top panels shall be included. All vent openings shall be covered with corrosion resistant fine screen coverings. The cabinets shall be IP-42 protection class for indoor application and IP65 for outdoor application. The temperature rise inside all the cabinets/enclosures shall not exceed 10 deg.C above ambient temperature.
12.0	<b>Spare feeders</b>	25%
13.0	<b>Accessories</b>	Power distribution board, Voltage & current meters, power factor meter, KVA, frequency, panel alarms, switches etc. One set of tool shall be provided for maintenance and testing purposes.

#### 4.0 APPROVAL

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

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

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

CLAUSE NO.	TECHNICAL SPECIFICATIONS												
	<p><b>E-1 WEATHER MONITORING STATION</b></p> <p>As a part of weather monitoring station, Bidder shall provide following measuring instruments with all necessary software &amp; hardware required to integrate with SCADA so as to enable availability of data from meteorological instrument in SCADA. Each instrument shall be supplied with necessary cables, transmitters and accessories (Trackers, Mounting and base stand etc.) Provided by OEM of the sensors only.</p> <p>Aux. power required by instruments and data logger (If supplied) shall be from UPS only. Data logger shall have provision to receive redundant power supply.</p> <p>All the instruments to be supplied shall have valid calibration certificate</p> <p>Single sensor for measuring combination of Wind Speed, Wind Direction, Relative humidity and Rainfall is also acceptable however offered sensor shall meet the specification as mentioned in following sections.</p>												
1.0	<p><b>SOLAR RADIATION SENSORS</b></p> <p>Contractor shall provide Solar Radiation Sensors as per specification given in following section. Contractor has the option to provide these sensors on separate base or on a single base (radiation monitoring station) with tracker, shadow ring and transmitter etc provided by the OEM. Calibration certificate with calibration traceability to World Radiation Reference (WRR) or World Radiation Centre (WRC) shall be furnished along with solar radiation sensors. Bidder shall provide Instrument manual in hard and soft form.</p>												
1.1	<p><b>Pyranometer</b></p> <p>Bidder shall provide minimum <b>03 (Three) numbers</b> of Secondary Standard Pyranometers as per ISO 9060 <b>for measuring incident solar radiation as for following</b></p> <ul style="list-style-type: none"> <li>• <b>Global Horizontal Irradiance (GHI)- 1 Nos.</b></li> <li>• <b>Global Inclined Irradiance (GII)-1 Nos</b></li> <li>• <b>Diffuse Horizontal Irradiance (DHI)- 1 Nos</b></li> </ul> <table border="1"> <thead> <tr> <th>Sl.No</th><th>Details</th><th>Values</th></tr> </thead> <tbody> <tr> <td>1.</td><td>Principle</td><td>Thermopile</td></tr> <tr> <td>2.</td><td>Spectral Response.</td><td>310 to 2800 nm</td></tr> <tr> <td>3.</td><td>Sensitivity</td><td>Min 7 micro-volt/w/m<sup>2</sup></td></tr> </tbody> </table>	Sl.No	Details	Values	1.	Principle	Thermopile	2.	Spectral Response.	310 to 2800 nm	3.	Sensitivity	Min 7 micro-volt/w/m <sup>2</sup>
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TECHNICAL SPECIFICATION BID DOC. NO:RE-CS-5747-004-9		E-1	PAGE 2										

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CLAUSE NO.	TECHNICAL SPECIFICATIONS																			
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4.0	<p><b>RAIN GUAGE (Qty- 1no)</b></p> <p>Rain Gauge shall be of Self Recording Type and recording facility shall be provided in Electronics. The Gauge shall be rugged having material of construction resistant to atmospheric corrosion. The Instrument shall have automatic functions for computing rainfall for pre set time periods.</p> <table border="1"> <tr> <td>Sl.No</td><td>Details</td><td>Values</td></tr> <tr> <td>1.</td><td>Accuracy</td><td>5% or Below</td></tr> <tr> <td>2.</td><td>Sensitivity</td><td>1.0 mm</td></tr> <tr> <td>3.</td><td>Operating Temperature</td><td>0 to 50 deg C</td></tr> </table>	Sl.No	Details	Values	1.	Accuracy	5% or Below	2.	Sensitivity	1.0 mm	3.	Operating Temperature	0 to 50 deg C											
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6.0	<p><b>METEOROLOGICAL MAST</b></p> <p>One Meteorological Mast of telescopic type and of specified height to be placed on an existing structure (such as Buildings etc) so that height of the Meteorological Sensors from the Ground Level (GL) is 10 meters. The Mast is required for mounting the Meteorological Sensors. Necessary Hangers and Holders along with electrical Grounding Set shall be provided by the vendor for installation of the Sensors. Material of Construction of the Mast shall be metallic and robust and shall be</p>																							
DEVELOPMENT OF 100 MW FLOATING SOLAR PV PROJECT AT NTPC RAMAGUNDAM IN TELANGANA		TECHNICAL SPECIFICATION BID DOC. NO:RE-CS-5747-004-9	E-1 PAGE 5																					

CLAUSE NO.	TECHNICAL SPECIFICATIONS	
7.0	<p>resistant to atmospheric corrosion. Fencing shall be provided for weather monitoring station.</p> <p><b>CALIBRATION</b></p> <p>All the instruments to be supplied shall have valid and traceable calibration certificate. Each Pyranometer shall be recalibrated at an interval not more than two years and all other instruments shall be recalibrated at an interval not more than four years.</p>	

8.0	DATA LOGGER	Weather Monitoring system shall be provided with standalone Data logger suitable for outdoor application with IP65 Protection and industrial grade hardware suitable for operating temperature up to 55 Deg C. Data logger shall be calibrated and proven in field for at least one year in outdoor environment. Data logger shall have following minimum features:																
	<table border="1"> <tbody> <tr> <td>Processor</td><td>32 bits</td></tr> <tr> <td>Time synchronization</td><td>With Built in GPS Clock or with Solar SCADA GPC Clock</td></tr> <tr> <td>Wireless communication</td><td>GSM/GPRS Modem</td></tr> <tr> <td>Data storage</td><td>SD card, Min 2GB for storage of raw and processed data locally at resolution of 1 Second for retrieval whenever required. Data to be stored shall be in unencrypted CSV or equivalent format.</td></tr> <tr> <td>Display</td><td>LCD display for easy maintenance and debugging for site engineer</td></tr> <tr> <td>Scan resolution</td><td>1 Sec</td></tr> <tr> <td>Analog to Digital Converter (ADC)</td><td>16 Bit, Sampling -10 Hz (Min)</td></tr> <tr> <td>I/P Channel</td><td>As required with 20 % spare of each type of channel</td></tr> </tbody> </table>	Processor	32 bits	Time synchronization	With Built in GPS Clock or with Solar SCADA GPC Clock	Wireless communication	GSM/GPRS Modem	Data storage	SD card, Min 2GB for storage of raw and processed data locally at resolution of 1 Second for retrieval whenever required. Data to be stored shall be in unencrypted CSV or equivalent format.	Display	LCD display for easy maintenance and debugging for site engineer	Scan resolution	1 Sec	Analog to Digital Converter (ADC)	16 Bit, Sampling -10 Hz (Min)	I/P Channel	As required with 20 % spare of each type of channel	
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It shall have facility for arithmetic processing (Time Integration, Simple Average, and Moving Average etc.) of incoming raw data. Data logger shall be interfaced with Solar SCADA on modbus preferably on TCP-IP.

DEVELOPMENT OF 100 MW FLOATING SOLAR PV PROJECT AT NTPC RAMAGUNDAM IN TELANGANA	TECHNICAL SPECIFICATION BID DOC. NO:RE-CS-5747-004-9	E-1	PAGE 6
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CLAUSE NO.	TECHNICAL SPECIFICATIONS		
	<p>Vendor shall submit Factory Acceptance Test (FAT) report and procedure before dispatch of material to site.</p> <p>Data logger shall be provided with key-locked door access and all the cables (Power and Signal) to the data logger shall be protected with heavy duty HDPE pipes.</p> <p>Project file (software, settings and sample reports) shall be handed over to site on permanent storage media (CD/DVD) in two copies after data integrity is verified by site and weather monitoring is commissioned</p>		
DEVELOPMENT OF 100 MW FLOATING SOLAR PV PROJECT AT NTPC RAMAGUNDAM IN TELANGANA	TECHNICAL SPECIFICATION BID DOC. NO:RE-CS-5747-004-9	E-1	PAGE 7

CLAUSE NO.	TECHNICAL SPECIFICATIONS																																				
	<p style="text-align: center;"><b>E-2 FIRE FIGHTING AND ALARM SYSTEM</b></p> <p>The SPV plant shall be equipped with suitable fire protection &amp; fire fighting systems for protection of entire equipment switchyard &amp; control room as per CEIG requirements.</p> <p><b>1.0</b> Bidder shall comply with recommendation of Tariff Advisory Committee to incurring minimal premium for insurance. The installation shall meet all applicable statutory requirements, safety regulations in terms of fire protection.</p> <p><b>2.0</b> The fire fighting system for the proposed power plant for fire protection shall be consisting of:</p> <ul style="list-style-type: none"> <li>a) Sand buckets</li> <li>b) Portable fire extinguishers</li> <li>c) Microprocessor based fire alarm panel.</li> </ul> <p><b>2.1</b> <b>Portable Fire Extinguishers and Sand Buckets</b></p> <p>Bidder to provide following numbers of type tested portable fire extinguishers as per relevant code in the rooms mentioned below.</p> <table border="1"> <thead> <tr> <th>Rooms</th><th>DCP Type (ABC type) (10 Kg. Capacity)</th><th>CO<sub>2</sub> Type 9 kg capacity</th><th>Foam Type Hand 9 kg</th><th>Hand Portable pressurized water CO<sub>2</sub> 9 Litre</th><th>Sand Buckets</th></tr> </thead> <tbody> <tr> <td>Control Room</td><td>2</td><td>2</td><td>1</td><td>1</td><td>1</td></tr> <tr> <td>Each Inverter Room</td><td>1</td><td>1</td><td></td><td></td><td></td></tr> <tr> <td>ACDB Room (If applicable)</td><td>1</td><td>1</td><td></td><td></td><td></td></tr> <tr> <td>Each Transformer Yard</td><td>1</td><td>1</td><td>1</td><td></td><td>1</td></tr> <tr> <td>Switchyard/ Metering Yard</td><td>2</td><td>2</td><td></td><td></td><td>1</td></tr> </tbody> </table> <p><b>2.2</b> <b>Microprocessor based fire alarm panel</b></p> <p>Bidder to provide intelligent microprocessor based main fire alarm panel of modular construction complete with central processing unit, input and output modules, power supply module, supervision control and isolator</p>	Rooms	DCP Type (ABC type) (10 Kg. Capacity)	CO <sub>2</sub> Type 9 kg capacity	Foam Type Hand 9 kg	Hand Portable pressurized water CO <sub>2</sub> 9 Litre	Sand Buckets	Control Room	2	2	1	1	1	Each Inverter Room	1	1				ACDB Room (If applicable)	1	1				Each Transformer Yard	1	1	1		1	Switchyard/ Metering Yard	2	2			1
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DEVELOPMENT OF 100 MW FLOATING SOLAR PV PROJECT AT NTPC RAMAGUNDAM IN TELANGANA	TECHNICAL SPECIFICATION BID DOC. NO:RE-CS-5747-004-9	E-2	PAGE 8																																		

CLAUSE NO.	TECHNICAL SPECIFICATIONS
2.3	<p>modules with 10% spare provisions in each loop. Fire detection alarm system shall include) but not limited to the following items</p> <ul style="list-style-type: none"> <li>a. Fire Alarm control Panel</li> <li>b. Multi Sensor smoke detector</li> <li>c. Heat Detectors</li> <li>d. Hooter cum strobe</li> <li>e. Manual call Point</li> <li>f. Hooter</li> <li>g. Fault isolation modules</li> <li>h. Control Modules</li> <li>i. Cables from Sensors to Fire panels.</li> <li>j. Digital output from the fire detection system shall be integrated with SCADA</li> <li>k. Network Control Module</li> <li>l. Interfacing of Fire Alarm System with SCADA for display and storage of status and alarm in SCADA</li> </ul> <p>Multi sensor type smoke detectors and heat detectors shall be provided for below false ceiling areas of control room and ACDB and/or inverter rooms. One (01) sensor shall be provided for each 20 sq. Meter of area. All the cable trench inside the control room and inverter room shall be provided with Multi Sensor smoke detector.</p> <p>Fault Isolation module shall be provided in every room and for every 15 sensors at location proposed by Bidder to be approved by employer during detail engineering.</p> <p><b>Fire Alarm Control Panel Indication</b></p> <ul style="list-style-type: none"> <li>i. Alarm conditions shall be immediately displayed on the control panel and in SCADA. Alarm LED shall flash on the control panel until the alarm has been acknowledged. Once acknowledged the LED shall remain lit. A subsequent alarm received from another zone after acknowledgement shall illuminate the alarm LED and the panel display shall show the new alarm information.</li> <li>ii. During an alarm condition, an alarm tone shall sound within the control panel until the alarm is acknowledged.</li> <li>iii. If the audible alarm signals are silenced for any reason, they shall automatically resound if another zone is activated.</li> <li>iv. All alarm signals shall be automatically “locked in” at the control panel until the operated device is returned to its normal condition and the control panel is manually reset</li> </ul>

CLAUSE NO.	TECHNICAL SPECIFICATIONS	
<p>There shall be weather proof Hooter cum strobe outside and strobe inside each Inverter room and control room for indication fire alarm for respective zone/area at suitable location that is visible from all direction. All the hardware, relay and accessories required for completeness of fire alarm system is in Bidder scope. Fire alarm system shall have its own battery and charger and it shall be provided power from UPS DB. Each Inverter room and control room shall be also be provided with manual call point, Alarm acknowledge and reset facility for alarm for respective zone only.</p> <p>Bidder shall submit document to employer for approval that will include fire alarm system configuration, layout, BoM, Datasheet and necessary test report.</p> <p>Bidder shall consider 30 % design and aging margin for selection of nos. of sensors in each loop and length of each loop. Bidder shall submit the certificate from OEM indicating maximum nos. of sensors in single loop and maximum length of single loop allowed with offered panel and type of cable to be used. Each Fire Alarm Control panel shall have provision for minimum 10 (Ten) % rounded to next higher integer but not less than 2 (two) nos. spare loops for future use of employer.</p> <p>Bidder shall submit Site Acceptance Test (SAT) for approval by employer. Complete fire alarm system shall be checked at site for verification of faithful performance and completeness of the system. Bidder shall carry out necessary modification and supply hardware/accessories if required.</p>		
DEVELOPMENT OF 100 MW FLOATING SOLAR PV PROJECT AT NTPC RAMAGUNDAM IN TELANGANA	TECHNICAL SPECIFICATION BID DOC. NO:RE-CS-5747-004-9	E-2 PAGE 10

CLAUSE NO.	TECHNICAL SPECIFICATIONS	एनटीपीसी NTPC		
	<b>C-9 EARTHING SYSTEM</b>			
1.0	<p><b>GENERAL REQUIRMENTS</b></p> <p>This specification is intended to outline the requirement of earthing (grounding) for Solar array (DC) side and AC Power block side of Solar PV Project. It is not the intent of the specification to specify all details of design and construction since the bidder has full responsibility for engineering and implementation of earthing system meeting the intent of the specification and functional requirement. Any additional equipment, material, services which are not specifically mentioned herein but are required for successful installation, testing and commissioning of earthing system for safe and satisfactory operation of the plant shall be included under scope of the bidder.</p> <p>Earthing requirement for outdoor metering yard/Switchyard has been mentioned elsewhere in the specification and hence shall be excluded from scope of this chapter unless earthing requirement of metering yard/Switchyard is specifically mentioned in this chapter.</p>			
1.1	<p><b>EARTHING DESIGN REQUIRMENT</b></p> <p>The object of protective earthing system is to provide as nearly as possible a surface under and around a station which shall be at a uniform potential and as nearly zero or absolute earth potential as possible. The purpose of this is to ensure that, in general, all parts of apparatus other than live parts, shall be at earth potential, as well as to ensure that operators and attendants shall be at earth potential at all times. Also by providing such an earth surface of uniform potential under and surrounding the station, there can exist no difference of potential in a short distance big enough to shock or injure an attendant when short-circuits or other abnormal occurrences take place.</p> <p>Care must be taken for equipment with functional earthing that its service is not disrupted due to undesired disturbances in protective earthing system.</p>			
1.2	<p><b>CODES AND STANDARD</b></p> <p>The equipment/product furnished for earthing system shall meet the requirements of all the applicable relevant National/International codes and standards or their latest amendment Codes and Standards. Product certification has to be CE/UL/BIS/TUV or equivalent. The relevant codes and standard for earthing system are tabulated below.</p>			
DEVELOPMENT OF 100 MW FLOATING SOLAR PV PROJECT AT NTPC RAMAGUNDAM IN TELANGANA		TECHNICAL SPECIFICATION BID DOC. NO:RE-CS-5747-004-9	C-9	PAGE 137

CLAUSE NO.	TECHNICAL SPECIFICATIONS		
	IS: 3043	Code of practice for Earthing.	
	IEEE: 80	IEEE guide for safety in AC substation grounding	
	IEEE: 837	Standard for qualifying permanent connections used in substation grounding	
	IS: 2309	Code of Practice for the protection of building and allied structures against lightning.	
	IS: 802	Code of practice for the use of Structural Steel in Overhead Transmission Line Towers.	
	IS: 2629	Recommended practice for hot dip galvanizing of iron & steel	
	IS: 2633	Method for testing uniformity of coating on zinc coated articles	
	IS: 513	Cold rolled low carbon steel sheets and strips	
	IS: 6745	Methods for determination of mass of zinc coating on zinc coated iron & steel articles.	
	IS 2062	HOT ROLLED MEDIUM AND HIGH TENSILE STRUCTURAL STEEL — SPECIFICATION	
	IS: 4736	Hot-dip Zinc coating for MS Tubes.	
	IS: 458	Precast Concrete Pipes (With and Without Reinforcement)	
	UL-467	Grounding and Bonding Equipment	
	IEC 62561-7	Requirements for earthing enhancing compounds	
		CEA regulations for electrical safety-2010	
		Indian Electricity Rules/ Indian Electricity Act.	
	<p>All standards, specifications and codes of practice referred to herein shall be the latest editions including all applicable official amendments and revisions as on date of opening of bid. In case of conflict between this specification and those (codes and standards, etc.) referred to herein, the former shall prevail. All work shall be carried out as per the above standards/ codes as applicable.</p> <p>The earthing system includes earth electrode, installation of earth electrode in suitable pit size, construction of earth pit with cover for the installation, connection of earth electrode with equipotential earth bus and connection of equipment to equipotential earth bus.</p>		
DEVELOPMENT OF 100 MW FLOATING SOLAR PV PROJECT AT NTPC RAMAGUNDAM IN TELANGANA		TECHNICAL SPECIFICATION BID DOC. NO:RE-CS-5747-004-9	C-9
			PAGE 138

CLAUSE NO.	TECHNICAL SPECIFICATIONS	
2.0	<p><b>EARTH ELECTRODE</b></p> <p>The earth electrode is in direct contact with the ground provides means for conducting earth current with ground. Earth Electrode material should have good electrical conductivity and mechanical strength and should not corrode in wide variety of soil conditions. For an effective earthing system, following type of vertical earth electrodes can be used.</p> <p>I. MS Rods Hot rolled, Medium or High Tensile Steel Rod as per IS 2062 of length not less than 3000 mm and diameter of 40 mm.</p> <p>II. Copper Bonded Rods High tensile-low carbon steel rod having diameter not less than 14/17 mm of Length 3000 mm to be selected based on earth fault current. The Rod shall comply with requirements of BS 4360 Grade 43A or EN10025:2-004 S275JR, molecularly bonded by 99.99% pure high conductivity copper on outer surface with copper coating thickness 250 micron or more in conformity to UL-467. Its surface shall be clean, free from mechanical defect and any visible oxide layer or foreign material.</p>	
2.1	<p><b>Earthing Enhancement Compound</b></p> <p>A low resistance earth electrode system is important to provide a low impedance path for the better dissipation of lightning/fault currents, and to protect personnel and equipment by minimizing and equalizing voltage potential differences. Earthing (ground) enhancement materials shall be used to improve the ground electrode resistance. Earth enhancement material shall be a superior conductive material which improves earthing effectiveness, especially in areas of poor conductivity (rocky ground, areas of moisture variation, sandy soils etc.). It shall be tested and should conform to the requirements of IEC 62561-7. It shall have the following characteristics:-</p> <ul style="list-style-type: none"> <li>a) High conductivity, improves earth's absorbing power and humidity retention capability, non-corrosive in nature having low water solubility but highly hygroscopic.</li> <li>b) Carbon based with min 95% of fixed carbon content premixed with corrosion resistant cement to have set properties. Cement shall not mix separately &amp; shall not have Bentonite.</li> <li>c) Resistivity of less than 0.2 ohms -meter.</li> <li>d) It shall not depend on the continuous presence of water to maintain its conductivity and shall be permanent &amp; maintenance free and in its "set form", maintains constant earth resistance with time.</li> </ul>	

CLAUSE NO.	TECHNICAL SPECIFICATIONS	एनटीपीसी NTPC
2.2	<p>e) It shall not dissolve, decompose or leach out with time and shall be environmental friendly, suitable for soils of different resistivity and any kind of earth electrode.</p> <p>The Earth enhancement material shall be supplied in sealed, moisture proof bags, marked with Manufacturer's name or trade name, quantity etc. The minimum quantity of earth enhancement compound to be used with each earth-pit shall be 25 Kg.</p> <p><b>Earthing conductor</b></p> <p>Earthing conductor is the conductor for buried below the ground at the depth of 600 mm connecting earth pits to make interconnection of earth pit. To interconnect earth pits, following type of conductor can be used. Application of specific conductor and its size has been mentioned in relevant clause:</p> <ul style="list-style-type: none"> <li>I. Galvanised Steel Flat (GS) Flat GS/GI Flat (Strip) conductor shall comply to IS 2026 with Galvanization of 85 Micron as per IS. Material shall be clean and free from mechanical defects.</li> <li>II. Copper Clad Steel (CCS) Earthing Conductor The Copper Bonded Steel Grounding Conductor shall be made of steel with the coating of 99.99% pure copper complying to ASTM B 869-96 and ASTM B 452-93 standards. Each strand of CCS shall have continuous, uniform coating and the conductor surface shall be smooth and free from mechanical defects.</li> <li>III. MS Rod Hot rolled, Medium or High Tensile Steel Rod as per IS 2062 of length not less than 3000 mm and diameter of 40 mm.</li> </ul>	
2.3	<p><b>Earthing Technical and Installation Requirement</b></p> <p>Careful consideration should be given to installing an earthing system that meet or exceed statutory requirements. Contractor shall select certified product and ensure good workmanship for installation for satisfactory performance to fulfill the designed parameters all the times. Following care shall be taken while installation of earthing.</p> <ul style="list-style-type: none"> <li>I. Metallic frame/ structure of all electrical equipment shall be earthed by two separate and distinct connections to earthing system, each of 100% capacity, Crane rails, tracks, metal pipes and conduits shall also be effectively earthed at two points. Steel RCC columns, metallic stairs, and rails etc. of the building housing electrical equipment shall be connected to the nearby earthing grid conductor</li> </ul>	

CLAUSE NO.	TECHNICAL SPECIFICATIONS	 નાન્દીપાંડી NTPC	
	<p>by one earthing ensured by bonding the different sections of hand rails and metallic stairs. Metallic sheaths/screens, and armour of multi-core cables shall be earthed at both ends. Metallic Sheaths and armour of single core cables shall be earthed as per requirement mentioned elsewhere in the specification. Every alternate post of the switchyard fence shall be connected to earthing grid by one GS flat and gates by flexible lead to the earthed post. Portable tools, appliances and welding equipment shall be earthed by flexible insulated cable. Metallic column for Inverter/Switchgear shelter/E-house shall be earthed with two distinct connections at minimum two column. All the wall cladding section shall be earthed at minimum two location with flexible copper cable of not less than 50 sq. mm.</p> <p>II. Each continuous laid lengths of cable tray shall be earthed at minimum two places by G.S. flats to earthing system, the distance between earthing points shall not exceed 30 meter. Wherever earth mat is not available, necessary connections shall be done by driving an earth electrode in the ground.</p> <p>III. Neutral connections and metallic conduits/pipes shall not be used for the equipment earthing. Lightning protection system down conductors shall not be connected to other earthing conductors above the ground level.</p> <p>IV. The earth conductors shall be free from pitting, laminations, rust, scale and other electrical, mechanical defects.</p> <p>V. Connections between earth leads and equipment shall normally be of bolted type. Contact surfaces shall be thoroughly cleaned before connections. Equipment bolted connections after being tested and checked shall be painted with anti-corrosive paint/compound.</p> <p>VI. Suitable earth risers as approved shall be provided above finished floor/ground level, if the equipment is not available at the time of laying of main earth conductor.</p> <p>VII. Connections between equipment earthing leads and between main earthing conductors shall be of welded type. For rust protection the welds should be treated with red lead compound and afterwards thickly coated with bitumen compound. All welded connections shall be made by electric arc welding. Resistance of the joint shall not be more than the resistance of the equivalent length of conductors.</p>		
DEVELOPMENT OF 100 MW FLOATING SOLAR PV PROJECT AT NTPC RAMAGUNDAM IN TELANGANA	TECHNICAL SPECIFICATION BID DOC. NO:RE-CS-5747-004-9	C-9	PAGE 141

CLAUSE NO.	TECHNICAL SPECIFICATIONS	
3.0	<p>VIII. Earthing conductors buried in ground shall be laid minimum 600 mm below grade level unless otherwise indicated in the drawing. Back filling material to be placed over buried conductors shall be free from stones and harmful mixtures. Back filling shall be placed in layers of 150 mm.</p> <p>IX. Earthing conductors embedded in the concrete floor of the building shall have approximately 50 mm concrete cover.</p> <p>X. A minimum earth coverage of 300 mm shall be provided between earth conductor and the bottom of trench/foundation/underground pipes at crossings. Earthing conductors crossings the road can be installed in pipes. Wherever earthing conductor crosses or runs at less than 300 mm distance along metallic structures such as gas, water, steam pipe lines, steel reinforcement in concrete, it shall be bonded to the same. Earthing conductors along their run on columns, walls, etc. shall be supported by suitable welding / cleating at interval of 1000mm and 750mm respectively.</p> <p>XI. Earth pit shall be constructed as per IS:3043. Electrodes shall be embedded preferably below permanent moisture level. Minimum spacing between electrodes shall be 600mm.</p> <p>XII. Earth pits shall be treated with earth enhancement compound if resistivity is more than 20 ohm meter.</p> <p>XIII. On completion of installation, continuity of earth conductors and efficiency of all bonds and joints shall be checked. Earth resistance at earth terminations shall be measured and recorded. All equipment required for testing shall be furnished by contractor.</p> <p>XIV. Contractor shall obtain all necessary statutory approvals for the earthing system before charging of the plant and electrical equipments.</p> <p><b>TECHNICAL DETAILS FOR AC EARTHING SYSTEM</b></p> <p>This section outlines the requirements of protective and functional earthing system to discharge AC fault current to earth and provide equipotential bonding for Transformer, HT and LT Switchgear Panel and other similar electrical equipments, Transformer neutral and shield.</p> <p>The Contractor shall furnish the detailed design and calculations as per IEEE 80/IS 3043 for Employer's approval for equipment earthing..</p>	

CLAUSE NO.	TECHNICAL SPECIFICATIONS	एनटीपीसी NTPC																																				
3.1	<p><b>Earthing System requirement for AC Earthing:</b></p> <ol style="list-style-type: none"> <li>1. Conductors above ground level and in built up trenches -Galvanized steel</li> <li>2. Conductors buried in earth -Mild steel</li> <li>3. Earth electrodes - Mild steel rod of diameter 40mm or Copper bonded steel rod of dia not less than 17 mm</li> <li>4. Life Expectancy - 25 years</li> <li>5. Fault Level - Mentioned Elsewhere</li> <li>6. Min. Steel corrosion - As per IS 3043</li> <li>7. Soil Resistivity -Actual as per site condition</li> </ol> <p>The sizes of earthing conductors for various electrical equipment shall be as below:</p> <table border="1"> <thead> <tr> <th>S No.</th> <th>Equipment</th> <th>Earth Conductor buried in Earth</th> <th>Earth conductor above ground level and in built up trenches</th> </tr> </thead> <tbody> <tr> <td>1</td> <td>33kV/11kV/6.6kV/3.3 kV/ switchgear equipment and 415V switchgear</td> <td>--</td> <td>65 x 8mm GS flat</td> </tr> <tr> <td>2</td> <td>415 V MCC/ Distribution boards / Transformers</td> <td>--</td> <td>50 x 6mm GS flat</td> </tr> <tr> <td>3</td> <td>LT Motors above 125 KW</td> <td>--</td> <td>50 x 6mm GS flat</td> </tr> <tr> <td>4</td> <td>LT Motors 25 KW to 125 KW</td> <td>--</td> <td>25 x 6mm GS flat</td> </tr> <tr> <td>5</td> <td>LT Motors 1 KW to 25 KW</td> <td>--</td> <td>25 x 3mm GS flat</td> </tr> <tr> <td>6</td> <td>Fractional House power motor</td> <td>--</td> <td>8 SWG GS wire</td> </tr> <tr> <td>7</td> <td>Control panel &amp; control desk</td> <td>--</td> <td>25 x 3 mm GS flat</td> </tr> <tr> <td>8</td> <td>Push button</td> <td>--</td> <td>8 SWG GI wire</td> </tr> </tbody> </table>	S No.	Equipment	Earth Conductor buried in Earth	Earth conductor above ground level and in built up trenches	1	33kV/11kV/6.6kV/3.3 kV/ switchgear equipment and 415V switchgear	--	65 x 8mm GS flat	2	415 V MCC/ Distribution boards / Transformers	--	50 x 6mm GS flat	3	LT Motors above 125 KW	--	50 x 6mm GS flat	4	LT Motors 25 KW to 125 KW	--	25 x 6mm GS flat	5	LT Motors 1 KW to 25 KW	--	25 x 3mm GS flat	6	Fractional House power motor	--	8 SWG GS wire	7	Control panel & control desk	--	25 x 3 mm GS flat	8	Push button	--	8 SWG GI wire	
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CLAUSE NO.	TECHNICAL SPECIFICATIONS			
		station/Junction Box		
	9	Columns, structures, cable trays and bus ducts enclosures	--	50 x 6mm GS flat
	10	Crane, rails, rail tracks & Other non-current carrying metal parts	--	25 x 6mm GS flat
3.2	Contractor shall ensure there at least two earth pits each dedicated for earthing of each Transformer, HT/LT Switchgear panel, transformer neutral, Battery Charger/UPS/Control Panel etc. shall be provided. Earth electrode shall be located near to the equipment and all earth electrodes shall be interconnected with parallel conductor buried in earth surrounding the equipment.			
3.3	Earthing system of different locations such as Inverter room/Pooling Switchgear/Sub pooling switchgear/Inverter shelter etc. shall be interconnected in single network with buried conductor of the size 65X8 GS Flat laid at 600 mm depth. Contractor shall submit the calculation based on the system of earth conductor and electrode connected in single network. Location and manner of interconnection shall be approved during detail engineering.			
3.4	For functional earthing of electronic component such as SCADA, contractor shall provide 1 no. (Min) isolated earth electrode near to the equipment connected with 2 run of copper cable of size not less than 25 sqmm. Contractor shall comply to the recommendation of OEM ( Original Equipment Manufacturer ) for electronic earthing and electrode can be connected with other earth electrode as per recommendation of OEM.			
3.5	Each inverter duty transformer having shield between HV and LV winding shall be provided with 2 nos. Isolated earth electrode connected with each other for functional earthing of transformer shield. Each electrode shall be connected with transformer shield with separate 25X6 Cu flat.			
4.0	<p><b>TECHNICAL DETAIL SOLAR ARRAY (DC) EARTHING (if applicable)</b></p> <p>This section outlines the earthing requirement for discharging DC fault current to earth of Solar PV plant and provide equipotential bonding for Module Mounting Structure (MMS), SMB Mounting structure, Module Frames etc.</p>			
DEVELOPMENT OF 100 MW FLOATING SOLAR PV PROJECT AT NTPC RAMAGUNDAM IN TELANGANA			TECHNICAL SPECIFICATION BID DOC. NO:RE-CS-5747-004-9	C-9
				PAGE 144

CLAUSE NO.	TECHNICAL SPECIFICATIONS	एनटीपीसी NTPC
	<p>System Requirement for the solar array DC earthing:</p> <p>Conductors buried in earth -GS Flat or CCS</p> <p>Conductors above ground level -GS Flat or CCS</p> <p>Earth Electrode -40 mm MS Rod or Copper bonded steel rod of dia. not less than 14 mm</p> <p>Life Expectancy -25 Years</p> <p>System fault level -5 KA for 3 Sec.</p> <p>Soil resistivity -Actual as per site conditions</p> <p>Min. Steel corrosion -As per IS 3043</p>	
4.1	<p>Each Module mounting structure (MMS), SPV Module frames, mounting arrangement for String Monitoring Boxes, Metallic Junction Boxes, Metal frames/Panel, Metallic Pipes of the solar array shall be effectively earthed by two separate and distinct connections to earthing system. Earthing system for solar array shall consist interconnected earth pits electrodes connected by 25X6 GS flat (Min.) or Copper Clad Steel (CCS) earthing Conductor of size not less than 120 SQMM laid at the depth of 600 MM below the ground. Minimum size of riser conductor to connect the structures to buried earthing conductor and structure to structure in the solar farm shall be 25X3 GS Flat or CCS of Min. 70 SQ MM size.</p>	
4.2	Periphery fencing wherever provided shall be earthed at every 100 meter interval with 25X3 GS flat connected with DC or AC side nearest buried earthing conductor.	
4.3	Earthing conductor for connection to structure and equipment may be kept on the ground below MMS. However, these conductor shall be laid 300 mm below the ground along the pathway and/or crossing the pathway.	
4.4	Equipment and structure in the solar farm shall be earthed in compliance to the IS: 3043 (Code of Practice for Earthing) and Indian Electricity Rules/Acts.	
4.5	The Contractor shall furnish the detailed design and calculations for Owner's approval as per IS 3043 to determine the number of earth pit and size of earth conductor. However the no. of earth pit electrodes for the DC earthing shall be as per Clause. 2.0 of Chapter A-2	
4.6	Buried earth conductor shall be laid all around periphery of solar array farm and at every 300 meter (Min.) across the rows of MMS. GS flat above the ground for structure earthing shall be connected to the nearest buried conductor or electrode. All the earth electrodes shall be interconnected in single network/mesh and no electrode or group of electrodes shall be isolated/islanded. These electrodes shall be uniformly	
DEVELOPMENT OF 100 MW FLOATING SOLAR PV PROJECT AT NTPC RAMAGUNDAM IN TELANGANA		TECHNICAL SPECIFICATION BID DOC. NO:RE-CS-5747-004-9
		C-9
		PAGE 145

CLAUSE NO.	TECHNICAL SPECIFICATIONS	एनटीपीसी NTPC
4.7	distributed in the solar farm at maximum practical extent and location of earth electrode shall be approved during detail engineering. A continuous earth path is to be maintained throughout the PV array.	
4.8	Connection of DC earthing system and AC earthing system with location and manner of connection shall be approved during detail engineering. Contractor shall submit the design calculation of earthing system of AC and DC side as standalone (no interconnection) system.	
4.9	Connection of riser to the structures shall be bolted or welded type. Portion of galvanized structure which undergoes welding at site shall be coated with two coats of cold galvanizing and anti-corrosion paint afterwards.	
4.10	Connections between equipment earthing leads and between main earthing conductors shall be of welded type. For rust protection, welds should be treated with red lead compound and afterwards thickly coated with bitumen compound. All welded connections shall be made by electric arc welding.	
4.11	Each PV Module frame shall be earthed in accordance with module manufacturer guidelines. In case module frame earthing is to be separately provided, it shall be earthed with minimum 2.5 SQMM flexible copper cable with lug at suitable location of module frame. The Number of PV modules in single loop of earthing connection to module frame shall be as per Module manufacturer recommendation. Both ends of the loop of copper cable for earthing shall be connected with nearest earthed structure or earth conductor.	
4.12	Contractor shall seek owner's approval for connecting solar array earth mesh with any other earth mat/earth grid of the solar PV plant.	
4.13	Size of earth conductor, nos. of earth pits given in this clause is applicable for solar array earthing only. Relevant method and practice of laying of earthing conductor, earth pits and riser not mentioned herewith but given elsewhere in this specification is applicable to solar array earthing also.	
5.0	<b>EARTHING REQUIREMENT FOR EQUIPMENT ON FLOATER</b>	
5.1	Aforementioned requirement of the earthing are applicable earth surfaces. For Floater area, contractor shall lay 25X6 GI Flat all along the periphery of the floater area. This periphery GI Flat shall be connected at suitable location by laying minimum 2 Nos. of 25X6 GI flat equi-spaced (Location	
DEVELOPMENT OF 100 MW FLOATING SOLAR PV PROJECT AT NTPC RAMAGUNDAM IN TELANGANA		TECHNICAL SPECIFICATION BID DOC. NO:RE-CS-5747-004-9
		C-9
		PAGE 146

CLAUSE NO.	TECHNICAL SPECIFICATIONS		
	<p>5.2 to be decided during detail engineering) along East-West and North-South direction making a grid 25X6 GI Flat on the floater.</p> <p>5.3 All the equipment/devices, module metallic frame &amp; structure on the floater shall be connected with 25X6 Flat.</p> <p>5.3 The earthing system of Floater shall be connected with earthing system of ground at each location of Inverter transformer with 2 (two) nos. of 120Sqmm copper earthing cable.</p>		
DEVELOPMENT OF 100 MW FLOATING SOLAR PV PROJECT AT NTPC RAMAGUNDAM IN TELANGANA	TECHNICAL SPECIFICATION BID DOC. NO:RE-CS-5747-004-9	C-9	PAGE 147

CLAUSE NO.	TECHNICAL SPECIFICATIONS	 <b>एनटीपीसी</b> <b>NTPC</b>			
	<b>C-10 PLANT ILLUMINATION SYSTEM</b>				
	<p>This chapter covers supply and installation of suitable illumination system along the approach roads to inverter room and inverter room(s), transformer yard and other facilities inside the plant.</p>				
1.0	<p><b>DESIGN PHILOSOPHY</b></p> <p>A comprehensive illumination system shall be provided in the entire project. Each building shall be provided with adequate light fittings, 6A/16A socket, fans, etc. Exhaust fans shall also be provided in toilets, battery room, etc</p> <p>All outdoor lighting system shall be automatically controlled by synchronous timer or photocell. Provision to bypass the timer or photocell shall be provided in the panel.</p>				
2.0	<p><b>LIGHTING SYSTEM DESCRIPTION for CMCS and inverter room</b></p> <p>Normal AC Lighting System: AC lighting system 415V, 3Phase, 4wire, will be fed from lighting panels Control Board (LPs) which in turn will be fed from the lighting distribution boards (LDBs) of AC Switch board MCC.</p> <p>Emergency AC Lightning System: The emergency lighting system consisting of 20% of the lights shall be fed from UPS DB or DCDB as per scheme adopted by the EPC bidder. Load of the same has to be considered for UPS/ Battery and charger sizing. Bidder shall provide indoor and outdoor emergency lighting at each inverter room, CMCS, security room and main gate.</p>				
3.0	<p><b>Lighting Fixture, Lamps &amp; Accessories</b></p> <ol style="list-style-type: none"> <li>All lighting fixtures and accessories shall be designed for continuous operation for its life under atmospheric conditions existing at site.</li> <li>AC lighting fixtures and accessories shall be suitable for operation on 240 V, AC, 50 Hz supply with supply voltage variation of +/-10%, frequency variation of +/- 5% and combined voltage and frequency variation (absolute sum) of 10% DC lighting fixtures and accessories shall be suitable for operation on 220 V, with variation between 190 V &amp; 240 V.</li> <li>All lighting fixtures shall be complete with lamp(s), lamp holder(s), LED chip assembly, terminal blocks, clamps, locking arrangements, fixing brackets etc. Driver circuit/Control gears shall be provided as applicable / specified. The fixtures shall be fully wired upto terminal block. The internal wiring of the fixtures shall be done with suitable low</li> </ol>				
<b>DEVELOPMENT OF 100 MW FLOATING SOLAR PV PROJECT AT NTPC RAMAGUNDAM IN TELANGANA</b>		<b>TECHNICAL SPECIFICATION</b> <b>BID DOC. NO:RE-CS-5747-004-9</b>	C-10 PAGE 148		

CLAUSE NO.	TECHNICAL SPECIFICATIONS		
	<p>smoke halogen free thermo-plastic or silicon rubber insulated or fire retardant PTFE copper conductor wires of suitable size and type. Further fuse protection of suitable rating in input side shall also be provided specifically for LED luminaires. However, the normal cross section of conductor shall be not less than 0.5 Sq. mm and minimum thickness of insulation shall be 0.6 mm. The wiring shall be capable of withstanding the maximum temperature to which it will be subjected under specified service conditions without deterioration and affecting the safety of the luminaire when installed and connected to the supply. All fixing /locking screws, washers, nuts, brackets, studs etc, shall be zinc plated and passivated.</p> <p>d. All lighting fixtures shall be provided with an external, brass/GI earthing terminal suitable for connecting 14 SWG, GI earthing wire. All metal or metal enclosed parts of the housing and accessories shall be bonded and connected to the earthing terminal as so to ensure satisfactory earthing continuity through out the fixture</p> <p>e. The lighting fixtures shall be designed for minimum glare. The finish of the fixtures shall be such that no bright spots are produced either by direct light source or by reflection</p> <p>f. The reflectors shall be manufactured from CRCA sheet steel or aluminium as specified. The aluminium reflectors shall be made of high purity aluminium sheet, polished electrochemically brightened and anodized or proven alternate arrangement of anodizing</p> <p>g. Starters shall have bi-metal electrodes and high mechanical strength. Starters shall be replaceable without disturbing the reflector or lamps and without use of any tool. Starter shall have brass contacts and radio interference suppressing capacitor.</p> <p>h. LED luminaires body shall such designed that heat sink/heat dissipating housing shall be mounted outside the overall luminaires fixture housing, and shall be suitably clearing the driver circuit. Further for outdoor type LED luminaires, the exposed heat sink shall be suitably designed to avoid dust/foreign particles accumulation on the same.</p> <p>i. LED luminaires housing/body shall be pressure die cast aluminium or extruded Aluminium or CRCA as specified alongwith finished powder coating. Care shall be taken in the design that there is no water stagnation anywhere.</p>		
4.0	<b>LED Luminaires:</b>		
4.1	<b>CODES AND STANDARDS</b>		
	All standards and codes of practice referred to herein shall be the latest edition including all applicable official amendments & revisions as on date of techno-commercial bid opening. In case of conflict between this		
DEVELOPMENT OF 100 MW FLOATING SOLAR PV PROJECT AT NTPC RAMAGUNDAM IN TELANGANA		TECHNICAL SPECIFICATION BID DOC. NO:RE-CS-5747-004-9	C-10
			PAGE 149

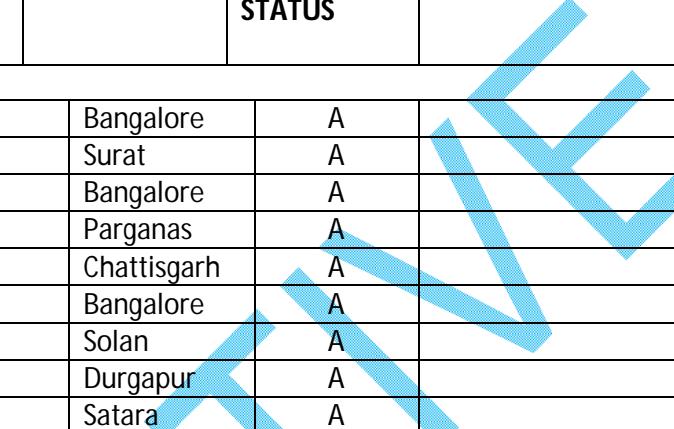
CLAUSE NO.	TECHNICAL SPECIFICATIONS	एनटीपीसी NTPC
	specification and those (IS codes, standards etc.) referred to herein, the former shall prevail. All work shall be carried out as per the following standards & codes.	
16101:2012	General Lighting. LEDs and LED modules Terms and definitions	
16102(Part 1):2012	Self Ballasted LED Lamps for General Lighting Services. Part-1 Safety Requirements.	
16102(Part 2):2012	Self Ballasted LED Lamps for General lighting Services. Part-2 Performance Requirements.	
16103(Part I):2012	LED modules for General lighting Safety Requirements.	
15885(Part 2/Sec. 13) :2012	Lamp control gear Part 2 particular Requirements Section 13 d.c. or a.c. Supplied Electronic control gear for LED modules	
16104:2012	d.c. or a.c. Supplied Electronic control gear for LED modules - Performance Requirements.	
16105:2012	Method of Measurement of Lumen maintenance of Solid-state Light (LED) Sources.	
16106:2012	Method of Electrical and photometric Measurements of Solid State Lighting (LED) Products	
16107:2012	Luminarie Performance	
16108:2012	Photobiological safety of Lamps and Lamp Systems	
IS 513	Cold rolled low carbon steel sheets and strips	
IS 12063	Classification of degree of protection provided by enclosures.	

