WBPDCL

THE WEST BENGAL POWER DEVELOPMENT CORPORATION LIMITED

(A Government of West Bengal Enterprise)

NOTICE INVITING TENDER (NIT)

e-Procurement

Tender Ref. No. S-672

NIT No: WBPDCL/CORP/NIT/E1676/22-23 dtd. 17/03/2023

National Competitive Bidding

For

E-tender cum reverse auction for Design & Engineering, Manufacture / Procurement, Supply, Erection, Testing and Commissioning of 22.5 MW Grid Connected Floating Solar Photovoltaic Power Plants on different Water Ponds at BkTPS, STPS & SgTPP of WBPDCL, West Bengal including warrantee obligation with 05 (Five) years comprehensive Operation and Maintenance on turnkey basis.

The West Bengal Power Development Corporation Limited

(A Government of West Bengal Enterprise)

Bidyut Unnauan Bhaban, Plot No. 3/C LA-Block, Sector-III, Bidhannagar,

Kolkata-700 106

March-2023

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BID INFORMATION SHEET

Sl. No	Aspect	:	Description of Aspect
1.	**Title of the NIT**	:	E-tender cum reverse auction for Design & Engineering, Manufacture / Procurement, Supply, Erection, Testing and Commissioning of 22.5 MW Grid Connected Floating Solar Photovoltaic Power Plants on different Water Ponds at BkTPS, STPS & SgTPP of WBPDCL, West Bengal including warrantee obligation with 05 (Five) years comprehensive Operation and Maintenance on turnkey basis.
2.	**NIT NO. & Date**	:	**WBPDCL/CORP/NIT/E1676/22-23 dtd. 17/03/2023**
3.	**Publishing Date**		17/03/2023 , 18:45 Hrs.
4.	**Document Download start date**		17/03/2023 , 18:45 Hrs.
5.	**Pre-bid queries submission end date**		Within 03/04/2023 up to 16:00 Hrs.
6.	**Pre-Bid Meeting**		06/04/2023 at 11.00 Hrs
7.	**Bid submission start date**		17/04/2023 at 18:30 Hrs
8.	**Bid submission end date**		02/05/2023 at 15:00 Hrs.
9.	**Earnest Money (B.G) physical submission at Corporate office**		From 17/04/2023 to 02/05/2023 (between 11:00 a.m. to 3:00 p.m.) (except Saturday/ Sunday/ Holidays of GoWB)
10.	**Technical Bid opening date**		04/05/2023 at 15:30 Hrs
11.	**Uploading of Technical Bid Evaluation sheet**		To be notified through system generated message
12.	**Financial Bid opening date**		To be notified through system generated message
13.	**Uploading of Financial Bid evaluation sheet**		To be notified through system generated message
14.	**Scope of Work**	:	Clause No. ITB1.3
15.	**Cost of the Tender**	:	**Not applicable**
16.	**Bid Security/ EMD**	:	**Rs. 403.94 Lakh**

Sl. No	Aspect	:	Description of Aspect
17.	**Name, Designation, Address and other details**	:	**The General Manager (M&C) ,** The West Bengal Power Development Corp. Ltd. Bidyut Unnayan Bhaban, Plot No. 3/C LA-Block, Sector-III, Bidhannagar,Kolkata-700 106
18.	**For any Bid quarry contact Person**		Sri Subhranshu Chatterjee, The Sr. Manager (Solar cell), Project Email:schatterjee01@wbpdcl.co.in, suvros1977@gmail.com Contact No: 8336905234 (for technical query)
			Smt. Sulagna Dass, Manager (PS),M&C Email: s.dass@wbpdcl.co.in Contact No: 8240042058
19.	**Date of Commencement for each contract**	:	From the date of issuance of Letter Of Award (LOA).
20.	**Time for Completion**	:	**12 (Twelve) Months from date of LOA for Project at BkTPS**
			12 (Twelve) Months from date of LOA for Project at STPS
			10 (Ten) Months from date of LOA for Project at SgTPP
21.	**Possession of Site for each contract**	:	Immediately on receipt of LOA from Purchaser (WBPDCL).
22.	**Performance guarantee for execution of contract for each Contract**	:	i. 3% of the Project Cost **plus GST** in the form of bank guarantee valid for a period of Seventy Two (72) months with further claim period for ninety (90) days thereafter. ii. Should be submitted within 15 days from the date of LOA.(BG Format **Annexure-2**)
23.	**Defects Liability Period for each contract each contract**	:	Sixty (60) calendar months upto successful completion of comprehensive O&M job from the date of issue of final completion certificate of first contract of each project (**Annexure-6**).
24.	**Minimum value of work for each RA Bill for each contract**	:	Rs.10.00 Lakhs. (Rupees Ten lakhs only)
25.	**Performance Warranty for each contract**	:	5% of the **Project Cost plus GST** will be retained by the Purchaser for the performance warranty and the same will be paid in 1% yearly after successful

Sl. No	Aspect	:	Description of Aspect
			completion of the work i.e. up to defect liability period.
26.	**Integrated project performance of Net Minimum Guaranteed Generation (NMGG) For each contract**	:	Integrated project performance of minimum solar energy generation at the rate specified **in Cl. No. 3.34 of NIT** annually per MW with degradation of 0.7% for any reason, from second year onwards.
27.	**Liquidated damages for Delay (LD Clause)** **For each contract**	:	a. **Time Delay:** 0.5 % of Project Cost plus GST for per week delay or part there of subject to a maximum of 10% of the Project Cost **plus GST if applicable**. b. **Milestone Delay:** Delay in attaining the milestones by the contractor shall lead to imposition of intermediary Liquidated damages @0.25% per week of delay upto the maximum extent of 5(Five) Percent of the Project Cost **plus GST if applicable**. c. **Total LD value (LD for Time Delay + LD for Milestone Delay) shall not exceed 10% of total Project Cost plus GST if applicable.**
28.	**Performance Penalty** **For each contract**	:	i) Penalty shall be levied for performance shortfall on PG test. Maximum penalty for failure of PG test shall be 5% of Project cost plus GST if applicable. ii) NMGG shall be considered during O&M period. This Integrated project performance of minimum solar energy at a rate specified in **Cl. No. 3.34 of Section III** annually per MW with degradation of 0.7% for any reason. If generated units fall short, then Rs.4.00 per unit of short fall will be deducted from performance warranty every year up to 5th year. Maximum deduction in case short fall of NMGG shall be 5% of total **Project Cost plus GST** if applicable. **iii) Maximum penalty for failure of PG test and NMGG in totality shall be not more than**

Sl. No	Aspect	:	Description of Aspect
			10% of project cost plus GST if applicable**.**
29.	**Statutory Taxes** **For each contract**	:	**Bidder shall submit the base price:** i) GST will be reimbursed at actual by the WBPDCL to the bidder on submission of appropriate supporting documents. ii) For others please refer **GCC Cl. No. 3.15**.
30.	**Operation and Maintenance Cost (Including all Consumables)** **For each contract**	:	**Operation and Maintenance Cost (Including all Consumables and spares for Routine and preventive maintenance, Break down maintenance, capital maintenance)**: **7.5%** of the Project cost (excluding Taxes and Duties) for 5(five) years. Clause No. GCC 3.8.4
31.	**Insurance for each contract**	:	Insurance of supply, erection work and workmen including third party insurance of each equipment are applicable and to be borne by the Contractor until final handover of the project upto defect liability period including successful completion of O&M period. Contractor will be responsible for maintaining the Insurance Policy for the complete Plant and Facilities during the O&M period also.
32.	**Mode of tendering**		E-tendering cum reverse auction.

Note: i) E-tendering cum reverse auction is common for three projects but there will be three separate LOA for each location i.e. for BKTPS, STPS & SgTPP. Tender-cum reverse auction will be evaluated considering total base price (Project cost) of all three projects together Clause 4.1.7.

ii) GST rate shall be considered according to the directive of the statutory authority during actual executive time. However, the calculation has been done on present GST as per Statutory authority.