CLAUSE NO.	TECHNICAL SPECIFICATIONS	
	IS 14700 (Part 3/Sec. 2)	Electro magnetic compatibility (EMC) – Limits for Harmonic emission – THD < 15% (equipment, input current < 16 Amps. per phase).
	IS 9000 (Part 6)	Environment testing: Test Z – AD: composite temperature/humidity cyclic test.
	IS 15885 (Part 2/Sec. 13) IS 16004 – 1 and 2	Lamp control gear: particular requirements for DC or AC supplied electronic control gear for LED modules.
	IS 4905 IEC 60598	Method for random sampling Ingress protection, luminaire performance and safety
	IEC 61000-3-2	Total Harmonic Distortion
	IEC 61000-4-5	Surge Protection
	IES-LM 80 along with TM 21/ IS 16105	Lumen Depreciation and Rated life of LED chip
	IES-LM 79 / IS 16106	Luminaire optics and color parameter and electrical parameter
4.2	<b>LED LIGHTING SYSTEM</b>	
	<p>LED Luminaires shall be used for the lighting of all the indoor &amp; outdoor areas. However for DC lighting &amp; hazardous areas conventional type luminaires shall be used. In false ceiling area LED luminaires shall be recessed mounting type &amp; in non-false ceiling area the LED luminaires shall be surface mounting type.</p> <p>The individual lamp wattage for LED shall be upto 3 watt for outdoor type luminaires. However for indoor type luminaires fractional wattage LEDs are also acceptable. The LED chip efficacy shall be min 120 Lm/W. The luminaire efficacy shall not be less than 80 Lm/W. Heat sink/heat dissipation arrangement shall be provided in the luminaires. The LED used in the luminaires shall have colour rendering index (CRI) of Min 70 and 80 for outdoor and indoor luminaires respectively.</p> <p>Colour designation of LED shall be “cool day light” (min 5700K) type for indoor type LED luminaires. Further for outdoor type luminaires, the colour designation shall be 5000K, except for well glass type LED luminaires, where the colour designation shall be 4000K. The LED luminaires shall</p>	

CLAUSE NO.	TECHNICAL SPECIFICATIONS	
	<p>have minimum life of 25,000 burning hours with 80% of lumen maintenance at the end of the life.</p> <p>The beam angle for LED chip for indoor type luminaires shall be 120 degrees. However for highbay &amp; flood light type outdoor luminaires the LED chip with suitable beam angle shall be used to deliver better lumen-output. The maximum junction temperature of bare LED without heat sink shall be limited to 85 deg C, further the lumen maintenance at this temperature shall be min 90%. The THD of tube light based LED Luminaires shall be less than 20%. For other type of luminaries, it shall be minimum 10%.</p> <p>Further the EMC shall be as per IS 14700. The power factor of the luminaire shall not be less than 0.9. The marking on luminaire &amp; safety requirements of luminaire shall be as per IS standards. Suitable heat sink/ heat dissipation arrangement, with proper thermal management shall be designed for the luminaires.</p> <p><b>Driver Circuit:</b> LED modules and drivers shall be compatible to each other. The LED module driver's ratings and makes shall be as recommended by corresponding LED manufacturer.</p> <p>LED Drivers may have following control &amp; protections:-</p> <ul style="list-style-type: none"> <li>• Suitable precision current control of LED.</li> <li>• Open Circuit Protection</li> <li>• Short Circuit Protection</li> <li>• Over Temperature Protection</li> <li>• Overload Protection</li> <li>• Surge Protection</li> </ul> <p>Lighting panels shall be powder coated with color shade RAL9002. Lighting panels shall have IP55 degree of protection.</p> <p>Wires of different phase shall normally run in separate conduit.</p> <p>Power supply shall be fed from 415 / 240 V normal AC supply through suitable number of conveniently located lighting distribution boards (LDB) and at least one 6/16A, 240V AC universal socket outlet with switch shall be provided in offices, cabins, etc.</p> <p>Suitable number of 63A, 3ph, 415V AC industrial receptacles shall be provided for welding purposes at one location.</p> <p>Incandescent lamps may be used only with DC Lighting.</p> <p>Electrification of all building shall be carried out as per IS 732-1989, IS 4648-1968 and other relevant standards.</p> <p>Indoor Lighting fixtures shall generally be controlled from switch boxes of each area not directly from lighting panel. Each switch shall control a maximum of three fixtures.</p> <p>All luminaries and their accessories and components shall be of type readily replaceable by available Indian makes.</p>	

CLAUSE NO.	TECHNICAL SPECIFICATIONS		
5.0	<p>Following test reports to be submitted for LED chip/LED luminaires:</p> <ul style="list-style-type: none"> <li>a) LED parameters like Lumen per watt, CRI, Beam angle from manufacturer.</li> <li>b) LM 80/IS: 16105 report.</li> <li>c) LM 79/IS: 16106 report</li> </ul> <p><b>JUNCTION BOXES, CONDUITS, FITTING &amp; ACCESSORIES</b></p> <p>Junction box for indoor lighting shall be made of fire retardant material. Material of JB shall be Thermoplastic or thermosetting or FRP type. Junction boxes for street lighting poles and lighting mast if applicable , shall be deep drawn or fabricated type made of min. 1.6 mm thick CRCA Sheet. The box shall be hot dip galvanized. The degree of protection shall be IP55.</p> <p>All switches and receptacles upto 16A shall be modular type. These shall be provided with pre-galvanized/galvanized modular switchbox &amp; plate.</p> <p><b>Conduits, Pipes and Accessories:</b></p> <p>Heavy duty PVC conduits conforming to IS: 9537 Part-III along with various accessories shall be used for indoor wiring in the buildings. These conduits shall be concealed in the wall/floor/roof. However, in PEB's, conduits can be fixed on surface.</p> <p>Pull out boxes shall be provided at suitable interval in a conduit run .Boxes shall be suitable for mounting on Walls, Columns, etc. Pull-out boxes shall have cover with screw. Pull out boxes used outdoor shall be weather proof type suitable for IP: 55 degree of protection and those used indoor shall be suitable for IP: 52 degree of protection.</p>		
6.0	<p><b>LIGHTING WIRES</b></p> <p>Lighting wires shall be 1100 V grade, light duty PVC insulated unsheathed, stranded copper/aluminium wire for fixed wiring installation. colour of the PVC insulation of wires shall be Red, Yellow, Blue and Black for R,Y,B phases &amp; neutral, respectively and white &amp; grey for DC positive &amp; DC negative circuits, respectively. Minimum size of wire shall not be less than 1.5.sq.mm. for copper</p>		
7.0	<p><b>LIGHTING POLES</b></p> <p>The Street Light system and peripheral lighting shall be designed generally in line with design guidelines. Height of the poles should be chosen so as not to affect working of Solar panels. The poles shall be hot-dip galvanized as per relevant IS2629/ IS2633/ IS4759. The average coating thickness of galvanizing shall be min. 70 micron. The System shall</p>		
<b>DEVELOPMENT OF 100 MW FLOATING SOLAR PV PROJECT AT NTPC RAMAGUNDAM IN TELANGANA</b>		<b>TECHNICAL SPECIFICATION</b> BID DOC. NO:RE-CS-5747-004-9	C-10 PAGE 153

CLAUSE NO.	TECHNICAL SPECIFICATIONS	एनटीपीसी NTPC																					
	<p>be capable of withstanding the appropriate wind load etc as per IS 875 considering prevailing soil/ site condition considering all accessories mounting on pole.</p> <p>The street light poles shall have loop in loop out arrangement for cable entry and light fixture / wiring protected with suitably rated MCB. The required illumination level shall be as per Cl. 9.0 taking consideration of existing lighting infrastructure.</p> <p>Hot dipped Galvanized with 80 mm thickness hexagonal/Octagonal lighting pole with inbuilt JB shall also be acceptable</p> <p>The luminaries used shall be minimum 32 W with minimum pole height of 2.5 m with 50 m for internal roads.</p>																						
8.0	<b>EARTHING</b>  Lighting panels, etc. shall be earthed by two separate and distinct connections with earthing system. Switch boxes, junction boxes, lighting fixtures, fans, single phase receptacles etc. shall be earthed by means of separate earth continuity conductor. The earth continuity conductor 14 SWG GI wire shall be run along with each conduit run. Cable armours shall be connected to earthing system at both the ends. Alternately Vendor may offer technically superior and proven product subject to approval of employer.																						
9.0	<b>AVERAGE ILLUMINATION LEVEL</b>  <table border="1"> <thead> <tr> <th>Location</th><th>Average Illumination Level (Lux)</th><th>Type of Fixture</th></tr> </thead> <tbody> <tr> <td>Control Room</td><td>300</td><td>LED Luminaries</td></tr> <tr> <td>Store Room</td><td>200</td><td>LED Luminaries</td></tr> <tr> <td>Switchgear Room, HT Room</td><td>150</td><td>LED Luminaries</td></tr> <tr> <td>Inverter Room</td><td>150</td><td>LED Luminaries</td></tr> <tr> <td>Street lighting-Roads</td><td>10</td><td>LED Luminaries</td></tr> <tr> <td>Yard/ Substation</td><td>20(general) 50(on strategic equipment)</td><td>LED Luminaries</td></tr> </tbody> </table>	Location	Average Illumination Level (Lux)	Type of Fixture	Control Room	300	LED Luminaries	Store Room	200	LED Luminaries	Switchgear Room, HT Room	150	LED Luminaries	Inverter Room	150	LED Luminaries	Street lighting-Roads	10	LED Luminaries	Yard/ Substation	20(general) 50(on strategic equipment)	LED Luminaries	
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		<b>PROJECT : Development of 100 MW Floating Solar PV</b> <b>Project at NTPC Ramagundam in Telangana</b> <b>PACKAGE : SOLAR</b> <b>CONT. NO. :</b>			<b>INDICATIVE VENDOR LIST</b> <b>Subsystem- Electrical &amp; Mechanical</b>		<b>DOC NO. :</b> <b>REVISION NO. 00</b> <b>PAGE : 1</b>
SI. No.	ITEM	QP / INS CAT.	QP No. -	ACCEPTABLE SUPPLIER AS PER DATABASE	PLACE	SC APPL STATUS	REMARKS
1.	SPV module	I	Q-001	BHEL Warree Emmvee Vikram Solar Lanco Solar Tata Power Solar Alpex Synergy Photonix HHV Solar	Bangalore Surat Bangalore Parganas Chattisgarh Bangalore Solan Durgapur Satara Bangalore	A A A A A A A A A A	
2.	Power Conditioning Unit (PCU)	I	Q-002	Schneider ABB Bongfiglioli Fecon AEG Hitachi-Hirel Hitachi-Hirel Vacon	Bangalore Bangalore Germany Germany Bangalore Gandhinagar Sananad Bangalore	A A A A A A A A	Conditions apply Conditions apply Conditions apply Conditions apply Conditions apply Conditions apply Conditions apply Conditions apply
3.	String Monitoring Box (SMB)	II	Q-003	Trinity Touch Hensel AEG Statcon Weidmuller	Palwal Sriperumbudur Bangalore Pilkhuwa Spain	A A A A A	Conditions apply Conditions apply Conditions apply Conditions apply Conditions apply



**PROJECT : Development of 100 MW Floating Solar PV**  
**Project at NTPC Ramagundam in Telangana**  
**PACKAGE : SOLAR**  
**CONT. NO. :**

**INDICATIVE VENDOR LIST**  
**Subsystem- Electrical & Mechanical**

**DOC NO. :**  
**REVISION NO. 00**  
**PAGE : 2**

SI. No.	ITEM	QP / INS CAT.	QP No. -	ACCEPTABLE SUPPLIER AS PER DATABASE	PLACE	SC APPL STATUS	REMARKS
---------	------	---------------	----------	-------------------------------------	-------	----------------	---------

4.	Weather station panel (comprising of Pyranometer, anemometer & thermometer etc.)	III		Any make-model with VDE/ CE/UL/ CSA marking or BIS approved with CML no. (Refer Note-6)			
5.	DC Cable Connector	III		Any make-model which is Type Tested as per EN 50521 or having marking of VDE/ CE/UL/ CSA/ "BIS with CML no." (Refer Note-1)			
6.	Floor mounted Draw out type indoor LT Switchgear Panel (MCC etc.) Refer Note-5	I	Q-004	L&T	Mumbai / Coimbatore/ Ahmednagar	A	BOIs preferably with VDE/CE/UL/CSA marked or BIS approved with valid CML no.
				GE	Bangalore	A	
				C&S Electric	Noida / Hardwar	A	
				Schneider	Nasik	A	ACB from Schneider, France
				Nitya Electrocontrols	Noida	A	
				Siemens	Kalwa	A	Conditions apply
				Tricolite	Sahibabad/ Manesar	A	Conditions apply
7.	LV Air Circuit Breaker	*		C&S Electric	Noida	A	*(part of Swgr MQP)
				L&T	Mumbai	A	
				GE	Bangalore	A	
				Siemens	Germany	A	



**PROJECT : Development of 100 MW Floating Solar PV**  
**Project at NTPC Ramagundam in Telangana**  
**PACKAGE : SOLAR**  
**CONT. NO. :**

**INDICATIVE VENDOR LIST**  
**Subsystem- Electrical & Mechanical**

**DOC NO. :**  
**REVISION NO. 00**  
**PAGE : 3**

SI. No.	ITEM	QP / INS CAT.	QP No. -	ACCEPTABLE SUPPLIER AS PER DATABASE	PLACE	SC APPL STATUS	REMARKS
---------	------	---------------	----------	-------------------------------------	-------	----------------	---------

				Schneider	France	A	
8.	Floor mounted Fixed type indoor LT Switchgear Panel ( ACDB / DCDB / MLDB etc.) Refer Note-5	I	Q-005	Switching Circuits	Kolkata	A	BOIs preferably with CE/VDE/UL/CSA marked or BIS approved with valid CML no.
				Hindustan Control & equipment Ltd	kolkata	A	With fabrication & painting at unit II & MP Electrical Narendrapur
				Maktel	Vadodara	A	Prior Type Testing
				Jakson	Greater Noida	A	
				Vidyut Control	Gaziabad	A	
				Adlec Power	Rohad ( Jhajjar)	A	
				Pyrotech	Udaipur	A	
				Conquerent Control System	Manesar	A	Condition apply ,upto 1250A
				Control & Schematics	Hyderabad	A	
				Positronics	Vadodara	A	
				Anand Power Ltd.	Noida	A	
				Additionally all vendors identified for Floor mounted Draw out type indoor LT Switchgear Panel			
9.	Wall mounted fixed type indoor / outdoor LT	I	Q-006	Control Devices	Kolkata	A	BOIs preferably with CE/VDE/UL/CSA marked or BIS approved with valid CML no.



**PROJECT : Development of 100 MW Floating Solar PV**  
**Project at NTPC Ramagundam in Telangana**  
**PACKAGE : SOLAR**  
**CONT. NO. :**

**INDICATIVE VENDOR LIST**  
**Subsystem- Electrical & Mechanical**

**DOC NO. :**  
**REVISION NO. 00**  
**PAGE : 4**

SI. No.	ITEM	QP / INS CAT.	QP No. -	ACCEPTABLE SUPPLIER AS PER DATABASE	PLACE	SC APPL STATUS	REMARKS
---------	------	---------------	----------	-------------------------------------	-------	----------------	---------

	Switchgear non compartmentalized Panel ( Lighting panels / AC / DC Fuse boards etc.) Refer Note-5						
				Jasper	Noida	A	
				Havells	Faridabad	A	
				Novateur Electrical & distribution systems	Murthal	A	
				Avaid Technovator	Manesar	A	
				Additionally all vendors identified for Floor mounted Draw out type indoor LT Switchgear Panel			
				Additionally all vendors identified for Floor mounted fixed type indoor LT Switchgear Panel			
10.	Lighting & Welding Transformer	III	Q-007	Southern Electric	Chennai	A	
				Indcoil	Thane	A	
				Pragati	Thane	A	
				Prayog	Pune	A	
				Precise	Mumbai	A	
				Logicstat	Delhi	A	
				Gujarat Plug in	Vadodara	A	



**PROJECT : Development of 100 MW Floating Solar PV**  
**Project at NTPC Ramagundam in Telangana**  
**PACKAGE : SOLAR**  
**CONT. NO. :**

**INDICATIVE VENDOR LIST**  
**Subsystem- Electrical & Mechanical**

**DOC NO. :**  
**REVISION NO. 00**  
**PAGE : 5**

SI. No.	ITEM	QP / INS CAT.	QP No. -	ACCEPTABLE SUPPLIER AS PER DATABASE	PLACE	SC APPL STATUS	REMARKS
---------	------	---------------	----------	-------------------------------------	-------	----------------	---------

				AE	Thane	A	
				Power Pack Enterprises	Mumbai	A	
				Amex Impex,	Ahmedabad	A	
11.	LT CT/PT/CBCT/ Control Transformer	III		Kappa	Bangalore	A	
				Southern Electric	Chennai	A	
				Precise	Mumbai	A	
				G&M	Baroda	A	CBCT Only
				Silkaans	Mumbai	A	
				Ind Coil	Mumbai	A	
				Pragati	Thane	A	
				Prayog	Pune	A	
				AE	Mumbai	A	
				Logicstat	Delhi	A	For control transformer only
				C&S Electric	Noida	A	For CT only
				Newtek	Aurangabad	A	For CT/PT/Control transformer
12.	1.1Kv LT Power Cable (From SMB to PCU)	Refer Note- 2	Q-008	Universal Cable Ltd.	Satna	A	
				NICCO	Shamnagar , Kolkata	A	
				Torrent Cable Ltd	Nadiad	A	
				Incab	Pune	A	
				Hindustan Vidyut Products Ltd	Faridabad	A	
				KEI Industries	Bhiwadi	A	
				Delton Cable Ltd	Faridabad	A	A) Unarmoured cable all sizes.



PROJECT : Development of 100 MW Floating Solar PV  
Project at NTPC Ramagundam in Telangana  
PACKAGE : SOLAR  
CONT. NO. :

INDICATIVE VENDOR LIST  
Subsystem- Electrical &  
Mechanical

DOC NO. :  
REVISION NO. 00  
PAGE : 6

SI. No.	ITEM	QP / INS CAT.	QP No. -	ACCEPTABLE SUPPLIER AS PER DATABASE	PLACE	SC APPL STATUS	REMARKS
------------	------	---------------------	----------	--	-------	-------------------	---------

							B) Armoured cable up to 3.5 x 240 sq. Mm with GI strip armour and 1CX70 sq mm with Al strip armour
				Paramount Cable	Khushkhera	A	
				Polycab Wires Pvt. Ltd	Daman	A	
				Gemscabs Industries	Bhiwadi	A	
				Cords Cables	Bhiwadi	A	
				Havells India Ltd.	Alwar	A	
				Ravin Cables	Pune	A	
				Thermocables	Hyderabad	A	
				Sbee Cables	Bangalore	A	
				Suyog Cables	Vadodara	A	
				Gupta Power Cables	Khurda	A	
				Finolex	Pune	A	
				Scot Innovation wires and cables	Baddi	A	
				Anhui Hualing	China	A	
				LS Cable	Korea	A	
				Radiant Cables	Hyderabad	A	
				Tirupati Plastomatics	Jaipur	A	
				Apar Industries	Umbergaon	A	
				Special Cables	Rudrapur	A	
				ABB Kabel	Germany	A	
				Advance cable	Bengaluru	A	
				Step Industries	Shahjahanpur	A	
				Taihan Electric Wire	Korea	A	
				Tbea Shandong	China	A	
				CMI	Baddi	A	
				Dynamic Cables	Jaipur	A	Conditional Approval



**PROJECT : Development of 100 MW Floating Solar PV**  
**Project at NTPC Ramagundam in Telangana**  
**PACKAGE : SOLAR**  
**CONT. NO. :**

**INDICATIVE VENDOR LIST**  
**Subsystem- Electrical & Mechanical**

**DOC NO. :**  
**REVISION NO. 00**  
**PAGE : 7**

SI. No.	ITEM	QP / INS CAT.	QP No. -	ACCEPTABLE SUPPLIER AS PER DATABASE	PLACE	SC APPL STATUS	REMARKS
---------	------	---------------	----------	-------------------------------------	-------	----------------	---------

				Indo Alusys	Bhiwadi	A	
13.	1.1 KV Control Cable	Refer Note-2	Q-009	Universal Cable Ltd.	Satna	A	
				NICCO	Shamnagar , Kolkata	A	
				Torrent Cable Ltd	Nadiad	A	
				Incab	Pune	A	
				Polycab WiresPvt. Ltd	Daman	A	
				Hindustan Vidyut Products Ltd	Faridabad	A	
				KEI Industries	Bhiwadi	A	
				Delton Cable Ltd	Faridabad	A	
				Paramount Cable	Khushkhera	A	
				Gemscabs Industries	Bhiwadi	A	
				Cords Cables	Bhiwadi	A	
				SPM Cables	Hyderabad	A	
				Elkay Telelink	Faridabad	A	
				Havells India Ltd.	Alwar	A	
				R.R. Kabel	Silvasa	A	
				Ravin Cables	Pune	A	
				Gupta Power cable	Khurda	A	
				Thermocables	Hyderabad	A	
				Finolex	Pune	A	
				Sbee Cables	Bangalore	A	
				Suyog Cables	Vadodara	A	
				Scot Innovation wires and Cables	Baddi	A	



**PROJECT : Development of 100 MW Floating Solar PV**  
**Project at NTPC Ramagundam in Telangana**  
**PACKAGE : SOLAR**  
**CONT. NO. :**

**INDICATIVE VENDOR LIST**  
**Subsystem- Electrical & Mechanical**

**DOC NO. :**  
**REVISION NO. 00**  
**PAGE : 8**

SI. No.	ITEM	QP / INS CAT.	QP No. -	ACCEPTABLE SUPPLIER AS PER DATABASE	PLACE	SC APPL STATUS	REMARKS
---------	------	---------------	----------	-------------------------------------	-------	----------------	---------

				Anhui Hauling	China	A	
				LS Cable	Korea	A	
				Radiant Cables	Hyderabad	A	
				Tirupati Plastomatics	Jaipur	A	
				Apar Industries	Umbergaon	A	
				Special Cables	Rudrapur	A	
				Advance cable	Bengaluru	A	
				Step Industries	Shahjahanpur	A	
				Taihan Electric Wire	Korea	A	
				Tbea Shandong	China	A	
				CMI	Baddi	A	
				Goyoline Fibres(I) Ltd	Daman	A	
				Indo Alusys	Bhiwadi	A	
14.	HT Cable Upto 11KV	Refer Note 2	Q-010	Universal Cable Ltd.	Satna	A	
				NICCO	Shamnagar, Kolkata	A	
				Torrent Cable Ltd	Nadaid	A	
				Incab	Pune	A	
				Polycab Wires Pvt. Ltd	Daman	A	
				KEI Industries	Bhiwadi	A	
				Havells India Ltd.	Alwar	A	
				Sri ram Cables	Bhiwadi	A	
				Krishna Electrical Industries Ltd	Gwalior	A	
				Apar Industries	Valsad	A	



**PROJECT : Development of 100 MW Floating Solar PV  
Project at NTPC Ramagundam in Telangana  
PACKAGE : SOLAR  
CONT. NO. :**

**INDICATIVE VENDOR LIST  
Subsystem- Electrical &  
Mechanical**

**DOC NO. :  
REVISION NO. 00  
PAGE : 9**

SI. No.	ITEM	QP / INS CAT.	QP No. -	ACCEPTABLE SUPPLIER AS PER DATABASE	PLACE	SC APPL STATUS	REMARKS
------------	------	---------------------	----------	--	-------	-------------------	---------

				Finolex	Pune	A	
				KEC International	Vadodara	A	
				Tirupati Plastomatics	Jaipur	A	
				Gupta Power	Kashipur	A	
				Paramount	Khuskhera	A	
				Gemscab	Bhiwadi	A	
				Sterlite	Haridwar	A	
15.	HT Cable upto 33KV	Refer Note 2	Q-011	Universal Cable Ltd.	Satna	A	
				Torrent Cable Ltd	Nadiad	A	
				Polycab Wires Pvt. Ltd	Daman	A	
				KEI Industries	Bhiwadi	A	
				Havells India Ltd.	Alwar	A	
				Apar Industries	Valsad	A	
				Finolex	Pune	A	
				KEC International	Vadodara	A	
				Gupta Power	Kashipur	A	
				Paramount	Khuskhera	A	
				Gemscab	Bhiwadi	A	
				Sterlite	Haridwar	A	
16.	DC Cable (Interconnecting SPV Modules, SPV Module to SMB) As per NTPC specification	I	Q-012	Siechem	Pondicherry	A	Upto 35 sq.mm.



**PROJECT : Development of 100 MW Floating Solar PV**  
**Project at NTPC Ramagundam in Telangana**  
**PACKAGE : SOLAR**  
**CONT. NO. :**

**INDICATIVE VENDOR LIST**  
**Subsystem- Electrical & Mechanical**

**DOC NO. :**  
**REVISION NO. 00**  
**PAGE : 10**

SI. No.	ITEM	QP / INS CAT.	QP No. -	ACCEPTABLE SUPPLIER AS PER DATABASE	PLACE	SC APPL STATUS	REMARKS
---------	------	---------------	----------	-------------------------------------	-------	----------------	---------

				Apar	Khatalwada	A	Conditions apply
17.	Battery ( Ni-Cd)	II	Q-013	M/S HBL-Power System	Hyderabad	A	Up to 990 Ah with conditions
				M/S Amcosoft	Bangalore	A	8Ah to 990Ah- KPH type 10Ah to 1365 Ah- KPM type 11Ah to 1550Ah – KPL type
18.	Battery Plante /Tubular	II	Q-014	M/s Exide	Kolkata	A	
				Hoppeke	Brilon, Germany	A	
19.	Battery charger	II	Q-015	M/s Amararaja	Tirupati	A	
				M/s HBL- Power System	Hyderabad	A	
				M/s Chhabhi electrical	Jalgaon	A	
				M/s. Chloride Power	Kolkatta	A	
				M/s Statcon	Hapur	A	Up to 220, V 850 A
				M/s Dubas	Bangalore	A	Up to 220 V, 250 A
				M/s Saft Nife Power Systems	Singapore	A	
				M/s Masstek	Jalgaon	A	
20.	Earthing & Lightning Protection Material like GI Strip/GI Wire etc	III		Main contractor Approved Sources box subject to galvanization at NTPC approved sources as per Note-4			
21.	HT Cable Termination Kits & Straight Through Jointing Kit	III		M/s 3M Electro & Communication	Pune	A	Upto 33KV



PROJECT : Development of 100 MW Floating Solar PV  
Project at NTPC Ramagundam in Telangana  
PACKAGE : SOLAR  
CONT. NO. :

INDICATIVE VENDOR LIST  
Subsystem- Electrical &  
Mechanical

DOC NO. :  
REVISION NO. 00  
PAGE : 11

SI. No.	ITEM	QP / INS CAT.	QP No. -	ACCEPTABLE SUPPLIER AS PER DATABASE	PLACE	SC APPL STATUS	REMARKS
------------	------	---------------------	----------	--	-------	-------------------	---------

	(Heat shrinkable type)						
				Raychem	Halol	A	Upto 33KV
				Hari Consolidated	Delhi	A	Upto 11KV( conditions apply)
22.	Lighting fixtures with accessories including lamp (Filament type)	II	Q-016	M/s Crompton	Mumbai	A	
				M/s Bajaj Electricals	Mumbai	A	
				M/s Philips	Noida	A	
				M/s Wipro	Mumbai	A	
				M/s Surya Roshni	Noida	A	Conditions apply
23.	Lighting fixtures with accessories including lamp (LED type)	II	Q-017	M/ s Wipro	Pune	A	Conditions apply
				M/s Surya Roshni	Noida	A	Conditions apply
				M/s Bajaj	Mumbai	A	Conditions apply
				M/s Goldwyn	Noida	A	
				M/s Philips	Noida	A	
24.	MCB Boxes/Junction boxes / Link Boxes/ Test Link Box/ Adopter box, Switch Boxes, Pull Boxes (Hot Dip Galvanized)	III		Main Contractor approved sources with galvanization from NTPC approved sources			BOIs preferably with CE/VDE/UL/CSA marked or BIS approved with valid CML no, Refer Note-6
25.	Industrial /welding	III		Schneider	Nasik	A	



**PROJECT : Development of 100 MW Floating Solar PV**  
**Project at NTPC Ramagundam in Telangana**  
**PACKAGE : SOLAR**  
**CONT. NO. :**

**INDICATIVE VENDOR LIST**  
**Subsystem- Electrical & Mechanical**

**DOC NO. :**  
**REVISION NO. 00**  
**PAGE : 12**

SI. No.	ITEM	QP / INS CAT.	QP No. -	ACCEPTABLE SUPPLIER AS PER DATABASE	PLACE	SC APPL STATUS	REMARKS
---------	------	---------------	----------	-------------------------------------	-------	----------------	---------

	receptacles & boxes						
				M/s BCH	Faridabad	A	
				M/s Ajmera	Mumbai	A	
				M/s. Sakthi & Crown	Chennai	A	
				Any other make having CE / UL / CSA mark or BIS approval with valid CML number.			
26.	PVC conduit/hume pipe/lighting wire/GI pipes/HDPE pipe/Structural Steel/GI steel rigid conduit/epoxy conduit	III		BIS licensee with valid CML number / ISI marked with valid CML number			
27.	MV Switchgear Panel (Refer Note-5)	I	Q-018	BHEL	Bhopal	A	Upto 33KV
				Megawin	Salem	A	Upto 33KV
				L&T	Ahmednagar	A	Upto 33KV
				Siemens	Mumbai	A	Upto 33KV
				Jyoti	Vadodara	A	Upto 33KV
				ABB	Nasik	A	Upto 33KV
				Schneider	Kolkata	A	Upto 11KV -Salt lake works -VG series Interrupter made at Salt Lake Works
28.	MV Vacuum Type Circuit Breaker	(part of		Siemens	Mumbai	A	Upto 33kv



**PROJECT : Development of 100 MW Floating Solar PV**  
**Project at NTPC Ramagundam in Telangana**  
**PACKAGE : SOLAR**  
**CONT. NO. :**

**INDICATIVE VENDOR LIST**  
**Subsystem- Electrical & Mechanical**

**DOC NO. :**  
**REVISION NO. 00**  
**PAGE : 13**

SI. No.	ITEM	QP / INS CAT.	QP No. -	ACCEPTABLE SUPPLIER AS PER DATABASE	PLACE	SC APPL STATUS	REMARKS
---------	------	---------------	----------	-------------------------------------	-------	----------------	---------

		Swgr MQP)					
				BHEL	Bhopal	A	Upto 33kv
				L&T	Ahmednagar	A	Upto 33kv
				ABB	Nasik	A	Upto 33kv
				ABB	Italy	A	Upto 33Kv
				Megawin	Salem	A	Upto 33kv
				Jyoti	Vadodara	A	Upto 33kv
				Schneider	Kolkata	A	Upto 11kv
29.	IEC 61850 compliant Numerical Protection Relays	(Part of Swgr MQP)		SEL	Pullman, USA	A	
				ALSTOM T&D	Stafford, UK	A	P14X, P34X, P44X, P64X, P74X models only.
				ALSTOM T&D	Chennai	A	P14X, P24X, P34X, P44X, P64X, P74X models only.
				ABB	Finland	A	
				ABB	Baroda	A	For 6XX Series
				GE Multilin	Zamudio, Vizcaya, Spain/ Markham, Ontario, Canada	A	F-650 only
				Schneider	Stone, UK	A	PX30, PX40, VAMP 5X and VAMP 2XX models only.
				Siemens	Germany	A	7SX Series only



**PROJECT : Development of 100 MW Floating Solar PV**  
**Project at NTPC Ramagundam in Telangana**  
**PACKAGE : SOLAR**  
**CONT. NO. :**

**INDICATIVE VENDOR LIST**  
**Subsystem- Electrical & Mechanical**

**DOC NO. :**  
**REVISION NO. 00**  
**PAGE : 14**

SI. No.	ITEM	QP / INS CAT.	QP No. -	ACCEPTABLE SUPPLIER AS PER DATABASE	PLACE	SC APPL STATUS	REMARKS
---------	------	---------------	----------	-------------------------------------	-------	----------------	---------

				Siemens	Goa	A	7SR2X , 7SJ66X series only
30.	Single Rod Air Terminal Type Solar Array Lightning Arrestor	III		Main Contractor approved sources: subject to manufacturer / supplier having valid Type Test Report as per IS 2309 or equivalent Standard			
31.	ESE Type Solar Array Lightning Arrestor	III		Main Contractor approved sources: subject to manufacturer / supplier having valid Type Test Report as per latest version of NF C 17-102 & country of origin documents			
32.	Lighting Poles	III		BIS Licensee as per IS 2713			
33.	Cable Lug	III		M/s Dowell	Mumbai	A	
				M/s Billets Elektro Werke Ltd. ( 3 D)	Umbergaon	A	
				M/s Chetna	Nasik	A	
				Additional Vendors with Make-Model having mark of VDE/ UL /CSA / BIS with CML no. Refer Note-1			
34.	Cable Gland	III		Any Make-Model having mark of VDE/ UL /CSA / BIS with CML no. Refer Note-1			
35.	GI Cable Tray, fitting, accessories including bends	Refer Note-3	Q-019	Inar Profiles Ltd	Enkapalli (Vishakhapatnam)	A	



**PROJECT : Development of 100 MW Floating Solar PV**  
**Project at NTPC Ramagundam in Telangana**  
**PACKAGE : SOLAR**  
**CONT. NO. :**

**INDICATIVE VENDOR LIST**  
**Subsystem- Electrical & Mechanical**

**DOC NO. :**  
**REVISION NO. 00**  
**PAGE : 15**

SI. No.	ITEM	QP / INS CAT.	QP No. -	ACCEPTABLE SUPPLIER AS PER DATABASE	PLACE	SC APPL STATUS	REMARKS
---------	------	---------------	----------	-------------------------------------	-------	----------------	---------

				Vatco	Mumbai	A	Galvanization at Sigma Mumbai
				Indiana cable trays	Mumbai	A	Galvanization at Karamtara galvanizer- Mumbai
				Industrial Perforation	Kolkata	A	Galvanized and offered for inspection at M/s Industrial Perforation Pvt Ltd, Ganganagar , Kolkata, WB
				Ratan Projects	Howrah	A	Galvanization at DMP Projects- Howrah
				India Electric Syndicate	Kolkata	A	Galvanization at BMW Industries/B.P Projects- Howrah
				Steelite engg.	Mumbai	A	
				Premier Power Products	Howrah	A	Galvanising at Neha Galvaniser- Howrah
				Indiana Gratings	Pune	A	
				M.J. Engineering	Okhla/ Bhiwadi	A	
				T.R.G	Chennai	A	Galvanization at TM Radhakrishna Chetty & Co-Chennai
				Amtech	Pune	A	Galvanization at B.G. Shirke - Pune
				Kannade Anand Udyog	Mumbai	A	Fabrication at their units: Plot No. 42, Morivali, MIDC Thane & Plot No.: D-35 Anand Nagar MIDC, Addl. Ambernath , Dist.Thane Galvanization and offer the galvanized cable trays for inspection at D-34 Anand Nagar MIDC, Addl. Ambernath, Dist.Thane.
				Rukmani	Raipur	A	Ladder type cable trays only
				Passive Infra	Hasangarh (Rohtak)	A	
				Unitech Fabricators & Engineers	Howrah/ Hoogly (Kolkata)	A	
				Patny System	Hyderabad	A	
				Rabi Engg	Kolkata	A	Galvanizing from NTPC approved sources
				MKSD Industries	Taloja	A	Galvanising at Encorp Power trans PVT Ltd, Palghar



**PROJECT : Development of 100 MW Floating Solar PV**  
**Project at NTPC Ramagundam in Telangana**  
**PACKAGE : SOLAR**  
**CONT. NO. :**

**INDICATIVE VENDOR LIST**  
**Subsystem- Electrical & Mechanical**

**DOC NO. :**  
**REVISION NO. 00**  
**PAGE : 16**

SI. No.	ITEM	QP / INS CAT.	QP No. -	ACCEPTABLE SUPPLIER AS PER DATABASE	PLACE	SC APPL STATUS	REMARKS
---------	------	---------------	----------	-------------------------------------	-------	----------------	---------

				Reliable Sponge	Kalunga	A	
				Rukmani	Hoogly	A	Galvanization at Rukmani Fab & Gal- Howrah
				Eros Metal Works	Nagpur	A	Conditions apply
				Indmark Formtech	Pune	A	Conditions Apply
36.	Cable Tray Flexible Tray Support System	Refer Note- 3	Q-020	Vatco	Mumbai	A	Galvanising at Sigma Mumbai
				Inar profiles	Enkapalli	A	
				Industrial perforations	Kolkata	A	
				Premier power products	Howrah	A	Galvanising at Neha Galvaniser- Howrah
				Steelite engg.	Mumbai	A	
				Indiana gratings	Pune	A	Galvanising at Poona Galvaniser- Pune
				Amtech	Pune	A	Galvanising at B.G. Shirke- Pune
				Ratan Projects	Howrah	A	Galvanization at NTPC approved sources
				MKSD Industries	Taloja	A	Galvanising at Encorp Power trans PVT Ltd, Palghar
				Indmark Formtech	Pune	A	Conditions apply
				Patny Systems	Hyderabad	A	
37.	Piping – ERW ( IS 1239)	II		Main Contractor approved sources; with valid BIS license			
38.	Fire Extinguisher	III		BIS approved sources with valid BIS License.			
39.	Circuit Breaker 33KV (outdoor type)	I	Q-027	Siemens	Aurangabad	A	
				ABB	Vadodara	A	
				CGL	Nasik	A	
				BHEL	Hyderabad	A	