SECTION-I

INSTRUCTION TO THE BIDDER (ITB)

A. SCOPE & QUALIFICATION

1.1 NAME OF THE WORK

E-tender cum reverse auction for Design & Engineering, Manufacture / Procurement, Supply, Erection, Testing and Commissioning of 22.5 MW Grid Connected Floating Solar Photovoltaic Power Plants on different Water Ponds at BkTPS, STPS & SgTPP of WBPDCL, West Bengal including warrantee obligation with 05 (Five) years comprehensive Operation and Maintenance on turnkey basis at various locations of West Bengal on Turnkey basis.

1.2 SOURCE OF FUND

The West Bengal Power Development Corporation Ltd (hereinafter referred to as **WBPDCL** or "**PURCHASER**") intends to finance the work covered under these Bidding Documents. The Source of the fund is grant from Govt. of West Bengal.

1.3 SCOPE OF WORK:

The brief scope of work covered under this Tender shall be included but not limited to the following:-

1.3.1. The scope of work shall be on the basis of single source responsibility, completely covering all the Equipment/Material specified under the **Technical Specifications**. The work is to be executed on turnkey basis. The Purchaser will not supply any material departmentally. It shall include the following:

a. Detailed Site Survey of the Power Plant Raw Water Pond areas BkTPS, STPS and SgTPP of WBPDCL for Designing and Engineering.

b. Submission of Detailed Design Report indicating technical suitability of site for installation of the Power Plant with layout plan.

c. Detail calculation of Solar Energy generation (MWp and MW ac) and selection of Module considering NMGG stipulation of Cl 3.34 of GCC for the first five year as well as 25 years of life.

d. Detailed Design of the Equipment/ Materials and Submission of Billing Breakup (BBU) with matching the project cost.

e. Obtaining approval of engineering drawing, technical data, operational manual etc. and necessary inspection from the Purchaser.

f. Complete manufacturing including shop testing.

g. Procurement, Packing, forwarding, transportation and insurance of Equipment/ Material from the manufacturer's works to the Site.

h. Material Supply, Receipt, storage, preservation, insurance and conservation of Equipment/ Material at the Site.

i. Grading, clearing of vegetation of the Site such as bank of the Pond and Site of the Control Building.

j. Design and assemble of floater & mounting structure and mooring & anchoring system for Floaters with SPV panel. Detail GA and data sheet of each type of floater including its fixing arrangement. Maximum capacity of weight can withstand i.r.o. of each type of floater. Maximum DC Cable carrying capacity of floaters.

k. Design calculation of total generation including NMGG requirement for next five years shall be substantiated with latest version of PVsyst for approval with maximum accurate weather data like latest version of Solargis.

l. Providing power supply for construction purposes.

m. Construction of RCC/PEB type Inverter room with Power conditioning unit and associated RCC type LT and HT switchgear cum SCADA & Control room.

n. Construction of Equipment for switchgear room, SCADA room, store room, battery & Battery Charger room with all electrical fitting and Control room with Central Monitoring and Control Station, security cabin etc.

o. Installation and commissioning of equipment as per technical design.

p. All associated electrical and civil works required for interfacing with grid i.e. transformer(s), breakers, isolators, panels, protection system, cables. metering, earthing etc.

q. Power evacuation up to the terminal point at 33kV voltage level as specified in technical specifications for each locations.

r. Water supply arrangement for Control Building.

s. Construction of roads, walkways and drainage system of Control Building.

t. SCADA system for remote monitoring and control of SPV panels with all hardware & software.

u. Till the commissioning of the plant and handing over the same to the Purchaser, the necessary security arrangement of all the materials and equipment will be the sole responsibility of the Contractor.

v. Final check-up of equipment, installation, and commissioning of power plant and putting the system into successful functional operation.

w. Reliability tests, performance and guarantee tests, wherever applicable, on completion of commissioning.

x. Insurance of all the Equipment/ Materials.

y. Supply of Mandatory Spares.

z. Providing training up to the satisfaction of the purchaser operating personnel at Manufacturers works, Operating power stations and at site or abroad.

i Providing training material to the end users during onsite training for end users.

ii Preparing commissioning certificate and documentation as per MNRE, GoI

iii Handing over of power plant.

iv Operation & maintenance manpower of SPV Plant along with electrical equipment, consumables and spare parts for a period of five years from the date of successful completion of trial run.

v Providing of routine and break down maintenance of grid connected floating solar PV power plants during comprehensive maintenance period.

vi Fulfilment of guarantee obligation.

Note: All the engineering drawing, documents, design, sizing calculation, layout etc. shall be submitted for approval from WBPDCL or Consultant of WBPDCL.

1.3.2. **SUPPLY:**

a) **The Supply scope includes the following but not limited to:**

Design, Manufacture / Procurement, Supply and delivery of all the materials like Floater, PV Module, Module Mounting Structure, Anchors, Grid Connected Inverters, Transformer, String Monitoring Boxes, Inverter LT Panel, HT Panel, LT Panel, other LT boards, Web based monitoring systems, Weather Monitoring Systems, PLC/DCS, Cables, System protection and other accessories conforming to the Technical Specification as required for successful Installations & commissioning of Floating Solar

PV Power Plant on different Water Ponds of BKTPS, STPS & SgTPP of WBPDCL on turnkey basis.

b) Latest licensed version of PVSyst Premium License (minimum 2 users). Pre activated License is not acceptable. License to be handed over to WBPDCL.

c) Mandatory Spares as per list **E of Section V**.

1.3.3. **SURVICE, ERECTION & OTHER SEVICES:**

The Erection and Commissioning scope includes the following but not limited to:

Installation, Testing and Commissioning of Grid connected Floating Solar Photovoltaic Power Plants on different Water Ponds of BKTPS, STPS & SgTPP of WBPDCL on turnkey basis including warrantee obligation with 05 (Five) years comprehensive Operation and Maintenance.

1.3.4. **OPERATION AND MAINTENANCE:**

Five (5) years comprehensive Operation & Maintenance(O&M) of the Solar PV Plant including power evacuation along with electrical equipment, consumables and spare parts from the date of successful completion of trial run and completion of all facilities of each project. PG test shall be completed within six months from the Start date of O&M Contract in line with Cl. no. 4.26.

1.4 QUALIFYING REQUIREMENT FOR BIDDERS:

The Bidder shall meet the following minimum qualification for installation of 22.5 MW grid connected Floating Solar PV Power Plants of WBPDCL:

1.4.1. GENERAL :

The Bidder, who intends to participate in the Bid, must have to meet the following criteria:

1.4.1.1 The Bidder shall be a Sole Proprietorship / Partnership Firm or Comp

any incorporated in India under The Indian Partnership Act 1932 or LLP Act 2008 or Companies Act, 2013.

1.4.1.2 Bidders shall have to submit:

a) Financial statement along with audit report of last three (3) consecutive financial years (FY2019-20, FY20-21 & FY21-22).

b) Acknowledgement of Income Tax Return for the last three Assessment Years (Assessment Year, 2020-21 & 2021-22, 2022-23).

1.4.1.3 The bidder must have valid GST, PF Registration, Return cum Challan (latest available) for Provident fund, ESI registrations; and these are to be submitted along with the bid.

1.4.1.4 If the Bidder is **Bidding Consortium** then-

Joint Venture Bidders shall comply with the following requirements

i Number of members in a Joint Venture shall not exceed **02 (Two)**;

ii Subject to the provisions of clause (i) above, the Bid should contain the detail information required for each member of the Joint Venture, viz. Financial Capacity, Technical capacity etc. of each member;

iii Members of the Joint Venture shall nominate one member as the lead member (the "Lead Member"). Lead Member shall meet at least 51% requirement of Financial Capacity and at least 50% of Technical Capacity. The nominated Lead member shall remain unchanged during the entire period of project execution including the Defects Liability Period. The nomination(s) shall be supported by a Power of Attorney, as per the format at (**Form- 12**) duly Signed by all the other Members of the Joint Venture. Each of the other Member(s) shall meet at **least** 40% of the required Technical Capacity and 30% of the required Financial Capacity.

iv The duties, responsibilities and powers of Lead Member shall be specifically included in the Joint Bidding Agreement or Memorandum of Understanding. The Lead Member shall be authorized to incur liabilities and to receive instructions and payments for and on behalf of the Consortium. The Lead Member should have entire responsibility pertaining to execution of the Project;

v All the Consortium Member should fulfill the criteria as per clause No.1.4.1.

vi The Bid should include a brief description of the roles and responsibilities of individual members, particularly with reference to financial, technical and defect liability obligations which will satisfy the sub-clause 1.4.1.4(iii) above;

vii All the members of the bidding consortium after the award and signing of the EPC Contract Agreement shall be obliged to continue to discharge their responsibility as the "members" of the consortium for a period covering the entire project completion period including defect liability plus Five (5) years of the Operation & Maintenance period of the project. This five (5) years period shall be deemed to be effective from the date of commencement of the O&M period this project.

viii **Conflict of interest**-An individual Bidder cannot at the same time be a member of a Consortium applying for the Project. Further, a member of a particular Bidder Consortium cannot be member of any other Bidder Consortium applying for the Project;

ix No Change in the composition of the Consortium will be allowed to be permitted by the Client during the Selection Process and during the subsistence of the Contract (in case the successful Bidder is a consortium).

x Members of the Consortium shall enter into a binding JV Bidding Agreement duly registered (herein after called as "JV/Consortium Agreement"), for the purpose of submitting a Bid. The registred JV/Consortium Agreement, to be submitted along with the Bid as per format Form-11 of the NIT.

xi The award of the contract will be conferred on the Lead Member only.

1.4.2. TECHNICAL REQUIREMENT:

The Bidder, who intends to participate in the Bid, must have to meet the following technical criteria:

Route-1:

1.4.2.1. The Bidder should have experience of successfully completed contract in Planning, Designing, Supply, Installation, Testing & Commissioning of Grid connected Rooftop and/or Ground Mounted and/or Floating Solar PV Power plants at any organization /PSU/ Government Organization having cumulative capacity of at least **10 (Ten) MWp capacity or higher** out of which at least one plant capacity at a single location is **5 MWp** or higher during preceding 07 (Seven) years from the last date of bid submission. This plant(s) should be in successful operation since their commissioning for minimum **1 (one) year**. A certificate to this effect issued by the concerned authority is to be submitted.

AND

1.4.2.2. The Bidder should have minimum one-year experience of comprehensive Operation & Maintenance for minimum **01 (one)** number **5 (Five) MWp** capacity Solar PV Power Plant which is in operational in India before the date of Bid submission. The bidder shall furnish documentary evidences of satisfactory performances of the said solar power plants by way of submission of monthly generation data on annual basis / performance certificates issued by the purchaser for minimum 1 (one) year.

OR

Route-2:

1.4.2.3. The Bidder should have executed in the last ten (10) years an industrial project either as developer or as EPC Contractor in the area of power/ steel/ oil and gas/ petrochemical/fertilizer/cement/coal mining including coal handling plant and/ or any other process industry and the same should be in successful operation in India for last one year ending at last date of Bid submission.

AND

1.4.2.4. The Bidder should have executed at least one Electrical Sub-station of 33 kV or above voltage level, consisting of equipment such as 33kV or above voltage level circuit breakers and Power transformer etc, either as developer or as EPC Contractor which should be in successful operation for at least one (1) year prior to the date of techno-commercial bid opening.

Note:

1. If the Bidder is Bidding Consortium and comes through **Route-1** then the combined technical capability of those Members in such consortium should satisfy the clause 1.4.2.1 & 1.4.2.2 conditions.

2. The works referred to **Route.2** Clause 1.4.2.3 & 1.4.2.4 can be in same or different projects.

3. The execution of industrial project as EPC Contractor under **Route-2** means, such EPC Contractor is responsible for all the activities i.e. Design/Engineering, Procurement, Construction and Commissioning of a project/work.

1.4.3. FINANCIAL REQUIREMENT:

The Bidder, who intends to participate in the Bid, must have to meet the following criteria:

i. Minimum Average Annual Turnover (**MAAT**) of the Bidder during the last 3 (three) financial years ending 31st March of the previous financial year shall be **Rs. 55.00 Cr**.

ii. If the Bidder is bidding Consortium, then the combined MAAT of those Members in such consortium should satisfy the above conditions of eligibility.

iii. Net worth as per the financial statement of the last financial year as referred in **clause No: 1.4.1.2 (a)** of this NIT should be positive for all the three financial years.

iv. If the Bidder is Bidding Consortium, then combined Net Worth of the both partner should be positive for all the three financial years.

v. **"Net worth"** means the aggregate value of the paid-up share capital and all reserves created out of the profits and securities premium account, after deducting the aggregate value of the accumulated losses, deferred expenditure and miscellaneous expenditure not written off, as per the audited balance sheet, but does not include reserves created out of revaluation of assets, write-back of depreciation and amalgamation;

1.4.4. OTHER QUALIFICATION REQUIREMENT

1.4.4.1 Bidder shall have adequate design, manufacturing and/or fabrication capability and capacity available to perform the work properly and expeditiously within the time period specified. The evidence shall specifically cover, with written details, the installed manufacturing and/or fabrication capacities and present commitments (excluding those anticipated under these bidding documents). If the present commitments are such that the installed capacity results in an inadequacy of manufacturing and/or fabrication capacities to meet the requirements appropriate to the works covered in his bid, then the details of alternative arrangements to be organized by the bidder and/or his collaborator/associate for this purpose and which shall meet the Purchaser's approval, shall also be furnished.

1.4.4.2 Bidder shall have an adequate project management organization covering the areas related to engineering of Equipment/Materials,

interface engineering, procurement of equipment and the necessary field services required for successful construction, testing and commissioning of all the Works covered in the scope of work for this package and as required by the bidding documents.

1.4.4.3 Bidder shall have established quality assurance systems and organization designed to achieve high levels of system reliability, both during his manufacturing and/or fabrication and field installation activities.

1.4.4.4 Notwithstanding anything stated herein, WBPDCL reserves the right to inquire and review the bidder's capability and capacity to perform the work at the time of evaluation.

1.5 RESPONSIBILITY OF BIDDERS

1.5.1 The WBPDCL will not assume any responsibility regarding information gathered, interpretations or conclusions made by the bidder or regarding information,

1.5.2 or deductions the bidder may derive from the data furnished by the WBPDCL. Verbal agreement or conversation with any employee of the WBPDCL either before or after the submission of bid shall not affect or modify any of the terms or obligations contained herein.

1.5.3 It shall be the sole responsibility of bidders to determine and to satisfy themselves by such means as they consider necessary or desirable as to all matters pertaining to this bidding process including in particular all factors that may affect the cost, duration and execution of the work.

1.5.4 It must be understood and agreed by the bidders that factors which may affect the cost, duration and execution of the works have properly been investigated and considered while submitting the bid. Claims whatsoever including those for financial adjustment in the price of the Contract awarded in accordance with these bidding documents will not be entertained by the Purchaser. Neither any change in time schedule of Contract nor any financial adjustments arising thereof shall be permitted by the Purchaser, which are based on the lack of investigation or its effect on the cost of the Contract to the bidder.

1.5.5 If the Bidder did not execute Electrical Sub-station of 33 kV or above voltage level then the Bidder have to engage WBPDCL approved vendor for 33kV Substation work.

1.5.6 Notwithstanding anything stated herein, WBPDCL reserves the right to inquire and review the bidder's capability and capacity to perform the work at the time of evaluation.

1.6 EXPENDITURE OF BIDDING

The bidder shall bear all costs associated with the preparation and submission of his bid and WBPDCL in no case shall be responsible or liable for these costs, regardless of the conduct or outcome of the bidding process.