**PROJECT : Development of 100 MW Floating Solar PV**  
**Project at NTPC Ramagundam in Telangana**  
**PACKAGE : SOLAR**  
**CONT. NO. :**

**INDICATIVE VENDOR LIST**  
**Subsystem- Electrical & Mechanical**

**DOC NO. :**  
**REVISION NO. 00**  
**PAGE : 17**

SI. No.	ITEM	QP / INS CAT.	QP No. -	ACCEPTABLE SUPPLIER AS PER DATABASE	PLACE	SC APPL STATUS	REMARKS
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				GE T&D	Kanchipuram	A	
40.	Isolator 33 kv (outdoor type)	I	Q-028	GR Power	Hyderabad	A	
				Hivelm	Chennai	A	
				S&S Power	Pondicherry	A	
				Switchgear & Structural	Hyderabad	A	
				Siemens Ltd	Hyderabad	A	
41.	PT (Outdoor Type, upto 33Kv)	I	Q-029	Mehru	Bhiwadi	A	
				Vishal Transformer	Meerut	A	
				Heptacare	Meerut	A	
42.	33KV CT (Outdoor Type)	I	Q-030	Mehru	Bhiwadi	A	
				GE T&D	Hosur	A	
				ABB	Vadodara	A	
				CGL	Nasik	A	
				BHEL	Jhansi/Bhopal	A	
				Vishal Transformer	Meerut	A	
				Heptacare	Meerut	A	
43.	Surge Arrestor	I	Q-032	Oblum	Hyderabad	A	
				Lamco	Hyderabad	A	
				Xian	China	A	



**PROJECT : Development of 100 MW Floating Solar PV**  
**Project at NTPC Ramagundam in Telangana**  
**PACKAGE : SOLAR**  
**CONT. NO. :**

**INDICATIVE VENDOR LIST**  
**Subsystem- Electrical & Mechanical**

**DOC NO. :**  
**REVISION NO. 00**  
**PAGE : 18**

SI. No.	ITEM	QP / INS CAT.	QP No. -	ACCEPTABLE SUPPLIER AS PER DATABASE	PLACE	SC APPL STATUS	REMARKS
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				CGL	Nasik	A	
44.	AB Tariff energy meter	II	Q-033	SEMS	Udaipur/Solan	A	Inspection with representative from Local Electricity Board.
				Elster	Mumbai	A	
				L&T	Mysore	A	With CMS software.
45.	Conductor	II		Smita	Ghaziabad	A	
				Gupta Power Infra	Bhubaneswar	A	
				Saravathy	Bangalore	A	
				Galaxy	Sangli	A	
				Hindustan Vidyut products	Faridabad	A	
				Apar Industries	Vadodara / Silvassa	A	
				Hira Cables	Hirakud	A	
				JSK	Silvassa	A	
				DIAMOND	VADODARA	A	
				HIREN ALUMINIUM	SILVASSA	A	
				LUMINO	KOLKATA	A	
46.	Disc Insulator/Pin Insulator	II		Aditya Birla	Rishra	A	
				IEC	Bhopal	A	
				WSI	Chennai	A	
				BHEL	Bangalore	A	
				Imperial Ceramics	Bikaner	A	Upto 90KN
				SARVANA	CUDDALORE	A	



**PROJECT : Development of 100 MW Floating Solar PV**  
**Project at NTPC Ramagundam in Telangana**  
**PACKAGE : SOLAR**  
**CONT. NO. :**

**INDICATIVE VENDOR LIST**  
**Subsystem- Electrical & Mechanical**

**DOC NO. :**  
**REVISION NO. 00**  
**PAGE : 19**

SI. No.	ITEM	QP / INS CAT.	QP No. -	ACCEPTABLE SUPPLIER AS PER DATABASE	PLACE	SC APPL STATUS	REMARKS
---------	------	---------------	----------	-------------------------------------	-------	----------------	---------

47.	Bus Post Insulator	II		Aditya Birla IEC WSI MODERN Insulator SARAVANA Global Energy	Halol Bhopal Chennai Abu Road Cuddalore	A A A A A	
48.	Clamps & connectors	III		KLEMMEN ENGG MILIND EMI NOOTAN ENGG TAG CORPORATION ITPL RASHTRAUDYOG PEE VEE ENGG MEGHA Engg EXALT	CHENNAI MUMBAI MUMBAI MUMBAI CHENNAI MUMBAI KOLKATA BANGALORE CHENNAI Mumbai	A A A A A A	
49.	Insulator hardware, conductor accessories & earthwire accessories	III		RASHTRA UDYOG IAC ITPL EMI Transmission EMTT	KOLKATA KOLKATA MUMBAI MUMBAI Kolkatta	A A A A A	



**PROJECT : Development of 100 MW Floating Solar PV**  
**Project at NTPC Ramagundam in Telangana**  
**PACKAGE : SOLAR**  
**CONT. NO. :**

**INDICATIVE VENDOR LIST**  
**Subsystem- Electrical & Mechanical**

**DOC NO. :**  
**REVISION NO. 00**  
**PAGE : 20**

SI. No.	ITEM	QP / INS CAT.	QP No. -	ACCEPTABLE SUPPLIER AS PER DATABASE	PLACE	SC APPL STATUS	REMARKS
---------	------	---------------	----------	-------------------------------------	-------	----------------	---------

50.	Aluminium tube	II		HINDALCO INDALCO CENTURY EXTRUSIONS JINDAL ALUMINUM TUBE ALOM EXTRUSIONS BALCO SUDAL Banco	RENUKUT ALUPURAM KOLKATA BANGALORE KOLKATA KORBA NASIK Vadodara	A A A A A A A A	
51.	Switchyard Control & Relay Panel / SAS	I	Q-034	GE (Alstom) Siemens ABB Schneider BHEL	Chennai Kalwa/Goa Peenya Noida Bhopal	A A A A A	
52.	Numerical Relays for Switchyard	(part of C&R MQP)		GE Siemens ABB	UK/Chennai Germany Sweden/ Bangalore	A A	Approved for C&R Panel only
53	FIBRE OPTIC CABLES	III		BIRLA ERICSSON OPTICAL AKSH FIBER	REWA BHIWADI	A A	



PROJECT : Development of 100 MW Floating Solar PV  
Project at NTPC Ramagundam in Telangana  
PACKAGE : SOLAR  
CONT. NO. :

INDICATIVE VENDOR LIST  
Subsystem- Electrical &  
Mechanical

DOC NO. :  
REVISION NO. 00  
PAGE : 21

SI. No.	ITEM	QP / INS CAT.	QP No. -	ACCEPTABLE SUPPLIER AS PER DATABASE	PLACE	SC APPL STATUS	REMARKS
------------	------	---------------------	----------	--	-------	-------------------	---------

				FINOLEX	PUNE/GOA	A	
				R&M	SWITZERLAND	A	
				HFCL	GOA	A	
54	RELAY TEST KIT	III		OMICRON	USA/AUSTRALIA	A	
				DOBLE	USA	A	
				MEGGER	UK	A	
55	LEAKAGE CURRENT ANALYSER FOR SURGE ARRESTOR	III		DOBLE ENGG	USA	A	
				ISA	ITALY	A	
				TRANSINOR	NORWAY	A	
56	GPS	III		HATHWAY	USA	A	
				SIEMENS	GERMANY	A	
				HOPF	GERMANY	A	
				SERTEL	CHENNAI	A	
				ARBITER	USA	A	
57	SF6 GAS FILLING AND EVACUATING PLANT, GAS RECYCLING & PURIFYING PLANT, GAS LEAKAGE	III		AI QUALITEK	USA	A	
				DILO	GERMANY	A	
				EMT	UK	A	
				ENERVAC	CANADA	A	
				VACCUUM PLANT INDUSTRIES	PUNE	A	
				WIKA	USA	A	



**PROJECT : Development of 100 MW Floating Solar PV**  
**Project at NTPC Ramagundam in Telangana**  
**PACKAGE : SOLAR**  
**CONT. NO. :**

**INDICATIVE VENDOR LIST**  
**Subsystem- Electrical & Mechanical**

**DOC NO. :**  
**REVISION NO. 00**  
**PAGE : 22**

SI. No.	ITEM	QP / INS CAT.	QP No. -	ACCEPTABLE SUPPLIER AS PER DATABASE	PLACE	SC APPL STATUS	REMARKS
---------	------	---------------	----------	-------------------------------------	-------	----------------	---------

	DETECTOR						
58	Transformer (Oil filled type) Refer Note-8	I		BHEL	Bhopal		up to 400 kV Class
				GE( T&D)	Naini		up to 400 kV Class
				Toshiba	Hyderabad	A	up to 400 kV Class
				TELK	Agnamaly, Kerala	A	up to 400 kV Class
				ABB	Vadodara	A	up to 765 kV Class
				CG Power & Industrial Solutions Ltd.	Kanjur Marg	A	up to 400 kV Class
				EMCO	Thane	A	up to 400 kV Class
				BHEL	Jhansi	A	up to 220 kV Class
				Schneider	Vadodara	A	up to 50 MVA, 132 kV Class
				T&R	Ahmedabad	A	up to 90 MVA, 132 kV Class
				Kanohar	Merrut	A	up to 16 MVA, 33 kV Class
				EMCO	Jalgaon	A	up to 16 MVA, 33 kV Class
				Kirloskar	Mysore	A	up to 16 MVA, 33 kV Class
				Andrew Yule	Chennai	A	up to 10 MVA, 33 kV Class
				Tesla (unit-2)	23A, Sector-B, Industrial Area, Govindpura, Bhopal	A	up to 5.0 MVA, 33 kV Class
				Indotech Transformers	Chennai	A	up to 16 MVA, 11 kV Class
				Hammond Power Solutions	Hyderabad	A	up to 10 MVA, 33 kV Class



**PROJECT : Development of 100 MW Floating Solar PV**  
**Project at NTPC Ramagundam in Telangana**  
**PACKAGE : SOLAR**  
**CONT. NO. :**

**INDICATIVE VENDOR LIST**  
**Subsystem- Electrical & Mechanical**

**DOC NO. :**  
**REVISION NO. 00**  
**PAGE : 23**

SI. No.	ITEM	QP / INS CAT.	QP No. -	ACCEPTABLE SUPPLIER AS PER DATABASE	PLACE	SC APPL STATUS	REMARKS
---------	------	---------------	----------	-------------------------------------	-------	----------------	---------

				CG Power & Industrial Solutions Ltd.	Malanpur	A	up to 7.5 MVA, 33 KV Class
				ECE	Sonepat	A	up to 4.0 MVA, 11 KV Class
				Voltamp	Savli	A	up to 3.5 MVA, 33 KV Class
				Kirloskar	Pune	A	up to 2.0 MVA, 33 KV Class
				RAYCHEM RPG	Pune	A	Up to 5 MVA, 33 KV Class
				Esennar	Medak	A	Up to 16 MVA, 66 KV Class
				Technical Associate Ltd	Sitarganj	A	up to 16 MVA, 33 KV Class, Approval Conditions Apply
				Prime Meiden Ltd	Nellur	A	up to 63 MVA, 132 KV Class
				KRYFS Power Components Ltd	Silvassa	A	Up to 2.5 MVA, 33 KV Class
				Sudhir Transformers	Bangalore	A	Up to 12.5 MVA, 33KV Class
				Sudhir Power Ltd	Silvassa	A	Up to 12.5 MVA, 33KV Class
59	Dry Type Transformer (refer note-8)	I	Q-036	ABB Raychem Toshiba BHEL Kirloskar Voltamp Hammond Power Solutions	Savli Hyderabad Jhansi Pune Savli Hyderabad	A A A A A A	up to 8 MVA, 24 KV Class Up to 3.5 MVA, 33 KV Class Up to 2.0 MVA, 33 KV Class Up to 6.3 MVA, 33 KV Class Up to 4.0 MVA, 33 KV Class Up to 3.25 MVA, 33 KV Class Up to 95 KVA, 33 KV Class
				Sudhir Power Ltd	Silvassa	A	Up to 1 MVA, 11 KV Class
60.	132KV Cables	I	Q-037	Iijin Electric KEI Industries Phelps Dodge Universal Cable Ltd.	South Korea Bhiwadi Bangkok Satna	A A A A	



**PROJECT : Development of 100 MW Floating Solar PV**  
**Project at NTPC Ramagundam in Telangana**  
**PACKAGE : SOLAR**  
**CONT. NO. :**

**INDICATIVE VENDOR LIST**  
**Subsystem- Electrical & Mechanical**

**DOC NO. :**  
**REVISION NO. 00**  
**PAGE : 24**

SI. No.	ITEM	QP / INS CAT.	QP No. -	ACCEPTABLE SUPPLIER AS PER DATABASE	PLACE	SC APPL STATUS	REMARKS
61.	Battery Health Monitoring System (220V/110V)	II	Q-038	M/s. Chloride Power	Kolkatta	A	
				M/s Dubas	Bangalore	A	
				M/s HBL- Power System	Hyderabad	A	

Under Sub Supplier approval status as per NTPC column:

A: mean that manufacturer proposed main contractor for this items is acceptable to NTPC.

CA: mean that manufacturer proposed by main contractor is acceptable to NTPC with certain conditions

DR-mean that manufacturer proposed by main contractor for the items will be assessed by NTPC. Main contractor is obliged to procure the item from "DR" category manufacturer only after written approval from NTPC

**Under QP / INSPN CATEGORY column:**

CAT-I : For these items the Quality Plans approved by NTPC & final acceptance will be on physical inspection & witness by NTPC

CAT-II : For these items the Quality Plans approved by NTPC. However no physical inspection shall be done by NTPC. The final acceptance by NTPC shall be on basis of verification of documents as per approved QP

CAT-III : For these items Main supplier approves the Quality Plans. The final acceptance by NTPC shall be on basis of certificate of conformance by the main supplier.

**General Notes:**

- 1) Vendors acceptance is subject to sub-QR clearance as applicable. Sub-QR/Proveness criteria as per the scope/technical specification shall also be applicable for consideration as approved manufacturer/vendor
- 2) Vendor list & inspection category of the mandatory spares shall be as mentioned above.
- 3) For item not appearing in the above list, Main Contractor to approach NTPC for acceptable vendors & inspection categorization of the same.
- 4) NTPC Approval conditions to above identified vendors shall be adhered to. Vendor's approval conditions will be informed on specific request of Main Contractor.

**Note-1- "TYPE TEST REPORT AS PER EN 50521" OR "VDE / CE / UL / CSA MARKING CERTIFICATION PREFERABLY FROM THIRD PARTY AGENCY" OR "BIS APPROVAL LETTER" SHALL BE SUBMITTED FOR NTPC's VERIFICATION /INFORMATION.**



**PROJECT : Development of 100 MW Floating Solar PV**  
**Project at NTPC Ramagundam in Telangana**  
**PACKAGE : SOLAR**  
**CONT. NO. :**

**INDICATIVE VENDOR LIST**  
**Subsystem- Electrical & Mechanical**

**DOC NO. :**  
**REVISION NO. 00**  
**PAGE : 25**

SI. No.	ITEM	QP / INS CAT.	QP No. -	ACCEPTABLE SUPPLIER AS PER DATABASE	PLACE	SC APPL STATUS	REMARKS
---------	------	---------------	----------	-------------------------------------	-------	----------------	---------

**Note-2-**

**Category of inspection for LT Power Cable:**

<b>TOTAL CONTRACT QUANTITY PER SIZE</b>		<b>CATEGORY OF INSPECTION</b>
For cable total quantity $\leq$ 2.5 KM		Cat-III - submission of TC & Certificate of Conformance by Main Contractor for the manufacturers having successfully supplied to any NTPC project-site through Corporate contracts for atleast 2 years
For cable total quantity above 2.5 km & up to $\leq$ 10 km per size/type		Cat-II for the manufacturers having successfully supplied to any NTPC project-site through Corporate contracts for atleast 2 years
TOTAL QUANTITY MORE THAN 10 KM PER SIZE/TYP		Cat-I

**Category of inspection for Control Cable :**

<b>TOTAL CONTRACT QUANTITY PER SIZE</b>		<b>CATEGORY OF INSPECTION</b>
For cable total quantity $\leq$ 2.5 KM		Cat-III - submission of TC & Certificate of Conformance by Main Contractor for the manufacturers having successfully supplied to any NTPC project-site through Corporate contracts for at least 2 years
For cable total quantity above 2.5 km & up to $\leq$ 10 km per size/type		Cat-II for the manufacturers having successfully supplied to any NTPC project-site through Corporate contracts for at least 2 years
For cable total quantity above 10 km per size/type		Cat-I

**Category of inspection for HT cables**

<b>TOTAL CONTRACT QUANTITY PER SIZE/TYPE</b>		<b>CATEGORY OF INSPECTION</b>
LESS THAN EQUAL TO 500 M		CAT-III
GREATER THAN 500 M		CAT-I

**Note-3-**

**FOR CABLE TRAYS & CABLE TRAY SUPPORT SYSTEM THE CATEGORY OF INSPECTION SHALL BE AS FOLLOWS**



**PROJECT : Development of 100 MW Floating Solar PV  
Project at NTPC Ramagundam in Telangana  
PACKAGE : SOLAR  
CONT. NO. :**

**INDICATIVE VENDOR LIST  
Subsystem- Electrical &  
Mechanical**

**DOC NO. :  
REVISION NO. 00  
PAGE : 26**

SI. No.	ITEM	QP / INS CAT.	QP No. -	ACCEPTABLE SUPPLIER AS PER DATABASE	PLACE	SC APPL STATUS	REMARKS
------------	------	---------------------	----------	--	-------	-------------------	---------

<b>TOTAL CONTRACT QUANTITY PER SIZE /TYPE</b>			<b>CATEGORY OF INSPECTION</b>
For cable total quantity $\leq$ 2.5 KM			Cat-III - submission of TC & Certificate of Conformance by Main Contractor for the manufacturers having successfully supplied to any NTPC project-site through Corporate contracts for at least 2 years
For cable total quantity above 2.5 km & up to $\leq$ 10 km per size/type			Cat-II for the manufacturers having successfully supplied to any NTPC project-site through Corporate contracts for at least 2 years
TOTAL QUANTITY MORE THAN 10 KM PER SIZE/TYPE			Cat-I

**Note-4- Indicative List of acceptable galvanizing sources:**

1. M/s M J Engg, Delhi 2. M/s Indmark , Pune 3. M/s A.V. Engg, Kolkata 4. M/s Inar Profiles, Vishakapatnam 5. M/s Anand Udyog, Mumbai 6. M/s Techno Engg, Chandigarh 7. M/S Steelite Engg, Mumbai	8. M/s National Galvanizer, Kolkata 9. M/s Unistar Galvanizer, Kolkata 10. M/s B.P. Project. Kolkata 11. M/s Bajaj Pune 12. M/s Electrocare Industries, Mumbai 13. M/s B.G. Shirke, Pune 14. M/s Gurpreet Galvanizer, Hyderabad	15. M/s Sigma, Mumbai 16. M/s Radhakrishnan Shetty, Chennai 17. Karamtara Mumbai 18. Poona Galvanizers Pune 19. Neha Galvanizer- Kolkata 20. Unitech Fabricators & Galvanizers- Hoogly 21. Patny Systems- Mehdak	22. Indian Gratings, Pune 23. Encorp Power trans PVT Ltd, Palghar 24. Reliable Sponge, Kalunga 25- Rukmani Fab & Gal- Howrah
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**Note-5:**

a. Raw material & Bought Out components for main equipment will be finalized with vendor identified by Main Contractor.

**Note-6:** "VDE / CE / UL / CSA MARKING CERTIFICATION PREFERABLY FROM THIRD PARTY AGENCY" OR "BIS APPROVAL LETTER" SHALL BE SUBMITTED FOR NTPC's VERIFICATION /INFORMATION.

**Note-7:** Approval conditions shall be adhered to.



PROJECT : Development of 100 MW Floating Solar PV  
Project at NTPC Ramagundam in Telangana  
PACKAGE : SOLAR  
CONT. NO. :

INDICATIVE VENDOR LIST  
Subsystem- Electrical & Mechanical

DOC NO. :  
REVISION NO. 00  
PAGE : 27

SI. No.	ITEM	QP / INS CAT.	QP No. -	ACCEPTABLE SUPPLIER AS PER DATABASE	PLACE	SC APPL STATUS	REMARKS
------------	------	---------------------	----------	--	-------	-------------------	---------

**Note-8:**

8.1 Raw material & bought out components for main equipment will be finalized with vendor identified by Main Contractor.

8.2 For Auxiliary Transformers (Oil Filled & Dry Type- below 1.0 MVA, 11 KV Class):

a. Main Contractor's approved sub-vendors will also be acceptable subject to sub-vendor shall have minimum two years of supply experience for similar rating & type of transformers.

b. NTPC will review the Routine Test Inspection Report, witnessed by Main Contractor as per IS 2026/IS 1180 for Oil Filled Transformer and as per IS 11171 for Dry type Transformer

INDICATIVE



**PROJECT : Development of 100 MW Floating Solar PV Project at NTPC Ramagundam in Telangana**  
**PACKAGE:**  
**SUPPLIER :**  
**CONT. NO.:**

**LIST OF ITEMS  
REQUIRING QUALITY  
PLAN AND SUB- SUPPLIER  
APPROVAL  
SUB SYSTEM: C & I**

**DOC. No. :  
Revision No. :  
DATE: 28.11.2018  
PAGE : 1 OF 7**

SL. NO.	ITEM	QP/IN SPN CAT	QP NO.	PROPOSED SUPPLIER	PLACE	SUB- SUPPLIER APPROVAL STATUS/ CATEGORY	REMARKS
---------	------	---------------	--------	-------------------	-------	---	---------

1	INSTRUMENTATION CABLE(REFER NOTE-1)	I		DELTON CABLES LTD	FARIDABAD	A	PVC, FRLS TYPE
		I		PARAMOUNT COMMUNICATION LTD	KHUSHKHERA	A	PVC, FRLS TYPE
		I		CORDS CABLE INDUSTRIES LTD	BHIWADI/ KAHARANI	A	PVC, FRLS TYPE
		I		KEI INDUSTRIES LTD	BHIWADI	A	PVC, FRLS TYPE
		I		POLY CAB WIRES PVT. LTD	DAMAN	A	PVC, FRLS TYPE
		I		THERMOCABLES	HYDERABAD	A	PVC, FRLS TYPE
		I		ELKAY TELELINKS	FARIDABAD	A	PVC, FRLS TYPE
		I		GUPTA POWER	KHURDHA	A	PVC, FRLS, SHIELDED, MULTI PAIR, TWISTED, TYPE A, B, F&G
		I		NICCO	KOLKATA	A	PVC, FRLS TYPE
		I		UNIVERSAL CABLE	SATNA	A	PVC, FRLS TYPE
		I		CMI	FARIDABAD	A	ONLY FOR F & G TYPE
		I		ADVANCE CABLES PVT LTD	BANGLORE	A	ONLY FOR 0.5 SQMM F&G TYPE CABLES
		I		GEMSCAB INDUSTRIES LTD	BHIWADI	A	ONLY FOR 0.5 SQMM F&G TYPE CABLES
		I		APAR INDUSTRIES LIMITED	VALSAD	A	ONLY FOR 0.5 SQMM F&G TYPE CABLES
		II		SUYOG ELECTRICALS LTD	HALOL	A	ONLY FOR 0.5 SQMM F&G TYPE CABLES
		I		SPECIAL CABLES PVT LTD	RUDRAPUR	A	ONLY FOR 0.5 SQMM F&G TYPE CABLES
		I		T C COMMUNICATION	GAZIABAD	A	PVC, FRLS TYPE
		II		TEW & C	USA	A	
		II		HABIA CABLES	SWEEDEN	A	
		II		KERPEN CABLES	GERMANY	A	
		II		LAPP CABLES	GERMANY	A	
		II		THERMO ELECRTA BV	NETHERLAND	A	
2	FIRE ALARM PANEL -MICROPROCESSOR BASED & MANNUAL CALL POINTS	II		NOTIFIER	USA	A	UL CERTIFICATION OF MODEL NO ALSO PROVIDED WITH COC
				TYCO	USA	A	SIMPLEX BRAND
				AUTRONICA	NORWAY	A	



**PROJECT : Development of 100 MW Floating Solar PV Project at NTPC Ramagundam in Telangana**  
**PACKAGE:**  
**SUPPLIER :**  
**CONT. NO.:**

**LIST OF ITEMS  
REQUIRING QUALITY  
PLAN AND SUB- SUPPLIER  
APPROVAL  
SUB SYSTEM: C & I**

**DOC. No. :**  
**Revision No. :**  
DATE: 28.11.2018  
**PAGE : 2 OF 7**

SL. NO.	ITEM	QP/IN SPN CAT	QP NO.	PROPOSED SUPPLIER	PLACE	SUB- SUPPLIER APPROVAL STATUS/ CATEGORY	REMARKS
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				SCHRAK	AUSTRIA	A	
				EDWARDS	USA	A	
				TOSHNIWAL INDUSTRIAL PVT LTD	AJMER	A	CONDITONAL AS PER APPROVAL LETTER NETRA/STH/03
				M/S SHIELD FIRE SAFETY AND SECURITY LTD	UK	A	
3	ADDRESSABLE DETECTORS (MULTI SENSOR), INTERFACE UNITS ,HOOTER CUM STROBE & HOOTER	II		NOTIFIER	USA/GURGAON	A	
				TYCO	USA	A	SIMPLEX BRAND
				AUTRONICA	NORWAY	A	
				SCHRAK	AUSTRIA	A	
				EDWARDS	USA	A	
				SHIELD FIRE SAFTY	UK	A	
4	FIBRE OPTIC CABLES (REFER NOTE 2)	II		BIRLA ERICSSON OPTICAL	REWA	A	
				AKSH FIBER	BHIWADI	A	
				FINOLEX	PUNE/GOA	A	
				R&M	SWITZERLAND	A	
				HFCL	GOA	A	
				JIANGSU TONGGUANG	CHINA	A	
				R&M	SWITZERLAND	A	
				MOLEX	UK	A	
				CORNING	USA	A	
5	OPERATOR WORK STATION	III		DELL/HP/IBM/LENEVO/COMPAQ /FUJITSU OR OEM APPROVED SOURCES		A	
6	24V INTELLIGENT BATTERY CHARGER /DCDB & BHMS	I		ELTEK	GURGAON	A	MODULES FROM ELTEK
				MASS TECH	JALGAON	A	MODULES FROM ELTEK
				CHHABI	JALGAON	A	MODULES FROM EMERSON



**PROJECT : Development of 100 MW Floating Solar PV Project at NTPC Ramagundam in Telangana**  
**PACKAGE:**  
**SUPPLIER :**  
**CONT. NO.:**

**LIST OF ITEMS  
REQUIRING QUALITY  
PLAN AND SUB- SUPPLIER  
APPROVAL  
SUB SYSTEM: C & I**

**DOC. No. :**  
**Revision No. :**  
DATE: 28.11.2018  
**PAGE : 3 OF 7**

SL. NO.	ITEM	QP/IN SPN CAT	QP NO.	PROPOSED SUPPLIER	PLACE	SUB- SUPPLIER APPROVAL STATUS/ CATEGORY	REMARKS
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				VERTIV ENERGY PVT LTD	MUMBAI	A	WITH MODULES FROM EMERSON-CHINA
7	PLC BASED SCADA SYSTEM	I		M/S BEIJING K&U ELECTRICAL	BEIJING	A	CQA/9518/LWA/B-437 DTD 01.02.2018
				GE INTELLEGENT PLATEFORMS PVT LTD	BANGALORE	A	NOTESHEET NO. 3428 DTD 12.11.2010
				ABB	BANGALORE	A	
				SCHNEIDER	NASIK	A	
				ROCKWELL	SAHIBABAD	A	
				SIEMENS	NASIK	A	
				HONEYWELL	PUNE	A	APPROVAL AS PER LETTER DATED CW-EN-9661-M03-001 DTD 28.02.2014
				M/S VIRTUAL AUTOMATION	RANGAREDDY	A	CQA/001/151/NKTPP/V-205/VIRTUAL AUTOMATION DTD 29.08.2017
				M/S COTMAC ELECTRONICS PVT LTD	PUNE	A	CQA/001/151/NKTPP/C-352/COTMAC DTD 16.08.2017
				M/S TECH-MASTERS	HYDERABAD	A	CQA/001/151/NKTPP/T-440/TECH MASTER DTD 16.08.2017
				M/S POWERTECH SWITCHGEAR (I) PVT LTD	SONEPAT	A	CQA/001/147/KHARGONE/PLC PANEL DTD 10.07.2017
				M/S UNITY INDUSTRIAL AUTOMATION PVT LTD	DELHI	A	CQA/5505/906/TAPOVAN/U-131/PLC PANEL DTD 27.10.2017
				EMCONS	RANCHI	A	CQA/4410-155E/E-350/EMCONS DTD 31.01.2018
				SCHNEIDER	BANGALORE	A	01/PETF/9548-155/TATA DTD 06.11.2015
				M D INDUSTRIES	VADODARA	A	CQA/5505-902/ M472/PLC PANEL DATED 24.05.2018
8	NI-CD BATTERY FOR PLC SYSTEM (REFER NOTE 5)	I		AMCO SAFT	BANGALORE	A	
				HBL POWER SYSTEM	HYDERABAD	A	
		II		SAFT	FRANCE/ SWEDEN	A	
				HOPPECKE BATTERIEN GMBH & CO KG	GERMANY		
9	BATTERY(LEAD-ACID PLANTE)	II		HOPPECKE BATTERIEN GMBH & CO KG	GERMANY	A	



**PROJECT : Development of 100 MW Floating Solar PV Project at NTPC Ramagundam in Telangana**  
**PACKAGE:**  
**SUPPLIER :**  
**CONT. NO.:**

**LIST OF ITEMS  
REQUIRING QUALITY  
PLAN AND SUB- SUPPLIER  
APPROVAL  
SUB SYSTEM: C & I**

**DOC. No. :**  
**Revision No. :**  
**DATE: 28.11.2018**  
**PAGE : 4 OF 7**

SL. NO.	ITEM	QP/IN SPN CAT	QP NO.	PROPOSED SUPPLIER	PLACE	SUB- SUPPLIER APPROVAL STATUS/ CATEGORY	REMARKS
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	(REFER NOTE 3)	I		EXIDE	KOLKATA	A	
10	ELECTRICAL ACTUATOR	II		ANTRIEB TECHNIK PVT LTD	CHENNAI	A	
		II		AUMA	BANGALORE	A	
		II		LIMITORQUE	FARIDABAD	A	
		II		ROTORK	BANGLORE	A	
		I		ROTORK CONTROLS (INDIA) PRIVATE LTD	CHENNAI	A	
		III		AUMA	GERMANY	A	
		III		LIMITORQE	USA	A	
		III		ROTORK	UK	A	
		III		NIPPON GEAR	JAPAN	A	
		III		DREHMO GMBH	GERMANY	A	
11	SMF LEAD-ACID BATTERY FOR MICROPROCESSOR BASED FIRE ALARM PANEL	III		AMARRAJA	TIRUPATI	A	
				EXIDE	KOLKATTA	A	
				HBL POWER SYSTEM	HYDERABAD	A	
12	UPS SYSTEM WITH ACDB (REFER NOTE 4)	I		FUJI ELECTRIC	JAPAN	A	
				HITACHI HIREL	GANDHINAGA R	A	APPROVED UP TO 120 KVA, 1Φ
				VERTIV ENERGY PVT LTD	PUNE	A	UP TO 125 KVA FOR 1 PHASE & 300 KVA FOR 3 PHASE
				VERTIV ENERGY PVT LTD	MUMBAI	A	UP TO 160 KVA
				KELTRON	TRIVENDRUM	A	
				MERLIN & GERIN	FRANCE	A	
				GUTUR	SWITZERLAND	A	
				AEG (SAFT)	GERMANY	A	



**PROJECT : Development of 100 MW Floating Solar PV Project at NTPC Ramagundam in Telangana**  
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**CONT. NO.:**

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PLAN AND SUB- SUPPLIER  
APPROVAL  
SUB SYSTEM: C & I**

**DOC. No. :**  
**Revision No. :**  
**DATE: 28.11.2018**  
**PAGE : 5 OF 7**

SL. NO.	ITEM	QP/IN SPN CAT	QP NO.	PROPOSED SUPPLIER	PLACE	SUB- SUPPLIER APPROVAL STATUS/ CATEGORY	REMARKS
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13	GPS/MASTER SLAVE CLOCK SYSTEM	I		SIGNALS AND SYSTEMS PVT. LTD. (SANDS )	CHENNAI	A	
		I		MASIBUS	GANDHINAGAR	A	
		I		SERTEL ELECTRONICS PVT. LTD.	CHENNAI	A	
		II		HOPF ELECTRONIK GMBH	GERMANY	A	BRAND NAME:MOBATIME
		II		HATHWAY	USA	A	
		II		MEIN BERG	GERMANY	A	
		II		MOSER BAER AG	SWITZERLAND	A	
14	CONTRO DESK	I		PYROTECH WORKSPACE SOLUTIONS PVT LTD	UDAIPUR	A	BOI SHALL BE AS PER NTPC APPROVED MAKES
				COSMOS MEDIA PRODUCTS PVT LTD	GREATER NOIDA	A	1. H BLOCK SHOULD BE FROM KNURR GERMANY 2. COMPLETE INTEGRATED MOSAIC GRID SHOULD BE PROCURED FROM NTPC APPROVED SOURCES LIKE PRO PLAN/SUBKLEW 3. SOLID ACRYLIC SURFACE SHOULD BE PROCURED FROM DU PONT/NTPC APPROVED SOURCES 4. EXTRUDED AL PROFILE STRUCTURE SHOULD BE PROCURED FROM HINDALCO (WITH KNURR DESIGN)
				ADARSHA CONTROL SYSTEM PVT LTD	BANGALURU	A	1. MOSAIC ITEMS SHOULD BE FROM NTPC APPROVED SOURCES . 2. ACRYLIC SOLID SURFACE (ASS) SHOULD BE PROCURED FROM DU PONT /NTPC APPROVED SOURCES 3. WOOD WORKS ARE TO BE DONE BY M/ S C K FURN BANGALURU
15	BLANK PANELS / CABINETS	III		MAIN CONTRACTOR APPROVED SOURCES			
16	COMPRESSION	III		MAIN CONTRACTOR APPROVED SOURCES			



**PROJECT : Development of 100 MW Floating Solar PV Project at NTPC Ramagundam in Telangana**  
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**CONT. NO.:**

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PLAN AND SUB- SUPPLIER  
APPROVAL  
SUB SYSTEM: C & I**

**DOC. No. :**  
**Revision No. :**  
**DATE: 28.11.2018**  
**PAGE : 6 OF 7**

SL. NO.	ITEM	QP/IN SPN CAT	QP NO.	PROPOSED SUPPLIER	PLACE	SUB- SUPPLIER APPROVAL STATUS/ CATEGORY	REMARKS
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	FITTINGS(SS)						
17	COMPUTER FURNITURE	III		MAIN CONTRACTOR APPROVED SOURCES			
18	DESK FOR OWS/EWS/PRINTER/SERVER	III		MAIN CONTRACTOR APPROVED SOURCES			
19	FRP JUNCTION BOX	III		MAIN CONTRACTOR APPROVED SOURCES			
20	GRAPHIC INTERFACE UNIT	III		MAIN CONTRACTOR APPROVED SOURCES			
21	IMPULSE PIPES/TUBES	III		MAIN CONTRACTOR APPROVED SOURCES			
22	LEVEL INDICATOR (FLOAT & BOARD TYPE)	III		MAIN CONTRACTOR APPROVED SOURCES			
23	MINI UPS UP TO 3.5 KVA	III		MAIN CONTRACTOR APPROVED SOURCES			
24	PRINTER (INKJET / LASER)	III		MAIN CONTRACTOR APPROVED SOURCES			
25	TERMINAL BOX	III		MAIN CONTRACTOR APPROVED SOURCES			
26	INSTRUMNETATION VALVES AND FITTINGS	III		MAIN CONTRACTOR APPROVED SOURCES		UP TO 300 CLASS AND SIZES UP TO 600 NB	

#### LEGENDS:

##### 1. SYSTEM SUPPLIER / SUB-SUPPLIER STATUS CATEGORY (SHALL BE FILLED BY NTPC).

**A** – For those items proposed Sub-vendors are acceptable to NTPC subject to meeting NTPC Technical specification requirement.

##### 2. INSPECTION CATEGORY:

**Cat I:** For those items the quality plans are approved by NTPC and final acceptance will be on physical inspection witness by NTPC.

**CAT II:** For those items the quality plans are approved by NTPC. However no physical inspection will be done by NTPC. The final acceptance by NTPC shall be on the basis of review of documents as per QP.

**CAT III:** For those items Main Supplier approves quality plans. The final acceptance by NTPC shall be on the basis of certificate of conformance by Main Supplier.



**PROJECT : Development of 100 MW Floating Solar  
PV Project at NTPC Ramagundam in Telangana**  
**PACKAGE:**  
**SUPPLIER :**  
**CONT. NO.:**

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PLAN AND SUB- SUPPLIER  
APPROVAL  
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**DOC. No. :**  
**Revision No. :**  
**DATE: 28.11.2018**  
**PAGE : 7 OF 7**

SL. NO.	ITEM	QP/IN SPN CAT	QP NO.	PROPOSED SUPPLIER	PLACE	SUB- SUPPLIER APPROVAL STATUS/ CATEGORY	REMARKS

**NOTE-1:** For total contract quantity per size/type more than 10 km, inspection category will be CAT-I. For quantity more than 1 km but less than or equal to 10 km, inspection category will be CAT II with COC. And for quantity less than or equal to 1 km, inspection category will be CAT-III.

**NOTE-2:** For quantity less than or equal to 10 km, inspection category for fiber optic cable will be CAT-III.

**NOTE 3:** For UPS less than or equal to 10 KVA rating and Intelligent Battery Charger 24v Dc less than or equal to 40 amp rating, inspection category will be CAT-III.