B. THE BIDDING DOCUMENTS

1.7 CONTENTS OF BIDDING DOCUMENTS

The scope of work, bidding procedures, Contract terms and conditions and technical specifications are prescribed in the bidding documents. The set of bidding documents uploaded for the purpose of bidding includes the sections stated below together with any addendum/amendment (Clause No. **1.10)** to be issued**.**

Section I	:	Instructions To Bidders (**ITB**)	
Section II	:	Bid Data Sheet (**BDS**)	
Section III	:	General Conditions of Contract (**GCC**)	
Section IV	:	Special Conditions of Contract (**SCC**)	
Section V		Technical Specification	
Section VI	:	**Form**	
		1	Check List
		2	Forwarding Letter for submission of Bid Security
		3	Bid Form/Undertaking
		4	Bid Security (Bank Guarantee format)
		5	Summary Statement of Yearly Turnover and Net Worth
		6	Capability Status
		7	Statement of Similar type of order, Orders executed as on date of issuance of NIT
		8	Curriculum Vitae of Key Personnel
		9	Format for Submission of Pre-Bid Queries
		10	Format for Proposed modifications
		11	JV/Consortium Agreement
		12	Power of Attorney
		13	Declaration for Net Minimum Guaranteed Generation
Section VII		**Annexure**	
		1	Proforma of Contract Agreement

		2	Proforma of Bank Guarantee for Mobilisation Advance
		3	Proforma of Bank Guarantee for Contract Performance
		4	Proforma for extension of Bank Guarantee
		5	Proforma of Indemnity Bond
		6	Completion Certificate
		7	Application for Payments
		8	Taking-Over Certificate
		9	No-Claim Certificate
		10A	Indemnity for Equipment
		10B	Application for Material Gate Pass
		11	Application for material gate pass
		12	Authorization letter

The bidder is expected to examine all instructions, forms, terms, conditions, specifications and other information in the bidding documents. Failure to furnish all information required as per the bidding documents or uploading of a bid not substantially responsive to the bidding documents in every respect will be at the bidder's risk and may result in rejection of his bid.

1.8 CLARIFICATIONS ON BIDDING DOCUMENTS

1.8.1 A prospective bidder requiring any clarification on bidding documents may notify the WBPDCL by uploading the same in the e-tendering portal, which shall be available to all the participant bidders, as per Standard Format enclosed with this document **Form 9** and **Form 10** not later than the date and time specified in NIT. The soft copy of the same must be sent in Excel format at the mail address : **Email:** s.dass@wbpdcl.co.in

1.8.2 The WBPDCL will issue clarification(s) as it may think fit after pre-bid meeting prior to the deadline/ extended deadline for submission of bids prescribed by the WBPDCL. Written copies of the WBPDCL's response will be uploaded in the e-tendering portal in the corrigendum folder which shall be available to all the participant bidders

1.8.3 Any queries sent by the bidders after the date and time notified in NIT or any extended date, if any, shall not be entertained.

1.9 PRE-BID MEETING

1.9.1 The bidder or its authorized representative is invited to attend pre-bid meeting to be held on the date, time and location specified **in NIT or any**

specific change, which will be uploaded before the meeting date. The purpose of the meeting will be to clarify the exact scope of work, and any issues regarding the bidding documents and the technical specifications for its clarification, if raised at this stage by the bidders. The Purchaser shall not be under any obligation to entertain /respond to the suggestions made or to incorporate modifications sought for by the prospective bidders.

1.9.2 Any modification/amendment of the bidding documents shall be made by the Purchaser exclusively through the issue of an amendment pursuant to **ITB. 1.10**

1.9.3 Non-attendance at the pre-bid meeting will not be a cause for disqualification of bidders but at the same time shall not entitle them to raise any query at a later date.

1.9.4 Any essential requirement not included in the Price Schedules but required for successful commissioning and operation of Works as per scope of Contract shall be indicated by the bidders as per **Form: 9** of Section VI and submitted before the pre-bid meeting by the date specified in the NIT in line with **ITB.1.9.1.** The Purchaser shall make related modifications/ amendments as may be considered necessary based on this form in the bidding documents as per provisions mentioned in this clause.

1.9.5 Bidders shall not be permitted to indicate any additional requirements in the bid for any reason whatsoever after the Purchaser has considered such amendments.

1.9.6 Venue of Pre bid meeting: WBPDCL Corporate office, Kolkata

1.10 AMENDMENT OF BIDDING DOCUMENTS

1.10.1 At any time, but not later than seven (7) days prior to the deadline for submission of bids, the Purchaser may, for any reason, whether at its own initiative or in response to a clarification request by a prospective bidder, modify the bidding documents by issue of an addendum/amendment.

1.10.2 The addendum/amendment will be intimated through e-tendering portal at corrigendum folder. The Purchaser shall assume that the information contained therein have been taken into account by the bidder in its bid. The Purchaser will bear no responsibility or liability arising out of non-cognizance of the same in time or otherwise by the bidder.

1.10.3 In order to afford prospective bidders reasonable time in which to take the addendum/amendment into account in preparing their bids, Purchaser may, at its discretion, extend the deadline for the submission of bids.

1.10.4 WBPDCL has the liberty to modify the bidding documents by issue of an addendum/amendment or to cancel the bid at any time.

1.10.5 For the information of bidders, the addendum/ amendments, if any, shall be uploaded on the e-tendering portal **https://wbtenders.gov.in.**

C. PREPARATION OF BIDS

1.11 ABOUT THE BID

1.11.1 **Mode of Tendering:** E-Tender cum Reverse Auction**.**

1.11.2 **Collection of Bid Document**

The bidder can search & download NIT & Bid Document(s) electronically from e-tender portal **https://wbtenders.gov.in** once he/she logs on to the portal using the Digital Signature Certificate (DSC). This is the only mode of collection of Bid Documents.

1.11.3 **Language of the bid**

The bid prepared by the bidder and all correspondences and documents relating to the bid, exchanged between the bidder and the WBPDCL shall be written in the **English language**, provided that any printed literature furnished by the bidder may be written in another language so long as the bid is accompanied by an English translation of its pertinent passages. Failure to comply with this may disqualify a bid. For purposes of interpretation of the bid, the English translation shall govern.

1.11.4 The bidder is expected to examine all instructions, forms, terms, conditions, specifications and other information in the bidding documents. Failure to furnish all information required as per the bidding documents or uploading of a bid not substantially responsive to the bidding documents in every respect will be at the bidder's risk and may result in rejection of his bid.

1.12 DEVIATION

This tender is a '**No Deviation**' tender.

Request for any deviation may be considered only if pointed out by any bidder in the Pre Bid meeting. The queries and proposed modification regarding tender must be submitted by writing as per format (**Vide Form -9 and Form-10**) before pre bid meeting (**ITB. 1.9).**

1.13 GENERAL GUIDANCE FOR E- TENDER

Instructions/Guidelines for electronic submission of the tenders have been mentioned below for assisting the bidders to participate in e-Tendering.

1.13.1 **Registration of Bidder**:

Any bidder willing to take part in the process of e-Tendering will have to be enrolled & registered with the Government e-Procurement System, by logging on to **https://wbtenders.gov.in** The contractor is to click on the link for e-Tendering site as given on the web portal.

1.13.2 **Digital Signature certificate (DSC):**

Each bidder is required to obtain a Class-II or Class-III Digital Signature Certificate (DSC) for submission of tenders from the approved service provider of the National Informatics Centre (NIC) on payment of requisite amount. Details are available at the Web Site stated above. DSC is given as a USB e-Token.

1.14 SITE VISIT

1.14.1 The bidder is advised to visit and physically examine the geographical locations of Sites of work and its surroundings and obtain for himself on his own responsibility all information that may be necessary for preparing the bid, submission of offer and entering into a Contract for execution of works. The cost of visiting the site shall be borne by the bidder only.

1.14.2 The bidder and any of its authorized personnel or agents will be granted permission by the Purchaser to enter upon its premises and lands/Ponds for the purpose of such inspection, but only upon the express condition that the bidder, its personnel and agents will release and indemnify the Purchaser and its personnel and agents from and against all liability in respect thereof and will be responsible for death or personal injury, loss of or damage to property and any other loss, damage, costs and expenses incurred as a result of the inspection.

1.14.3 The site inspection shall be completed before the Pre-bid Meeting, if applicable or within 20 days after the NIT issue date, whichever is earlier.

1.15 BID PRICES

Unless otherwise specified in the Technical Specification, Bidders shall quote for the entire works on a "**Single Responsibility**" basis such that the total bid price considering BkTPS, STPS & SgTPP covers all the Contractor's obligations mentioned or to be reasonably inferred from the bidding documents in respect of design, manufacture, including procurement, packing, forwarding transportation, handling, insurance, delivery, installation, testing, pre-commissioning, commissioning, completion of the work and conductance of guarantee tests for the work including supply of spare (if any). This includes the acquiring of all permits, approvals and licenses etc. as may be specified in the bidding documents. The bidder shall quote in the appropriate schedule for the proposed bid price for the entire scope of work covered under the bidding documents

1.15.1 PRICE SCHEDULE OF THE BIDDING

1.15.2.1 **Price Schedule-1(Supply Schedule)**: Price Schedule-1 will consist of price of Equipment / Materials, including type tests, charges to be manufactured within/outside India i.e. basic cost (ex-factory, ex-works, ex-warehouse, or off-the-shelf, as applicable), then transport, loading, unloading, insurance charge. This price is inclusive of PVsyst software. This base price shall be inclusive of Customs related Duties, BOCW, entry tax (if any) etc. payable on components and raw materials incorporated or to be incorporated in the goods. Bidder shall submit the base price only. Local transportation including transit insurance, and Taxes to delivery of Equipment / Materials to the Site shall also be included in Price Schedule -1 i.e. Supply Schedule for BKTPS, STPS & SgTPP.

1.15.2.2 **Price Schedule-2(Erection Schedule):** Price for Installation and Erection service shall be quoted in the Price Schedule -2 (Service Schedule) and shall include the rates and prices for all labour, Contactor's Equipment Supply of consumables Materials and all matters and things of whatsoever nature, charges for insurance covers other than transit insurance The price schedule shall include the provision of operation and maintenance manuals, training of Purchaser and their nominated personnel and other services, as identified in the bidding documents and necessary for the proper execution of Installation and Erection Services. GST, Customs related duties, BOCW and other tax and duties shall not be included in the service and consumables materials price but shall be quoted in this Price Schedule for BKTPS, STPS & SgTPP.

1.15.2.3 **Price Schedule-3 (Operation and Maintenance):** Price for O&M contract

shall be **7.5% of the basic project cost for each EPC Contract of each Project (excluding GST) for 5(five)** years which is predefined and O&M contract shall be placed on this basis (**refer clause-3.8.4.6**) after completion of the project for BKTPS, STPS & SgTPP.

1.15.2 The taxes, duties and levies shall be indicated by the bidder in the respective price schedule and shall be quoted as per the rates in force seven (7) days prior to the last date of submission of bids with respect of direct transaction between Contractor and Purchaser. Details of Tax and Duties will be guided by the clause no **GCC 3.15**.

1.15.3 The bidder shall fill in price for all items described in the price schedules. Item against which no price is entered by the bidder will not be paid for by WBPDCL when executed and shall be deemed to have been covered in other prices in the Price Schedule where the evaluation is being done on the basis of total prices quoted for all the Price Schedules.

1.15.4 All the prices shall be quoted in INR (Indian rupees) only. Foreign exchange component or foreign exchange variation will not be entertained for any reason whatsoever.

1.15.5 If any rebate/discount is offered, the price after overall discount shall be brought out in the Price Schedule. Conditional rebates/discount, if any, offered by any bidder shall not be considered during bid evaluation.

1.15.6 The financial proposal to be submitted in Finance Cover and should contain the following document in one cover. The bidder should fill up the BOQ with quoted value. Once completion of quoting rates, the bidder must encrypt the rates and upload the same with digitally signed. (Only downloaded copies of the above document are to be uploaded, virus scanned and digitally signed by the bidder).

1.15.7 **Reverse e-auction process will be executed among all the eligible bidders.**

1.15.8 PRICE ADJUSTMENT

Price quoted by the bidder shall be firm during the entire period of contact and Bid evaluation for BkTPS, STPS & SgTPP will be done on the total quoted price only.

1.16 PERIOD OF VALIDITY OF BIDS

1.16.1 The bids submitted by the bidder shall remain valid for a minimum period of **180 days** from the next day of opening of Technical bid. A bid valid for a

shorter period than 180 days shall be rejected by the WBPDCL.

1.16.1 In exceptional circumstances, WBPDCL may solicit the bidder's consent to an extension of bid validity for a further period without any change in the terms and conditions of the NIT. The request and response thereto shall be made in writing by post or e-mail followed by post confirmation. The bidder may refuse the request without having his bid security forfeited. Bidders agreeing to the request will neither be required nor permitted to modify their respective bids, but will be required to extend the validity of their bid securities correspondingly. The provisions of ITB.1.17.5 regarding discharge and forfeiture of bid security shall continue to apply during the extended period of bid validity.

1.17 BID SECURITY

1.17.1 Bid Security / Ernest Money Deposit (EMD) of **Rs. 403.94 Lakh** must be submitted in form of Demand Draft (DD) / Banker's Cheque (BC) drawn in favour of **'The West Bengal Power Development Corporation Limited (WBPDCL)'** payable at Kolkata issued from any schedule commercial Bank of India or in form of Bank Guarantee (BG) (Vide **Form 4** Section-VI) issued from any schedule Commercial Bank of India towards EMD as prescribed in the NIT, initially valid for **180 (One hundred Eighty) days** with claim period of another 3 (three) months, subject to further extension if required. Earnest Money in any other form or amount will not be accepted.

To submit BG, bidders shall have to opt for EXEMPTION in this portal and scanned copy of the BG is to be uploaded in the portal. After completion of the bid-submission period, the original BG must be submitted at the office of General Manager (M&C), Corporate Office, WBPDCL, at the specified date and time. Otherwise, your bid shall not be considered for evaluation.

Bank Guarantee (BG) shall be from any scheduled bank authorized to do the business in India. Bank Guarantee will be in the name of The West Bengal Power Development Corporation Limited. The Bank Guarantees (BG), if submitted, should remain valid for six months period from the date of opening of the Tender.

For BG:

Beneficiary Name: The West Bengal Power Development Corporation Limited
Bank Name:The Indian Bank
Bank Branch:LA Block,Salt Lake,Sector-III
Bank Account No.: CA 21175164054
IFSC Code:IDIB000S550

No interest will be payable by the WBPDCL on the deposited Earnest Money under any circumstances.

There is no exemption in EMD for this tender.

The MSME / NSIC Registration shall not be considered for exemption in EMD.

1.17.2 Bid security of the unsuccessful bidders will be discharged / returned as promptly as possible after the expiration of the validity of bid security or after the date of signing of Contract Agreement with the successful bidder whichever is earlier.

1.17.3 The bid security of the successful bidder will be discharged on furnishing the Performance Guarantee and signing of the Contract Agreement by the bidder as per **ITB. 1.33.**

1.17.4 If the bid security is not in adequate value the bid will be rejected by the WBPDCL and returned to the bidder with in thirty (30) days of the bid opening date.

1.17.5 The bid security shall be forfeited in the following circumstances:

a) If the bidder withdraws its bid as a whole or in part as per **ITB.1.21,** during the period of bid validity specified by the bidder in its bid.

b) If the bidder deviates from any clarification/confirmation given by him subsequent to submission of his bid.

c) If the bidder does not accept the correction of its bid price pursuant to if any

d) If the successful bidder fails, within the specified time limit either to accept the Letter of Award (LoA) and sign the Contract Agreement

unconditionally or, to furnish the Contract Performance Guarantee, in accordance with **ITB. 1.34** WBPDCL may cancel the bid and no interest shall be paid by the Purchaser on the bid security.