**NOTE 4:** For UPS with ACDB less than or equal; to 10 KVA rating, inspection category of the same will be CAT-III.

**NOTE 5:** For item not appearing in the pre-award list, bidder and NTPC will mutually discussed in future

NTPC

Main Contractor

	 <b>NTPC</b>	INDICATIVE FIELD QUALITY PLAN				Annexure-II				
		ITEM : CIVIL WORK		QP NO. :	1	PROJECT:	Development of 100 MW Floating Solar PV Project at NTPC Ramagundam in Telangana			
		SUB-SYSTEM : CIVIL AND STRUCTURAL STEEL WORKS		REV. NO. :	0	PACKAGE:				
				DATE :		CONTRACT NO.				
				PAGE :		MAIN CONTRACTOR				
Sl. No	Activity and operation	Characteristics / instruments		Class of check	Type of Check	Quantum Of check	Reference Document	Acceptance Norms	Format of Record	Remarks
1	2	3		4	5	6	7	8	9	D* 10
1	<b>GENERAL REQUIREMENTS</b>									
A	Availability of QA& QC manpower and laboratory		-	A	Physical	Once prior to start of work and thereof monthly	Tech Specs and Const. Drawings	SR	✓	
B	Sampling for testing of building materials, concrete mix design etc.		As agreed / required	A	Physical	As specified in FQP for various materials	Tech Specs and Const. Drawings	SR/TR	✓	Test report along with the recommendations from specialist agency to be submitted to NTPC.
C	Submission of schedule of tests to be done monthly / quarterly		-	A	Physical	Once prior to start of work and thereof monthly	Tech Specs and Const. Drawings	SR	✓	
D	Stacking and storage of construction materials and components at site		As per IS:4082	A	Physical	Random	Tech Specs and Const. Drawings and IS: 4082	SR	✓	
2	<b>EXCAVATION AND FILLING IN FOUNDATION WORKS</b>									
	<b>Excavations-</b>									
2.1	Nature, type of soil/rock before and during excavations	As agreed / required	C	Visual	Random in each shift	Tech Specs and Const. Drawings	SR			
2.2	Initial ground level before start of excavations	As agreed / required	C	Measurement	100%	Tech Specs and Const. Drawings	SR	✓		
2.3	Final shape and Dimensions of excavations.	As agreed / required	C	Measurement	100%	Tech Specs and Const. Drawings	SR			
2.4	Final excavation levels	As agreed / required	B	Measurement	100%	Tech Specs and Const. Drawings	SR	✓		
2.5	Side slope of final excavation	As agreed / required	B	Measurement	Random in each shift	Tech Specs and Const. Drawings	SR			
	<b>Fill/ Backfill -</b>									
2.6	<b>Standard proctor Test</b>	Optimum moisture content and max. dry density before fill	As per IS: 2720, Proctor needle apparatus,etc.	B	Physical	One in every 10000 cum for each type and source of fill materials	IS 2720 (Pt.VII), Tech Specs and Const. Drawings	SR/TR	✓	
2.70	<b>Moisture content</b>	Moisture content of fill before compaction	As per IS: 2720, balance, oven, rapid moisture meter, etc.	B	Physical	One in every 10000 cum for each type and source of fill materials	IS 2720 (Pt.II), Tech Specs and Const. Drawings	SR/TR	✓	
2.8	<b>Degree Of Compaction Of Fill / Backfill</b>									
i		Dry density by core cutter method ---- OR ---- Dry density in place by sand displacement method	As per IS: 2720/compaction test (core cutter), balance, rapid moisture meter etc.	A	Physical	One sample for every 10000 SQM area for each compacted layer.	IS 2720 (Pt. XXIX), Tech Specs and Const. Drawings OR IS 2720 (Pt. XXVIII), Tech Specs and Const. Drawings	SR/TR	✓	

	 <b>NTPC</b>	INDICATIVE FIELD QUALITY PLAN				Annexure-II				
		ITEM : CIVIL WORK		QP NO. :	1	PROJECT:	Development of 100 MW Floating Solar PV Project at NTPC Ramagundam in Telangana			
		SUB-SYSTEM : CIVIL AND STRUCTURAL STEEL WORKS		REV. NO.:	0	PACKAGE:				
				DATE :		CONTRACT NO.				
				PAGE :		MAIN CONTRACTOR				
Sl. No	Activity and operation	Characteristics / instruments		Class of check	Type of Check	Quantum Of check	Reference Document	Acceptance Norms	Format of Record	Remarks
1	2	3		4	5	6	7	8	9	D*
3.0	<b>MATERIALS</b>									
3.1	<b>CEMENT</b>									
		Physical & Chemical Properties	as per IS:4031	A	Testing	At Random	As per relevant IS Codes/ Tech Specification	TR	✓	Each consignment of cement shall be duly correlated with manufacturers TC. One sample from each lot shall be tested for setting time and compressive strength. If cement is stored more than 90 days in godown of contractor same shall be retested for comp. Strength & setting time.
3.2	<b>Coarse Aggregate</b>	Moisture content	as per IS:2386	B	Physical	Once for each stack of 100 Cu.M. or part thereof	IS : 456 IS : 383/Tech Spec	SR/LB	✓	During monsoon when this has to be done every day before start of concreting
ii		Specific gravity, water absorption	IS:2386	A	Physical	Once for each source & for every change of source	IS: 2386 Part-III, IS:456, IS:383/Tech Spec	SR/LB/ TR	✓	
iii		Sieve analysis, flakiness index, elongation index,	IS:2386	B	Physical	One per 100 cum., or part thereof	IS: 2386 Part-I, IS:383/Tech	SR/LB	✓	
iv		Deleterious materials (coal & lignite, clay lumps, material finer than 75 micron sieve, soft fragment, shale)	IS:2386	A	Physical	Once per source/ on every change of source	IS: 2386 Part-II, IS:383/Tech Spec	SR/LB/ TR	✓	
v		Soundness	IS:2386	A	Physical	-do-	IS: 2386 Part-V, IS:383	SR/LB/ TR	✓	
vi		Crushing value abrasion value and impact value	IS:2386	A	Physical	-do-	IS:383, IS-2386 Part IV/Tech Spec	SR/LB/ TR	✓	
3.3	<b>Fine Aggregate</b>									
i		Moisture content, water absorption	balance , oven, rapid moisture meter etc.	B	Physical	To be done every day before start of work	IS: 2386 Part-III IS:383	SR/LB/T R	✓	
ii		Deleterious materials (coal & lignite, clay lumps, material finer than 75 micron sieve, soft fragment, shale)	IS:2386	A	Physical	Once per source& for on every change of source	IS: 2386 Part-II, IS:383	SR/LB/T R	✓	
iii		All other tests similar to coarse aggregates as mentioned above.					IS-2386, IS-383	SR/LB/T R	✓	except test for flakiness index, elongation index, abrasion value, impact value
3.4	<b>Water</b>									
i		Complete tests as per IS:456	Burette, conical flask, pipette etc.	B	Testing	One for each source.	IS:3025 part 22 and 23 (for test procedure ), IS:456(for acceptance criteria )	SR/LB/T R	✓	

		INDICATIVE FIELD QUALITY PLAN				Annexure-II					
		ITEM : CIVIL WORK		QP NO. :	1	PROJECT:	Development of 100 MW Floating Solar PV Project at NTPC Ramagundam in Telangana				
		SUB-SYSTEM : CIVIL AND STRUCTURAL STEEL WORKS		REV. NO.:	0	PACKAGE:					
				DATE :		CONTRACT NO.					
				PAGE :		MAIN CONTRACTOR					
Sl. No	Activity and operation	Characteristics / instruments		Class of check	Type of Check	Quantum Of check	Reference Document	Acceptance Norms	Format of Record	Remarks	
1	2	3		4	5	6	7	8	9	D* 10	
3.5	<b>CONCRETE</b>										
		4 Trial mixes to ascertain the workability and cube strength	After receiving the recommended mix design from specialist agency,	A	Physical	One for each mix proportion	NTPC tech specification		SR/LB	✓	
i		Crushing strength (works Tests cubes)	IS:516	A	Physical	One set of 6 cubes per 50 CuM or part thereof for each grade of concrete per shift whichever is earlier.	IS:516, IS:456, NTPC Tech. Spec.		SR/LB/TR	✓ Min. of 6 cubes for each mix, 3 specimen shall be tested at 7 days remaining 3 shall be for 28 days comp. Strength.	
ii		Workability - slump test	IS:1199	B	Physical	At the time of concrete pouring at site every two hrs.	IS:456/NTPC Tech. Spec.		SR/LB/TR	✓	
3.5.1	<b>Admixtures for Concrete</b>	Type of admixture	As per IS:9103	B	Review of MTC	For each lot received at site	Designed mix and IS:9103		MTC	✓ Admixture of appd. Brand and tested quality shall be used (each lot of admixture will included with brochure in which the type of admixture and its properties shall be clearly indicated)	
3.6	<b>Concrete conveying, placing&amp; compaction</b>										
i		mixing of concrete shall be done in a approved mixer such as to produce a homogenous mix				To be calibrated at the time of starting and subsequently once in three months, and shall conform to IS:4925	Review of calibration chart/ Certificate, IS 4926		✓		
ii		Arrangement for transportation & placement of concrete.	As required	C	Visual	100%	Before clearance for concreting	Inspection Report	✓		
iii		Handling and Transportation of concrete	As required	C	Physical	100%	As per construction/erection methodology (to be approved one week prior to start of	SR			
iv		Placement of concrete	Visual	B	Physical	100%	As per construction/erection methodology and tech.specs / No segregation	SR	✓		
v		Compacting	As required	C	Physical	At Random	IS:456	SR	✓		
vi		Curing	As required	C	Physical	At Random	Period of curing as per IS 456 (use gunny bags / curing compound)	SR	✓		
3.7	<b>TEST/CHECK ON RCC STRUCTURE IN HARDENED CONDITIONS</b>										
i		Dimensional check on finished structures & Dimensional tolerances	As required	B	Measurement	Approved Drawing	As per IS:456/ tech. Specification.		SR/LB	✓	
ii		Water Tightness Test of liquid retaining structure/ tanks	As required	B	Test	100%	IS:3370/ Tech. Specification		SR/LB	✓	
3.8	<b>REINFORCEMENT STEEL</b>										
i		Physical and Chemical Properties for each lot as per relevant IS codes	As required/ agreed	A	Review of MTC	Each batch of delivery	IS : 1786, IS:432, IS:1566, Tech Specs and Const. Drawings		MTC	✓	
ii		Freedom from cracks surface flaws, Lamination.	As agreed / required	C	Visual	Random in each shift	IS: 1852, IS:432, IS:1786, Tech Specs and Const. Drawings		SR	To be checked at site. Steel collected from source should be free from excessive rust. To be stored as per Technical Specs.	

		INDICATIVE FIELD QUALITY PLAN				Annexure-II					
		ITEM : CIVIL WORK		QP NO. :	1	PROJECT:	Development of 100 MW Floating Solar PV Project at NTPC Ramagundam in Telangana				
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				DATE :		CONTRACT NO.					
				PAGE :		MAIN CONTRACTOR					
Sl. No	Activity and operation	Characteristics / instruments		Class of check	Type of Check	Quantum Of check	Reference Document	Acceptance Norms	Format of Record	Remarks	
1	2	3		4	5	6	7	8	9	D*	
3.9	PLACEMENT OF REINFORCEMENT STEEL									10	
i		Bar bending schedule with necessary lap, Spacers & Chairs	As agreed / required	B	Visual & Measurement	Random in each shift	Approved Drawings, Tech Specs and Const. Drawings, IS:2502	SR	✓		
ii		Bending of bars, cutting tolerance	As agreed / required	C	Visual & Measurement	Random in each shift	Approved Drawings, Tech Specs and Const. Drawings, IS:2502	SR	✓		
iii		Acceptance - Cover, spacing of bars, spacers and chairs after the reinforcement cage is put inside the formwork	As agreed / required	B	Visual & Measurement	Random in each shift	Approved Drawings, Tech Specs and Const. Drawings	SR	✓		
3.10	STAGING AND FORMS										
i		Materials and accessories	As agreed / required	C	Visual	Once before start of work	As per relevant IS, Tech Specs and Const. Drawings	SR			
ii		Soundness of staging, shuttering and scaffolding including application of mould oil / release agent	As agreed / required	C	Visual	Once before start of work	As per manufacturer's spec.and as per 3696,4014, 4990, Tech Specs and Const. Drawings	SR			
iii		Acceptance of formwork before start of concreting		B	Physical / visual	Before start of each concreting	As per provisions and tolerances, Tech Specs and Const. Drawings	SR	✓		
3.11	DAMP PROOF COURSE						Tech Specs and Const. Drawings				
i		Material - Hot bitumen and water proofing materials etc.	As agreed / required	B	Review of MTC	Each batch of delivery at site	Tech Specs and Const. Drawings, IS 702	SR	✓		
ii		Acceptance of damp proof course	As agreed / required	B	Acceptance	100%	Tech Specs and Const. Drawings	SR			
3.12	GROUTING										
i		Material	As agreed / required	B	Review of MTC	Each batch of delivery	Tech Specs and Const. Drawings	SR	✓		
		Type of mix - fluid mix, plastic mix, stiff mix etc.	As agreed / required	C	Physical	Prior to start of work	Tech Specs and Const. Drawings	SR	✓		
ii		Mixing, placement, application and grout pressure	As agreed / required	C	Physical	Random in each shift	Tech Specs and Const. Drawings	SR			
iii		Compressive strength	As agreed / required	C	Physical	Random in each shift	Tech Specs and Const. Drawings	SR	✓		
iv		Acceptance of the grouts	As agreed / required	B	Physical	Each grout section	Tech Specs and Const. Drawings	SR			
3.13	PRE-CAST CONCRETE										
i		Crushing strength	compression strength testing machine	A	Physical	one sample of six cubes per 50m m3 or part thereof	IS:516 & IS: 456	SR/LB	✓	A minimum of three specimen shall be tested for 7 and 28 days compressive strength	
ii		Workmanship and dimensions	Visual	B	Physical	100%	As per IS:456/NTPC Tech. specification.	Register			
iii		Load Test	As required	B	Physical	1% up to 1000 nos. and 0.5% for more than 1000 nos. for each type	IS:456/ As decided by NTPC Site Engr. In charge.	Inspection Report	✓	Applicable members i.e. drains covers .	

		INDICATIVE FIELD QUALITY PLAN				Annexure-II					
		ITEM : CIVIL WORK		QP NO. :		1	PROJECT:	Development of 100 MW Floating Solar PV Project at NTPC Ramagundam in Telangana			
		SUB-SYSTEM : CIVIL AND STRUCTURAL STEEL WORKS		REV. NO.:		0	PACKAGE:				
				DATE :			CONTRACT NO.				
				PAGE :			MAIN CONTRACTOR				
Sl. No	Activity and operation	Characteristics / instruments		Class of check	Type of Check	Quantum Of check	Reference Document	Acceptance Norms	Format of Record	Remarks	
1	2	3		4	5	6	7	8	9	D*	10
4.00	BRICK MASONRY										
4.1	Test on Bricks										
		Dimensions , shape, compressive strength, water absorption, warpage, efflorescence.	As agreed / required	B	Measurement/ Physical Test	As per relevant IS Code/ One Sample for 30,000 nos. or part thereof	IS: 1077, IS:13757, IS: 12894 / Tech Specs and const. Drawings	Inspection Report	✓	Efflorescence shall be checked at each source. Warpage test is applicable for facing bricks only as per IS:2691. For clay bricks as per IS 1077, warpage test is not required.	
4.2	Masonry construction	Workmanship, verticality and alignment	As agreed / required	B	Visual/ Physical	100%	IS 2212, IS 1905 , Tech Specs and Const. Drawings	SR/LB			
5.00	FINISHING AND ALLIED WORKS							.			
5.1	PLASTERING - WORKMANSHIP										
i		Curing	As agreed / required	C	Physical	100%	Tech specifications, construction drawings and agreed methodology	SR			
ii		Thickness and finishing of plaster, grooves etc.	As agreed / required	B	Visual/ Measurement	Random in each shift	Tech Specs and Const. Drawings	SR/LB			
iii		Trueness of plastering system	As agreed / required	B	Visual/ Physical	Random in each shift	Tech Specs and Const. Drawings	SR			
6.00	SHEETING AND OTHER WORKS										
6.1	PAINTING SYSTEM - CONCRETE WORKS AND PLASTERED MASONARY SURFACES										
i	Materials and accessories- Oil Bound, Acrylic Emulsion, Chemical Resistant, Oil EIC	Shade, type from brand and manufacturer as approved by NTPC	As agreed / required	B	Review of MTC	Each batch of delivery	Tech Specs and Const. Drawings	SR/MTC	✓		
ii	Surface preparation	As required	As agreed / required	C	Physical /visual	Random in each shift	Tech Specs and Const. Drawings	SR			
iii	Acceptance of painted surfaces	As required	As agreed / required	B	Physical	Each surface at random	Tech Specs and Const. Drawings	SR			
6.1.1	PAINTING SYSTEM - STEEL WORKS (OTHER THAN STRUCTURAL STEEL WORKS)										
i		Paining Materials and accessories	-	B	Review of MTC	Each batch of delivery	Tech Specs and Const. Drawings	SR/MTC	✓		
ii		Surface preparation	As agreed / required	C	Physical /visual	Each Erection Mark	Tech Specs and Const. Drawings,	SR	✓		
iii		Primer Thickness	Elcometer	B	Measurement	Each Erection Mark	Tech Specs and Const. Drawings	SR	✓		
iv		DFT of paint	Elcometer	B	Measurement	Each Erection Mark	Tech Specs and Const. Drawings	SR	✓		
v		Acceptance of painted surfaces	Elcometer	B	visual and measurement	Each Erection Mark	Tech Specs and Const. Drawings	SR			
7.3	WATER PROOFING										
		Methodology for the application of water proofing system	As required	B	Review	for each type of treatment	Tech Specs and Const. Drawings	SR	✓		
7.3.1	Roof / Basement Treatment										
i	Graded under bed	Levels / slopes	As required	C	Physical	100%	Tech Specs and Const. Drawings				
ii	Elastomeric coatings	Material- Primer coat, finishing coat	As required	B	Review of MTC	Each lot of delivery	Tech Specs and Const. Drawings	SR	✓		
iii	Wearing course	Materials - PCC, chicken wire mesh, elastomeric sealant	As required	B	Review of MTC	Each lot of delivery	Tech Specs and Const. Drawings	SR	✓		
iv		Acceptance of water proofing work	As agreed / required	B	Physical	100%	Tech Specs and Const. Drawings				

	 <b>NTPC</b>	INDICATIVE FIELD QUALITY PLAN				Annexure-II				
		ITEM : CIVIL WORK		QP NO. :	1	PROJECT:	Development of 100 MW Floating Solar PV Project at NTPC Ramagundam in Telangana			
		SUB-SYSTEM : CIVIL AND STRUCTURAL STEEL WORKS		REV. NO. :	0	PACKAGE:				
				DATE :		CONTRACT NO.				
				PAGE :		MAIN CONTRACTOR				
Sl. No	Activity and operation	Characteristics / instruments		Class of check	Type of Check	Quantum Of check	Reference Document	Acceptance Norms	Format of Record	Remarks
1	2	3		4	5	6	7	8	9	D*
7.4	<b>Fencing and Gates</b>									
i	PVC coated chain link fencing, Welded wire mesh (IS 1566), Reinforced barbed tape galvanized (IS 2629) etc.	Materials	As agreed / required	B	Review of MTC	Each batch of delivery	Tech Specs and Const. Drawings	SR/MTC	✓	MTC shall contain all the parameters specified in the technical specifications / relevant IS Codes
ii		Acceptance of the installation	As agreed / required	B	Physical / measurements	Each installation	Tech Specs and Const. Drawings	SR		
7.5	<b>FLOOR FINISHES AND ALIED WORKS</b>									
7.5.1	<b>Cement Concrete Flooring</b>									
i		Glass/ PVC strips in joints	As agreed / required	C	Physical	Random in each shift	Tech Specs and Const. Drawings	SR		
ii		Finishing and acceptance	As agreed / required	B	Physical	100%	Tech Specs and Const. Drawings	SR		
7.5.2	<b>Tiles</b>									
i	Ceramic, vitrified, glass mosaic, acid alkali resistant, heavy duty cement concrete	Materials	As agreed / required	B	Review of MTC	Each lot of delivery	Tech Specs and Const. Drawings	SR	✓	MTC shall contain all the parameters specified in the technical specifications / relevant IS Codes
ii		Finishing and acceptance	As agreed / required	B	Physical	100%	Tech Specs and Const. Drawings	SR		
7.5.3	<b>Kota Stone, Granite and Marble</b>									
i		Quality, texture, thickness, colour for each lot of delivery from approved source	As agreed / required	C	Physical	Each batch of delivery	Tech Specs and Const. Drawings	SR	✓	
ii		Finishing and acceptance	As agreed / required	B	Physical	100%	Tech Specs and Const. Drawings	SR		
8.0	<b>WATER SUPPLY / SANITORY INSTALLATIONS</b>									
8.1	<b>Water supply fittings and fixtures</b>									
i	Materials	GI/ MS pipes and fittings	As agreed / required	B	Review of MTC	Each lot of delivery as per Specifications	Tech Specs and Const. Drawings	SR	✓	
ii	Disinfection	Before use	As agreed / required	C	Physical	Each installation	Tech Specs and Const. Drawings	SR		
iii	Hydraulic test	Before use / leakage	As agreed / required	B	Physical	Each installation	Tech specs and const drawings	SR	✓	
iv		Acceptance and working	As agreed / required	B	Acceptance	Random	Tech Specs and Const. Drawings	SR		

	 <b>NTPC</b>	INDICATIVE FIELD QUALITY PLAN				Annexure-II				
		ITEM : CIVIL WORK		QP NO. :	1	PROJECT:	Development of 100 MW Floating Solar PV Project at NTPC Ramagundam in Telangana			
		SUB-SYSTEM : CIVIL AND STRUCTURAL STEEL WORKS		REV. NO. :	0	PACKAGE:				
		DATE :		DATE :		CONTRACT NO.				
		PAGE :				MAIN CONTRACTOR				
Sl. No	Activity and operation	Characteristics / instruments		Class of check	Type of Check	Quantum Of check	Reference Document	Acceptance Norms	Format of Record	Remarks
1	2	3		4	5	6	7	8	9	D* 10
8.2	Sand cast iron / cast iron pipes									
i	Material	SCI / CI pipes and fittings / joints	As agreed / required	B	Review of MTC	Each lot of delivery as per Specifications	Tech Specs and Const. Drawings	SR	✓	
ii		Acceptance and leakage	As agreed / required	B	Physical	Random	Tech Specs and Const. Drawings	SR		
8.3	Sanitary fittings and fixtures									
i	Material	Sanitary items and fixtures i.e. water closets, urinals, wash basins, sinks, mirrors, shelves, towel rail, soap containers, geyser, water cooler, etc., water supply / sanitation pipes, manholes	As agreed / required	B	Physical	Each lot of delivery as per Specifications	Tech Specs and Const. Drawings	SR	✓	
ii		Acceptance of installations of all sanitary items and fixtures	As agreed / required	B	Acceptance	100%	Tech Specs and Const. Drawings	SR		
8.4	RCC Pipes									
i	Material	RCC pipes	As agreed / required	B	Review of MTC	Each lot of delivery as per Specifications	Tech Specs and Const. Drawings /IS 458	SR	✓	
ii		Acceptance and leakage	As agreed / required	B	Physical	Random	Tech Specs and Const. Drawings	SR		
8.5	Water Storage Tanks									
i	Material	Over head / loft type	As agreed / required	B	Physical	Each lot of delivery as per Specifications	Tech Specs and Const. Drawings	SR	✓	
ii		Acceptance and leakage	As agreed / required	B	Acceptance	Random	Tech Specs and Const. Drawings	SR		
9.0	SPECIAL ITEMS									
9.1	Earthing Mat (Grounding System)									
i	Material	Earthing mat	As agreed / required	B	Physical	Each lot of delivery as per Specifications	As per relevant IS and Tech. Specs / Manufacturer's, IS 3043	SR/MTC	✓	
ii		Weld sizes & length	Visual/Tape	B	Visual/ Measurement	100%	Tech Specs and Const. Drawings			NTPC approved electrodes shall be used
iii		D P test	DP test Kit	B	Physical	10% at random of the offered lot	Tech Specs and Const. Drawings	TR	✓	
iv		Earth test	Earthing test kit	A	Physical	100%	Tech Specs and Const. Drawings,	SR	✓	

Sl. No	Activity and operation	INDICATIVE FIELD QUALITY PLAN					Annexure-II				
		ITEM : CIVIL WORK		QP NO. :		1	PROJECT:	Development of 100 MW Floating Solar PV Project at NTPC Ramagundam in Telangana			
		SUB-SYSTEM : CIVIL AND STRUCTURAL STEEL WORKS		REV. NO. :		0	PACKAGE:				
		DATE :		CONTRACT NO.			MAIN CONTRACTOR				
		PAGE :									
Sl. No	Activity and operation	Characteristics / instruments		Class of check	Type of Check	Quantum Of check	Reference Document	Acceptance Norms	Format of Record	Remarks	
1	2	3		4	5	6	7	8	9	D*	10
10.00	ROAD WORKS										
10.1	Construction of Sub-Grade and earthen/hard shoulders										
i		Standard proctor Test to determine optimum moisture content and max. dry density	As per IS: 2720, Proctor needle apparatus,etc.	A	Physical	One in every 2000 cum for each type and source of fill materials	As per Technical Specifications/ BOQ /IRC/MORTH	SR/TR	✓		
ii		Moisture content of fill before compaction	As per IS: 2720, balance, oven etc.	B	Physical	One in every 2000 cum for each type and source of fill materials		SR/TR			
iii		Dry density by core cutter method ---- OR---- Dry density in place by sand displacement method	As per IS: 2720/compaction test (core cutter), balance etc.	A	Physical	One in every 500 SQM area for each compacted layer.		SR/TR	✓		
10.2	Granular Sub Base (GSB)										
i		Gradation	As required / agreed	B	Physical	One test per 200 cum of aggregate		SR	✓		
ii		Atterberg Limit	As per IS: 2720	B	Physical	One test per 200 cum of aggregate		SR	✓		
iii		Moisture content prior to compaction	As per IS: 2720	B	Physical	One test per 250 SQM of aggregate		SR	✓		
iv		Density of compacted layer	As per IS: 2720	A	Physical	One test per 500 SQM of aggregate		SR / TR	✓		
v		Deleterious constituents	As required / agreed	B	Physical	As required		SR	✓		
vi		CBR	As per IS: 2720	B	Physical	As required		SR / TR	✓		
10.3	Water Bound Macadam (Non-Bituminous)										
i		Aggregate Impact value	Aggregate Impact value Test Apparatus	A	Physical	One test per 200 cum of Test aggregate		SR	✓		
ii		Grading	Set of IS Sieves	B	Physical	One test per 100 cum of aggregate		SR			
iii		Flakiness index and elongation index	Flakiness test gauge	B	Physical	One test per 200cum of aggregate		SR			
iv		Atterberg Limits of binding material	Atterberg limits determination	A	Physical	One test per 25 cum of binding material		SR	✓		
v		Atterberg Limits of portion of aggregate passing 425 micron sieve	Atterberg limits determination	A	Physical	One test per 100cum of aggregate		SR	✓		

Sl. No	Activity and operation	INDICATIVE FIELD QUALITY PLAN				Annexure-II				
		ITEM : CIVIL WORK		QP NO. :	1	PROJECT:	Development of 100 MW Floating Solar PV Project at NTPC Ramagundam in Telangana			
		SUB-SYSTEM : CIVIL AND STRUCTURAL STEEL WORKS		REV. NO.:	0	PACKAGE:				
		PAGE :		DATE :		CONTRACT NO.				
Sl. No	Activity and operation	Characteristics / instruments		Class of check	Type of Check	Quantum Of check	Reference Document	Acceptance Norms	Format of Record	Remarks
1	2	3		4	5	6	7	8	9	D* 10
10.4	Bituminous Surfacing - Open graded premix carpet and Seal coat	Quality of binder	Penetrometer with St. needle	A	Physical	No. of samples per Lot & tests as per IS:73, IS:217, IS:8887 as applicable	As per Technical Specifications/ BOQ /IRC/MORTH	SR	✓	
i		Aggregate Impact Value / Los angeles abrasion value	Aggregate Impact Value Test apparatus	A	Physical	One test per 50 cum of aggregate		SR	✓	
iii		Flakiness Index and elongation index of aggregates	Flakiness test gauge	B	Physical	One test per 50 cum of aggregate		SR		
iv		Stripping value of aggregate (Immersion tray test)	As required / agreed	B	Physical	Initially one set of 3 representative specimen per source, and on every change of source		SR		
v		Water absorption test		A	Physical	Initially one set of 3 representative specimen		SR	✓	
vi		Water sensitivity of mix	As required / agreed	A	Physical	Initially one set of 3 representative specimen per source, and on every change of source		SR	✓	
vii		Grading of aggregates	Set of Sieves	B	Physical	One test per 25 cum of aggregates		SR		
viii		Soundness ( Magnesium and Sodium Sulphate)	As required as per IS:2386	A	Physical	Once per source by each method and on every change of source		SR	✓	
ix		Polished stone value	As required as per BS:812(Part 114)	B	Physical	As required		SR		
x		Temperature of binder at application	Thermometer	B	Physical	At regular close intervals		SR		
xi		Binder content	Bitumen extractor	A	Physical	One test per 500 cum& not less than two tests per day		SR	✓	
xii		Rate of spread of materials	As required / agreed	B	Physical	One test per 500 cum and not less than 2 tests per day		SR		

		INDICATIVE FIELD QUALITY PLAN				Annexure-II					
		ITEM : CIVIL WORK		QP NO. :		1	PROJECT:	Development of 100 MW Floating Solar PV Project at NTPC Ramagundam in Telangana			
		SUB-SYSTEM : CIVIL AND STRUCTURAL STEEL WORKS		REV. NO.:		0	PACKAGE:				
				DATE :			CONTRACT NO.				
				PAGE :			MAIN CONTRACTOR				
Sl. No	Activity and operation	Characteristics / instruments		Class of check	Type of Check	Quantum Of check	Reference Document	Acceptance Norms	Format of Record	Remarks	
1	2	3		4	5	6	7	8	9	D*	10
xiii		Percentage of fractured faces	Bitumen extractor	A	Physical	When gravel is used one test per 50cum of aggregates		SR	✓		
10.5	Tack Coat/ Prime coat/ fog coat			A	Physical	NO. of samples per lot & tests as per IS:73, IS:217, IS:8887 as applicable		SR	✓		
i		Quality of binder	Penetrometer with Standard needle	B	Physical	At regular close intervals		SR			
ii		Temperature of binder at application	Thermometer	B	Physical	One test per 500 cum and not less than 2 tests		SR			
iii		Rate of spread of binder	As required / agreed	B	Physical			SR			
10.6	Alignment, Level, Surface regularity and rectification										
		Horizontal alignment, Surface levels and Surface regularity	As required / agreed	B	Physical	As per section 900 of MORTH specification	As per Technical Specifications/ BOQ/ Referred Standards and construction	SR			
		Rectification	As required / agreed	B	Physical	Each rectification	As per Technical Specifications/ BOQ/	SR	✓		
11.00	False Ceiling										
i		Materials ( gypsum glass, glass fibre membrane, fibre board acoustical tiles etc)	As agreed / required	B	EIC Approved source and review of MTC/ test reports	For each lot received at site	Tech Specs and Const. Drawings	SR	✓	Compare MTC with technical specification and requirement	
ii		Installation finishing and acceptance	As agreed / required	B	Visual / physical	Random	Tech Specs and Const. Drawings	SR			
12.0	GEOTECHNICAL INVESTIGATION WORK										
i		Deployment of approved Geotechnical Investigation Agency - Equipments, Manpower etc.	As required / agreed	A	Physical	Once before commencement of work	As per technical specifications and relevant IS Codes	SR	✓		
ii		Execution of Geotechnical Investigation - locations, type etc. as per scheme	As required / agreed	B	Physical	Each Location	As per technical specifications and relevant IS Codes	SR	✓		
iii		Collection of disturbed and undisturbed samples , their packing and storage	As required / agreed	B	Physical	each sampling	As per technical specifications and relevant IS Codes	SR			
iv		Conducting field tests as per investigation scheme- such as, SPT/ERT/SCPT/PLT/PMT etc.	As required / agreed	B	Physical	each field test	As per technical specifications and relevant IS Codes	SR			
v		Submission of Field Bore logs in approved format	As required / agreed	B	Review	Within 24 hours after completion of each BH	As per technical specifications and relevant IS Codes	SR	✓		
vi		Submission of laboratory test schedule and selection of samples for laboratory testing	As required / agreed	A	Review and acceptance	as per consultation with engineer during dispatch of samples to approved laboratory	As per technical specifications and relevant IS Codes	SR	✓		
vii		Submission of Final Geotechnical investigation report along with recommendations	As required / agreed	B	Physical	After completion of investigation work and review of draft reports	As per technical specifications and relevant IS Codes	-	✓		
13.00	STRUCTURAL STEEL MATERIAL (For Site Fabrication)										
i	Procured by contractor	Structural steel procured from NTPC approved sources- Mechanical (YS, UTS, Elg, UT if specified),,and Chemical properties (CE as per IS)		A	Review	For each batch of each section delivered at site	Technical Specification and Construction Drawings, IS 2062	SR	✓	Correlated MTC shall be verified.	
13.1	PRE-WELDING REQUIREMENTS										

	 <b>NTPC</b>	INDICATIVE FIELD QUALITY PLAN				Annexure-II				
		ITEM : CIVIL WORK		QP NO. :	1	PROJECT:	Development of 100 MW Floating Solar PV Project at NTPC Ramagundam in Telangana			
		SUB-SYSTEM : CIVIL AND STRUCTURAL STEEL WORKS		REV. NO. :	0	PACKAGE:				
		DATE :		DATE :		CONTRACT NO.				
		PAGE :				MAIN CONTRACTOR				
Sl. No	Activity and operation	Characteristics / instruments		Class of check	Type of Check	Quantum Of check	Reference Document	Acceptance Norms	Format of Record	Remarks
1	2	3		4	5	6	7	8	9	D* 10
i		Welding Procedure Specification (WPS*)	-	A	Review	Each Welding Process	Technical Specification and Construction Drawings, ASME-IX/ AWS D 1.1	WPS	✓	*To be approved by CQA
ii		PQR and Welder's Qualification	-	A	Physical	Each welder	PQR/ WQR, AWS-D1.1/ASME-IX, Technical Specification and Construction Drawings	TR	✓	
iii		Welding consumables	-	B	Physical	Random in each shift	Approved WPS, Latest NTPC	SR	✓	
13.2	FIT-UP									
i		Marking and Cutting	Tape, ruler etc.	B	Visual & Measurement	Each plate/ Section	Technical Specification and Construction Drawings/ Approved cutting plan	SR		
ii		Match markings for trial assembled components	-	B	Physical	Each fit-up	Technical Specification and Construction Drawings	SR		
iii		Weld Fit Up- Edge Preparation/ Gap/ Alignment	Tape, ruler etc.	B	Physical	Each fit-up	Technical Specification and Construction Drawings, IS 7215	SR	✓	If required suitable stiffeners shall be provided to prevent deflection.
13.3	PRE HEATING (wherever applicable)									
i		Pre-Heating Temperature	Thermal chalk	B	Measurement	Each pre-heating	Technical Specification and Construction Drawings	SR	✓	
ii		Post Weld Heat Treatment (PWHT), if required	Thermo couple with time temperature	A	Time & Temperature	Each PWHT	Technical Specification and Construction Drawings, Approved WPS	SR	✓	

		INDICATIVE FIELD QUALITY PLAN				Annexure-II					
		ITEM : CIVIL WORK		QP NO. :	1	PROJECT:	Development of 100 MW Floating Solar PV Project at NTPC Ramagundam in Telangana				
		SUB-SYSTEM : CIVIL AND STRUCTURAL STEEL WORKS		REV. NO. :	0	PACKAGE:					
		DATE :		DATE :		CONTRACT NO.					
		PAGE :				MAIN CONTRACTOR					
Sl. No	Activity and operation	Characteristics / instruments		Class of check	Type of Check	Quantum Of check	Reference Document	Acceptance Norms	Format of Record	Remarks	
1	2	3		4	5	6	7	8	9	D*	10
13.4 WELDING REQUIREMENTS											
i	Sequence of welding	-	B	Physical	Random in each shift	Technical Specification and Construction Drawings, Agreed scheme	SR				
ii	Removal/ grinding of temporary	-	B	Measurement	All cleats/ attachments	Technical Specification and Construction Drawings	SR				
iii	Completeness after welding- Dimensions/ distortion	Weld gauge	B	Visual	Each structure component	Technical Specification and Construction Drawings, IS 822	SR	✓			
iv	Completeness of welding (each butt & fillet weld)		B	Visual	Each structure component	Technical Specification and Construction Drawings, Approved Drg.	SR	✓			
13.5 NON DESTRUCTIVE AND DESTRUCTIVE TESTING											
13.5.1 FILLET WELDS											
i	size and visual examination	As required/ agreed	B	Visual/ Measurement	100%	As per technical specifications and construction drawings, IS 822, AWS D 1.1	SR		As per requirement of NTPC Engineer		
ii	Dye Penetration Test	As required/ agreed	B	Physical	5% of Weld length with min. 300mm at each location	As per technical specifications and construction drawings, IS 822, AWS D 1.1	SR				
13.5.2 BUTT WELDS											
i	Visual examination	As required/ agreed	B	Visual	Random in each shift	As per technical specifications and	SR		As per requirement of NTPC Engineer		
ii	DPT	As required/ agreed	B	Physical	100% on all butt welds after back gouging on root run and 10% on final weld	As per technical specifications and construction drawings, IS 822, AWS D 1.1	IR		All butt welds to be back gouged before DPT		
iii	Radiography Test	As required/ agreed	A	Physical	10%	As per technical specifications and construction drawings, IS 822, AWS D 1.1	IR	✓	Wherever RT is not feasible UT to be carried out. In case of failure of any welds in SPOT/RT or UT the % of retesting shall be doubled at that particular location. Acceptance criteria of NDT on welds shall be as per AWS D1.1.		
13.6 FOUNDATION CHECKS											
i	Dimensions and levels- Shape, lines (including diagonal checks)	Theodolite, Tape etc.	B	Physical/ Measurement	Each Foundation	Tech Specs and Const. Drawings	SR	✓			
ii	Foundation Bolts and Embedment's- Verticality, Levels, pitch distance	Theodolite, Tape, Piano wires etc.	B	Physical/ Measurement	Each Foundation	Tech Specs and Const. Drawings	SR	✓			
13.7 PAINTING SYSTEM											
i	Painting Materials and accessories	-	A	Review of MTC	Each batch of delivery	Tech Specs and Const. Drawings	SR/MTC	✓	Mfr.'s T.C. shall be correlated with the consignment received.		
ii	Submission of painting methodology	-	B	For Review of painting system	Before start of painting work	Tech Specs and Const. Drawings					
iii	Surface preparation	As agreed / required	B	Physical /visual	Each Erection Mark	Tech Specs and Const. Drawings,	SR	✓			
iv	Primer Thickness	Elcometer	B	Measurement	Each Erection Mark	Tech Specs and Const. Drawings	SR	✓			
v	DFT of paint	Elcometer	B	Measurement	Each Erection Mark	Tech Specs and Const. Drawings	SR	✓			
vi	Acceptance of painted surfaces	Elcometer	B	Visual and measurement	Each Erection Mark	Tech Specs and Const. Drawings	SR				

	 <b>NTPC</b>	INDICATIVE FIELD QUALITY PLAN				Annexure-II					
		ITEM : CIVIL WORK		QP NO. :	1	PROJECT:	Development of 100 MW Floating Solar PV Project at NTPC Ramagundam in Telangana				
		SUB-SYSTEM : CIVIL AND STRUCTURAL STEEL WORKS		REV. NO. :	0	PACKAGE:					
		DATE :		MAIN CONTRACTOR							
		PAGE :									
Sl. No	Activity and operation	Characteristics / instruments		Class of check	Type of Check	Quantum Of check	Reference Document	Acceptance Norms	Format of Record	Remarks	
1	2	3		4	5	6	7	8	9	D* 10	
<b>13.8 PRE-ASSEMBLY CHECKS</b>											
i	Punch Erection marks and match marks	-		B	Visual/ Physical	Each structural member	Tech Specs and Const. Drawings			Markings for -	
ii	Pre-assembly as per match mark	-		B	Visual/ Physical	Each structural member	Tech Specs and Const. Drawings				
iii	Camber, sweep and total length after trial assembly of structure.	Theodolite, Tape, plumb, piano wires etc.	B	Visual/ Physical	Each structural member	Tech Specs and Const. Drawings	SR	✓			
iv	Control assembly check at shop	Theodolite, Tape, plumb, piano wires etc.	B	Visual/ Physical	Every first and tenth set of identical structure	Tech Specs and Const. Drawings					
V	Completion of primer & intermediate coat of paint		B	Visual / Physical	Random	Tech Specs and Const. Drawings	SR				
<b>13.9 ERECTION CHECKS</b>											
i	Alignment, slopes, level, tolerances of erected member	Theodolite, Tape, plumb, piano wires etc.	B	Measurement	Each structural member	Tech Specs and Const. Drawings	SR	✓			
ii	Tightening of bolts/ Torque including foundation bolts with lock nuts	Wrench/ Torque wrench if specified	B	Visual/ Physical	Each structural member	Tech Specs and Const. Drawings	SR	✓			
iii	Completion of all erection fillet & butt welds		B	Visual	Each structural member	Tech Specs and Const. Drawings	SR	✓			
iv	Acceptance of erected structure	Theodolite, Tape, plumb, piano wires etc.	B	Visual/ Physical	Each erected structure	Tech Specs and Const. Drawings, IS 7215 and IS 12843	SR	✓			
<b>13.10 PERMANENT BOLTS AND NUTS AND WASHERS</b>											
i	Material- Permanent mild steel Bolts, mild steel Nuts, High strength structural Bolts, Washers-Dimensions, properties, Class, storage along with MTC	Screw gauge, Vernier, Tape etc.	A	Physical and MTC Review	Once for each lot of delivery	Tech Specs and Const. Drawings	SR/MTC	✓			
ii	Contact surfaces before bolting	-	B	Physical	Random before assembly for bolting	Tech Specs and Const. Drawings, IS 4000	SR				
iii	Inspection of the assembled bolts	-	B	Physical	Randomly in each shift for assembled bolts	Tech Specs and Const. Drawings, IS 4000	SR				
iv	Tensioning	As agreed / required	B	Physical	Randomly during snug tight test and after full tensioning	Tech Specs and Const. Drawings, IS 4000	SR	✓			
v	Acceptance of installed bolts	-	B	Physical	Each bolt	Tech Specs and Const. Drawings	SR				

Legend to be used: Class # : A = Critical, B=Major, C=Minor; SR = Site Register , TR= Test Report,MfrTC = Manufacturer's Test Certificate

Categorization Witnessing & Accepting (As per NTPC QA&I System)

Format No.: QS-01-QAI-P-09/F2-R1

Engg. Div./QA&I

 <b>PROJECT:</b> Development of 100 MW Floating Solar PV Project at NTPC Ramagundam in Telangana <b>PACKAGE:</b> SOLAR <b>MAIN SUPPLIER:</b> <b>CONTRACT NO.:</b>	LIST OF ITEMS REQUIRING QUALITY PLAN AND SUB- SUPPLIER APPROVAL				NTPC DOC NO			
					REV. NO.	0		
	SUB SYSTEM: CIVIL WORKS				DATE	28.11.2018		
	SR. NO.	ITEM	QAP / INSP. CAT	QAP NO.	PROPOSED SUB SUPPLIER	PLACE OF MANUFACTURING	APPROVAL STATUS / CATEGORY	REMARKS
1.	<b>CEMENT</b>	III	-		BIS APPROVED SOURCES HAVING VALID BIS LICENCE	-	-	
2.	<b>CONSTRUCTION CHEMICALS - ADMIXTURES, PLASTISIZERS, RETARDERS WATER PROOFING COMPOUNDS GROUTS</b>	III	-		SIKA INDIA LTD	-	A	
					CICO TECHNOLOGIES LTD	-	A	
					FOSROC CHEMICALS (I) PVT LTD	-	A	
					BASF	-	A	
3.	<b>PAINT AND PAINTING SYSTEM</b>	III	-		BERGER	-	A	
					SHALIMAR PAINTS	-	A	
					JENSON AND NICHOLSON	-	A	
					KANSAI NEROLAC	-	A	
					AKZO NOBEL	-	A	
					ASIAN PAINTS	-	A	
4.	<b>GI PIPES</b>	III	-		BIS APPROVED SOURCES HAVING VALID BIS LICENCE	-		
5.	<b>BITUMEN ASPHALT</b>	III	-		ALL GOVERNMENT REFINERIES	-		
6.	<b>PLASTIC/ PVC PIPES</b>	III	-		BIS APPROVED SOURCES HAVING VALID BIS LICENCE	-		
7.	<b>BITUMEN IMPREGNATED FIBER BOARD JOINT FILLER , BITUMEN SEALING COMPOUND</b>	III	-		BIS APPROVED SOURCES HAVING VALID BIS LICENCE	-		
8.	<b>CERAMIC / VITRIFIED TILES</b>	III	-		BIS APPROVED SOURCES HAVING VALID BIS LICENCE	-	-	