1.18 SIGNING OF BIDS

All documents should be digitally signed by the bidders and uploaded by them.

D. SUBMISSION OF BID

1.19 SUBMISSION OF BID

1.19.1 Tenders are to be submitted through online to the website stated above in two folders at a time for each work one in (i) **Techno-commercial Proposal** & the other is (ii) **Financial Proposal** before the prescribed date & time using the Digital Signature Certificate (DSC). Virus scanned copy of the documents are to be uploaded duly digitally Signed. The documents will get encrypted (transformed into non readable formats).

1.19.2 **General process of submission:**

The bidder needs to download the Forms / Annexure from the website **https://wbtenders.gov.in**, carefully go through the documents and prepare the required documents, fill up the particulars in the designated cell and upload the scanned documents in Portable Document Format (PDF) to the website **https://wbtenders.gov.in** in the designated locations of Technical Bid.

The bidder needs to download the BOQ, fill up the BOQ in the designated Cell and upload the same in the designated location of Financial Bid in Excel.

All the documents uploaded by the Tender Inviting Authority form an integral part of the contract. Bidders are required to upload all the Bid Documents along with the other documents, as asked for in the tender, through the above website within the stipulated date and time as given in the Tender.

1.19.3 It is a two part bidding process so the offer contains two Proposals: **(i) Technical-Commercial Proposal and (ii) Financial Proposal.**

1.19.3.1 TECHNO-COMMERCIAL PROPOSAL:

The Technical Proposal shall contain scanned copies and/or

declarations in the following standardized formats in two covers/folders:

1. Statutory Cover(**C1**) &
2. Non- Statutory Cover(**C2**)

C1. STATUTORY COVER:

Statutory contain three folders:

1) "**Tender fee and EMD**" folder
2) "**NIT**" Folder and
3) "**Form**" Folder.

1) " EMD" folder:

i. Earnest Money (EMD)/Bid Security

Scanned copy of Demand Draft (DD) / Banker's Cheque (BC) drawn in favour of **"**The West Bengal Power Development Corporation Ltd (WBPDCL)**"** payable at Kolkata from any scheduled commercial Bank of India **or** Bank Guarantee (BG) (**Form-4 Section-VI**) issued from any scheduled Commercial Bank of India towards EMD/bid security as prescribed in the NIT.

2) "NIT" Folder

i. Addenda /Corrigenda: if published

Note: Bidders are to keep track of all the Addendum / Corrigendum issued with a particular tender and upload all the above digitally signed along with the NIT. Tenders submitted without the Addendum / Corrigendum will be treated as informal and liable to be rejected.

3) "Forms" folder:

i. This folder will contain all the following forms given is **section-VI** of this documents
ii. Check List **(Form – 1)-document should submit accordingly,**
iii. Forwarding Letter for submission of Bid Security **(Form – 2)**
iv. Bid Form **(Form – 3),**
v. If EMD is Bank Guarantee (BG) then (**Form-4)**
vi. Summary statement of yearly turnover and net worth **(Form – 5)**

vii. Capability Status **(Form – 6)**

viii. Statement of Similar Type of Order. Orders Executed as on date of issuance of NIT **[Applicability up to the extent of meeting Technical QR]. (Form – 7).**

ix. Curriculum Vitae of Key Personnel ***(Form – 8).***

x. JV/Consortium Agreement(**Form-11**) –if JV/Consortium

xi. Power of Attorney**(Form-12)-** if JV/Consortium

xii. Net Minimum Guaranteed Generation(NMGG) –**Form-13**

*(**Only downloaded copies of the above documents duly filled up and are to be uploaded, virus scanned and digitally signed by the bidder**).*

C2. NON STATUTORY COVER:

Sl. No.	Category Name	Detail(s)
A	Certificate(s)	**1.** Copy of the GST Certificate
		2. Copy of the PAN certificate/ PAN Card
		3. Declaration of PF Registration Number **or** Proof of PF Registration, Last Paid PF, ESI Challan etc
		4. Copy of the ESIC registration.
B	Company Detail(s)	**5.** Copy of the Registration Certificate under Company Act (Company Incorporation Certificate) or copy of the Registered Deed for Partnership Firm
C	Credential	**6.** Copy of the Order(s)/ Contract Agreement(s) with the Purchaser / any other Proof of Purchase, as primary agency [Applicability up to the extent of meeting Technical QR]. **AND** Corresponding Copy of the Completion Certificate(s) /Commissioning report signed by the Purchaser / Ordering Authority to substantiate the proof of completion of the Solar PV Power Plant(s). [Applicability up to the extent of meeting Technical QR].

Sl. No.	Category Name	Detail(s)
D		**7**. Audited Balance Sheet & Statement of Profit & Loss A/c. [Applicability as per Financial capability].
		8. Copy of Acknowledgement of Income Tax Returns [Applicability as per Financial capability].

Bidders are requested to submit all the documents as per the same serial in the above table given.

1.19.3.2 FINANCIAL PROPOSAL

The Financial Proposal shall contain Price Bid in the worksheet of file named BOQ –in Excels format.

i This excel file named BOQ to be filled up and uploaded in form of Excel file in the BOQ folder (Cover).

ii BOQ file consist of one worksheet with two part i.e. 1) Supply Schedule & 2) Erection Schedule

iii Details of the BOQ sheets are mentioned below:

Sl. No.	Item Description	Quantity	Units	Basic cost to be entered by the bidder in INR
1	2	4	5	13
1	**Supply Schedule**			
1.01	Cost in Rs. for 22.5 MW Grid connected Floating Solar PV plants for Supply of Materials as per Clause No: 1.3.2 (a) of the NIT.	1.000	Lot	
1.02	Supply of **Pvsyst Software** as per 1.3.2 (b)	1.000	Lot	
1.03	Mandatory spares as per list – of Section V and as per Clause No: 1.3.2 (c) of the NIT.	1.000	Lot	
2	**Erection & Commissioning Schedule**			
2.01	Cost in Rs. for 22.5 MW Grid connected Floating Solar PV plants for Installation Service as per Clause No: 1.3.3 of the NIT	1.000	Lot	
2.02	Cost in Rs. for 22.5 MW Grid Connected Floating Solar PV plants for Testing and Commissioning as per Clause No: 1.3.3 of the NIT	1.000	Lot	

2.03	Cost in Rs. of Material used for civil items used for Erection & Commissioning for 5 MW Grid Connected Floating Solar PV plants as per Clause No: 1.3.3 of NIT	1.000	Lot	

iv Filling up procedure of above sheet:

a) **Supply Schedule(Sl. No.1):** To be filled up by the bidders. It is related to the supply items as per **ITB. 1.15.2.1.** and **inclusive of Transportation, Inland Transit Insurance, PV Syst Software and Mandatory Spares.**

b) **Erection Schedule(Sl. No.2):** To be filled up by the bidders. It is related to the corresponding equipment installation service, testing & commissioning including Civil material and works of the project as per **ITB.1.15.2.2 including site insurance.**

c) Bidders are advised to price their bids in such a manner that **Sl. No. 2.02** of Erection Schedule **(Sl. No.2)** of the above BOQ sheet should **not be less than 4% of the cost of item** Sl. No.1.01 of supply schedule**(**Sl No.1) of the above sheet.

d) Bidders are advised to price their bids in such a manner that the price of Civil Works Component (sl No.2.03 of BOQ sheet) of the bid price (including Site Fabricated Structural works price should not be less than 3% of total supply price of Main Equipment i.e. **Sl. No.1.01** of supply schedule.

e) Mandatory spares component of each project should not be less than 1.0% of total project cost of each project i.e. for BkTPS, STPS & SgTPP.

f) Functional Guarantee of the Plant and Installation Services

The minimum (or maximum) requirements stated in the Specification for functional guarantee required in the specification are :

Functional Guarantee	**Minimum (or maximum, as appropriate) requirements**
1. Defects Warranty	Five years for the entire solar PV power plant
2. Project Components Warrantee	Guarantees/warranties provided by the project component manufacturers beyond the defects liability period, performance warranty period and extended warranties; warranty of PV modules, floaters = 5 years
3. Production Warranty	Guaranteed Yearly Energy Production during the first five years of operation

g) **Evaluation of L1 will be done based on minimum base price of total project cost of BkTPS, STPS & SgTPP quoted by the bidder during reverse e-auction.**

h) After reverse E-auction, the selected L1 bidder will have to submit the details Billing Breakup(BBU) of the final L1 price for issuance of LOA within 48 hours after completion of E-auction.

i) In BOQ**, five years comprehensive O&M cost is not considered, O&M cost is predefined which is 7.5% of the basic project cost.**

1.20 DEADLINE FOR SUBMISSION OF BIDS

1.20.1 The original Demand Draft/B.G against Earnest Money Deposit (EMD) must be submitted physically in the tender box at the office of the GM(M&C), Corporate office, WBPDCL, under sealed cover super-scribing the name of the work with NIT no., name of the bidder, name of the work etc. on or before the date & time mentioned in the bid data sheet or any extension of date & time . If the bidder fails to submit the original copies within the due date and time his tender will not be opened and his bid will be rejected.

1.20.2 Bids must be received by WBPDCL at the online e-tendering portal address specified in **NIT**, no later than the time and date mentioned in **NIT.**

1.20.3 The WBPDCL may, at its discretion, under intimation to the bidders who have downloaded the bidding documents, extend the deadline for the submission of bids / opening of bids by issuing an addendum and hosting the same on the e-tender portal, in which case all rights and obligations of WBPDCL and bidders previously subject to the original deadline shall thereafter subject to the deadline as extended.

1.20.4 In the event, the deadline for uploading of bid is extended by the WBPDCL, the bidders who have already uploaded their bids within the original deadline of submission shall have the option to upload their revised bid in substitution either in full or in part of earlier bid. In the absence of a revised bid, the original bid shall be considered for opening and subsequent evaluation. Wherever, the bidder has submitted the revised bid in full, in modification of earlier bid, the earlier bid shall be returned unopened to the bidder.

1.20.5 Submission of original Bid Security (**EMD**) (Offline Submission)

a) The original copies of the DD/BC towards DD/BC/BG towards EMD (Bid

security) as per NIT shall be submitted along with a forwarding letter **(Form –2**) within the date and time as specified in the bids.

b) If the bidder fails to submit the original copies of the Bid Security within the due date and time, his tender will not be opened and his bid will stand rejected.

1.21 WITHDRAWAL OF BIDS

The bidder shall not be permitted to withdraw their bid during the interval between bid submission deadline (as mentioned in NIT) and the period of bid validity as per **ITB.1.16.** If any withdrawal of bid is made by the bidder during the above period, it shall result in the forfeiture of the bid security

E. OPENING AND EVALUATION OF TENDER

1.22 BID OPENING

1.22.1 As it is a two part Bidding so WBPDCL will open the bids electronically at e-tendering portal by the authorized personnel(s) using their Digital Signature Certificate (DSC), at the scheduled date & time for opening of bids as mentioned in NIT for Techno-commercial bid(first part) and Financial bid(second part) will be opened on the date and time as intimated to the bidder on successful completion of evaluation of Techno-commercial bids. The bidders' representatives who desire may attend/witness the bid opening event through e-tendering portal at their respective end. In the event of the specified date for the opening of bids being declared a holiday for the WBPDCL or suspended for any involuntary reasons, the bids will be opened at the appointed time & date which shall be intimated/ communicated to all the intending bidders.

1.22.2 Bids that are not opened at bid opening will not be considered for further evaluation, regardless of the circumstances. The reason for which bids are not being opened will be notified to all the bidders through e-tendering portal.

1.22.3 The bidders' names, bid withdrawal and the presence or absence of the requisite bid security and such other details which WBPDCL at his discretion may consider appropriate will be notified in the e-tendering portal at the bid opening date.

1.22.4 In this case of Single stage two part bids, on the date of opening of bid, the

techno-commercial bid shall only be opened. The date for opening of the Price bid shall be intimated electronically at the appropriate time to the bidders whose bid is found responsive in the techno-commercial evaluation.

1.22.5 In the event, Purchaser, in its discretion, decides not to open the bid for want of adequate response to the bidding, the Purchaser may either extend the bid submission deadline or cancel the bidding process any time before issuance of Letter of Award(LOA).

1.23 PROCESS TO BE CONFIDENTIAL

1.23.1 Subject to ITB. 1.24, no bidder shall contact the Purchaser on any matter related to its bid from the time of opening of the bids to the time the Contract is awarded.

1.23.2 Any effort by a bidder to influence Purchaser or others connected in the process of examination, clarification, evaluation and comparison of bids, and in decisions concerning the award of Contract, may result in the rejection of his bid.

1.24 CLARIFICATION OF BIDS

1.24.1 During bid evaluation, Purchaser may, at its discretion and if so required, ask the bidders for any clarification in support of their compliance to stipulated Qualifying Requirements (QR) or any other matter related to its bid except to the extent in ITB.1.24.2. The request for clarification required from the bidder and the response thereto shall be in writing and shall be delivered by registered speed post/email/courier / hand delivery under acknowledgement / email / fax so as to reach the Purchaser within the time specified in the request for clarification issued by Purchaser.

1.24.2 Any post-bid change in the price or substance (techno-commercial) of the bid shall not be sought, offered or accepted.

1.25 DETERMINATION OF RESPONSIVENESS

1.25.1 The Purchaser will examine the bids to determine whether they are complete, whether any computational errors have been made, whether required securities have been furnished, whether power of attorney of signatory of the bid has been submitted, whether the documents have been properly signed and whether the bids are generally in order and substantially responsive to the requirements of the bidding documents.

1.25.2 For the purpose of this clause, a substantially responsive bid is one which conforms to all the Terms, Conditions and Specifications of the bidding documents without material deviation or reservation. The Purchaser's determination of a bid's responsiveness shall be based on the contents of the bid itself without recourse to extrinsic evidence.

1.25.3 Any material information/ data/ document required to be submitted by the bidders as per provisions of bidding documents, if not submitted by the bidder, may render the bid to be non-responsive provided such information/ data/ documents is such that it may adversely affect the evaluation.

1.25.4 The Purchaser may waive any minor infirmity, non-conformity or irregularity in a bid that does not constitute a material deviation, and that does not prejudice or affect the relative ranking of any bidder, as a result of the technical and commercial evaluation pursuant to **ITB. 1.28** & **ITB. 1.29**.

1.25.5 If a bid is not substantially responsive to the requirements of the bidding documents, it may be rejected by Purchaser and the same cannot subsequently be made responsive by the bidder by correction.

1.25.6 Conditional bid shall not be accepted by Purchaser

1.26 TIME SCHEDULE

The basic consideration and the essence of the Contract shall be the strict adherence to the time schedule specified in the Bids and NIT after the Commencement Date of the Contract as incorporated in the Contract Agreement for completion of Works. Bidders are required to base their prices on the time schedule mention in Clause no. **GCC 3.22**. No credit will be given for earlier completion for the purpose of evaluation.

1.27 PROCEDURE OF EVALUATION OF BIDS

1.27.1 The Purchaser will carry out a detailed evaluation of the bids determined to be substantially responsive as per clause no. **ITB 1.25** in order to determine whether the technical aspects are in accordance with the requirements set forth in the bidding documents. **Bids submitted by bidders with any deviations shall be rejected.**

1.27.2 The Purchaser will determine to its satisfaction whether the bidder selected as having submitted the lowest evaluated responsive bid is qualified to

satisfactorily perform the Contract in terms of the qualifying requirements stipulated in NIT.