 <b>PROJECT:</b> Development of 100 MW Floating Solar PV Project at NTPC Ramagundam in Telangana <b>PACKAGE:</b> SOLAR <b>MAIN SUPPLIER:</b> <b>CONTRACT NO.:</b>	LIST OF ITEMS REQUIRING QUALITY PLAN AND SUB- SUPPLIER APPROVAL				NTPC DOC NO		
					REV. NO.	0	
	SUB SYSTEM: CIVIL WORKS				DATE	28.11.2018	
SR. NO.	ITEM	QAP / INSP. CAT	QAP NO.	PROPOSED SUB SUPPLIER	PLACE OF MANUFACTURING	APPROVAL STATUS / CATEGORY	REMARKS
9.	<b>PARTICLE BOARDS, PLYWOOD, MDF</b>	III	-	BIS APPROVED SOURCES HAVING VALID BIS LICENCE	-	-	
10.	<b>HIGH SOLID CONTENT LIQUID APPLIED URETHANE BASED ELASTOMERIC MEMBRANE FOR WATER PROOFING</b>	III	-	STP	-	A	
				IWL INDIA LTD	-	A	
				LLOYDS	-	A	
				CICO TECHNOLOGIES LTD	-	A	
				FOSROC CHEMICALS (I) PVT LTD	-	A	
11.	<b>POLYTHENE WATER STORAGE TANKS</b>	III	-	BIS APPROVED SOURCES HAVING VALID BIS LICENCE	-		
12.	<b>MINERAL WOOL FOR THERMAL INSULATION</b>	III		ROCKWOOL INDIA LTD.	HYDERABAD	A	
				PUNJSTAR INSULATION FIBRE COMPANY	BHILAI	A	
				LAPINUS	MALANPUR (MP)	A	
				MINWOOL	RAJANANDGAON	A	
				LLOYD INSULATION	BHILAI	A	
				GOENKA ROCKWOOL (I) PVT LTD	RAIPUR	A	
				SHREERAM EQUITECH PVT LTD	DURG	A	
				U.P. TWIGA	BULENDSHAHAR	A	
13.	<b>CI PIPES</b>	III	-	BIS APPROVED SOURCES HAVING VALID BIS LICENCE			
14.	<b>MODULE MOUNTING STRUCTURES (MMS)</b>	III		MAIN CONTRACTOR'S APPROVED SOURCES			

 <b>PROJECT:</b> Development of 100 MW Floating Solar PV Project at NTPC Ramagundam in Telangana <b>PACKAGE:</b> SOLAR <b>MAIN SUPPLIER:</b> <b>CONTRACT NO.:</b>	LIST OF ITEMS REQUIRING QUALITY PLAN AND SUB- SUPPLIER APPROVAL				NTPC DOC NO		
					REV. NO.	0	
	SUB SYSTEM: CIVIL WORKS				DATE	28.11.2018	
	SR. NO.	ITEM	QAP / INSP. CAT	QAP NO.	PROPOSED SUB SUPPLIER	PLACE OF MANUFACTURING	APPROVAL STATUS / CATEGORY
15.	<b>GALAVANISED STEEL STRUCTURES FOR TRANSMISION LINE</b>	I		L&T	PITAMPUR	A	
				NAMPA STEEL	HOWRAH	A	
				UNITECH POWER TRANSMISSION LTD.	NAGPUR	A	
				L&T	PONDICHERRY	A	
				ASSOCIATED POWER STRUCTURES	VADODARA	A	
				GOOD LUCK STEEL TUBES	SIKANDRABAD	A	
				R.S. INFRAPROJECTS PVT. LTD	SURAJPUR	A	
				ADVANCE STEEL TUBE	SAHIBABAD	A	
				RICHARDSON & CRUDDAS (1972) LTD	NAGPUR	A	
16.	<b>GALVANISED STEEL STRUCTURE (LATTICE &amp; PIPE )</b>	I		GOOD LUCK STEEL TUBES	SIKANDRABAD	A	
				RICHARDSON & CRUDDAS (1972) LTD	NAGPUR	A	
				L&T	PONDICHERY	A	
				L&T	PITAMPUR	A	
				R.S. INFRAPROJECTS PVT. LTD	SURAJPUR	A	
				VIJAY TRANSMISSION P. LTD	RAIPUR	A	
				UNIQUE STRUCTURES & TOWERS LTD.	RAIPUR	A	
				VATCO ELEC-POWER PVT. LTD.	NAVIMUMBIAI	A*	*Galvanising at M/s Sigma Galvaniser, Navi Mumbai
				R.S. INFRAPROJECTS PVT. LTD	GHAZIABAD	A	
				ADVANCE STEEL TUBE ,	SAHIBABAD	A	
				SANGAM STRUCTURES LTD.	ALLAHABAD	A	

 <b>PROJECT:</b> Development of 100 MW Floating Solar PV Project at NTPC Ramagundam in Telangana <b>PACKAGE:</b> SOLAR <b>MAIN SUPPLIER:</b> <b>CONTRACT NO.:</b>	LIST OF ITEMS REQUIRING QUALITY PLAN AND SUB- SUPPLIER APPROVAL				NTPC DOC NO	
					REV. NO.	0
	SUB SYSTEM: CIVIL WORKS				DATE	28.11.2018
	SR. NO.	ITEM	QAP / INSP. CAT	QAP NO.	PROPOSED SUB SUPPLIER	PLACE OF MANUFACTURING
					NEW MODERN TECHNOMECH (OR)	MAYURBHANJ (OR)
					UNITECH POWER TRANSMISSION LTD.	NAGPUR
					ASSOCIATED POWER STRUCTURES	VADODARA
					RELIABLE SPONGE PVT LTD,	KALUNGA, ODISHA
17	<b>FOUNDATION BOLT</b>	III			MAIN CONTRACTOR'S APPROVED SOURCES	
<b>LEGENDS:</b> 1. SYSTEM SUPPLIER/SUB-SUPPLIER APPROVAL STATUS CATEGORY (SHALL BE FILLED BY NTPC) A – For these items proposed vendor is acceptable to NTPC. To be indicated with letter "A" in the list along with the condition of approval, if any. DR – For these items "Details required" for NTPC review. To be identified with letter "DR" in the list.  2. QP/INSPN CATEGORY: CAT-I : For these items the Quality Plans are approved by NTPC and the final acceptance will be on physical inspection witness by NTPC. CAT-II : For these items the Quality Plans approved by NTPC. However no physical inspection shall be done by NTPC. The final acceptance by NTPC shall be on the basis review of documents as per approved quality plan. CAT-III : For these items Main Supplier approves the Quality Plans. UNITS/ WORKS : Place of manufacturing Place of Main Supplier of multi units/works.						
NOTE 1: For the items placed in CAT-III for Civil Works, the review and final acceptance shall be done by NTPC-EIC/ FQA on the basis of MTC / certificate of conformance in line with Indicative FQP / Technical Specifications. NOTE 2: Clearance from NTPC Engineering required wherever the Proveness / Sub-QR criteria mentioned against that particular BOIs or Sub-Suppliers in the Technical specifications.						



**PURCHASE SPECIFICATION:  
AUXILIARY TRANSFORMER**

PS-439-AUX

Rev No: 00

PAGE : 1 OF 6

**Specification of auxiliary transformer 30 KVA, 380V/433V, dYN11**

**1.0 Technical parameters and specifications:**

#	Technical parameter	Specification
1	Transformer type	Dry type
2	IP class	The transformers shall be housed in an enclosure (Corrosion resistant) having degree of protection of IP-54 or higher.
3	Type of cooling	AN
4	Governing Standard	IS: 2026, IS:11171 or equivalent to any other international standard, Indian Electricity Act 2003, BEE Guideline & CEA notifications.
5	Rating in KVA	30 KVA
6	No. of phases	3
7	Frequency	50 Hz, +/- 3%
8	HV winding	433V, 3-Ph with <b>Start</b> Connection
9	LV windings	380V, 3-Ph, with <b>Delta</b> connection
10	Winding material	Electrolytic grade copper for both HV and LV windings
11	Winding Insulation	Class F or better
12	Neutral on LV side	Neutral terminal shall be brought out separately to facilitate earthing connections.
13	Vector Group	dYN11
14	Short circuit withstand time (thermal)	2 sec.
15	% Impedance	As per IS: 1180
16	Termination HV/LV/Orientation	Air insulated cable box with disconnecting chamber, for both HV and LV sides. Cable box / Cable box / 180°.
17	Cable entry on HV side	Bottom entry of cables. <b>Cable supply in bidder scope.</b>
18	Cable entry on LV side	Bottom entry of cables. <b>Cable supply in bidder scope.</b>
19	Cables and accessories	Cables, Cable glands cable lugs (Dowell/Comet/3D make) and connecting hardware shall be in bidder scope of supply.
20	Tapping on HV winding	Off circuit tap changer (OCTC) switch with five tap positions: +5%, +2.5%, 0, -2.5%, -5%.
21	Loading Capability	Continuous operation at rated KVA on any tap with voltage variation of +/-10%. Transformer shall be capable of being loaded in accordance with IS: 6600 / IEC 60076-7.
22	Ambient temperature	Max 50 deg C
23	Temperature rise	90 deg C. ( class F) 115 deg C. ( class H)



**PURCHASE SPECIFICATION:  
AUXILIARY TRANSFORMER**

PS-439-AUX

Rev No: 00

PAGE : 2 OF 6

	24	Flux density	Not to exceed 1.9 Wb/sq.m at any tap position with +/-10% voltage variation from voltage corresponding to the tap. Transformer shall also withstand following over-fluxing conditions due to combined voltage and frequency fluctuations: a) 110% for continuous rating b) 125% for at least one minute c) 140% for at least five seconds Bidder shall furnish over-fluxing characteristics up to 150%
	25	Air Clearance	As per CBIP
	26	Load loss principal tap at 75°C, with IS tolerance	This shall be provided by bidder.
	27	No Load loss at rated voltage on principal tapping and at rated frequency, with IS tolerance	This shall be provided by bidder.
	28	No load current at rated voltage and rated frequency	This shall be provided by bidder. To be indicated as percentage.
	29	Efficiency at 75°C, UPF	As per IS 1180 and CBIP
	30	Regulation at full load, 75 °C	< 2 % for UPF For 0.8 PF lagging, to be indicated by bidder.
	31	Harmonics	Shall be designed to suppress harmonics especially 3 <sup>rd</sup> & 5 <sup>th</sup> .
	32	Vibration & noise	Noise level shall be according to NEMA TR-1 standard
	33	Highest system voltage	LV side: 1.1 kV HV side: 1.1 kV
	34	Bushing rating, Insulation class (Winding & bushing)	As per relevant IS/IEC Creepage distance : 35 mm/kV
	35	Overall dimensions in mm Length x Breadth x Height	This shall be provided by bidder.
	37	Weight of transformer in Kg	This shall be provided by bidder.
	38	Painting	The inside of enclosure and accessories (except M. Box) shall be painted with two coats of fully glossy white colour with total DFT of 25 to 60 microns. The external paint colour of transformer & accessories shall be blue corresponding to <b>RAL 5012</b> . The external surface of transformer & accessories shall have two coats of chemical resistant epoxy zinc phosphate primer and two coats of polyurethane finish paint with total DFT of 80 to 150 microns. The internal surface of Marshalling



**PURCHASE SPECIFICATION:  
AUXILIARY TRANSFORMER**

PS-439-AUX

Rev No: 00

PAGE : 3 OF 6

		Box shall have two coats of chemical resistant epoxy zinc phosphate primer and two coats of chemical & thermal resistant epoxy enamel white paint with total DFT of 80 to 150 microns.
39	Constructional features	As per relevant clause of this specification
40	Fittings and accessories	As per relevant clause of this specification

**2.0 Tests on auxiliary transformer**

<b>2.1</b>	<b>SI.No.</b>	<b>ROUTINE TESTS</b>
	1	All routine test shall be carried out in accordance with IEC 60076.
	2	Measurement of Voltage Ratio & phase displacement
	3	Measurement of winding resistance on all the taps (as per IEC 60076-1)
	4	Vector group and Polarity Check
	5	Magnetic Balance and Magnetising Current Test
	6	Measurement of no load current with 415 V, 50 Hz AC supply
	7	Measurement of no load losses and current at 90%, 100% & 110% of rated voltage
	8	Load Loss & Short Circuit Impedance Measurement on principal & Extreme Taps
	9	IR measurement (As per IEC 60076-1)
	10	Separate Source Voltage Withstand Test /Applied voltage test.
	11	Induced overvoltage test/Induced voltage withstand (IVW) test .
	12	Repeat no load current/loss & IR after completion of all electrical test
	13	Oil leakage test on completely assembled transformer along with radiators (as per relevant clause of this sub section)
	14	Marshalling Box/Cable box: It shall not be possible to insert a thin sheet of paper under gaskets and through enclosure joints.
	15	IR measurement on wiring of Marshalling Box.

**2.2 Type Tests**

<b>SI.No.</b>	<b>TYPE TESTS</b>
1.	Temperature Rise test at a tap corresponding to maximum losses as per IS 2026.
2.	Short Circuit test as per IEC (if applicable)
3.	Noise Level Measurement

**3.0 Constructional features and details of transformer components**

3.0	Dry Type Transformer shall be constructed in accordance to IS: 2026, IS: 11171 or equivalent to any other international standard, Indian Electricity Act 2003, BEE Guideline & CEA notifications. Transformer rating and all related technical parameters including tap changer (if applicable) shall be as per system requirement/SLD and relevant standards. Transformer shall be suitable for
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**PURCHASE SPECIFICATION:  
AUXILIARY TRANSFORMER**

PS-439-AUX

Rev No: 00

PAGE : 4 OF 6

continuous indoor duty application. Transformer shall be complete & functional in all respect. The other important construction particulars shall be as below.

All materials / components used shall be of best quality and class most suitable for working under the conditions specified.

These shall withstand the variations of temperature and atmospheric conditions, overload, over-excitation, short-circuits as per specified standards without distortion or deterioration, without development of stresses in any part and also without affecting the strength and suitability of the various parts for the work that they have to perform.

### **3.1 Core**

3.2.1	The core shall be constructed from non-ageing, cold rolled, super grain oriented silicon steel laminations equivalent to M4 grade steels or better.
3.2.2	The insulation structure of the core to clamp plates shall be such that it withstands a voltage of 2kV (rms) for one minute in air.
3.2.3	Adequate lifting lugs will be provided to enable the core & windings to be lifted.

### **3.2 Windings**

3.3.1	Windings shall be of electrolytic grade copper free from scales and burrs.
3.3.2	Windings shall be subjected to a shrinking and seasoning process so that no further shrinkage occurs during service.
3.3.3	Windings shall have uniform insulation.
3.3.4	Tapping shall be so arranged as to preserve the magnetic balance of the transformer at all voltage ratios.
3.3.5	The completed core and coil assembly shall be dried in vacuum and shall be immediately impregnated with oil after the drying process to ensure elimination of air and moisture within the insulation.
3.3.6	Windings shall be made in dust proof and conditioned atmosphere. Bidder shall indicate those details of facilities (as available at the winding works) that will ensure meeting this requirement.

### **3.4 Internal earthing**

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

3.5.1	a) Bushing below 52 kV shall be oil communicating type with porcelain insulator.  b) No arcing horns to be provided on the bushings.
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### **3.6 Bushing CTs**

1. Shall be of adequate rating for protection as required, WTI (WTI CTM applicable for transformer above 50 KVA) etc.
2. All CTs (except WTI) shall be mounted in the turret of bushings, mounting inside the tank is not permitted.

### **3.7 Cable boxes & disconnecting chamber (Disconnecting chamber applicable 3.3 kV and above)**

- (a) HV Cable boxes shall be of phase segregated air insulated type & shall be of sufficient size to accommodate Employer's cable & termination. Phase segregation shall be achieved by insulating barriers (for 3.3 kV and above side)
- (b) Cable boxes shall have bus bars / suitable terminal connectors of adequate size & bolt holes to receive cable lugs.
- (c) A suitable removable gland plate of non-magnetic material drilled as per the Employer's instruction shall also be provided in the cable box
- (d) The support from base for the cable box (for 3.3 kV and above side) shall be of galvanized iron.
- (e) The contractor shall provide earthing terminals on the cable box, to suit Employer's GI flat.
- (f) The minimum length provided for terminating 33 kV, 11KV & 3.3 KV XLPE cable shall be 1000 mm (for 33 kV) 650 mm (for 3.3 kV and 11 kV) from cable gland plate to the cable lug) for the cable boxes, for 433V side suitable length shall be provided (shall be discussed during detail engineering). The final cable size, number & length of terminating XLPE cable shall be furnished during detailed engineering.
- (g) Cable boxes shall be designed such that it shall be possible to move away the transformer without disturbing the cable terminations, leaving the cable box on external supports (as applicable).
- (h) Cable boxes shall have removable top cover (for transformer above 100 KVA) & ample clearance shall be provided to enable either transformer or each cable to be subjected separately to high voltage test.



**PURCHASE SPECIFICATION:  
AUXILIARY TRANSFORMER**

PS-439-AUX

Rev No: 00

PAGE : 6 OF 6

**3.8 Fittings and accessories**

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

a	Winding temperature indicator (WTI)	Shall be Platinum resistance type temperature detector in each limb. Single Indicating meter may be provided for display of temperature of all limbs. Accuracy class of Indicating meter shall be +/- 1% or better and it shall have least count of 0.1 °C or better. 1 no. 4-20 mA signal shall be provided for remote monitoring of winding Temperature.
b	RTD/Thermistors	1 No. PT-RTD shall be embedded in each limb with alarm and trip contacts for remote annunciation. Additional 1 No. thermistor/RTD shall be embedded in each limb.
c	Bi-directional wheel/skids, M.Box, OCTC, Bushing CTs (as applicable), Cooling equipment.	
d	Cover lifting eyes, transformer lifting lugs, towing holes and core and winding lifting lugs, inspection cover, Bilingual R&D Plate, Terminal marking plates, two nos. earthing terminals etc.	
e	Bolts & nuts (exposed to atmosphere) shall be galvanized steel/SS.	

The fittings listed above are only indicative and other fittings, which generally are required for satisfactory operation of the transformers are deemed to be included.

**4.0 Inspection and testing of transformers at bidder works**

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

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

6.1	Following documents shall be submitted to BHEL at the time of delivery of the consignment: (1) As built drawings of transformer (2) Routine test reports on transformer (3) Type test reports on transformer (4) Test certificate for transformer oil (5) Operations and maintenance manual of transformer
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# PURCHASE SPECIFICATION

## LT SWITCHGEAR

PS-439-LT SWITCHGEAR

REV NO: 00

PAGE : 1 OF 10

### 1.0 Introduction

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

#### 1.1 Technical specification

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

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

The scope shall include all associated devices, components, relays, contactors, switches etc. required for satisfactory operation of the switch boards as per the proposed logic control scheme. The scope of supply shall also include necessary spares required for operation & maintenance of switchgear equipments for a period of 5 (five) years & special tools & plants required for erection & maintenance.

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



**PURCHASE SPECIFICATION**  
**LT SWITCHGEAR**

PS-439-LT SWITCHGEAR

REV NO: 00

PAGE : 2 OF 10

## 1.2 STANDARDS

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

Sl. No.	Standards	Description
1	IEC 60947/IS13947	Specification for Low-Voltage Switchgear and Control gear.
2	IS: 10118 (Part 1 to 4)	Code of practice for selection, installation and maintenance of switchgear & control gear.
3	IS 3043	Code of practice for earthing.
4	IS 3072	Code of practice for installation and maintenance of Switchgear
5	IS: 2705	Current Transformers
6	IS: 3156	Voltage Transformers
7	IS: 3231	Electrical Relays for Power System Protection
8	IEC 60255	Electrical Relays
9	IS 3202	Code of practice for climate proofing of electrical equipment.
10	IS: 8828	Circuit breakers for over current protection for household and similar installations
11	IS: 13703 / IEC 60269	HRC Cartridge fuses
12	IS: 11353	Guide for uniform system of marking and identification of conductors and apparatus terminals.

## 2.0 TECHNICAL PARAMETERS

### A. POWER SUPPLY (AC SYSTEM)

(i)	Voltage	415V + 10%, 3 Phase, 4 wire,Neutral Solidly Earthed
(ii)	Frequency	50 Hz +/- 5%
(iii)	Minimum system fault level	As per system fault current (for 1 sec)
(iv)	Short time rating for bus bars, ckt. breakers, current transformers and swgr. Assembly.	As per system fault current (for 1 sec)
(v)	Maximum ambient air Temperature	50 deg. C

### BUS BARS

(vi)	Continuous current rating at 50°C ambient:	As Per Requirement
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## PURCHASE SPECIFICATION LT SWITCHGEAR

PS-439-LT SWITCHGEAR

REV NO: 00

PAGE : 3 OF 10

(vii)	Temperature Rise allowed above ambient	40 <sup>0</sup> C for plain joints 55 <sup>0</sup> C for Silver plated joints
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### B. MCCB

(i)	Rated voltage	415V
(ii)	Rated Insulation Level	690V
(iii)	Rated ultimate and service SC breaking capacity(As per system requirement)	As per system fault current (for 1 sec)
(iv)	Rated making capacity	2.1 times of System fault current
(v)	Utilization category	A

### C. DIGITAL MFM

(i)	Accuracy class	0.5
(ii)	MFM shall be provided at LT incomm feeder. MFM shall have suitable communication port for integration with SCADA system.	

### D. CURRENT TRANSFORMERS

(i)	Type	Cast Resin Bar Primary
(ii)	Voltage class and frequency	650V, 50HZ
(iii)	CT Secondary Current	1 A
(iv)	Class of insulation	E or better
(v)	Accuracy class & burden	
	a) For Protection	5P20, 5VA
	b) For Metering	Class 1.0, 5VA (min)
(vi)	Instrument Security Factor for metering CT	5

### E. VOLTAGE TRANSFORMERS

(i)	Type	Cast Resin
(ii)	Voltage Ratio	415 / 110V for line PT 415/ $\sqrt{3}$ / 110/ $\sqrt{3}$ V for Bus PT
(iii)	Neutral Solidly Earthed	Vee Vee
(iv)	Accuracy Class	0.5
(v)	Rated Voltage factor	1.1 continuous, 1.5 for 30 sec.
(vi)	Class of insulation	E or better
(vii)	One minute power frequency withstand voltage	2.5 KV

### F. HRC FUSES

(i)	Voltage Class	650 Volts



**PURCHASE SPECIFICATION**  
**LT SWITCHGEAR**

PS-439-LT SWITCHGEAR

REV NO: 00

PAGE : 4 OF 10

(ii)	Rupturing capacity	80kA (RMS) for AC circuits
<b>G. CONTACTORS</b>		
(i)	Type	Air break electro magnetic
(ii)	Utilising Category	AC3 of IS/IEC 60947 for nonreversible AC4 of IS/IEC 60947 for reversible drives
<b>H. SWGR. CUBICLE CONSTRUCTIONAL REQUIREMENTS</b>		
(i)	Colour finish	
	Exterior	RAL9002 (Main body) RAL 5012 (Extreme end covers) ,The paint thickness shall not be less than 50 microns
	Cable entry	
(ii)	Power Cables	Bottom
	Control Cables	Bottom

### 3.0 DETAILS OF INDOOR DISTRIBUTION BOARDS

#### **Applicable for Auxiliary Power Supply system.**

- 3.1 Switchboards shall be of metal enclosed, indoor, wall mounted type.
- 3.2 All switchboard frames and load bearing members shall be fabricated using suitable mild steel structural sections or pressed and shaped cold-rolled sheet steel of thickness 2.0 mm. Frames shall be enclosed in cold-rolled sheet steel of thickness 1.6 mm. Doors and covers shall also be of cold rolled sheet steel of thickness 1.6 mm. Stiffeners shall be provided wherever necessary. The gland plate thickness shall be 3.0 mm for hot / cold-rolled sheet steel and 4.0 mm for non-magnetic material.
- 3.3 All panel edges and cover / door edges shall be reinforced against distortion by rolling, bending or by the addition of welded reinforcement members. The top covers of the panels should be designed such that they do not permanently bulge/ bend by the weight of maintenance personnel working on it.
- 3.4 The switchboards shall be of bolted design. The complete structures shall be rigid, self-supporting, and free from flaws, twists and bends. All cut outs shall be true in shape and devoid of sharp edges.
- 3.5 All switchboards shall be of dust-proof and vermin-proof construction and shall be provided with a degree of protection of IP: 5X as per IS/IEC 60947. All cutouts shall be provided with EPDM / Neoprene gaskets. Feeder Pillar with IP 55 enclosure protection meeting the technical requirement is also acceptable.
- 3.6 All switchboards shall be of uniform height not exceeding 2450 mm.



**PURCHASE SPECIFICATION**  
**LT SWITCHGEAR**

PS-439-LT SWITCHGEAR

REV NO: 00

PAGE : 5 OF 10

- 3.7 Switchboards shall be supplied with base frames made of structural steel sections, along with all necessary mounting hardware required for welding down the base frame to the foundation / steel insert plates.
- 3.8 All equipment and components shall be neatly arranged and shall be easily accessible for operation and maintenance. Replacement /Maintenance of individual equipment/ component shall be possible without switching off or isolating the other equipments/components.
- 3.9 Each switchboard shall be provided with undrilled, removable type gland plate. For all single core cables, gland plate shall be of non-magnetic material. The gland plate shall be provided with gasket to ensure enclosure protection.
- 3.10 The minimum clearance in air between phases and between phases and earth for the entire busbars shall be 25mm. For all other components, the clearance between "two live parts", "a live part and an earthed part", shall be at least ten (10) mm throughout. Wherever it is not possible to maintain these clearances, insulation shall be provided by sleeving or barriers. However, for busbars the clearances specified above should be maintained even when the busbars are sleeved or insulated. All connections from the busbars up to switch / fuses/MCCB shall be fully insulated and securely bolted to minimize the risk of phase to phase and phase to earth short circuits. All busbars and jumper connections shall be of high conductivity aluminium alloy / copper of adequate size.
- 3.11 All switchboards shall be provided with three phase and neutral busbars. Entire busbar system shall be insulated with PVC sleeves. Busbar sleeves shall be compliant to UL224 (Extruded insulating tubing), CE/UL certified, having fire retardant properties and working temperature of 105°C.
- 3.12 The cross-section of the busbars shall be uniform throughout the length of switchboard section and shall be adequately supported and braced to withstand the stresses due to the specified short circuit currents. Neutral busbar short circuit strength shall be same as main busbars.
- 3.13 All busbars shall be adequately supported by non-hygroscopic, non-combustible, track-resistant and high strength sheet molded compound or equivalent type polyester fiber glass molded insulator. Separate supports shall be provided for each phase and neutral busbar. If a common support is provided, anti-tracking barriers shall be provided between the supports. Insulator and barriers of inflammable material such as Hylam shall not be accepted. The busbar insulators shall be supported on the main structure.
- 3.14 All busbar joints shall be provided with high tensile steel bolts, belleville / spring washers and nuts, so as to ensure good contacts at the joints. Non-



**PURCHASE SPECIFICATION  
LT SWITCHGEAR**

PS-439-LT SWITCHGEAR

REV NO: 00

PAGE : 6 OF 10

silver plated busbar joints shall be thoroughly cleaned at the jointed locations and suitable contact grease shall be applied just before making a joint. All bolts shall be tightened by torque spanner to the recommended value. The overlap of the busbars at each joint surface shall be such that the length of overlap shall be equal to or greater than the width of the busbar. All copper to aluminium joints shall be provided with suitable bimetallic washers.

- 3.15 All busbars shall be colour coded as per IS: 375.
- 3.16 Wherever the busbars are painted with black Matt paint, the same should be suitable for temperature encountered in the switchboard under normal operating conditions.
- 3.17 The Bidder shall furnish calculations establishing the adequacy of bus bar sizes for specified current ratings.
- 3.18 Panel space heaters shall be provided and the supply for this shall be tapped from incomer, before the isolating switch/circuit breaker. Incoming circuit to space-heater shall have an isolating switch, HRC fuse and neutral link of suitable rating. Panel illumination and plug-socket shall also be tapped from the space heater supply.
- 3.19 A galvanized steel / Copper / Aluminium earth bus shall be provided at the bottom of each panel and shall extend throughout the length of each switchboard. It shall be welded / bolted to the framework of each panel and breaker earthing contact bar. Vertical earth bus shall be provided in each vertical section which shall in turn be bolted / welded to main horizontal earth bus.
- 3.20 The earth bus shall have sufficient cross section to carry the momentary short circuit and short time fault current to earth without exceeding the allowable temperature rise.
- 3.21 All non-current carrying metal work of the switchboard shall be effectively bonded to the earth bus. Electrical conductivity of the whole switchgear enclosure framework and truck shall be maintained even after painting.
- 3.22 All metallic cases of relays, instruments and other panel-mounted equipment shall be connected to earth by independent stranded copper wires of size not less than 2.5 sq. mm. All the equipment mounted on the door shall be earthed through flexible wire/braids. Insulation color code of earthing wires shall be green. Earthing wires shall be connected to terminals with suitable clamp connectors, soldering is not acceptable. Looping of earth connections, which would result in loss of earth connections to other devices, when a device is



## PURCHASE SPECIFICATION LT SWITCHGEAR

PS-439-LT SWITCHGEAR

REV NO: 00

PAGE : 7 OF 10

removed, is not acceptable. However, looping of earth connections between equipment to provide alternative paths to earth bus is acceptable.

- 3.23 VT and CT secondary neutral point earthing shall be at one place only, i.e. on the terminal block. Such earthing shall be made through links so that earthing of one secondary circuit shall be removed without disturbing the earthing of other circuit.
- 3.24 All hinged doors having potential carrying equipment mounted on it shall be earthed by flexible wire/ braid. For doors not having potential carrying equipment mounted on it, earth continuity through scraping hinges/ hinge pins of proven design may also acceptable. The Contractor shall establish earth continuity at site also.
- 3.25 All switchboards shall be supplied completely wired internally upto the terminals, ready to receive external cables.
- 3.26 All auxiliary wiring shall be carried out with 650V grade, single core stranded copper conductor, colour coded, PVC insulated wires. Conductor size shall be 1.5 mm<sup>2</sup> (min.) for control circuit wiring and 2.5 mm<sup>2</sup> (min) for CT and space heater circuits.
- 3.27 Extra flexible wires shall be used for wiring to devices mounted on moving parts such as hinged doors. The wire bunches from the panel inside to the doors shall be properly sleeved or taped.
- 3.28 All wiring shall be properly supported, neatly arranged, readily accessible and securely connected to equipment terminals and terminal blocks.
- 3.29 All internal wiring terminations shall be made with solderless crimping type tinned copper lugs which shall firmly grip the conductor or an equally secure method. Similar lugs shall also be provided at both ends of component to component wiring. Insulating sleeves shall be provided over the exposed parts of lugs to the extent possible. Screw-less (spring loaded) / cage clamp type terminal shall also be provided with lugs.
- 3.30 Printed single tube ferrules marked to correspond with panel wiring diagram shall be fitted at both ends of each wire. The wire identification marking shall be in accordance with IS: 375. Red Ferrules should be provided on trip circuit wiring.
- 3.31 Cable termination arrangement for power cables shall be suitable for heavy duty, 1.1 kV grade, stranded aluminium conductor, PVC/ XLPE insulated, armoured / unarmoured and PVC sheathed cables. All necessary cable terminating accessories such as supporting clamps and brackets, hardware etc., shall be provided by the contractor, to suit the final cable sizes.



## PURCHASE SPECIFICATION LT SWITCHGEAR

PS-439-LT SWITCHGEAR

REV NO: 00

PAGE : 8 OF 10

- 3.32 All power cable terminals shall be of stud type and the power cable lugs shall be of tinned copper solderless crimping ring type conforming to IS: 8309. All lugs shall be insulated/ sleeved.
- 3.33 All Switchgears, MCCs, Distribution Boards, Fuse boards, all feeders, local push-button stations etc. shall be provided with prominent, engraved identification plates.
- 3.34 All name plates shall be of non-rusting metal or 3-ply Lamicoid, with white engraved lettering on black background. Inscription & lettering sizes shall be subject to Employer's approval.
- 3.35 Caution name plate "Caution Live Terminals" shall be provided at all points where the terminals are likely to remain live and isolation is possible only at remote end.
- 3.36 The gaskets, wherever specified, shall be of good quality EPDM / neoprene with good ageing, compression and oil resistance characteristics suitable for panel applications.
- 3.37 The bidder shall, ensure that the equipment offered will carry the required load current at site ambient conditions specified and perform the operating duties without exceeding the permissible temperature as per indian standards / specification. Continuous current rating at 50 deg C ambient in no case shall be less than 90% of the normal rating specified.
- 3.38 ON/OFF status and protection trip status of incomers and bus coupler (if available) be provided for SCADA system.
- 3.39 Suitable changeover and interlocking arrangement shall be provided for incomers and bus coupler.
- 3.40 It shall be the responsibility of the contractor to fully coordinate the overload and short circuit breakers/fuses with the upstream and downstream circuit breakers / fuses, to provide satisfactory discrimination. Further the various equipment supplied shall meet the requirements of type ii class of co-ordination as per IS: 8544.
- 3.41 All sheet steel work shall be pretreated, in tanks, in accordance with is: 6005. Degreasing shall be done by alkaline cleaning. Rust and scales shall be removed by pickling with acid. After pickling, the parts shall be washed in running water. Then these shall be rinsed in slightly alkaline hot water and dried. The phosphate coating shall be "class-c" as specified in is: 6005. The phosphated surfaces shall be rinsed and passivated. After passivation, electrostatic powder coating shall be used. Powder should meet



## PURCHASE SPECIFICATION LT SWITCHGEAR

PS-439-LT SWITCHGEAR

REV NO: 00

PAGE : 9 OF 10

requirements of IS 13871 (powder coating specification). Finishing paint shade for complete panels excluding end covers shall be RAL9002 & RAL5012 for extreme end covers of all boards, unless required otherwise by the employer. The paint thickness shall not be less than 50 microns.

### 4.0 MCCB

- a. MCCB shall be fixed type module, air break type, having trip free mechanism with quick make and quick break type contacts. MCCB shall have current limiting feature. MCCB of identical ratings shall be physically and electrically interchangeable. MCCB shall be provided with 1 NO and 1NC auxiliary contacts.
- b. MCCB shall have inbuilt front adjustable releases (overload & short circuit) and shall have adjustable earth fault protection unit also. The protection settings shall have suitable range to achieve the required time & current settings. LED indications shall also be provided for faults, MCCB status (on/off etc).
- C. MCCB terminals shall be shrouded and designed to receive cable lugs for cable sizes relevant to circuit rating. Extended cable terminal arrangement for higher size cable may also be offered. ON and OFF position of the operating handle of MCCB shall be displayed and the rotary operating handle shall be mounted on the door of the compartment housing MCCB. The compartment door shall be interlocked mechanically with the MCCB, such that the door can not be opened unless the MCCB is in OFF position. Means shall be provided for defeating this interlock at any time. MCCB shall be provided with padlocking facility to enable the operating mechanism to be padlocked. The MCCBs being offered shall have common/interchangeable accessories for all ratings like aux. switch, shunt trip, alarm switch etc. The MCCBs shall have the current discrimination up to full short circuit capacity and shall be selected as per manufacturer's discrimination table.

### 5.0 FUSES

- 5.1 All fuses shall be of HRC cartridge fuse link type. Screw type fuses shall not be accepted. Fuses for AC circuits shall be rated for 80kA rms (prospective) breaking capacity at 415V AC and for DC circuits, 20kA rms breaking capacity at 240V DC.
- 5.2 Fuse shall have visible operation indicators. Insulating barriers shall be provided between individual power fuses.



## **PURCHASE SPECIFICATION LT SWITCHGEAR**

PS-439-LT SWITCHGEAR

REV NO: 00

PAGE : 10 OF 10

- 5.3      Fuse shall be mounted on insulated fuse carriers, which are mounted on fuse bases. Wherever it is not possible to mount fuses on carriers, fuses shall be directly mounted on plug-in type of bases. In such cases one set of insulated fuse pulling handles shall be supplied with each switchboard.
- 5.4      The Neutral links shall be mounted on fuse carriers which shall be mounted on fuse bases.

### **6.0 DERATING OF COMPONENTS**

The Bidder shall, ensure that the equipment offered will carry the required load current at site ambient conditions specified and perform the operating duties without exceeding the permissible temperature as per Indian Standards / Specification. Continuous current rating at 50 deg C ambient in no case shall be less than 90% of the normal rating specified.

The Bidder shall indicate clearly the derating factors if any employed for each component and furnish the basis for arriving at these derating factors duly considering the specified current ratings and amb. Temperature of 50 deg C



# SAFETY PLAN

PROJECT- 100 MW Floating Solar Project ,NTPC, Ramagundam

Doc ref. No. :BHE:NTPC RDM:HSE:01\_Rev00 dated 25.11.2019  
Rev01 dated 15.01.2020



Prepared : N RABINDRABABU SAFETY OFFICER/QUEST

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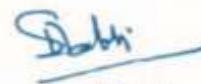
Approved : M SREENATH AGM/BHEL-EDN

# HEALTH SAFETY ENVIRONMENT POLICY



In BHEL, Health, Safety and Environment (HSE) responsibilities are driven by our commitment to protect our employees and people we work with, community and environment. BHEL believes in zero tolerance for unsafe work/non-conformance to safety and in minimizing environmental footprint associated with all its business activities. We commit to continually improve our HSE performance by:

- Developing safety and sustainability culture through active leadership and by ensuring availability of required resources.
- Ensuring compliance with applicable legislation, regulations and BHEL systems.
- Taking up activities for conservation of resources and adopting sound waste management by following Reduce/Recycle/Reuse approach.
- Continually identifying, assessing and managing environmental impacts and Occupational Health & Safety risks of all activities, products and services adopting approach based on elimination/ substitution/reduction/control.
- Incorporating appropriate Occupational Health, Safety and Environment criteria into business decisions, design of products & systems and for selection of plants, technologies and services.
- Imparting appropriate structured training to all persons at workplace and promoting awareness amongst customers, contractors and suppliers on HSE issues.
- Reviewing periodically this policy and HSE Management Systems to ensure its relevance, appropriateness and effectiveness.
- Communicating this policy within BHEL and making it available to interested parties.



Atul Sobti  
Chairman & Managing Director

June 5, 2018

Creating  of tomorrow  
**BHARAT HEAVY ELECTRICALS LIMITED**



## CONTENTS

Sr. No.	Description
1.0	INTRODUCTION
2.0	APPLICATION
3.0	TERMINOLOGIES
4.1	ROLES AND RESPONSIBILITIES.
4.2	SAFETY OFFICER (SAFETY OFFICER)
4.3	ALL EMPLOYEES
5.0	SITE INCHARGE OF SUBCONTRACTOR
5.1	DEPLOYMENT OF TOOLS & PLANTS
5.2	DEPLOYMENT OF MANPOWER
5.3	PROVISION OF PPEs
5.4	PROVISION OF INFRASTRUCTURE
6.0	SAFETY TRAINING & AWARENESS
7.0	SAFETY COMMUNICATION
8.0	OPERATIONAL CONTROL
8.1	EXCAVATION SAFETY
9	WORK PERMIT
10	HOUSE KEEPING



11	WASTE MANAGEMENT
12	WARNINGS & SIGNS
13	EMERGENCY PREPAREDNESS
14	FIRE SAFETY PROCEDURE
15	CONTROL OF DOCUMENTS
16	SAFETY INSPECTION
17	MONTHLY SAFETY REVIEW MEETING
18	TYPICAL DETAILS OF FLOATING SOLAR POWER PLANT
19	ANNEXURES 1. Formats to be used at site 2. JSA (HIRAs) for PV floating system work, Tree felling and clearance work



## 1.0

## INTRODUCTION

The purpose of this Safety Plan is to provide for the systematic identification, evaluation, prevention and control of general workplace hazards, specific job hazards, potential hazards and environmental impacts that may arise from foreseeable conditions during execution of the 100 MW Floating Solar Project.

This document shall be followed by Client's Sub-Contractors at all installation and servicing sites. In case customer specific documents are to be referred, the same will be followed in conjunction with this document.

## 2.0 APPLICATION

The document is applicable for execution of the 100 MW Floating Solar Project and it is expected that Client and Sub-contractor are committed to the following guidelines:

- Ensure that the Health and Safety of all persons at work site is not adversely affected by the work.
- Ensure protection of environment at the worksite.
- Ensure compliance at all times with the relevant statutory and contractual Safety requirements.
- Provide trained, experienced and competent personnel. Ensure medically fit personnel only are engaged at work.
- Provide and maintain plant, places and systems of work that are safe and without risk to health and the environment.
- Provide all personnel with adequate information, instruction, training and supervision.
- Effectively control, co-ordinate and monitor the activities of all personnel on the Project sites including contractors in respects of Safety.
- Establish effective communication on SAFETY matters with all relevant parties involved in the Project works.
- Ensure that all work planning takes into account all persons that may be affected by the work.
- Ensure fitness testing of all T&Ps. Lifting appliances like cranes, chain pulley blocks etc. are to be certified by competent authority.
- Ensure timely provision of resources to facilitate effective implementation of SAFETY requirements.
- Ensure continual improvements in SAFETY performance
- Ensure conservation of resources and reduction of wastage.
- Capture the data of all incidents including near misses, process deviation etc. Investigate and analyze the same to find out the root cause.
- Ensure timely implementation of correction, corrective action and preventive action.



### **3.0 TERMINOLOGIES**

#### **INCIDENT**

Work- related event(s) in which an injury or ill health (regardless of severity) or fatality occurred, or could have occurred.

#### **NEAR MISS**

An incident where no ill health, injury, damage or other loss occurs, but it had a potential to cause, is referred to as “Near-Miss incident”.

#### **MAN-HOURWORKED**

The total number of employee hours worked by all employees including subcontractors working in the premises. It includes managerial, supervisory, professional, technical, clerical and other workers including contract labors. Man-hours worked shall be calculated from the payroll or time clock recorded including overtime. When this is not feasible, the same shall be estimated by multiplying the total man-days worked for the period covered by the number of hours worked per day. The total number of workday for a period is the sum of the number of men at work on each day of period. If the daily hours vary from department to department separate estimate shall be made for each department and the result added together.

#### **FIRST AID CASES**

First aids are not essentially all reportable cases, where the injured person is given medical treatment and discharged immediately for reporting on duty, without counting any lost time. Please refer Format 03 for requirement of items with respect to treatment for First Aid Cases.

#### **LOST TIME INJURY**

Any work injury which renders the injured person unable to perform his regular job or an alternative restricted work assignment on the next scheduled work day after the day on which the injury occurred.

#### **MEDICAL CASES**

Medical cases come under non-reportable cases, where owing to illness or other reason the employee was absent from work and seeks Medical treatment.



## **TYPE OF INCIDENT / ACCIDENT & THEIR REPORTING:**

The three categories of Incident / accident are as follows:

### **Non-Reportable Cases:**

An accident, where the injured person is given medical help and discharged for work without counting any lost time.

### **Reportable Cases:**

In this case the injured person is disabled for 48 hours or more and is not able to perform his duty.

### **Injury Cases:**

These are covered under the heading of non-reportable cases. In these cases the accident caused injury to the person, but he still continues in his duty.

## **TOTAL REPORTABLE FREQUENCY RATE**

Frequency rate is the number of Reportable Lost Time Injury (LTI) per one Million Man hours worked. Mathematically, the formula read as:

$$\frac{\text{Number of Reportable LTI}}{\text{Total Man Hours Worked}} \times 1,000,000$$

## **SEVERITY RATE**

Severity rate is the Number of days lost due to Lost Time Injury (LTI) per one Million Man hours worked. Mathematically, the formula reads as:

$$\frac{\text{Days lost due to LTI}}{\text{Total Man Hours Worked}} \times 1,000,000$$

## **INCIDENCE RATE**

Incidence Rate is the Number of LTI per one thousand manpower deployed.



Number of LTIx1000

Average number of manpower deployed

MANAGEMENT REPRESENTATIVE: Representative from Project Head

OCP: Operation Control Procedures

PPE: Personal Protective Equipment



## **4.0 ROLES & RESPONSIBILITIES**

### **4.1 SAFETY OFFICER**

- Carry out safety inspection of Work Area, Work Method, Men, Machine & Material, and other tools and tackles. Record observations as per Format 01 on a weekly basis.
- Facilitate inclusion of safety elements into Work Method Statement.
- Highlight the requirements of safety through Tool-box / other meetings.
- Conduct investigation of all accident/dangerous occurrences & recommend appropriate safety measures.
- Advice & co-ordinate for implementation of SAFETY permit systems & OCPs. Convene SAFETY meeting & minute the proceedings for circulation & follow-up action.
- Plan procurement of PPE & Safety devices and inspect their healthiness.
- Facilitate administration of First-Aid
- Facilitate screening of workmen and safety induction.
- Conduct fire drill and facilitate emergency preparedness
- Design campaigns, competitions & other special emphasis programs to promote safety in the workplace.
- Notify site personnel for non-conformance to safety norms observed during site visits / site inspections.
- Recommend to Site In charge for immediate discontinuance of work until rectification, of such situations warranting immediate action in view of imminent danger to life or property or environment.
- To decline acceptance of such PPE / safety equipment that do not conform to specified requirements.
- Encourage raising Near Miss Report on safety along with, improvement initiatives on safety.

### **4.2 ALL EMPLOYEES**

- To adopt safe working practices
- To take corrective action and preventive action in case any non-conformity is observed on product / process / system with respect to Occupational Health, Safety and Environment.
- To report all incidents including near miss to SAFETY officer or SAFETY coordinator.
- In case any particular activity / work has extremely high consequential risk or high environmental impact, the employee



shall bring it to the notice of Site In charge before starting the work.

- To ensure that the workers are engaged by the contractor for the job after undergoing induction training.
- To ensure that the persons engaged in his area, follow the safety rules like using appropriate PPEs.
- To get involved in exercises like Job Safety Analysis and Work Permit System.
- To engage licensed electricians for site electrical works.
- To report any incident including near misses or safety lapses immediately to safety officer/SAFETY coordinator
- To support/co-operate with audit team members as & when safety audits are carried out.
- To involve in investigation, if any incident occurs in his work area.
- To participate in safety promotional programmers'.
- To attend the safety committee meeting, if he is a member/invitee
- To ensure that only suitable Tackles & Plants and qualified persons are engaged.

## 5.0 SUB-CONTRACTOR REPRESENTATIVE AT SITE

- Shall fill-up agreement form for compliance to relevant SAFETY Plan for Site Operations.
- Shall ensure fulfillment of relevant safety requirements of 100 MW floating solar Project and practice very strictly in his area of work in consultation with his concerned engineer and the safety officer.
- Shall screen all workmen for health and competence requirement before engaging for the job and periodically thereafter as required.
- Shall not engage any employee below 18 years.
- Shall arrange for all necessary PPEs like life jackets, safety helmets, belts, safetyshoes, face shield, high visibility vest, hand gloves etc. before starting the job. Shall ensure that no working men/women carry excessive weight more than stipulated in BOCW Rules and Regulations.
- Shall ensure that all Tackles & Plants engaged are tested for fitness and have valid certificates from competent authorities.
- Shall adhere to the instructions laid down in Operation Control Procedures (OCPs Point No 8)
- Shall ensure that person working above 3.3 meter should use Safety Harness tied to a life line/stable structure.
- Shall ensure that materials are not thrown from height. Caution to be exercised to prevent fall of material from height.
- Shall report all incidents (Fatal/Major/Minor/Near Miss) to the Site engineer /SAFETY officer of the 100 MW floating solar Project.
- Shall ensure that adequate illumination is arranged during night



work.

- Shall ensure that all personnel working under subcontractor are working safely and do not create any Hazard to self and to others.
- Shall ensure display of adequate signage/posters on HSE.
- Shall ensure that mobile phone is not used by workers while working.
- Shall ensure conductance of mock drill, induction training and training on the site.
- Shall ensure good housekeeping.
- Shall ensure adequate valid fire extinguishers are provided at the worksite.
- Shall adequate drinking water at work site.
- Shall ensure adequate emergency preparedness.

## 5.1 DEPLOYMENT OF TOOLS & PLANTS

- As a measure to ensure that machinery, equipment and tools being mobilized to the construction site are fit for purpose and are maintained in safe operating condition and complies with legislative and owner requirement, inspection shall be arranged by in-house competent authority for acceptance as applicable.
- The machinery and equipment to be employed for this purpose shall include but not limited to the following:
  - Mobile cranes.
  - Side Booms.
  - Forklifts.
  - Grinding machine.
  - Drilling machine.
  - Air compressors.
  - Welding machine.
  - Generator sets.
  - Dump Trucks, tractors.
  - JCBs, Excavators.
  - Hand tools.
  - Road Rollers
  - Vibration Compactors
  - Boring Machine
  - Chipping Machines
  - Hammer Machines
  - Breakers

## 5.2 DEPLOYMENT OF MANPOWER

- As a measure to ensure that manpower being mobilized to the construction site is fit and competent for safe working, screening arrangement shall be made by the sub-contractors to fulfill contractual as well as legislative requirement.



- Examination of medical fitness shall be conducted through qualified medical professional for all workers to be deployed.
- Gate pass is linked with medical check-up fitness certificate and compulsory completion of safety induction training. For under water works valid diving certificates are compulsory.

### 5.3 DEPLOYMENT OF PPEs

The following matrix recommends usage of minimum PPEs against the respective job. The PPEs shall conform to the relevant standards as listed in the reference under clause 3.0 and bear ISI mark. All the PPEs shall be periodically checked for its quality before issue. The users shall be advised to check the PPEs themselves for any defect before putting on. The defective ones shall be repaired/ replaced. The issuing agency shall maintain register for issue and receipt of PPEs. The Helmets shall have logo or name (abbreviation of agency name permitted) affixed or printed on the front. The body harnesses shall be serial numbered

S.no	Type of work	PPEs (Subject to applicability of process)
1	Concrete, asphalt mixing	Nose mask, hand glove, apron and gum boot
2	Welders/Grinders/ Gas cutters	Welding/face screen, apron, hand gloves. Helmet fitted with welding shield is preferred for welders
3	Stone/ concrete breakers	Safety goggles, hand gloves
4	Electrical Work	Rubber hand glove, Electrical Resistance shoes
5	Insulation Work	Hand gloves
6	Work at height	Double lanyard full body harness, Fall arrestor (specific cases)
7	Grit/Sand blasting	Blast suit, blast helmet, gloves
8	Painting	Plastic gloves, respirator for spray Painting)
9	Work on water for PV floaters, floating system	Life jackets, Rescue Boat with trained rescue team.
10	Work in water for anchoring and mooring system	SCUBA apparatus, Rescue Boat with trained rescue team

Rescue boat with trained and authorized boat operators with rescue team shall be available at site all the time till all persons involved reach the shore.

Besides the PPEs mentioned above, the persons shall use helmet and safety shoe. The visitors shall be issued Helmet and any other PPEs as deemed appropriate for use in the area of work.

#### Color Code for Helmets:



1. Workmen: Yellow.
2. Safety staff: Green.
3. Engg, supervisor, visitor, site in charge : White.

## **MEDICAL FACILITIES**

### **FIRST AID PROVIDER**

- Every injury shall be treated, recorded and reported.
- Refresher course on first aid shall be conducted as necessary.
- List of qualified first aiders and their contact numbers should be displayed at major locations.

### **FIRST AID BOX**

- 
- First aid facilities shall be provided and maintained.
- The first aid box shall be kept by first aider who shall always be readily available during the working hours of the work place. His name and contact number to be displayed on the box.
- The first aid box shall be distinctly marked with a Red Cross on white background.
- Details of contents of first aid box is given in Format No.02
- Monthly inspection of First Aid Box shall be carried out by the Site In charge as per format no 02.

### **HEALTH CHECKUP**

The persons engaged at the site shall undergo health checkup as per the **format no 03** before induction.

- a. Height workers
- b. Drivers/crane operators/riggers
- c. Confined space workers
- d. Shot/sandblaster
- e. Welding and NDE personnel.



## **PROVISION OF EMERGENCY VEHICLE**

- In case of any emergency a vehicle shall be made available at workplace on short notice to handle any emergency. This shall be by way of tying up with customer's medical centre /local hospitals/ sub-contractors by mutual aid agreement.



## 6.0 SAFETY TRAINING & AWARENESS

### **SAFETY INDUCTION TRAINING**

All persons entering into project site shall be given SAFETY induction training by the SAFETY officer of 100 MW floating solar Project.

In-house induction training subjects shall include but not limited to:

- Briefing of the Project .
- Safety objectives and targets.
- Site SAFETY rules.
- Site SAFETY hazards
- First aid facility.
- Emergency Contact No.
- Accident reporting.
- Fire prevention and emergency response.
- Proper safety wear & gear must be issued to all the workers being registered for the induction.
- They must arrive fully dressed in safety wear & gear to attend the induction.
- Any one failing to conform to this safety wear& gear requirement shall not qualify to attend.
- Each employee shall undergo safety induction training
- 

### **TOOL BOX TALK**

- Tool Box talk shall be conducted by safety officer to work groups prior to the start of work. The agenda shall consist of the following:
- Details of the job being intended for immediate execution.
- The relevant hazards and risks involved in executing the job and their control and mitigating measures.
- Specific site condition to be considered while executing the job like high temperature, humidity, unfavorable weather etc.
- Recent non-compliances observed.
- Appreciation of good work done by any person.
- Record of Tool box talk shall be maintained as per format no 06

### **TRAINING ON HEIGHT WORK**

Training on height work shall be imparted to all workers working at height by in- house/external faculty. The training shall include following topics:



- Use of PPEs
- Use of fall arrester, life line.
- Safe climbing through monkey ladders.
- Inspection of PPEs.
- Medical fitness requirements.
- Mock drill on rescue at height.

### **SAFETY PROMOTION-SIGNAGE, POSTERS,**

#### **Display of SAFETY posters and banners.**

- Site shall arrange appropriate posters, banners, slogans in local/Hindi/,English languages at workplace

#### **Display of SAFETY signage**

- Appropriate SAFETY signage shall be displayed at the work area to aware workmen and passersby about the work going on and do's and don'ts to be followed.

### **SAFETY awareness program/SAFETY training program**

- Site will arrange SAFETY awareness program periodically on different topics including medical awareness for all personnel working at site.
- SAFETY officer shall arrange training program based on site condition

## **7.0 SAFETY COMMUNICATION**

### **MONTHLY SAFETY REPORTING**

- SAFETY information of Site shall be reported monthly through Monthly Site SAFETY report (MSR) as per format 04
- The period of reporting shall be 1st of each calendar month.



## 8.0 OPERATIONAL CONTROL

### 8.1 EXCAVATION WORK SAFETY:

- Avoid damage / personal injury during excavation work at sites.
- Ensure proper barricading by ribbon or Hard barricading of the excavated area.
- Proper side slopes of the excavation as per the type of soil should be maintained.
- Where side slopes cannot be provided due to space constraints before excavation, sheet piling must be done to prevent the collapse of earth.
- As soon as the job is completed, immediate back filling to be done.
- No personnel be allowed within the swing area of mechanical excavator when work is in progress.
- Proper lighting to be arranged when the excavation is carried out at night.
- Excavated earth to be dumped/ stored in a designated place only.
- Surplus earth to be transported and disposed in the authorized area.
- Site safety department to identify all possible hazard areas related to excavation work and ensure control.
- Use proper PPE's.
- Ensure adequate caution signs are displayed in the area of operation.

## 9..WORK PERMIT SYSTEM

- The following activities shall come under Work Permit System
  - a. Height working of 3.3 metre and above
  - b. Excavation more than 4 meter depth
  - c. Heavy lifting by machinery
  - d. Works of floaters involving activity in water other than shore
- "SAFETY Procedure for Work Permit System" shall be followed while implementing permit system.
- Permit applicant shall apply for work permit of particular work activity at particular location before starting of the work with Job Hazard Analysis.
- Permit signatory shall check that all the control measures necessary for the activity are in place and issue the permit to the permit holder.
- Permit holder shall implement and maintain all control measures during the period of permit  
He will close the permit after completion of the work. The closed permit shall be archived with SAFETY personnel of site.



- Permission for Works in water shall be permitted after checks related to compliance to wearing PPEs, availability of safety boat

## **10. HOUSEKEEPING**

- Proper housekeeping to be maintained at work place and the following are to be taken care of on daily basis.
- All surplus earth and debris are removed/disposed off from the working areas to identified locations.
- Unused/Surplus cables, steel items and steel scrap lying scattered at different places/elevation within the working areas are removed to identified locations.
- All wooden scrap, empty wooden cable drums and other combustible packing materials, shall be removed from workplace to identified locations. Sufficient waste bins shall be provided at different work places for easy collection of scrap/waste. Scrap chute shall be installed to remove scrap from higher location.
- Access and egress (stair case, gangways, ladders etc.) path should be free from all scrap and other hindrances.
- Workmen shall be educated through tool box talk about the importance of housekeeping and encourage not to litter.
- Fabricated steel structures, pipes & piping materials shall be stacked properly.
- No parking of trucks/trolleys, cranes and trailers etc. shall be allowed in the camp, which may obstruct the traffic movement as well as below LT/HT power lines.
- Utmost care shall be taken to ensure over all cleanliness and proper upkeep of the working areas.

## **11. WASTE MANAGEMENT**

### **STORAGE AND COLLECTION**

- Different types of rubbish/waste should be collected and stored separately.
- Paper, oily rags, smoking material, flammable, metal pieces should be collected in separate bins with close fitting lids.
- Rubbish should not be left or allowed to accumulate on construction and other workplaces.
- Construction rubbish should not be burnt near working site.

### **SEGREGATION**

- Earmark the scrap area for different types of waste.



- Store wastes away from building.
- Oil spill absorbed by non-combustible absorbent should be kept in separate bin.
- Clinical and first aid waste stored and incinerated separately.

## **DISPOSAL**

- Sufficient containers and scrap disposal area should be allocated.
- All scrap bin and containers should be conveniently located.
- Provide self-closing containers for flammable/spontaneously combustible material.
- Keep drainage channels free from choking.
- Maintain a schedule for collection and disposal of waste.

## **12. WARNING AND SIGNS**

- Appropriate sign to be displayed at scrap storage area
- No toxic, corrosive or flammable substance to be discarded into public sewage system.
- Waste disposal shall be in accordance with best practice.

## **13.0 :EMERGENCY PREPAREDNESS AND RESPONSE**

- Emergency preparedness and response capability of site shall be developed as per project requirement.
- Availability of adequate number of first aid providers and fire fighters shall be ensured by sub-contractors
- Assembly point shall be earmarked and access to the same from different location shall be shown
- Fire exit shall be identified and pathway shall be clear for emergency escape in Stores area and office area.
- Appropriate type and number of fire extinguishers shall be deployed as per fire extinguisher deployment plan of BHEL and validity shall be ensured periodically through inspection
- First aid boxes shall be strategically placed at work places to cater to emergency needs.

## **14.0: FIRE SAFETY PROCEDURE**

1. Site-in-charge / Safety Officer will make periodical review of the site Fire Protection, Prevention Preparedness, Site conditions and available fire protection equipment.
2. A mutual aid agreement with local Fire station for availability of Fire tender shall be made.



3. It is very imperative good contact with Local fire station for availability of Fire tender in case of emergencies, in addition to their own fire equipment.
4. Fire Protection, Prevention and Preparedness Inspections - The Contractor /Sub-Contractor will be required to make frequent fire prevention inspections of his work site and operating facilities. Deficiencies will be corrected at once.
5. Emergency telephone number to be displayed at all important places.

## **15. CONTROL OF DOCUMENTS**

All documents shall be controlled as per SAFETY Procedure for Document Control and On water, in water have maintain required documents, certificates.

## **16.0 SAFETY INSPECTION**

Inspection on SAFETY for different activities being carried out at site shall be done to ensure compliance to safety requirements. Before start the work ensure all required PPEs on water, in water and other working locations.

## **DAILY SAFETY CHECKS**

Both the Site Supervisors and SAFETY Supervisors are to conduct daily site safety inspection around work activities and premises to ensure that work methods and the sites are maintained to the acceptable standard.

## **INSPECTION OF PPE**

- PPEs shall be inspected by SAFETY officer at random once in a week as per **Format no 07** for its compliance to standard and compliance to use and any adverse observation shall be recorded in the PPE register.
- The applicable PPEs for carrying out particular activities are listed below.
- The IS standard to be complied to, for different PPEs, is given as follows:

## **RELEVANT IS-CODES FOR PERSONAL PROTECTION**

IS: 2925 – 1984	Industrial Safety Helmets.
IS: 4770 – 1968	Rubber gloves for electrical purposes.
IS: 5557 – 1969	Industrial and Safety rubber knee boots.
IS: 5983 – 1978	Eye protectors.
IS: 9167 – 1979	Ear protectors.
IS: 3521 – 1983	Industrial Safety Belts and Harness
IROS (or MMD)	Life jackets/Vests



## **INSPECTION OF Tools & Plants**

- A master list of Tools & Plants shall be maintained by each subcontractor.
- All Tools & Plants being used at site shall be inspected by SAFETY officer once in a month as per Format no 08 for its healthiness and maintenance.
- The Tools & Plants which require third party inspection shall be checked for its validity during inspection.
- The certificate of Tools & Plants shall be monitored as per Format no 09

## **INSPECTION OF CRANES AND WINCHES**

- Cranes and winches shall be inspected by the operator through a daily checklist for its safe condition (as provided by the equipment manufacturer) before first use of the day.
- Cranes and Winches shall be inspected by SAFETY officer once in a month as per format no 10 for healthiness, maintenance and validity of third party inspection and SWL shall be displayed.
- The date of third party inspection and next due date shall be painted on cranes and winches.

## **INSPECTION ON HEIGHT WORKING (ONLY FOR CMCS AS APPLICABLE)**

- Inspection on height working shall be conducted by SAFETY Coordinator of Construction agency before start of work to ensure safe working condition including provision of
  - Safety Harness
  - Fencing and barricading
  - Warning signage
  - Covering of opening
  - Proper scaffolding with access and egress.
  - Illumination
- Inspection on height working shall be conducted once in a week by SAFETY officer as per format no 11
- Height working shall not be allowed during adverse weather.

## **INSPECTION ON ELECTRICAL INSTALLATION /APPLIANCES**

- Ensure proper earthing in electrical installation. Verify values per month.
- Use ELCB with 30 mille amps sensitivity at electrical booth.
- Electrical installation shall be properly covered at top where required
- Use appropriate PPEs while working
- Use portable electrical light < 24 V in confined space and potentially wet area.



- Monthly inspection shall be carried out for all ELCBs/RCCBs.

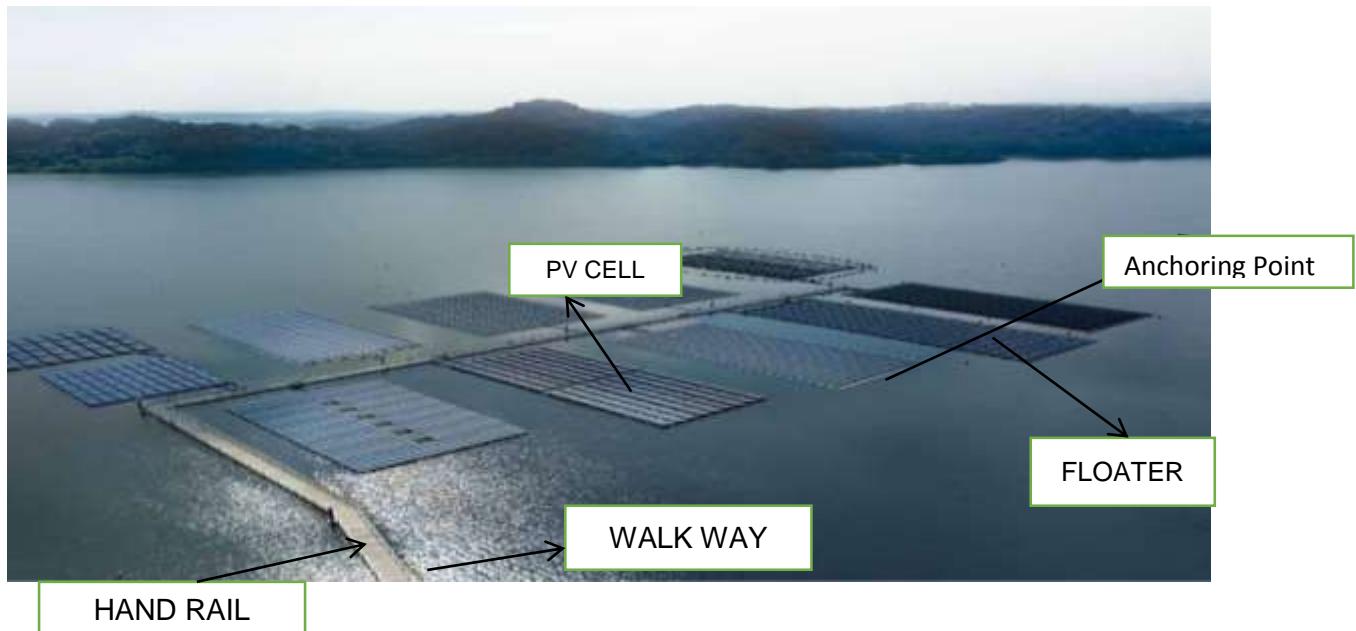
## 17. MONTHLY SAFETY REVIEW MEETING

- Site shall hold SAFETY review meeting every month to discuss and resolve SAFETY issues of site and improve SAFETY performance. It will also discuss the incidents occurred since previous meeting its root cause and corrective action and preventive action.
- The meeting shall be chaired by Site In charge, convened by SAFETY coordinator and attended by all HOS, Site In charge of Subcontractors and SAFETY representative of Subcontractors.
- MOM on the discussion will be circulated to the concerned for implementation.

## 18.0 TYPICAL DEPICTION OF FLOATING SOLAR PV SYSTEM (FOR GENERAL REFERENCE)

### FLOATING SOLAR POWER ERECTION SAFETY

(Floating platform Under construction)





(Typical View of completed Solar PV Floating platform)

### SYSTEM COMPONENTS:

1. Solar PV modules for conversion of solar radiation to electrical energy/
2. Anchoring systems: Anchoring system refers to permanent under-water structure to secure floating platforms.
3. Pontoon: A pontoon is floatation device with enough buoyancy to float by itself as well as with a heavy load.
4. Floats: Multiple plastic hollow floats with effective buoyancy to self-weight ratio are combined over and over again, forming a giant pontoon. The floats are typically made of HDPE (high density polyethylene), known for its tensile strength, maintenance free property.
5. Mooring system: A mooring system usually refers to any permanent structure on the banks to which floats are secured.
6. Cables and connectors: Electricity is drawn from the solar array and transported to the land. Therefore, the power can be fed to the grid or stored in batteries.

### RISKS AND HAZARDS:

1. Identified as per Job Risk Assessment exercise and HIRA Doc 1 and 2 attached.

### PRECAUTIONS:

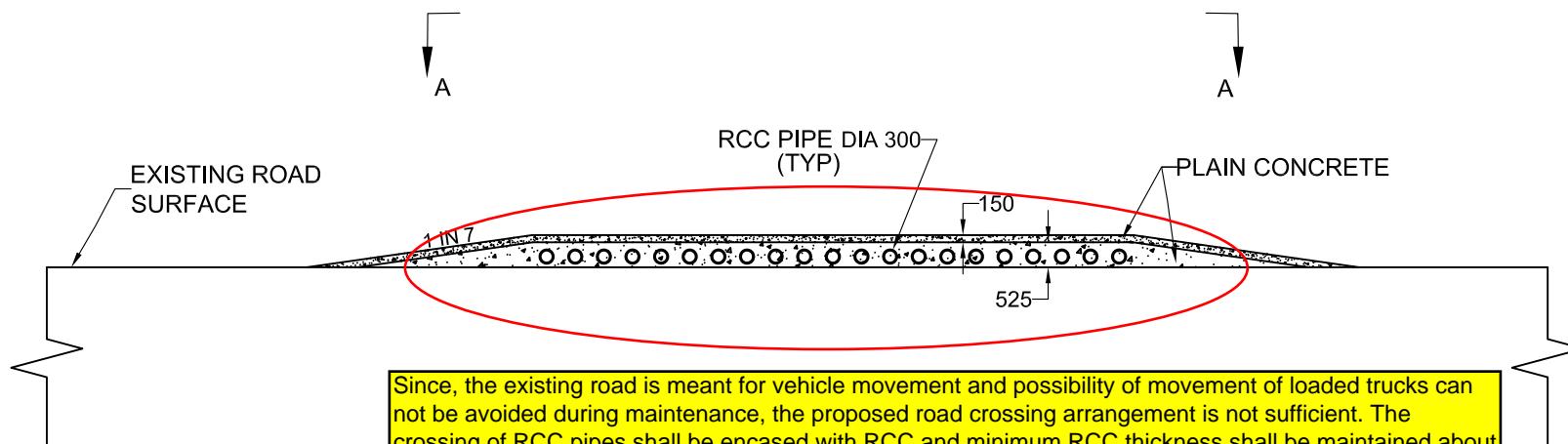
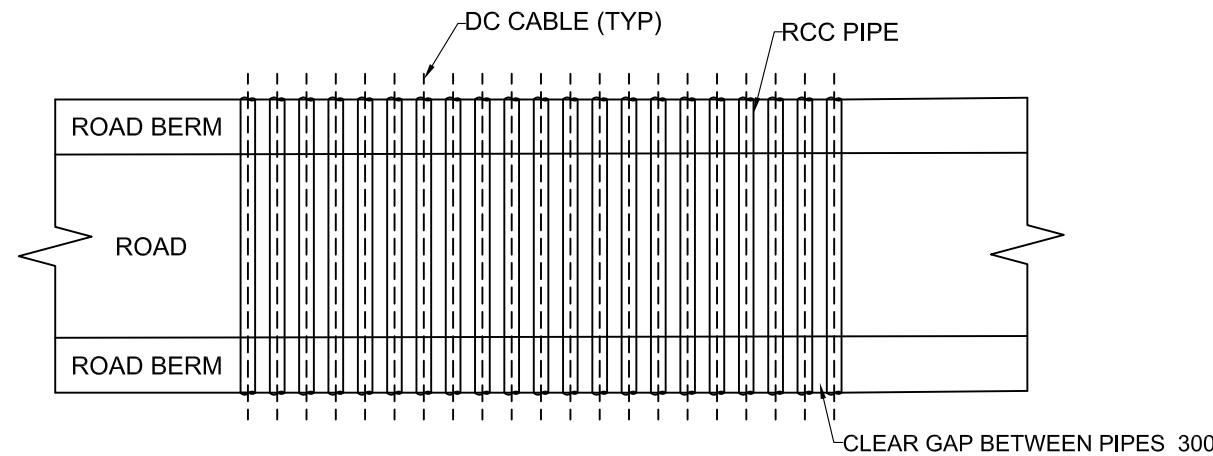
1. As mentioned in HIRA Doc 1 and 2.

## 19.0 SITE RECORDING FORMATS

\*\*\*\*\*

This is hume pipe arrangement for DC cable. For Ramagundam project, similar arrangement shall be adapted for HT cable crossing over the bund. Please incorporate the comments mentioned by NTPC (Highlighted in yellow)

NOTE: 1. ALL DIMENSIONS ARE IN MM



Since, the existing road is meant for vehicle movement and possibility of movement of loaded trucks can not be avoided during maintenance, the proposed road crossing arrangement is not sufficient. The crossing of RCC pipes shall be encased with RCC and minimum RCC thickness shall be maintained about the pipes for their safety.

TYP. DETAIL OF DC CABLES ROAD CROSSING  
ARRANGEMENT ON BUND

## UNPRICED PRICE BID (TO BE SUBMITTED WITH TECHNO-COMMERCIAL BID)

### Bill of Quantity (BOQ) Cum Rate Schedule

BOQ for (BOS2) of 100MW (AC) Floating Solar Photovoltaic Grid-connected Power plant for NTPC at Ramagundam							
#	Bidder scope of supply and works (as briefly outlined)	Qty	Unit	Unit Rate (Excluding GST)	TOTAL Amount	% GST 	Item billed to Edn/Nodal
1	Supply of FRP/Aluminium ladder type cable tray with cover and supporting arrangement consisting of mounting bar and clamp with SS 304 hardware for clamping with HDPE floaters – 300mm wide	12700	meter	608	77,15,250		Nodal
2	Supply of FRP/Aluminium ladder type cable tray with cover and supporting arrangement consisting of mounting bar and clamp with SS 304 hardware for clamping with HDPE floaters – 600mm wide	7700	meter	990	76,23,000		Nodal
3	Supply of double compression weatherproof metallic cable gland, bi-metallic strip or washer, SS304 hardware for 400 sq.mm cable- For PCU DC & AC side, Transformer LV side	3550	set	760	26,96,580		Nodal
4	Supply of double compression weatherproof metallic cable gland for 33KV(E), 1CX150 sq.mm cable	480	Nos	1,575	7,56,000		Nodal
5	Supply of double compression weatherproof metallic cable gland for 33KV(E), 1CX630 sq.mm cable	75	Nos	1,845	1,38,375		Nodal
6	Supply of 30KVA, 380V/ 415V, dYN11 Dry Type transformer with IP 54 or higher rated outdoor enclosure(Corrosion resistant) with stand and accessories (Including lugs and glands for input and output side cables at both ends)	1	Set	85,500	85,500		EDN

7	Supply of 1.1KV, 3.5CX25 sq.mm XLPE aluminium armoured cable – From Aux Transformer to CMCS and PCU to Aux transformer	1500	meter	203	3,03,750		Nodal
8	63 mm, 6kg/sq.cm HDPE pipe for 1.1kV, 3.5CX25 sq.mm cable	200	m	113	22,500		
9	Supply of Hume pipes (NP 2 or above, dia 300mm) for HT cable crossing over the reservoir bund	32	m	1,350	43,200		Nodal
10	Supply of outdoor ladder type cable tray (Aluminium / FRP) with mounting arrangements for HT cables on sloping sides of the reservoir bund	100	m	765	76,500		Nodal
11	Supply of trefoil clamps (Non corrosive) for entire HT cables laying	1	set	9,00,000	9,00,000		
12	Supply of indoor cable termination kit for 33KV(E),1CX150 sq.mm cable	480	Nos	5,850	28,08,000		Nodal
13	Supply of indoor cable termination kit for 33KV(E), 1CX630 sq.mm	75	Nos	8,100	6,07,500		Nodal
14	Supply of outdoor straight through joint kits for 33KV(E), 1CX150 sq.mm cable	25	Nos	38,250	9,56,250		Nodal
15	Supply of outdoor straight through joint kits for 33KV(E), 1CX630 sq.mm cable	60	Nos	43,650	26,19,000		Nodal
16	Supply of wall mounted LT switchgear for CMCS (With energy meter)	1	No	1,35,000	1,35,000		Nodal
17	Supply of UPS systems (5 KVA), with 1 hour backup, UPSDB and Ni-Cd type battery bank (Comprising of 2 x100% redundancy for Battery and Charger)	5	set	4,27,500	21,37,500		EDN
18	Supply of UPS systems (3 KVA),with 30 mins backup, UPSDB and Ni-Cd type battery bank (Comprising of 2 x100% redundancy for Battery and Charger)	37	sets	2,92,500	108,22,500		Nodal
19	Outdoor IP54 or higher enclosure for housing UPS and battery bank at final evacuation point (IC-OG panels)	1	No	67,500	67,500		Nodal

20	Supply of weather monitoring system (WMS)	1	set	9,00,000	9,00,000		Nodal
21	Supply of furniture for CMCS room	1	set	6,75,000	6,75,000		Nodal
22	Supply of fire-fighting and alarm system for CMCS	1	Set	4,05,000	4,05,000		Nodal
23	Supply of outdoor fire-fighting system for IFP & LPSFP	40	sets	1,35,000	54,00,000		Nodal
24	Supply of earthing system for inverter platform (Below water- Including hardware, bare down conductor as per standards, earthing rod etc)	36	set	1,35,000	48,60,000		Nodal
25	Supply of earthing system for Local Pooling Switchgear Floating Platform (LPSFP) (Below water- Including hardware, bare down conductor as per standards, earthing rod etc)	4	set	1,35,000	5,40,000		Nodal
26	Supply of earthing system for IC-OG panels as per Annexure "Earthing system specification"	1	set	1,35,000	1,35,000		Nodal
27	Supply of earthing system for CMCS as per Annexure "Earthing system specification"	1	set	1,35,000	1,35,000		
28	Supply of control, instrumentation and aux power cable for connecting 40 Nos of PCUs, 40 Nos of inverter Transformer, 90 Nos of HT panels, 42 Nos of UPS, 42 Nos of SCADA panel, 1 No WMS, 40 Nos of wireless transmitter system from SCADA panel on floating platform, 1 set of wireless receiver system at CMCS, 1 No Fire Alarm system at CMCS etc.	1	set	36,00,000	36,00,000		Nodal
29	Supply of wireless receiver support lattice tower structure near to CMCS building- Max height 20m with approx. tonnage 2Tonnes along with foundations.	1	No	3,60,000	3,60,000		Nodal
30	Supply of LED outdoor lighting system with 3 m pole, JB and fixtures	82	no.s	36,000	29,52,000		Nodal

31	Supply of Emergency lamps and associated cabling with conduits for CMCS (to be connected with UPS)	4	no.s	36,000	1,44,000		Nodal
32	Supply of lightning arrester system with earthing arrangement for CMCS building	1	set	1,35,000	1,35,000		Nodal
33	Supply of Pre-fabricated security cabin – Dimensions 3mX3mX2.4m(H)-minimum	1	No	4,50,000	4,50,000		Nodal
34	Supply of air conditioners for CMCS building- Capacity 1.5 Ton	2	Nos	67,500	1,35,000		Nodal
35	Supply of Water supply system with bore-well having submersible pump set, starter with protections (both of reputed make). Bore-well shall be with casing and filters for bore piping with valves etc. upto water storage tank located on top of CMCS building. Bore well shall be located adjacent to CMCS. Depth shall be such as to ensure permanent supply of clean water and may be decided as per Hydrological investigation	1	set	6,75,000	6,75,000		Nodal
36	Supply of miscellaneous items such as cable tags, cable ties, cable ferrules, cable route markers, hoarding board, sign boards, danger boards, display boards, plant Layout boards, electrical insulation mat, tool kits, first aid box, measuring instruments, items for remote connectivity of SCADA excluding FO cable, etc.	1	set	4,50,000	4,50,000		Nodal
37	Supply of ABT meter (To be mounted on BHEL supplied HT panels) make as per approved TRANSCO/SLDC with valid calibration certificates	12	Nos	2,25,000	27,00,000		Nodal
38	Supply of spare items	1	set	2,70,000	2,70,000		Nodal
<b><i>List of Works (I&amp;C activities)</i></b>							

1	<b>I&amp;C:</b> Laying and termination of 2RX1CX400 sq.mm XLPE AL DC power cables from 14 Nos of SCBs to PCU through covered cable trays (1AU = 2.5MWac block)	40	AU	4,05,000	162,00,000		EDN
2	<b>I&amp;C:</b> Transport of equipment from BHEL store to floating platform casting location, Placement and proper grouting of PCU, Transformer, HT panel, Electrical equipment enclosure (for housing SCADA panel with wireless transmitter and UPS with battery bank) on floating platform when the platform is casted near to the shore and towing the platform with equipment to the pre-defined location as per the instructions by the OEM of floating platform. Supply of platform, anchoring and mooring of platform is in BHEL scope. Bidder has to hire motor boats, barge mounted or land based heavy duty cranes, experienced rigging crew etc for this activity. ( 1AU = Works related to 1 platform)	40	AU	6,75,000	270,00,000		EDN
3	<b>I&amp;C :</b> Launching ramp: Construction of temporary platform cum ramp of approximate dimensions of 12 m x 5 m at edge of reservoir at location given by BHEL to enable loading and mounting of heavy electrical equipment from land onto Floating equipment platforms. Deepening of water depth at platform area upto 3 meters along ramp and excavation for approximately 150 m long approach way in water from deep end to ramp for enabling approach of floating platforms upto ramp and return. Platform shall be of RCC construction with ramp on land side for enabling movement of cranes onto platform.	1	AU	18,00,000	18,00,000		EDN

4	<b>I&amp;C:</b> Laying and termination of 30RX1Cx400sqmm LT power cable from PCU to transformer (Approx distance 3 m) ( 1AU = Works on 1 platform)	40	AU	54,000	21,60,000		EDN
5	<b>I&amp;C:</b> Laying and termination of 3RX1Cx150sqmm HT power cable from transformer to stand alone HT panel (Approx distance 3 m) ( 1AU = Works on 1 platform)	40	AU	40,500	16,20,000		EDN
6	<b>I&amp;C:</b> Erection of 30KVA Aux dry type transformer in one of the inverter floating platform, cabling and termination of aux power cables upto CMCS room (Approx distance 1.5Km) through HDPE pipes, floaters and underground trenches as per site requirement	1	AU	1,35,000	1,35,000		EDN
7	<b>I&amp;C:</b> Under water Earthing of electrical equipment on IFP & LPSFP as per standards (1AU = Earthing of equipment on 1 floating platform like, PCU, Transformer, HT panel, SCADA, UPS) ( 1AU = Works related to 1 platform)	40	AU	1,12,500	45,00,000		EDN
8	<b>I&amp;C:</b> Laying and termination of 3RX1Cx150sqmm HT power cable from stand-alone HT panel to LPSFP through cable floaters. HT cable floater installation as per the instructions of OEM is in bidder scope. Necessary clamps and fixing arrangements shall be supplied and installed by the bidder. Cable floaters supply is in BHEL scope. ( 1AU = Works related to 1 IF to LPSFP)	40	AU	4,05,000	162,00,000		EDN

9	<b>I&amp;C:</b> Laying and termination of 3RX1CX630 sq.mm HT power cable from LPSFP to reservoir bund through cable floaters. HT cable floater installation as per the instructions of OEM is in bidder scope. Necessary clamps and fixing arrangements for cables on HDPE floaters shall be supplied and installed by the bidder. Required tying arrangement in consultation with floater OEM for arresting movement of cable floaters is also in bidder scope. Cable floaters supply is in BHEL scope. ( 1AU = Laying of 1 trefoil run for 1KM)	10	AU	22,50,000	225,00,000		EDN
10	<b>I&amp;C:</b> Laying and termination of 3RX1CX630 sq.mm HT power cable from reservoir bund (crossing bund using trays and hume pipes ) to final evacuation point at NTPC switchyard via IC-OG and metering panels near to final evacuation point through underground cable trench. 2 trefoils shall be routed with a Center to center gap of 400mm. Similar 2 nearby trenches of gap min 1000mm for 4 Nos of 25MW feeders. ( 1AU = Laying of cables through 2 trenches for 1KM)	2	AU	31,50,000	63,00,000		EDN
11	<b>I&amp;C:</b> Erection and earthing of 8 Nos of outdoor HT panels (including fixing of ABT meters) near to evacuation point and 2 nos of indoor panels with adapter panels inside switchgear section B & F. All activities required for bus bar extension using adapter panel is in the scope of bidder, Supply of HT panels is in BHEL's scope.	1	AU	3,60,000	3,60,000		EDN

12	<b>I&amp;C:</b> Erection and earthing of electrical equipment at CMCS: SCADA and telemetry panels, UPS with battery bank, fire alarm system, A/C, WMS system, LA and wireless receiver system with RCC foundation near to CMCS building etc	1	AU	2,70,000	2,70,000		EDN
13	<b>I&amp;C:</b> Laying and termination of control/data/instrumentation/aux power cable inside CMCS room, WMS system on top of CMCS room and wireless receiver mast near to CMCS room	1	AU	1,35,000	1,35,000		EDN
14	<b>I&amp;C:</b> Laying and termination of OFC cable from CMCS to OWS at final evacuation point (along with the HT cables). 1AU= 1Km OFC cable laying including splicing termination etc.	3.5	AU	1,80,000	6,30,000		EDN
15	<b>I&amp;C:</b> Plant lighting system including outdoor cable laying, cable terminations at poles / lights as well as DB boards of inverter platforms. (1 AU= for 1 LED fixture)	82	AU	22,500	18,45,000		Nodal
16	<b>I&amp;C:</b> Emergency lighting system including cable laying, cable terminations at CMCS. (1 AU= for 1 LED fixture)	4	AU	9,000	36,000		Nodal
17	<b>I&amp;C:</b> Miscellaneous and safety items such as cable tags, cable markers, hoarding board, sign boards, danger boards, display boards, electrical insulation mat, air conditioners, office furniture, fire extinguishers, fire alarm system, weather monitoring system, items for remote connectivity of SCADA, identification markings using painting etc	1	AU	1,80,000	1,80,000		Nodal

18	<b>I&amp;C:</b> Pre-commissioning inspections/ checks/tests, MRT tests, coordination/liaison with state /central departments/CEIG etc for necessary approvals/clearances for commissioning, synchronization with grid/ plant commissioning.	1	AU	45,00,000	45,00,000		Nodal			
19	<b>I&amp;C:</b> Liasoning with railways and carrying out laying / tunneling works for 4 sets of 33KV(E), 3RX1CX630 sq.mm HT cable crossing below the railway line (If required). Presently cable crossing through existing hume pipes are considered. Hence this line item may be operated only if any objection from railways to use the existing hume pipes.	1	AU	22,50,000	22,50,000		Nodal			
20	Deputation of Safety supervisor for duration of I&C ( 1 AU = 1 Month )	6	AU	67,500	4,05,000		Nodal			
21	Provision of emergency vehicle/Ambulance on standby for duration of I&C ( 1 AU = 1 Month )	6	AU	1,80,000	10,80,000		Nodal			
<b>Grand Total (Supply+I&amp;C)</b>					<b>1755,40,905</b>					
QUOTE PERCENTAGE (%) ABOVE/BELOW (+/-) (OR) AT PAR TO TOTAL AMOUNT					XXXXXX					
QUOTED PERCENTAGE (%) IN WORDS ABOVE/BELOW (OR) AT PAR TO TOTAL AMOUNT					XXXXXX					
	<b>GST (As applicable) To be mandatorily indicated in the column above.</b>				Please indicate GST % in above Column					
	<b>NOTE:</b> 1. CONTRACTOR SHOULD QUOTE PERCENTAGE (%) ABOVE/BELOW (OR) AT PAR TO TOTAL AMOUNT									
	2. QUOTED PERCENTAGE (%) IS APPLICABLE ON ALL ITEM RATES UNIFORMLY.									



# **GENERAL CONDITIONS OF CONTRACT**

**2019**

ಭಾರತ್ ಹೆಚ್‌ಎಲ್ ಎಲೆಕ್ಟ್ರಿಕ್ಸ್ ಡಿವಿಷನ್, ವಿದ್ಯುನ್‌ಶಾಸ್ತ್ರ ವಿಭಾಗ, ಬೆಂಗಳೂರು

ಭಾರತ ಹೆಚ್ ಇಲೆಕ್ಟ್ರಿಕ್ಸ್ ಲಿಮಿಟೆಡ್, ಇಲೆಕ್ಟ್ರಾನಿಕ್ಸ್ ಡಿವಿಜನ್, ಬೆಂಗಳೂರು

*Bharat Heavy Electricals Limited, Electronics Division, Bengaluru*

## **CONTENTS**

### ***Chapter-1***

- 1. General Instructions to Tenderers*
  - 1.1. Dispatch Instructions*
  - 1.2. Submission of Tenders*
  - 1.3. Language*
  - 1.4. Price Discrepancy*
  - 1.5. Evaluation of Bids*
  - 1.6. Data to be enclosed*
  - 1.7. Authorisation and Attestation*
  - 1.8. Earnest Money Deposit*
  - 1.9. Security Deposit*
  - 1.10. Return of Security Deposit*
  - 1.11. Bank Guarantee*
  - 1.12. Validity of offer*
  - 1.13. Execution of Contract Agreement*
  - 1.14. Rejection of Tender and other Conditions*
  - 1.15 BHEL Fraud Prevention Policy*

## **2. Chapter-2**

*2.1. Definitions*

*2.2. Law Governing Contract and Court Jurisdiction*

*2.3. Issue of Notice*

*2.4. Use of land*

*2.5. Commencement of Work*

*2.6. Measurement of Work and Mode of Payment*

*2.7. Rights of BHEL*

*2.8. Responsibilities of Contractor in respect of Local Laws, Employment of Workers etc*

*2.9. Progress Monitoring, Monthly Review and Performance Evaluation*

*2.10. Time of Completion*

*2.11. Extension of Time for Completion*

*2.12. Over Run Compensation*

*2.13. Quantity Variation*

*2.14. Extra Works*

*2.15. Supplementary Items*

*2.16. Strikes & Lockout*

*2.17. Force Majeure*

*2.18. Arbitration and Reconciliation*

*2.19. Payments*

*2.20. Performance Guarantee for Workmanship*

*2.21. Closing of Contracts*

*2.22. Reverse Auction*

*2.23. Suspension of Business Dealings*

*2.24. Other Issues*

## **CHAPTER -1**

### **1. GENERAL INSTRUCTION TO TENDERERS**

#### **1.1. DESPATCH INSTRUCTION**

*i) The General Conditions of Contract form part of the Tender specifications. All pages of the tender documents shall be duly signed, stamped and submitted along with the offer in token of complete acceptance thereof. The information furnished shall be complete by itself. The tenderer is required to furnish all the details and other documents as required in the following pages*

*ii) Tenderers are advised to study all the tender documents carefully. Any submission of tender by the tenderer shall be deemed to have been done after careful study and examination of the tender documents and with the full understanding of the implications thereof. Should the tenderers have any doubt about the meaning of any portion of the Tender Specification or find discrepancies or omissions in the drawings or the tender documents issued are incomplete or shall require clarification on any aspects, the scope of work etc., he shall contact the authority inviting the tender well in time (so as not to affect last date of submission) for clarification before the submission of the tender. Tenderer's request for clarifications shall be with reference to Sections and Clause numbers given in the tender documents. The tender specifications and terms and conditions shall be deemed to have been accepted by the tenderer in the offer. Pre requirements and conditions shall be liable for rejection.*

*iii) Integrity pact (IP): If NIT calls for Integrity Pact, the same shall be duly signed & stamped by the authorised signatory & submitted along with tender document.*

#### **1.2. SUBMISSION OF TENDERS**

**1.2.1** *The tenderers must submit their tenders as per instructions in the NIT*

**1.2.2** *BHEL takes no responsibility for delay, loss or non-receipt of tenders sent by post/courier. The tenders received after the specified time of their submission are treated as 'Late Tenders' and shall not be considered under any circumstances. Offers received by Fax/Email/Internet shall be considered as per terms of NIT.*

**1.2.3** *Tenders shall be opened by authorised Officer of BHEL at his office at the time and date as specified in the NIT, in the presence of such of those tenderers or their authorised representatives who may be present*

*1.2.4 Tenderers whose bids are found techno commercially qualified shall be informed the date and time of opening of the Price Bids and such Tenderers may depute their representatives to witness the opening of the price bids. BHEL's decision in this regard shall be final and binding.*

*1.2.5 Before submission of Offer, the tenderers are advised to inspect the site of work and the environments and be well acquainted with the actual working and other prevalent conditions, facilities available, position of material and labour, means of transport and access to Site, accommodation, etc. No claim will be entertained later on the grounds of lack of knowledge of any of these conditions.*

### **1.3. LANGUAGE**

*1.3.1 The tenderer shall quote the rates in English language and international numerals. These rates shall be entered in figures as well as in words. For the purpose of the tenders, the metric system of units shall be used.*

*1.3.2 All entries in the tender shall either be typed or written legibly in ink. Erasing and over-writing is not permitted and may render such tenders liable for rejection. All cancellations and insertions shall be duly attested by the tenderer.*

### **1.4 PRICE DISCREPANCY:**

*1.4.1 Conventional (Manual) Price Bid opening:*

*i) If, in the price structure quoted for the required goods/services/works, there is discrepancy between the unit price and the total price (which is obtained by multiplying the unit price by the quantity), the unit price shall prevail and the total price corrected accordingly, unless in the opinion of BHEL there is obvious misplacement of decimal point in the unit price, in which case the total price as quoted shall govern and the unit price corrected accordingly*

*ii) If there is an error in a total corresponding to the addition or subtraction of subtotals, the subtotals shall prevail and the total shall be corrected;*

*iii) If there is a discrepancy between words and figures, the amount in words shall prevail, unless the amount expressed in words is related to an arithmetic error, in which case the amount in figures shall prevail subject of (i) and (ii) above.*

*iv) If there is such discrepancy in an offer, the same shall be conveyed to the bidder with target date up to which the bidder has to send his acceptance on the above lines and if the bidder does not agree to the decision of BHEL, the bid is liable to be ignored.*

*v) In case of lump sum price, if there is any difference between the amount in figures and in words, the amount quoted by the bidder in words shall be taken as correct.*

vi) In case of omission in quoting any rate for one or more items, the evaluation shall be done considering the highest quoted rate obtained against the respective items by other tenderers for the subject tender. If the tenderer becomes L-1, the notional rates for the omission items shall be the lowest rates quoted for the respective items by the other tenderers against the respective omission items for the subject job and the 'Total quoted price (loaded for omissions)' shall be arrived at. However the overall price remaining the same as quoted originally, the rates for all the items in the 'Total quoted price (loaded for omissions)' shall be reduced item wise in proportion to the ratio of 'Original' total price and the 'Total quoted price (loaded for omissions)'.

**1.4.2 Reverse Auction:** In case of Reverse Auction, the successful bidder shall undertake to execute the work as per overall price offered by him during the Reverse Auction process. In case of omission of rates, the procedure shall be as per 'Guidelines for Reverse Auction' enclosed.

i) Offers from tenderers who are under suspension (banned) by any Unit/Region/Division of BHEL shall not be considered.

ii) Offers from tenderers who do not comply with the latest guidelines of Ministry/Commissions of Govt of India shall not be considered.

### **1.5. EVALUATION OF BIDS**

i) Technical Bids submitted by the tenderer will be opened first and evaluated for fulfilling the Pre-Qualification criteria and other conditions in NIT/Tender documents, based on documentary evidences submitted along with the offer, BHEL reserves the right to ask for proofs/documents, clarification in relation to Technical/commercial data during tender evaluation

ii) Price Bids of shortlisted bidders shall only be opened either through the conventional price bid opening or through electronic Reverse Auction, at the discretion of BHEL

iii) Price Bids of unqualified bidders shall not be opened. Reasons for rejection shall be intimated to the vendor before the opening of Price bid.

### **1.6. DATA TO BE ENCLOSED**

The following information in full shall be furnished by the tenderer. Non-submission of this information may lead to rejection of the offer.

i) INCOME TAX PERMANENT ACCOUNT NUMBER, GSTIN, SAC, HSN Certified copies of PAN, GSTIN shall be furnished along with tender. The names, addresses and contact information of the Directors/Partners shall be furnished along with the offer.

ii) An attested copy of the Power of Attorney, in case the tender is signed by an individual other than the sole proprietor.

*iii) IN CASE OF INDIVIDUAL TENDERER:*

*His / her full name, address, PAN, GSTIN and place & nature of business to be furnished.*

*iv) IN CASE OF PARTNERSHIP FIRM*

*The names of all the partners and their addresses, a copy of the partnership deed/instrument of partnership shall be enclosed.*

*v) IN CASE OF COMPANIES:*

*Date and place of registration including date of commencement certificate in case of Public Companies (certified copies of Memorandum and articles of Association are also to be furnished). Nature of business carried on by the Company and the provisions of the Memorandum relating thereof.*

### **1.7. AUTHORISATION AND ATTESTATION**

*Tenders shall be signed by a person duly authorised/empowered to do so. An attested copy of the Power of Attorney, in case the tender is signed by an individual other than the sole proprietor shall be submitted along with the tenders*

### **1.8. EARNEST MONEY DEPOSIT**

*1.8.1 Every tender must be accompanied by the prescribed amount of Earnest Money Deposit (EMD) in the manner described herein.*

*The EMD may be accepted only in the following forms:*

- (i) Electronic Fund Transfer credited in BHEL account (before tender opening)*
- (ii) Banker's cheque/ Pay order/ Demand draft, in favor of BHEL (along with offer) In case total EMD amount is more than Rs 20 Lakh, the amount in excess of Rs 20 lakh maybe accepted in the form of Bank Guarantee from scheduled bank. The Bank Guarantee in such cases shall be valid for at-least six months.*
- (iii) Through SBI collect (before tender opening)*
- (iv) No other form of EMD remittance shall be acceptable to BHEL*

*1.8.2 EMD by the bidder will be forfeited as per Tender Documents if*

- i) After opening the tender and within the offer validity period, the tenderer revokes his/her tender or makes any modification in his tender which is not acceptable to BHEL.*
- ii) The Contractor fails to deposit the required Security deposit or commence the work within the period as per LOI/ Contract.*
- iii) EMD by the tenderer shall be withheld in case any action on the tenderer is envisaged in derailing the tender process by unlawful means*

*1.8.3 EMD shall not carry any interest.*

*1.8.4 In the case of unsuccessful bidders, the Earnest Money will be refunded to them within a reasonable time after acceptance of award by successful tenderer.*

*1.8.5 EMD of successful tenderer will be converted as part of Security Deposit*

### **1.9. SECURITY DEPOSIT**

*The total amount of Security Deposit will be 5% of the contract value (including all applicable taxes) EMD of the successful tenderer shall be converted and adjusted towards the required amount of Security Deposit.*

*1.9.1 Modes of Security deposit:*

*The balance amount to make up the required Security Deposit of 5% of the contract value may be accepted in the following forms:*

- i) Cash (as permissible under the extant Income Tax Act)*
- ii) Local cheques of Scheduled Banks (subject to realization)/ Pay Order/ Demand Draft/ Electronic Fund Transfer in favour of BHEL*
- iii) Bank Guarantee from Scheduled Banks/ Public Financial Institutions as defined in the Companies Act. The Bank Guarantee format should have the approval of BHEL*
- iv) Fixed Deposit Receipt issued by Scheduled Banks/ Public Financial Institutions as defined in the Companies Act (FDR should be in the name of the Contractor, a/c BHEL)*
- v) Securities available from Indian Post offices such as National Savings Certificates, Kisan Vikas Patras etc. (held in the name of Contractor furnishing the security and duly endorsed/ hypothecated/ pledged, as applicable, in favour of BHEL) (Note: BHEL will not be liable or responsible in any manner for the collection of interest or renewal of the documents or in any other matter connected therewith)*
- vi) 50% of the required Security Deposit, including the EMD, should be paid before start of the work. Balance of the Security Deposit can be collected by deducting 10% of the gross amount progressively from each of the running bills of the Contractor till the total amount of the required Security Deposit is collected. If the value of work done at any time exceeds the contract value, the amount of Security Deposit shall be correspondingly enhanced and the additional Security Deposit shall be immediately deposited by the Contractor or recovered from payment/s due to the Contractor. Security Deposit shall be released to the Contractor upon fulfilment of contractual obligations as per terms of the contract.*

*1.9.2 The Security Deposit shall not carry any interest.*

*1.9.3 The validity of Bank Guarantees towards Security Deposit shall be initially up to the completion period as stipulated in the Letter of Intent/Award (plus maintenance period if applicable), and 03 months claim period. The same shall be kept valid by proper renewal till the acceptance of Final Bills of the Contractor, by BHEL*

*1.9.4 BHEL reserves the right of forfeiture of Security Deposit in addition to other claims and penalties in the event of the Contractor's failure to fulfill any of the contractual obligations or in the event of termination of contract as per terms and conditions of contract. BHEL reserves the right to set off the Security Deposit against any claims of other contracts with BHEL.*

## **1.10. REFUND OF SECURITY DEPOSIT**

*50% of the security deposit may be refunded on completion of the work after payment of the final bill and the balance 50% of the security deposit is refunded only after the expiry of the maintenance period from date of completion of work as stipulated in the contract concerned.*

### **1.10.1 DEFECTS LIABILITY PERIOD:**

*The contractor shall be responsible to make good and remedy at his own expenses within such period as may be stipulated by the Engineer-in-charge, any defect which may develop or may be noticed before the expiry of the maintenance period of six months or as stipulated in NIT hereto from the certified date of completion and intimation of which has been sent to the contractor within seven days of the expiry of the said period by a letter sent by hand delivery or by registered post or Email. If contractor fails to attend to the above, defect will be rectified at contractor's risk & cost and same will be deducted from the security deposit/payable amounts available with BHEL.*

## **1.11. BANK GUARANTEES**

*Where ever Bank Guarantees are to be furnished/submitted by the contractor, the following shall be complied with*

- i) *Bank Guarantees shall be from Scheduled Banks / Public Financial Institutions as defined in the Companies Act.*
- ii) *The Bank Guarantees shall be as per prescribed BHEL formats.*
- iii) *It is the responsibility of the bidder to get the Bank Guarantees revalidated/extended for the required period (subject to a minimum period of six months), as per the advice of BHEL. BHEL shall not be liable for issue of any reminders regarding expiry of the Bank Guarantees.*
- iv) *In case extension/further extensions of any Bank Guarantees are not required, the bidders shall ensure that the same is explicitly endorsed by BHEL*
- v) *In case the Bank Guarantees are not extended before the expiry date, BHEL reserves the right to invoke the same by informing the concerned Bank in writing, without any advance notice/communication to the concerned bidder.*
- vi) *Bidders to note that any corrections to Bank Guarantees shall be done by the issuing Bank, only through an amendment in an appropriate non judicial stamp paper.*
- vii) *The Original Bank Guarantee shall be sent directly by the Bank to BHEL under Registered Post (Acknowledgement Due).*

### **1.12. VALIDITY OF OFFER**

*The rates in the Tender shall be kept open for acceptance for a minimum period of Ninety (90) DAYS from latest due date of offer submission (including extension, if any). In case BHEL calls for negotiations, such negotiations shall not amount to cancellation or withdrawal of the original offer which shall be binding on the tenderers.*

### **1.13 EXECUTION OF CONTRACT AGREEMENT**

*The successful tenderer's responsibility under this contract commences from the date of issue of the Letter of Intent by BHEL. The Tenderer shall submit an unqualified acceptance to the Letter of Intent/Award within the period stipulated therein.*

*The successful tenderer shall be required to execute an agreement in the prescribed form, with BHEL, within fifteen days (15 days) after the acceptance of the Letter of Intent/Award, and in any case before releasing the first running bill. The contract agreement shall be signed by a person duly authorized/empowered by the tenderer. The expenses for preparation of agreement document shall be borne by Tenderer.*

### **1.14. REJECTION OF TENDER AND OTHER CONDITIONS**

**1.14.1** *The acceptance of tender will rest with BHEL which does not bind itself to accept the lowest tender or any tender and reserves to itself full rights for the following without assigning any reasons whatsoever:-*

- a. To reject any or all of the tenders.*
- b. To split up the work amongst two or more tenderers as per NIT*
- c. To award the work in part if specified in NIT*
- d. In case of either of the contingencies stated in (b) and (c) above, the time for completion as stipulated in the tender shall be applicable.*

**1.14.2** *Conditional tenders, unsolicited tenders, tenders which are incomplete or not in the form specified or defective or have been materially altered or not in accordance with the tender conditions, specifications etc., are liable to be rejected.*

**1.14.3** *Tenders are liable to be rejected in case of unsatisfactory performance of the tenderer with BHEL, or tenderer under suspension (hold/banning /delisted ) by any unit / region / division of BHEL or tenderers who do not comply with the latest guidelines of Ministry/Commissions of Govt of India. BHEL reserves the right to reject a bidder in case it is observed that they are overloaded and may not be in a position to execute this job. The decision of BHEL will be final in this regard.*

*1.14.4 If a tenderer who is a proprietor expires after the submission of his tender or after the acceptance of his tender, BHEL may at their discretion, cancel such tender. If a partner of a firm expires after the submission of tender or after the acceptance of the tender, BHEL may then cancel such tender at their discretion, unless the firm retains its character.*

*1.14.5 BHEL will not be bound by any Power of Attorney granted by changes in the composition of the firm made subsequent to the execution of the contract. They may, however, recognize such power of Attorney and changes after obtaining proper legal advice, the cost of which will be chargeable to the contractor concerned.*

*1.14.6 If the tenderer deliberately gives wrong information in his tender, BHEL reserves the right to reject such tender at any stage or to cancel the contract if awarded and forfeit the Earnest Money/Security Deposit/any other money due.*

*1.14.7 Canvassing in any form in connection with the tenders submitted by the Tenderer shall make his offer liable to rejection.*

*1.14.8 In case the Proprietor, Partner or Director of the Company/Firm submitting the Tender, has any relative or relation employed in BHEL, the authority inviting the Tender shall be informed, along with the Offer. Failing to do so, BHEL may, at its sole discretion, reject the tender or cancel the contract and forfeit the Earnest Money/Security Deposit.*

*1.14.9 The successful tenderer should not sub-contract part or complete work detailed in the tender specification undertaken by him without written permission of BHEL's Construction Manager/Site Incharge. The tenderer is solely responsible to BHEL for the work awarded to him.*

*1.14.10 The Tender submitted by a techno commercially qualified tenderer shall become the property of BHEL who shall be under no obligation to return the same to the bidder. However unopened price bids and late tenders shall be returned to the bidders after finalization of contract.*

*1.14.11 Unsolicited discount received after the due date and time of Bid Submission shall not be considered for evaluation. However, if the party who has submitted the unsolicited discount/rebate becomes the L-I party, then the awarded price i.e contract value shall be worked out after considering the discount so offered.*

*1.14.12 BHEL shall not be liable for any expenses incurred by the bidder in the preparation of the tender irrespective of whether the tender is accepted or not.*

**1.15 BHEL Fraud Prevention Policy :**

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

**CHAPTER-2**

**2.1 DEFINITION:** The following terms shall have the meaning hereby assigned to them except where the context otherwise requires

- i) *BHEL shall mean Bharat Heavy Electricals Limited, a company registered under Companies Act 1956, with its Registered Office at BHEL HOUSE, SIRI FORT, NEW DELHI – 110 049, or its Authorised Officers or its Site Engineers or other employees authorised to deal with any matters with which these persons are concerned on its behalf.*
- ii) *“EXECUTIVE DIRECTOR” or ‘GROUP GENERAL MANAGER’ or “GENERAL MANAGER (Incharge)” or “GENERAL MANAGER” shall mean the Officer in Electronics Division, Mysore road, Bengaluru-560026*
- iii) *“COMPETENT AUTHORITY” shall mean Executive Director or Group General Manager or General Manager (In-charge) or General Manager or BHEL Officers who are empowered to act on behalf of the Executive Director or General Manager (In-charge) or General Manager of BHEL.*
- iv) *“ENGINEER” or “ENGINEER IN CHARGE” shall mean an Officer of BHEL as may be duly appointed and authorized by BHEL to act as “Engineer” on his behalf for the purpose of the Contract, to perform the duty set forth in this General Conditions of Contract and other Contract documents. The term also includes ‘CONSTRUCTION MANAGER’ or ‘SITE INCHARGE’ as well as Officers*
- v) *“SITE” shall mean the places or place at which the plants/equipment are to be erected and services are to be performed as per the specification of this Tender.*
- vi) *“CLIENT OF BHEL” or “CUSTOMER” shall mean the project authorities with whom BHEL has entered into a contract for supply of equipment or provision of services.*
- vii) *“CONTRACTOR” shall mean the successful Bidder/Tenderer who is awarded the Contract and shall include the Contractor’s successors, heirs, executors, administrators and permitted assigns.*

viii) "CONTRACT" or "CONTRACT DOCUMENT" shall mean and include the Work Order, Contract Agreement, the accepted appendices of Rates, Schedules, Quantities if any, General Conditions of Contract, Special Conditions of Contract, Instructions to the Tenderers, Drawings, Technical Specifications, the Special Specifications if any, the Tender documents, subsequent amendments mutually agreed upon and the Letter of Intent/Acceptance issued by BHEL. Any conditions or terms stipulated by the contractor in the tender documents or subsequent letters shall not form part of the contract unless, specifically accepted in writing by BHEL in the Letter of Intent/Award and incorporated in the agreement.

ix) "GENERAL CONDITIONS OF CONTRACT" shall mean the 'Instructions to Tenderers' and 'General Conditions of Contract' pertaining to the work for which above tenders have been called for.

x) "TENDER SPECIFICATION" or "TENDER" or "TENDER DOCUMENTS" shall mean General Conditions, Common Conditions, Special Conditions, Price Bid, Rate Schedule, Technical Specifications, Appendices, Annexures, Corrigendum's, Amendments, Forms, procedures, Site information, etc and drawings/documents pertaining to the work for which the tenderers are required to submit their offers. Individual specification number will be assigned to each Tender Specification.

xi) "LETTER OF INTENT" shall mean the intimation by a Post/Fax/email to the tenderer that the tender has been accepted in accordance with provisions contained in the letter. The responsibility of the contractor commences from the date of issue of this letter and all terms and conditions of the contract are applicable from this date.

xii) "COMPLETION TIME" shall mean the period by 'date/month' specified in the 'Letter of Intent/Award' or date mutually agreed upon for handing over of the intended scope of work, the erected equipment/plant which are found acceptable by the Engineer, being of required standard and conforming to the specifications of the Contract.

xiii) "PLANT" shall mean and connote the entire assembly of the plant and equipment's covered by the contract.

xiv) "EQUIPMENT" shall mean equipment, machineries, materials, structural, electrical and other components of the plant covered by the contract.

xv) "TESTS" shall mean and include such test or tests to be carried out on the part of the contractor as are prescribed in the contract or considered necessary by BHEL, in order to ascertain the quality, workmanship, performance and efficiency of the contractor or part thereof.

xvi) "APPROVED", "DIRECTED" or "INSTRUCTED" shall mean approved, directed or instructed by BHEL.

xvii) "WORK or CONTRACT WORK" shall mean and include supply of all categories of labour, specified consumables, tools and tackles and Plants required for complete and satisfactory site transportation, handling, stacking, storing, erecting, testing and commissioning of the equipment's to the entire satisfaction of BHEL.

xviii) "SINGULAR AND PLURALS ETC" words carrying singular number shall also include plural and vice versa, where the context so requires. Words imparting the masculine Gender shall be taken to include the feminine Gender and words imparting persons shall include any Company or Associations or Body of Individuals, whether incorporated or not.

xix) "HEADING" – The heading in these General Conditions are solely for the purpose of facilitating reference and shall not be deemed to be part thereof or be taken as instructions thereof or of the contract.

xx) "MONTH" shall mean calendar month unless otherwise specified in the Tender.

xxi) Day' or 'Days' unless herein otherwise expressly defined shall mean calendar day or days of twenty four (24) hours each. A week shall mean continuous period of seven (7) days.

xxii) "COMMISSIONING" shall mean the synchronization testing and achieving functional operation of the Equipment with associated system after all initial adjustments, trials, cleaning, re-assembly required at site if any, have been completed and Equipment with associated system is ready for taking into service.

xxiii) "WRITING" shall include any manuscript type written or hand written or printed statement or electronically transmitted messages, under the signature or seal or transmittal of BHEL.

xxiv) "TEMPORARY WORK" shall mean all temporary works for every kind required in or for the execution, completion, maintenance of the work.

xxv) 'CONTRACT PRICE' or 'CONTRACT VALUE' shall mean the sum including applicable taxes mentioned in the LOI/LOA/Contract Agreement subject to such additions thereto or deductions there from as may be made under provisions hereinafter contained

xxvi) "COMMENCEMENT DATE" or "START DATE" shall mean the commencement/start of work at Site as per terms defined in the Tender

xxvii) "SHORT CLOSING" or "FORE CLOSING" of Contract shall mean the premature closing of Contract, for reasons not attributable to the contractor and mutually agreed between BHEL and the contractor

xxviii) "TERMINATION" of Contract shall mean the pre mature closing of contract due to reasons as mentioned in the contract

## **2.2 LAW GOVERNING THE CONTRACT AND COURT JURISDICTION**

*The contract shall be governed by the Law for the time being in force in the Republic of India. The Civil Court having original Civil Jurisdiction at Bengaluru, shall alone have exclusive jurisdiction in regard to all claims in respect of the Contract. No other Civil Court shall have jurisdiction in case of any dispute, under this contract*

## **2.3 ISSUE OF NOTICE**

*2.3.1 Service of notice on contractor: Any notice to be given to the Contractor under the terms of the contract shall be served by sending the same by Registered Post / Speed Post / FAX / Email to or leaving the same at the Contractor's last known address of the principal place of business (or in the event of the contractor being a company, to or at its Registered Office). In case of change of address, the notice shall be served at changed address as notified in writing by the Contractor to BHEL. Such posting or leaving of the notice shall be deemed to be good service of such notice and the time mentioned to the condition for doing any act after notice shall be reckoned from the date so mentioned in such notice.*

*2.3.2 Service of notice on BHEL Any notice to be given to BHEL in-charge under the terms of the Contract shall be served by sending the same by post or Email or leaving the same at BHEL address or changed address as notified in writing by BHEL to the Contractor.*

## **2.4 USE OF LAND**

*No land belonging to BHEL or their Customer under temporary possession of BHEL shall be occupied by the contractor without written permission of BHEL.*

### **2.4.1 STORES AND MATERIALS:**

*The contractor shall, at his own expense, supply all stores and materials required for the contract, other than those which may be provided by BHEL at the rates detailed therein subject to their availability at the place of issue indicated therein. All stores and materials to be supplied by the Contractor shall be of the best kind as described in the Specifications and the Contractor shall, if required by the Engineer -in- charge furnish him with proof to his satisfaction that the store and materials so comply with the specifications.*

*The contractor shall, at his own expense and without delay, supply samples of stores and materials proposed to be used in the execution of the work for the approval of the Engineer-in-charge, who may reject all stores and materials not corresponding either in quality or character to the approved samples.*

*In the case of stores provided by BHEL, the Contractor shall bear the cost of loading, transporting to site, unloading, storing under cover as required, assembling & jointing the several parts together as necessary and incorporating & fixing these stores & materials in the work, including all preparatory work of whatever description that may be required, and closing, preparing, loading and returning empty cases or containers to the place of issue without any extra charges.*

*Contractor is responsible for safe & secure storage of above material.*

**2.4.2 PATENT RIGHTS:**

*The contractor shall fully indemnify BHEL, or the agent, servant, or employee of BHEL, against any action, claim or proceeding relating to infringement or the use of any patent or design or any alleged patent or design rights, and shall pay any royalties which may be payable in respect of any article/ or part thereof included in the contract.*

*In the event of any claims being made or action brought against BHEL, or any agent, or servant or employee of BHEL., in respect of any of the matters aforesaid, the contractor shall not apply when such increment has taken place in complying with the specific directions issued by the BHEL but the contractor shall pay any royalties payable in respect of any such use.*

**2.4.3 WATER :**

*The contractor shall allow in his tender and provide at his cost all water required for the work or his employees on the work, together with all pipes and fittings or other means that may be necessary or required to ensure a proper and ample supply of water for all purpose connected with the work.*

*In the event of a provision existing in the Tender documents for supply of water on payment by BHEL, water will be supplied from the BHEL supply System, or other sources at any points fixed by the Site Engineer/ Engineer-in-charge on the site of work. The contractor shall make necessary arrangement for lifting, pumping, carrying or conveying the water as required at his own cost. The levy of water charges to be borne by the Contractor in such case shall be specifically mentioned in the Tender documents.*

**2.4.4 TEMPORARY WORKSHOPS, STORES ETC :**

*The Contractor shall, during the progress of the work provide, erect and maintain at his own expense all necessary temporary workshops, store, offices, toilets etc., required for the proper and efficient execution of the work. The planning, siting and erection of these building shall have the approval of the Engineer-in-charge and the Contractor shall at all times keep them in a clean and sanitized condition to the entire satisfaction of the Engineer-in-charge.*

*On completion of the work all such temporary buildings shall be cleared and the site restored to its original state in a clean and tidy condition to the entire satisfaction of the Engineer-in-charge.*

**2.5 COMMENCEMENT OF WORK**

*2.5.1 Time is essence of contract and is specified in the tender document or in each individual work order.*

*2.5.2 The contractor shall commence the work within seven(07) days from LOI/work order or as intimated by BHEL and shall proceed with the same with due expedition without delay.*

*2.5.3 If the contractor fails to start the work within stipulated time as per LOI or as intimated by BHEL, then BHEL at its sole discretion will have the right to cancel the contract. The Earnest Money and/or Security Deposit with BHEL will stand forfeited without any further reference to him without prejudice to any and all of BHEL's other rights and remedies in this regard.*

*2.5.4 All the work shall be carried out under the direction and to the satisfaction of BHEL.*

## **2.6 MEASUREMENT OF WORK AND MODE OF PAYMENT:**

*2.6.1 All payments due to the contractors shall be made by electronic mode only, unless otherwise found operationally difficult.*

*2.6.2 For progress running bill payments: - The Contractor shall present detailed measurement sheets in triplicate, duly indicating all relevant details based on technical documents and connected drawings for work done during the month/period under various categories in line with terms of payment as per contract. The basis of arriving at the quantities, weights shall be relevant documents and drawings released by BHEL. These measurement sheets shall be prepared jointly with BHEL Engineers and signed by both the parties.*

*2.6.3 These measurement sheets will be checked by BHEL Engineer and quantities and percentage eligible for payment under various groups shall be decided by BHEL Engineer. The abstract of quantities and percentage so arrived at based on the terms of payment shall be entered in Measurement Book and signed by both the parties.*

*2.6.4 Based on the above quantities, contractor shall prepare the bills in prescribed format and work out the financial value. These will be entered in Measurement Book and signed by both the parties. Payment shall be made by BHEL after effecting the recoveries due from the contractor.*

*2.6.5 All recoveries due from the contractor for the month/period shall be effected in full from the corresponding running bills unless specific approval from the competent authorities is obtained to the contrary.*

*2.6.6 Measurement shall be restricted to that portion of work for which it is required to ascertain the financial liability of BHEL under this contract.*

*2.6.7 The measurement shall be taken jointly by persons duly authorized on the part of BHEL and by the Contractor.*

*2.6.8 The Contractor shall bear the expenditure involved if any, in making the measurements and testing of materials to be used/used in the work. The contractor shall, without extra charges, provide all the assistance with appliances and other things necessary for measurement.*

*2.6.9 If at any time due to any reason whatsoever, it becomes necessary to re-measure the work done in full or in part, the expenses towards such re measurements shall be borne by the contractor unless such re measurements are warranted solely for reasons not attributable to contractor.*

*2.6.10 Passing of bills covered by such measurements does not amount to acceptance of the completion of the work measured. Any left out work has to be completed, if pointed out at a later date by BHEL.*

*2.6.11 Final measurement bill shall be prepared in the final bill format prescribed for the purpose based on the certificate issued by BHEL Engineer that entire works as stipulated in tender specification has been completed in all respects to the entire satisfaction of BHEL. Contractor shall give unqualified "No Claim" Certificate. All the tools and tackles loaned to him should be returned in satisfactory condition to BHEL. The abstract of final quantities and financial values shall also be entered in the Measurement Books and signed by both parties to the contract. The Final Bill shall be prepared and paid within a reasonable time after completion of work.*

## **2.7 RIGHTS OF BHEL**

*BHEL reserves the following rights in respect of this contract during the original contract period or its extensions if any, as per the provisions of the contract, without entitling the contractor for any compensation.*

*2.7.1 To withdraw any portion of work and/or to restrict/alter quantum of work as indicated in the contract during the progress of work and get it done through other agencies to suit BHEL's commitment to its customer or in case BHEL decides to advance the date of completion due to other emergent reasons/ BHEL's obligation to its customer.*

*2.7.2 To terminate the contract or get any part of the work done through other agency or deploy BHEL's own/hired/otherwise arranged resources , at the risk and cost of the contractor after due notice of a period of two weeks by BHEL, in the event of:-*

- i) Contractor's continued poor progress*
- ii) Withdrawal from or abandonment of the work before completion of the work*
- iii) Contractor's inability to progress the work for completion as stipulated in the contract*
- iv) Poor quality of work*
- v) Corrupt act of Contractor*
- vi) Insolvency of the Contractor*

vii) Persistent disregard to the instructions of BHEL

viii) Assignment, transfer, sub-letting of contract without BHEL's written permission

ix) Non fulfillment of any contractual obligations / non-compliance of statutory requirements

x) In the opinion of BHEL, the contractor is overloaded and is not in a position to execute the job as per required schedule

2.7.3 To meet the expenses including BHEL overheads of 35% & Liquidated damage/penalties arising out of "Risk & Cost" as explained above under Sl.No. 2.7.2. BHEL shall recover the amount from any money due from Contractor, from any money due to the Contractor including Security Deposit or by forfeiting any T&P or material of the contractor under this contract or any other contract of BHEL or by any other means or any combination thereof

2.7.4 To terminate the contract or to restrict the quantum of work and pay for the portion of work executed in case BHEL's contract with their customer are terminated for any reason, as per mutual agreement.

2.7.5 To effect recovery from any amounts due to the contractor under this or any other contract or in any other form, the moneys BHEL is statutorily forced to pay to anybody, due to contractor's failure to fulfill any of his obligations. BHEL shall levy overheads of 35% on all such payments.

2.7.6 While every endeavor will be made by BHEL to this end, they cannot guarantee uninterrupted work due to conditions beyond their control. The Contractor will not be normally entitled for any compensation/extra payment on this account unless otherwise specified elsewhere in the contract.

2.7.7 In case the execution of works comes to a complete halt or reaches a stage wherein worthwhile works cannot be executed and there is no possibility of commencement of work for a period of not less than two months, due to reasons not attributable to the contractor and other than Force Majeure conditions, BHEL may consider permitting the contractor to de mobilize forthwith and re mobilize at an agreed future date. Cost of such demobilization/remobilization shall be mutually agreed. ORC (Over run Charges) in such cases shall not be applicable for the period between the period of demobilization and re mobilisation. The duration of contract/time extension shall accordingly get modified suitably. In case of any conflict, BHEL decision in this regard shall be final and binding on the contractor.

2.7.8 In the unforeseen event of inordinate delay in receipt of materials, drawings, fronts, etc, due to which inordinate discontinuity of work is anticipated, BHEL at its discretion may consider contractor's request to short close the contract, provided that the balance works are minor vis a vis the scope of work envisaged as per the contract. At the point of requesting for

short closure, contractor shall establish that he has completed all works possible of completion and he is not able to proceed with the balance works due to constraints beyond his control. In such a case, the estimated value of the unexecuted portion of work as mutually agreed, shall however be reduced from the final contract value.

#### **2.7.9 LIQUIDATED DAMAGES/PENALTY**

#### **COMPENSATION FOR DELAY:**

If the contractor fails to maintain the required progress in terms of condition 2.10 or to complete the work and clear the site on or before the contracted or extended the period of completion, he shall, without prejudice to any other right or remedy of the BHEL on account of such breach, pay as agreed compensation an amount calculated as stipulated below

For unfinished anticipated value of work where finished portion is fit for use

Rate of compensation as follows:

- Completion period (as originally stipulated) not exceeding 6 months. ....@ 1 percent per week
- Completion period (as originally stipulated) Exceeding 6 months and not exceeding 2 years...@ 0.5 percent per week
- Completion period (as originally stipulated) exceeding 2 years..... @ 0.25 percent per week

Provided always that the total amount of compensation for delay to be paid under condition shall not exceed the under noted percentage of the anticipated contract value

- Completion period (as originally stipulated) not exceeding 6 months. ....@ 10 percent of anticipated value of work
- Completion period (as originally stipulated) Exceeding 6 months and not exceeding 2 years...@ 7.5 percent of anticipated value of work
- Completion period (as originally stipulated) Exceeding 2 years.....@ 5 percent of anticipated value of work

The amount of compensation may be adjusted or set off against any sum payable to the Contractor under this or any other contract with the BHEL.

**2.7.10 POST TECHNICAL AUDIT OF WORK AND BILLS:** BHEL reserve the right to carry out a post-payment audit and technical examination of the work and final bill including all supporting vouchers, abstract etc., and to enforce recovery of any sums becoming due as a result thereof in the manner provided in the proceeding sub-paragraph's provided however that no such recovery shall be enforced after three years of passing the final bill

**2.8 RESPONSIBILITIES OF THE CONTRACTOR IN RESPECT OF LOCAL LAWS, EMPLOYMENT OF WORKERS ETC.**

*The following are the responsibilities of the contractor in respect of observance of local laws, employment of personnel, payment of taxes etc. The subcontractor shall fully indemnify BHEL against any claims of whatsoever nature arising due to the failure of the contractor in discharging any of his responsibilities hereunder:*

*2.8.1 The contractor at all times during the continuance of this contract shall, in all his dealings with local labour for the time being employed on or in connection with the work, have due regard to all local festivals and religious and other customs.*

*2.8.2 The contractor shall comply with all applicable State and Central Laws, Statutory Rules, Maternity act, Regulations etc. such as contract labour(R&A) Act 1970, Minimum wage Act 19748, Payment of wages Act 1936,ESI Act 1948, EPF Act 1952, Employees' compensation Act 1923, Provision of Companies Act 1948 & rules thereof, The interstate Migrant Workmen 1979, The Karnataka Factories Rules 1969, Payment of Bonus Act 1965, Payment of Gratuity Act 1972. Child labour Prohibition act 1986, Karnataka Minimum Wage Act , Prevention of sexual harassment at work place Act 2013, Guidelines/notification related to Safai Karamchari Act , Equal Remuneration Act 1976, The company's instructions as issued from time to time in regard to working hours, wages, leaves, holidays etc. for labour as may be enacted by the Government during the tenure of the Contract and having force or jurisdiction at Site. The Contractor shall also give to the local Governing Body, Police and other relevant Authorities all such notices as may be required by the Law.*

*The contractor shall produce the following registers and forms:*

- *Form XIII- Register of work men employed by contractor(Rule 75)*
- *Form XIV- Employment Card issued by contractor( Rule 76)*
- *Form XVI- Muster Roll ( Rule 78(1) (a)(i))*
- *Form XVII- Register of Wages ( Rule 78(1) (a)(i))*
- *Form XVIII- Register of wages cum Muster Roll( in case of weekly payment)*
- *Form XIX- Wage slip ( Rule 78(b))*
- *Form XX- Register of deduction for damages Or Loss Rule 78(1) (a)(ii))*
- *Form XXI- Register of files Rule 78(1) (a)(ii))*
- *Form XXII- Register of Advance Rule 78(1) (a)(ii))*
- *Form XXIII- Register of Overtime Rule 78(1) (a)(iii))*
- *Form XXIV- Return to be sent by the contractor to the Licensing officer (Rule 82(1))*

*2.8.3 The contractor shall obtain independent License under the Contract Labour (Regulations and Abolition Act)as required from the concerned Authorities based on the certificate (Form-V) issued by the Principal Employer/Customer*

2.8.4 *The contractor shall pay all taxes, fees, license charges, deposits, duties, tolls, royalties, commission or other charges which may be levied on account of his operations in executing the contract.*

2.8.5 *While BHEL would pay the inspection fees and Registration fees of Boiler & explosive/Electrical Inspectorate, all other arrangements for site visits periodically by the Inspectorate to site, Inspection certificate etc. will have to be made by contractor. However, BHEL will not make any payment to the Inspectorate in connection with contractor's Welders/Electricians qualification tests etc.*

2.8.6 *Contractor shall be responsible for provision of Health and Sanitary arrangements (more particularly described in Contract Labour Regulation & Abolition Act), Safety precautions etc. as may be required for safe and satisfactory execution of contract.*

2.8.7 *The contractor shall be responsible for proper accommodation including adequate medical facilities for personnel employed by him.*

2.8.8 *The contractor shall be responsible for the proper behavior and observance of all regulations by the staff employed by him.*

2.8.9 *The contractor shall ensure that no damage is caused to any person/property of other parties working at site. If any such damage is caused, it is responsibility of the contractor to make good the losses or compensate for the same.*

2.8.10 *All the properties/equipment/components of BHEL/their Client loaned with or without deposit to the contractor in connection with the contract shall remain properties of BHEL/their Client.*

2.8.11 *The contractor shall use such properties for the purpose of execution of this contract. All such properties/equipment/components shall be deemed to be in good condition when received by the contractor unless he notifies within 48 hours to the contrary. The contractor shall return them in good condition as and when required by BHEL/their Client. In case of non-return, loss, damage, repairs etc, the cost thereof as may be fixed by BHEL Engineer will be recovered from the contractor*

2.8.12 *Any delay in completion of works/or non-achievement of periodical targets due to the reasons attributable to the contractor, the same may have to be compensated by the contractor either by increasing manpower and resources or by working extra hours and/or by working more than one shift. All these are to be carried out by the contractor at no extra cost.*

2.8.13 *The contractor shall arrange, coordinate his work in such a manner as to cause no hindrance to other agencies working in the same premises.*

2.8.14 All safety rules and codes applied by the Client/BHEL at site shall be observed by the contractor without exception. The contractor shall be responsible for the safety of the equipment/material and works to be performed by him and shall maintain all light, fencing guards, slings etc. or other protection necessary for the purpose. Contractor shall also take such additional precautions as may be indicated from time to time by the Engineer with a view to prevent pilferage, accidents, fire hazards. Due precautions shall be taken against fire hazards and atmospheric conditions. Suitable number of Clerical staff, watch and ward, store keepers to take care of equipment/materials and construction tools and tackles shall be posted at site by the contractor till the completion of work under this contract. The contractor shall arrange for such safety devices as are necessary for such type of work and carry out the requisite site tests of handling equipment, lifting tools, tackles etc. as per prescribed standards and practices. Contractor has to ensure the implementation of Health, Safety and Environment (HSE) requirements as per directions given by BHEL/Customer. The contractor has to assist in HSE audit by BHEL/Customer and submit compliance Report. The contractor has to generate and submit record/reports as per HSE plan/activities as per instruction of BHEL/Customer. All tools, plant and equipment brought to the site shall become the property of BHEL and shall not be removed from the site without the prior written approval from BHEL. When the work is finally completed or the Contractor is determined for reasons other than the defaults of the contract, he shall forthwith remove from the site all tools, plants, equipment etc., (other than those as may have been provided by BHEL) and upon such removal, the same shall revert in, and become the property of the contractor.

2.8.15 The contractor will be directly responsible for payment of wages to his workmen on specified date of respective month declared as per applicable Labour Act. A pay roll sheet giving all the payments given to the workers and duly signed by the contractor's representative should be furnished to BHEL site for record purpose.

2.8.16 In case of any class of work for which there is no such specification as laid down in the contract, such work shall be carried out in accordance with the instructions and requirements of the Engineer.

2.8.17 Also, no idle charges will be admissible in the event of any stoppage caused in the work resulting in contractor's labour and Tools & Plants being rendered idle due to any reason at any time.

2.8.18 The contractor shall take all reasonable care to protect the materials and work till such time the plant/equipment has been taken over by BHEL or their Client whichever is earlier.

2.8.19 The contractor shall not stop the work or abandon the site for whatsoever reason of dispute, excepting force majeure conditions. All such problems/disputes shall be separately discussed and settled without affecting the progress of work. Such stoppage or abandonment shall be treated as breach of contract and dealt with accordingly

2.8.20 *The contractor shall keep the area of work clean and shall remove the debris etc. while executing day-to-day work. Upon completion of work, the contractor shall remove from the vicinity of work, all scrap, packing materials, rubbish, unused and other materials and deposit them in places specified by the Engineer. The contractor will also demolish all the hutments, sheds, offices, etc. constructed and used by him and shall clean the debris. In the event of his failure to do so, the same will be arranged to be done by the Engineer and the expenses recovered from the contractor. If the work is executed in Factory premises, no hutment will be allowed.*

2.8.21 *The contractor shall execute the work in the most substantial and workman like manner in the stipulated time. Accuracy of work and timely execution shall be the essence of this contract. The contractor shall be responsible to ensure that the quality, assembly and workmanship conform to the dimensions and clearance given in the drawings and/ or as per the instructions of the Engineer.*

2.8.22 *The Contractor to note that some of BHEL's T&Ps/MMDs may not be insured. The Contractor will take necessary precautions and due care to protect the same while in his custody from any damage/ loss till the same is handed over back to BHEL. In case the damage / loss is due to carelessness/ negligence on the part of the contractor, the Contractor is liable to get them repair/ replaced immediately and in case of his failure to do so within a reasonable time, BHEL will reserve the right to recover the loss from the contractor.*

2.8.23 *The contractor shall provide all watchmen necessary, for the protection of the site, the work, the materials, the tools , plant, equipment and anything else lying on the site during the progress of the work. He shall solely be responsible for and shall take all reasonable and proper steps for protecting, securing , lighting and watching all places on or about the work and the site which may be dangerous to any person whom so ever.*

2.8.24 **SITE DRAINAGE:** All water that may accumulate on the site during the process of the work, or in trenches and excavations shall be removed to the entire satisfaction of the Engineer-in-charge and at Contractors expense.

2.8.25 **INSPECTION OF THE WORK:** BHEL Officers concerned with the Contract shall have power at any time to inspect and examine any part of the work and the contractor shall give such facilities as may be required to given for such inspection and examination.

2.8.26 *In case the contractor is required to undertake any work outside the scope of this contract, the rates payable shall be those mutually agreed upon if the item rates are not mentioned in existing contract*

*i. For any item of work required to be carried out after the contract has been awarded and which is not covered by Contractors Schedule but is covered by C.P.W.D. schedule of rates the rate payable for such a fresh item will be derived from updated C.P.W.D. schedule of rates by the method of proportion as follows:*

- ii. Rate as per estimated updated C.P.W.D DSR and loading tender excess (plus or minus) on pro-rata basis for nearest analogous items. For other items rate as per estimated C.P.W.D DSR and loading tender excess(plus or minus)*
- iii. If rates are not available in C.P.W.D. DSR, deviated item rates will be derived from market rate with 15% profit and overheads.*

## **2.9 PROGRESS MONITORING, MONTHLY REVIEW AND PERFORMANCE EVALUATION**

**2.9.1** A detailed plan/programme for completion of the contractual scope of work as per the time schedule given in the contract shall be jointly agreed between BHEL and Contractor, before commencement of work . The above programme shall be supported by month wise deployment of resources viz Manpower, T&P, Consumables, etc. Progress will be reviewed periodically (Daily/Weekly/Monthly) vis a vis this jointly agreed programme. The Contractor shall submit periodical progress reports (Daily/Weekly/Monthly) and other reports/information including manpower, consumables, T&P mobilization etc as desired by BHEL.

**2.9.2** Monthly progress review between BHEL and Contractor shall be based on the agreed programme as above, availability of inputs/fronts etc, and constraints if any, as per prescribed formats. Manpower, T&P and consumable reports as per prescribed formats shall be submitted by contractor every month. Release of RA Bills shall be contingent upon certification by BHEL Site Engineer of the availability of the above prescribed formats duly filled in and signed.

**2.9.3** The burden of proof that the causes leading to any shortfall is not due to any reasons attributable to the contractor is on the contractor himself. The monthly progress review shall record shortfalls attributable to (i) Contractor, (ii) Force Majeure Conditions, and (iii) BHEL

## **2.10 TIME OF COMPLETION**

**2.10.1** Time is essence of the contract. The time schedule shall be as prescribed in the Contract. The time for completion shall be reckoned from the date of commencement of work at Site as certified by BHEL Engineers

**2.10.2** The entire work shall be completed by the contractor within the time schedule or within such extended periods of time as may be allowed by BHEL under clause 2.11

## **2.11 EXTENSION OF TIME FOR COMPLETION**

**2.11.1** If the completion of work as detailed in the scope of work gets delayed beyond the contract period, the contractor shall request for an extension of the contract and BHEL at its discretion may extend the Contract.

2.11.2 *Based on the monthly reviews jointly signed, the works balance at the end of original contract period less the backlog attributable to the contractor shall be quantified, and the number of months of 'Time extension' required for completion of the same shall be jointly worked out. Within this period of 'Time extension', the contractor is bound to complete the portion of backlog attributable to the contractor. Any further 'Time extension' or 'Time extensions' at the end of the previous extension shall be worked out similarly.*

2.11.3 *However if any 'Time extension' is granted to the contractor to facilitate continuation of work and completion of contract, due to backlog attributable to the contractor alone, then it shall be without prejudice to the rights of BHEL to impose penalty/LD for the delays attributable to the contractor, in addition to any other actions BHEL may wish to take at the risk and cost of contractor.*

2.11.4 *A joint programme shall be drawn for the balance amount of work to be completed during the period of 'Time Extension', along with matching resources (with weightages) to be deployed by the contractor as per specified format. Review of the programme and record of shortfall shall be done every month of the 'Time extension' period in the same manner as is done for the regular contract period.*

2.11.5 *During the period of 'Time extension', contractor shall maintain their resources as per mutually agreed program*

2.11.6 *At the end of total work completion as certified by BHEL Engineer, and upon analysis of the total delay, the portion of time extensions attributable to (i) Contractor, (ii) Force majeure conditions, and (iii) BHEL, shall be worked out and shall be considered to be exhausted in the same order. The total period of time extensions shall be the sum of (i), (ii) and (iii) above and shall be equal to period between the scheduled date of completion and the actual date of completion of contract. LD shall be imposed/levied for the portion of time extensions attributable to contractor and recoverable from the dues payable to the contractor.*

## **2.12 OVERRUN COMPENSATION (THIS CLAUSE IS NOT APPLICABLE IN BHEL FACTORY & TOWNSHIP PREMISES)**

2.12.1 *Over Run Compensation (ORC) is payable by way of rate revisions for periods beyond original, contract period subject to the following terms and conditions.*

2.12.2 *Rates shall be increased by 10% for the first twelve months of one or more extensions beyond original contract period. For the next twelve months of further extensions if any, rates shall be increased as above by 10% over the previous twelve months, and similarly for each subsequent twelve months extension.*

*2.12.3 Should there be any 'Time extension' for reasons attributable only to the contractor, then the work shall be executed by the contractor at the rates applicable for the period the work was planned*

*2.12.4 Payment of ORC shall be regulated as follows:*

*i) Contractor is entitled to Over Run Compensation (ORC) only for the portion of backlog attributable to BHEL.*

*ii) 50% of the compensation is allocated for deployment of resources agreed as per the joint programme drawn vide 2.11.4. Payment shall however be based on the actual deployment of resources for the month as certified by BHEL, as per weightages assigned therein*

*iii) 50% of the compensation, is allocated for achieving of planned progress agreed as per the joint programme drawn vide 2.11.4. Payment shall be on pro rata basis for actual achieved quantities*

*iv) Total Over Run Compensation shall be limited to 10% of the executed contract value as certified in Final Bill. For this purpose executed contract value excludes PVC, ORC, Supplementary/Additional Items and Extra Works done on Man-day rate basis*

*2.12.5 Contractor shall not be entitled for any Over Run Compensation (ORC) for the portion of backlog attributable to the contractor. Such works shall be executed at the rates applicable for the period the work was planned*

## **2.13 QUANTITY VARIATION**

*2.13.1 The quoted rates shall remain firm irrespective of any variations in the individual quantities.*

## **2.14 EXTRA WORKS**

*2.14.1 All rectifications/modifications, revamping, and reworks required for any reasons not attributable to the contractor, or needed due to any change in deviation from drawings and design of equipment, operation/maintenance requirements, mismatching, or due to damages in transit, storage and erection/commissioning, and other allied works which are not very specifically indicated in the drawings, but are found essential for satisfactory completion of the work, will be considered as extra works.*

*2.14.2 Extra works arising on account of the contractor's fault, irrespective of time consumed in rectification of the damage/loss, will have to be carried out by the contractor free of cost. Under such circumstances, any material and consumable required for this purpose will also have to be arranged by the contractor at his cost.*

*2.14.3 All the extra work should be carried out by a separately identifiable gang, without affecting routine activities. Daily log sheets in the pro-forma prescribed by BHEL should be maintained and shall be signed by the contractor's representative and BHEL engineer. No claim for extra work will be considered/entertained in the absence of the said supporting documents i.e. daily log sheets. Signing of log sheets by BHEL engineer does not necessarily mean the acceptance of such works as extra works.*

*2.14.4 BHEL retains the right to award or not to award any of the major repair/ rework/modification/rectification/fabrication works to the contractor, at their discretion without assigning any reason for the same*

*2.14.5 After eligibility of extra works is established and finally accepted by BHEL engineer/designer, payment will be released on competent authority's approval at the following rate.*

**MAN-HOUR RATE FOR ELIGIBLE EXTRA WORKS:** Single composite average labour man-hour rate, including overtime if any, supervision, use of tools and tackles and other site expenses and incidentals, consumables for carrying out any major rework/ repairs/ rectification/ modification/ fabrication as certified by site as may arise during the course of erection, testing, commissioning or extra works arising out of transit, storage and erection damages, payment , if found due will be as per applicable minimum wage act

*2.14.6 The above composite labour man hour rate towards extra works shall remain firm and not subject to any variation during execution of the work. PVC will not be applicable for extra works. Rate revision, Over Run Charges/compensation etc will not be applicable due to extra works.*

*2.14.7 Extra Works for Civil Packages shall be regulated as follows*

*i) Rates for Extra Works arising due to (1) non availability of BOQ (Rate Schedule), OR (2) change in Specifications of materials/works (3) rectification/modification/dismantling & re erecting etc due to no fault of Contractor, shall be in the order of the following:*

*a) Item rates are to be derived from similar nature of items in the BOQ (Rate Schedule) with applicable escalation derived from All India Consumer Price Index for Whole Sale Commodities.*

*b) As per applicable updated CPWD-DSR (or latest edition) with applicable escalation derived, Notification issued by the office of CPWD for 'Cost Index' in that Region where the project is being executed,*

*c) Item rates are to be worked out on the basis of prevailing market rates mutually agreed between BHEL and Contractor, plus 15% towards Contractor's overheads and profit.*

ii) PVC and ORC will not applicable be for (i) above.

## **2.15 SUPPLEMENTARY ITEMS**

### **2.15.1 For NON Civil Works**

*Supplementary items are items/works required for completion of entire work but not specified in the scope of work. Subject to certification of such items/works as supplementary items by BHEL Engineer, rates shall be derived on the basis of any one of the following on mutual agreement:*

- i) *Based on percentage breakup/rates indicated for similar/nearby items*
- ii) *In case (i) above does not exist, then BHEL/site may derive the percentage breakup/rates to suit the type of work*

### **2.15.2 For Civil Works**

i) *Rates for Supplementary Works/Additional Works arising out due to additions/alterations in the original scope of works as per contract subject to certification of BHEL Engineer shall be worked out as under:*

a) *Item rates which are available in existing BOQ (Rate Schedule) shall be operated with applicable escalation derived from All India Consumer Price Index for Whole Sale Commodities*

b) *Items of works which are not available in existing BOQ shall be operated as an 'Extra Works' and rate shall be derived as per clause no 2.14*

ii) *Execution of Supplementary Works/Additional Works through the Contractor shall be at the sole discretion of BHEL, and shall be considered as part of executed contract value for the purpose of Quantity Variation as per clause 2.13*

iii) *BHEL Engineer's decision regarding fixing the rate as above is final and binding on the contractor.*

iv) PVC and ORC will not be applicable for (i) above.

## **2.16 STRIKES & LOCKOUT**

2.16.1 *The contractor will be fully responsible for all disputes and other issues connected with his labour/employee. In the event of the contractor's labour/employee resorting to strike or the Contractor resorting to lockout and if the strike or lockout declared is not settled within a period of 15 days, BHEL shall have the right to get the work executed through any other*

*agencies and the cost so incurred by BHEL along with Overhead charges of 35% shall be deducted from the Contractor's bills along with overhead of 35%*

**2.16.2** *For all purposes whatsoever, the employees of the contractor shall not be deemed to be in the employment of BHEL*

#### **2.17 FORCE MAJEURE**

*The following shall amount to Force Majeure:-*

**2.17.1** *Acts of God, act of any Government, War, Sabotage, Riots, Strike, Civil commotion, Police action, Revolution, Flood, Fire, Cyclones, Earth quake and Epidemic and other similar causes over which the contractor has no control.*

**2.17.2** *If the contractor suffers delay in the due execution of the contractual obligation due to delays caused by force majeure as defined above, the agreed time of completion of the job covered by this contract or the obligations of the contractor shall be extended by a period of time equal to period of delay, provided that on the occurrence of any such contingency, the contractor immediately reports to BHEL in writing the causes of delay and the contractor shall not be eligible for any compensation.*

#### **2.18 ARBITRATION & RECONCILIATION**

**2.18.1** *In case amicable settlement is not reached in the event of any dispute or difference arising out of the execution of the Contract or the respective rights and liabilities of the parties or in relation to interpretation of any provision by the Contractor in any manner touching upon the Contract, such dispute or difference shall (except as to any matters, the decision of which is specifically provided for therein) be referred to the sole arbitration of the arbitrator appointed by BHEL/In charge.*

*The award of the Arbitrator shall be binding upon the parties to the dispute Subject as aforesaid, the provisions of Arbitration and Reconciliation Act 1996 (India) or statutory modifications or reenactments thereof and the rules made there under and for the time being in force shall apply to the arbitration proceedings under this clause. The venue of the arbitration shall be the place from which the contract is issued or such other place as the Arbitrator at his discretion may determine*

*2.18.2 In case of Contract with Public Sector Enterprise (PSE) or a Government Department, the following shall be applicable:*

*In the event of any dispute or difference relating to the interpretation and application of the provisions of the Contract, such dispute or difference shall be referred to by either party to the arbitration of one of the arbitrators in the department of public enterprises. The award of the arbitrator shall be binding upon the parties to the dispute, provided, however, any party aggrieved by such award may make further reference for setting aside or revision of the award to the Law Secretary, Department of Legal Affairs, Ministry of Law and Justice, Government of India. Upon such reference the dispute shall be decided by the Law Secretary or the Special Secretary or Additional Secretary when so authorized by the Law Secretary, whose decision shall bind the parties hereto finally and conclusively.*

*2.18.3 The cost of arbitration shall be borne equally by the parties.*

*2.18.4 Work under the contract shall be continued during the arbitration proceedings*

## **2.19 PAYMENTS**

*Payments to Contractors are made in any one of the following forms*

### *2.19.1 Running Account Bills (RA Bills)*

*i) These are for interim payments when the contracts are in progress. The bills for such interim payments are to be prepared by Contractor in prescribed formats (RA Bill forms).*

*ii) Payments shall be made according to the extent of work done as per measurements taken up to the end of the calendar month and in line with the terms of payments described in the Tender documents along with relevant statutory documents applicable for the work.*

*iii) Recoveries on account of electricity, water, statutory deductions, etc are made as per terms of contract*

*iv) Full rates for the work done shall be allowed only if the quantum of work has been done as per the specifications stipulated in the contract. If the work is not executed as per the stipulated specifications, BHEL may ask the contractor to re do the work according to the required specifications, without any extra cost. However, where this is not considered necessary 'OR' where the part work is done due to factors like non-availability of material to be supplied by BHEL 'OR' non availability of fronts 'OR' non availability of drawings, fraction payment against full rate, as is considered reasonable, may be allowed with due regard for the work remaining to be done. BHEL decision in this regard will be final and binding on the contractor.*

v) In order to facilitate part payment, BHEL Site Engineer at his discretion may further split the contracted rates/percentages to suit site conditions, cash flow requirements according to the progress of work

#### **2.19.2 Final Bill**

*Final Bill' is used for final payment on closing of Running Account for works or for single payment after completion of works. 'Final Bill' shall be submitted as per prescribed format after completion of works as per scope and upon material reconciliation, along with the following.*

- i) 'No Claim Certificate' by contractor
- ii) Clearance certificates where ever applicable viz Clearance Certificates from Customer, various Statutory Authorities like Labour department, PF Authorities, Commercial Tax Department, etc
- iii) Indemnity bond as per prescribed format BHEL shall settle the final bills after deducting all liabilities of Contractor to BHEL

#### **2.20 PERFORMANCE GUARANTEE FOR WORKMANSHIP**

*2.20.1 Even though the work will be carried out under the supervision of BHEL Engineers the Contractor will be responsible for the quality of the workmanship and shall guarantee the work done for a period of as mentioned in the contract/NIT from the date of commencement of guarantee period as defined in Technical Conditions of Contract, for good workmanship and shall rectify free of cost all defects due to faulty erection detected during the guarantee period. In the event of the Contractor failing to repair the defective works within the time specified by the Engineer, BHEL may proceed to undertake the repairs of such defective works at the Contractor's risk and cost, without prejudice to any other rights and recover the same from the balance security deposit.*

#### **2.20.2 BHEL shall release the balance security deposit subject to the following**

- i) Contractor has submitted 'Final Bill'
- ii) Guarantee period as per contract has expired
- iii) Contractor has furnished 'No Claim Certificate' in specified format
- iv) BHEL Site Engineer/Construction Manager has furnished the 'No Demand Certificate' in specified format

v) Contractor has carried out the works required to be carried out by him during the period of Guarantee and all expenses incurred by BHEL on carrying out such works is included for adjustment from the Guarantee money refundable.

## **2.21 CLOSING OF CONTRACTS**

*The Contract shall be considered completed and closed upon completion of all contractual obligations and settlement of Final Bill or completion of Guarantee period whichever is later. Upon closing of Contract, BHEL shall issue a completion certificate as per standard format, based on specific request of Contractor.*

## **2.22 REVERSE AUCTION/PRICE BID OPENING:**

- *BHEL reserves the right to go for reverse auction at any point of time before opening of Price Bid.*
- *Bids with non-acceptance of reverse auction will be liable for rejection.*
- *Opening of Price Bid at discretion of BHEL.*
- *BHEL shall be at liberty to cancel the tender at any time, before ordering, without assigning any reason.*

## **2.23 SUSPENSION OF BUSINESS DEALINGS**

*BHEL reserves the right to take action against Contractors who either fail to perform or Tenderers/Contractor who indulge in malpractices, by suspending business dealings with them in line with BHEL guidelines issued from time to time.*

## **2.24 OTHER ISSUES**

**2.24.1** *Value of Non judicial Stamp Paper for Bank Guarantees and for Contract Agreement shall be not less than Rs 200/- unless otherwise required under relevant statutes.*

**2.24.2** *In case of any conflict between the General Conditions of Contract and Special Conditions of Contract, provisions contained in the Special Conditions of Contract shall prevail.*

**2.24.3** *Unless otherwise specified in NIT, offers from consortium/JVs shall not be considered.*

**2.24.4** *BHEL may not insist for signing of Contract Agreements in respect of low value and short time period contracts*

## PART-II (PRICE BID)

### Bill of Quantity (BOQ) Cum Rate Schedule

#### BOQ for (BOS2) of 100MW (AC) Floating Solar Photovoltaic Grid-connected Power plant for NTPC at Ramagundam

#	Bidder scope of supply and works (as briefly outlined)	Qty	Unit	Unit Rate (Excluding GST)	TOTAL Amount	% GST 	Item billed to Edn/Nodal
1	Supply of FRP/Aluminium ladder type cable tray with cover and supporting arrangement consisting of mounting bar and clamp with SS 304 hardware for clamping with HDPE floaters – 300mm wide	12700	meter	608	77,15,250		Nodal
2	Supply of FRP/Aluminium ladder type cable tray with cover and supporting arrangement consisting of mounting bar and clamp with SS 304 hardware for clamping with HDPE floaters – 600mm wide	7700	meter	990	76,23,000		Nodal
3	Supply of double compression weatherproof metallic cable gland, bi-metallic strip or washer, SS304 hardware for 400 sq.mm cable- For PCU DC & AC side, Transformer LV side	3550	set	760	26,96,580		Nodal
4	Supply of double compression weatherproof metallic cable gland for 33KV(E), 1CX150 sq.mm cable	480	Nos	1,575	7,56,000		Nodal
5	Supply of double compression weatherproof metallic cable gland for 33KV(E), 1CX630 sq.mm cable	75	Nos	1,845	1,38,375		Nodal
6	Supply of 30KVA, 380V/ 415V, dYN11 Dry Type transformer with IP 54 or higher rated outdoor enclosure(Corrosion resistant) with stand and accessories (Including lugs and glands for input and output side cables at both ends)	1	Set	85,500	85,500		EDN

7	Supply of 1.1KV, 3.5CX25 sq.mm XLPE aluminium armoured cable – From Aux Transformer to CMCS and PCU to Aux transformer	1500	meter	203	3,03,750		Nodal
8	63 mm, 6kg/sq.cm HDPE pipe for 1.1kV, 3.5CX25 sq.mm cable	200	m	113	22,500		
9	Supply of Hume pipes (NP 2 or above, dia 300mm) for HT cable crossing over the reservoir bund	32	m	1,350	43,200		Nodal
10	Supply of outdoor ladder type cable tray (Aluminium / FRP) with mounting arrangements for HT cables on sloping sides of the reservoir bund	100	m	765	76,500		Nodal
11	Supply of trefoil clamps (Non corrosive) for entire HT cables laying	1	set	9,00,000	9,00,000		
12	Supply of indoor cable termination kit for 33KV(E),1CX150 sq.mm cable	480	Nos	5,850	28,08,000		Nodal
13	Supply of indoor cable termination kit for 33KV(E), 1CX630 sq.mm	75	Nos	8,100	6,07,500		Nodal
14	Supply of outdoor straight through joint kits for 33KV(E), 1CX150 sq.mm cable	25	Nos	38,250	9,56,250		Nodal
15	Supply of outdoor straight through joint kits for 33KV(E), 1CX630 sq.mm cable	60	Nos	43,650	26,19,000		Nodal
16	Supply of wall mounted LT switchgear for CMCS (With energy meter)	1	No	1,35,000	1,35,000		Nodal
17	Supply of UPS systems (5 KVA), with 1 hour backup, UPSDB and Ni-Cd type battery bank (Comprising of 2 x100% redundancy for Battery and Charger)	5	set	4,27,500	21,37,500		EDN
18	Supply of UPS systems (3 KVA),with 30 mins backup, UPSDB and Ni-Cd type battery bank (Comprising of 2 x100% redundancy for Battery and Charger)	37	sets	2,92,500	108,22,500		Nodal
19	Outdoor IP54 or higher enclosure for housing UPS and battery bank at final evacuation point (IC-OG panels)	1	No	67,500	67,500		Nodal

20	Supply of weather monitoring system (WMS)	1	set	9,00,000	9,00,000		Nodal
21	Supply of furniture for CMCS room	1	set	6,75,000	6,75,000		Nodal
22	Supply of fire-fighting and alarm system for CMCS	1	Set	4,05,000	4,05,000		Nodal
23	Supply of outdoor fire-fighting system for IFP & LPSFP	40	sets	1,35,000	54,00,000		Nodal
24	Supply of earthing system for inverter platform (Below water- Including hardware, bare down conductor as per standards, earthing rod etc)	36	set	1,35,000	48,60,000		Nodal
25	Supply of earthing system for Local Pooling Switchgear Floating Platform (LPSFP) (Below water- Including hardware, bare down conductor as per standards, earthing rod etc)	4	set	1,35,000	5,40,000		Nodal
26	Supply of earthing system for IC-OG panels as per Annexure "Earthing system specification"	1	set	1,35,000	1,35,000		Nodal
27	Supply of earthing system for CMCS as per Annexure "Earthing system specification"	1	set	1,35,000	1,35,000		
28	Supply of control, instrumentation and aux power cable for connecting 40 Nos of PCUs, 40 Nos of inverter Transformer, 90 Nos of HT panels, 42 Nos of UPS, 42 Nos of SCADA panel, 1 No WMS, 40 Nos of wireless transmitter system from SCADA panel on floating platform, 1 set of wireless receiver system at CMCS, 1 No Fire Alarm system at CMCS etc.	1	set	36,00,000	36,00,000		Nodal
29	Supply of wireless receiver support lattice tower structure near to CMCS building- Max height 20m with approx. tonnage 2Tonnes along with foundations.	1	No	3,60,000	3,60,000		Nodal
30	Supply of LED outdoor lighting system with 3 m pole, JB and fixtures	82	no.s	36,000	29,52,000		Nodal

31	Supply of Emergency lamps and associated cabling with conduits for CMCS (to be connected with UPS)	4	no.s	36,000	1,44,000		Nodal
32	Supply of lightning arrester system with earthing arrangement for CMCS building	1	set	1,35,000	1,35,000		Nodal
33	Supply of Pre-fabricated security cabin – Dimensions 3mX3mX2.4m(H)-minimum	1	No	4,50,000	4,50,000		Nodal
34	Supply of air conditioners for CMCS building- Capacity 1.5 Ton	2	Nos	67,500	1,35,000		Nodal
35	Supply of Water supply system with bore-well having submersible pump set, starter with protections (both of reputed make). Bore-well shall be with casing and filters for bore piping with valves etc. upto water storage tank located on top of CMCS building. Bore well shall be located adjacent to CMCS. Depth shall be such as to ensure permanent supply of clean water and may be decided as per Hydrological investigation	1	set	6,75,000	6,75,000		Nodal
36	Supply of miscellaneous items such as cable tags, cable ties, cable ferrules, cable route markers, hoarding board, sign boards, danger boards, display boards, plant Layout boards, electrical insulation mat, tool kits, first aid box, measuring instruments, items for remote connectivity of SCADA excluding FO cable, etc.	1	set	4,50,000	4,50,000		Nodal
37	Supply of ABT meter (To be mounted on BHEL supplied HT panels) make as per approved TRANSCO/SLDC with valid calibration certificates	12	Nos	2,25,000	27,00,000		Nodal
38	Supply of spare items	1	set	2,70,000	2,70,000		Nodal
<b><i>List of Works (I&amp;C activities)</i></b>							

1	<b>I&amp;C:</b> Laying and termination of 2RX1CX400 sq.mm XLPE AL DC power cables from 14 Nos of SCBs to PCU through covered cable trays (1AU = 2.5MWac block)	40	AU	4,05,000	162,00,000		EDN
2	<b>I&amp;C:</b> Transport of equipment from BHEL store to floating platform casting location, Placement and proper grouting of PCU, Transformer, HT panel, Electrical equipment enclosure (for housing SCADA panel with wireless transmitter and UPS with battery bank) on floating platform when the platform is casted near to the shore and towing the platform with equipment to the pre-defined location as per the instructions by the OEM of floating platform. Supply of platform, anchoring and mooring of platform is in BHEL scope. Bidder has to hire motor boats, barge mounted or land based heavy duty cranes, experienced rigging crew etc for this activity. ( 1AU = Works related to 1 platform)	40	AU	6,75,000	270,00,000		EDN
3	<b>I&amp;C :</b> Launching ramp: Construction of temporary platform cum ramp of approximate dimensions of 12 m x 5 m at edge of reservoir at location given by BHEL to enable loading and mounting of heavy electrical equipment from land onto Floating equipment platforms. Deepening of water depth at platform area upto 3 meters along ramp and excavation for approximately 150 m long approach way in water from deep end to ramp for enabling approach of floating platforms upto ramp and return. Platform shall be of RCC construction with ramp on land side for enabling movement of cranes onto platform.	1	AU	18,00,000	18,00,000		EDN

4	<b>I&amp;C:</b> Laying and termination of 30RX1Cx400sqmm LT power cable from PCU to transformer (Approx distance 3 m) ( 1AU = Works on 1 platform)	40	AU	54,000	21,60,000		EDN
5	<b>I&amp;C:</b> Laying and termination of 3RX1Cx150sqmm HT power cable from transformer to stand alone HT panel (Approx distance 3 m) ( 1AU = Works on 1 platform)	40	AU	40,500	16,20,000		EDN
6	<b>I&amp;C:</b> Erection of 30KVA Aux dry type transformer in one of the inverter floating platform, cabling and termination of aux power cables upto CMCS room (Approx distance 1.5Km) through HDPE pipes, floaters and underground trenches as per site requirement	1	AU	1,35,000	1,35,000		EDN
7	<b>I&amp;C:</b> Under water Earthing of electrical equipment on IFP & LPSFP as per standards (1AU = Earthing of equipment on 1 floating platform like, PCU, Transformer, HT panel, SCADA, UPS) ( 1AU = Works related to 1 platform)	40	AU	1,12,500	45,00,000		EDN
8	<b>I&amp;C:</b> Laying and termination of 3RX1Cx150sqmm HT power cable from stand-alone HT panel to LPSFP through cable floaters. HT cable floater installation as per the instructions of OEM is in bidder scope. Necessary clamps and fixing arrangements shall be supplied and installed by the bidder. Cable floaters supply is in BHEL scope. ( 1AU = Works related to 1 IF to LPSFP)	40	AU	4,05,000	162,00,000		EDN

9	<b>I&amp;C:</b> Laying and termination of 3RX1CX630 sq.mm HT power cable from LPSFP to reservoir bund through cable floaters. HT cable floater installation as per the instructions of OEM is in bidder scope. Necessary clamps and fixing arrangements for cables on HDPE floaters shall be supplied and installed by the bidder. Required tying arrangement in consultation with floater OEM for arresting movement of cable floaters is also in bidder scope. Cable floaters supply is in BHEL scope. ( 1AU = Laying of 1 trefoil run for 1KM)	10	AU	22,50,000	225,00,000		EDN
10	<b>I&amp;C:</b> Laying and termination of 3RX1CX630 sq.mm HT power cable from reservoir bund (crossing bund using trays and hume pipes ) to final evacuation point at NTPC switchyard via IC-OG and metering panels near to final evacuation point through underground cable trench. 2 trefoils shall be routed with a Center to center gap of 400mm. Similar 2 nearby trenches of gap min 1000mm for 4 Nos of 25MW feeders. ( 1AU = Laying of cables through 2 trenches for 1KM)	2	AU	31,50,000	63,00,000		EDN
11	<b>I&amp;C:</b> Erection and earthing of 8 Nos of outdoor HT panels (including fixing of ABT meters) near to evacuation point and 2 nos of indoor panels with adapter panels inside switchgear section B & F. All activities required for bus bar extension using adapter panel is in the scope of bidder, Supply of HT panels is in BHEL's scope.	1	AU	3,60,000	3,60,000		EDN

12	<b>I&amp;C:</b> Erection and earthing of electrical equipment at CMCS: SCADA and telemetry panels, UPS with battery bank, fire alarm system, A/C, WMS system, LA and wireless receiver system with RCC foundation near to CMCS building etc	1	AU	2,70,000	2,70,000		EDN
13	<b>I&amp;C:</b> Laying and termination of control/data/instrumentation/aux power cable inside CMCS room, WMS system on top of CMCS room and wireless receiver mast near to CMCS room	1	AU	1,35,000	1,35,000		EDN
14	<b>I&amp;C:</b> Laying and termination of OFC cable from CMCS to OWS at final evacuation point (along with the HT cables). 1AU= 1Km OFC cable laying including splicing termination etc.	3.5	AU	1,80,000	6,30,000		EDN
15	<b>I&amp;C:</b> Plant lighting system including outdoor cable laying, cable terminations at poles / lights as well as DB boards of inverter platforms. (1 AU= for 1 LED fixture)	82	AU	22,500	18,45,000		Nodal
16	<b>I&amp;C:</b> Emergency lighting system including cable laying, cable terminations at CMCS. (1 AU= for 1 LED fixture)	4	AU	9,000	36,000		Nodal
17	<b>I&amp;C:</b> Miscellaneous and safety items such as cable tags, cable markers, hoarding board, sign boards, danger boards, display boards, electrical insulation mat, air conditioners, office furniture, fire extinguishers, fire alarm system, weather monitoring system, items for remote connectivity of SCADA, identification markings using painting etc	1	AU	1,80,000	1,80,000		Nodal

18	<b>I&amp;C:</b> Pre-commissioning inspections/ checks/tests, MRT tests, coordination/liaison with state /central departments/CEIG etc for necessary approvals/clearances for commissioning, synchronization with grid/ plant commissioning.	1	AU	45,00,000	45,00,000		Nodal
19	<b>I&amp;C:</b> Liasoning with railways and carrying out laying / tunneling works for 4 sets of 33KV(E), 3RX1CX630 sq.mm HT cable crossing below the railway line (If required). Presently cable crossing through existing hume pipes are considered. Hence this line item may be operated only if any objection from railways to use the existing hume pipes.	1	AU	22,50,000	22,50,000		Nodal
20	Deputation of Safety supervisor for duration of I&C ( 1 AU = 1 Month )	6	AU	67,500	4,05,000		Nodal
21	Provision of emergency vehicle/Ambulance on standby for duration of I&C ( 1 AU = 1 Month )	6	AU	1,80,000	10,80,000		Nodal
<b>Grand Total (Supply+I&amp;C)</b>					<b>1755,40,905</b>		
QUOTE PERCENTAGE (%) ABOVE/BELOW (+/-) (OR) AT PAR TO TOTAL AMOUNT							
QUOTED PERCENTAGE (%) IN WORDS ABOVE/BELOW (OR) AT PAR TO TOTAL AMOUNT							
	<b>GST (As applicable) To be mandatorily indicated in the column above.</b>						
	<b>NOTE:</b> 1. CONTRACTOR SHOULD QUOTE PERCENTAGE (%) ABOVE/BELOW (OR) AT PAR TO TOTAL AMOUNT						
	2. QUOTED PERCENTAGE (%) IS APPLICABLE ON ALL ITEM RATES UNIFORMLY.						