1.27.3 The determination will take into account the bidder's financial, technical, production and execution capabilities, in particular its work in hand and future commitments. It will be based upon an examination of the documentary evidence of the bidder's qualifications submitted by the bidder to the bid, as well as such other information as the Purchaser deems necessary and appropriate.

1.27.4 An affirmative determination will be a prerequisite for award of the Contract to the bidder. A negative determination will result in rejection of the bidder's bid, in which event the Purchaser will proceed to the next lowest evaluated bid to make a similar determination of that bidder's capabilities to perform satisfactorily

1.27.5 The financial evaluation will be a two stage process. Initially the process of price bid decryption will be same as is normally executed in an e-Tender. Subsequent to this, **reverse e-auction** process will be executed among all the eligible bidders following the standard e-auction procedure of the portal, i.e. **https://wbtenders.gov.in.**

1.28 TECHNICAL BID EVALUATION

1.28.1 Only substantively responsive bids shall be evaluated for techno-commercial evaluation. In evaluating the techno-commercial bid, conformity to the eligibility/ qualification criteria, technical specifications, and Quality Assurance; and commercial conditions of the offered Services to those in the Tender Document is ascertained. If additional factors incorporated in the Tender Document shall also be considered in the manner indicated therein. Bids with substantive techno-commercial deviations shall be rejected as nonresponsive. Purchaser reserves its right to disallow deviations in technical Conditions.

1.29 FINANCIAL BID EVALUATION

After evaluation of the technical bid, purchaser will declare/upload the name of the technically qualified bidders name in the portal and Bidder will also can view the technically qualified successful bidder list in the tender documents. Technically disqualified bidders will be rejected and only successfully qualified Bidder's financial bid will be open in this case. After discover the L1 price, reverse auction will be conducted from the financial

qualified bidders.

F. AWARD OF CONTRACT

1.30 AWARD CRITERIA

1.30.1 The Purchaser will award the Contract to the successful bidder(s) whose bid has been determined to be substantially responsive and has been determined as the lowest bid after reverse auction that the bidder is determined to be qualified to perform the Contract satisfactorily. The Purchaser shall be the sole judge in this regard.

1.30.2 For the purpose of determining the capability and capacity of the bidder to perform the Contract, the Purchaser reserves the right to verify the authenticity of the documents submitted by the bidder for meeting the qualification requirements and may undertake verification of the facilities available with the bidder.

1.31 RIGHT TO REJECT BIDS

WBPDCL reserves the right to accept or reject any bid and to annul the bidding process and reject all bids at any time prior to award of contract, without thereby incurring any liability to affected bidder or bidders or any obligation to inform the affected bidder or bidders the reason for WBPDCL's action.

1.32 LETTER OF AWARD

1.32.1 After approval of bid evaluation by WBPDCL, the successful bidder may be invited for pre-award discussions. After pre-award discussions and prior to the expiry of the period of bid validity, WBPDCL will notify the successful bidder in writing by registered letter and E-mail, that his bid has been accepted. This letter (`Letter of Award' or **LOA or Material/Service Contract**) shall mention the sum which WBPDCL will pay to the Contractor in consideration of the execution & completion of the Works by the Contractor as prescribed under the Contract.

1.32.2 Material & Service Contract will be issued as per the Billing Breakup(BBU) of the BOQ Schedule submitted by L1 bidder(after reverse auction) in line with **Cl. No. 1.19.3.2 and Cl. No. 4.1.7**.

1.32.3 Within Seven (07) days of receipt of the LOA, the successful bidder shall

sign and return one (1) original copy of the same to WBPDCL as acknowledgment of acceptance of the same.

1.32.4 The **LOA or Material/Service Contract** will constitute the formation of the Contract as per provisions of **GCC.3.4.5.**

1.33 SIGNING OF CONTRACT AGREEMENT

1.33.1 WBPDCL will send the successful bidder the Contract Agreement (non judicial stamp paper of appropriate value) as per **Annexure: 1 of Section VII** in three (3) copies incorporating all agreements between the parties duly signed by the authorized signatory of the Purchaser along with the LOA.

1.33.2 Within Seven (07) days from the date of acceptance of LOA, the successful bidder shall sign the Contract Agreement and return two (2) copies to the Purchaser and retain one (1) copy of the same.

1.34 CONTRACT PERFORMANCE GUARANTEE

1.34.1 Within fifteen (21) days of LOA from WBPDCL, the successful bidder shall furnish to WBPDCL three separate Contract Performance Guarantee (CPG), as in the form of an unconditional and irrevocable Bank Guarantee equal to **three percent (3%)** of the Contract Price for BkTPS, STPS and SgTPP respectively i.e. for all the Contracts and as per the **Annexure: 2 of Section VII.**

1.34.2 Failure of the successful bidder to submit performance security as stated herein shall constitute sufficient ground for annulment of the award and forfeiture of his bid security, in which event the Purchaser may make the award to the next lowest evaluated bidder or call for new bids.

1.34.3 **Forfeiture of Contact Performance Guarantee**

Contract Performance Guarantee shall be forfeited if,

a. The successful bidder does not start to execute the work within 60 days after placement of Letter of Award (LOA) and/or,

b. The successful bidder discontinue the work without prior permission of WBPDCL and/or,

c. The successful bidder fails to install/procure the total capacity of the plant as mentioned in the Bid Document and/or,

d. The successful bidder fails to rectify/replace of the defective/damaged equipment(s)/work(s) within the Defect Liability Period.

1.35 MISREPRESENTATION BY THE BIDDER

If the bidder conceals any material information or makes a wrong statement or misrepresents facts or makes a misleading statement in the bid, in any manner whatsoever, in order to create circumstances for the acceptance of the bid, the purchaser reserves the right to reject such bid and/or cancel the LOA **or Material/Service Contract**, if issued.

SECTION-II

BID DATA SHEET

BID DATA SHEET (BDS)

The following bid specific data for the Equipment/ Materials / Works to be procured shall amend and/or supplement the clauses in the Instructions to Bidders (ITB). Whenever there is a conflict, the provisions herein shall prevail over those in the ITB.

Name of the Work:	E-tender cum reverse auction for Design & Engineering, Manufacture / Procurement, Supply, Erection, Testing and Commissioning of 22.5 MW Grid Connected Floating Solar Photovoltaic Power Plant on different Water Ponds of BkTPS, STPS & SgTPP of WBPDCL including warrantee obligation with 05 (Five) years comprehensive Operation and Maintenance on turnkey basis .

ITB Clause Ref., if any	**Data**
	2.1 A. SCOPE & QUALIFICATION
ITB. 1.2	WBPDCL intends to finance this Works through fund as to be received from GoWB under RIDF.
	End user of the Project The West Bengal Power Development Corporation Limited
ITB.1.3	Brief Scope of Work
ITB 1.4	**QUALIFYING REQUIREMENT FOR BIDDERS:** Prescribed in NIT
ITB 1.4.1.4	Whether Joint Venture is permitted - **YES**
	Type of Bidding: National Competitive Bidding **(NCB).**
	2.2 B. THE BIDDING DOCUMENTS
ITB.1.9	Clarification or any proposed modification on bidding document may be submitted by the bidders through mail to the mail address **Email: s.dass@wbpdcl.co.in** as per format of **Form 9 and Form 10 of Section VI**
	Date & Time up to which request for clarifications will be received: As per NIT
	Clarifications on bidding documents may be obtained from **https://wbtenders.gov.in**
	NOTE: Late submission of queries will not be entertained.

ITB. 1.10	Pre-bid Meeting **Venue :** The West Bengal Power Development Corporation Ltd. Bidyut Unnayan Bhaban, Plot No. 3/C LA-Block, Sector-III, Bidhannagar,Kolkata-700 106 **Date & Time : As per NIT**
ITB.1.10.4	The proposed modifications to the bid documents shall be sent by the bidders within the time mentioned in NIT through mail to the mail address **Email: s.dass@wbpdcl.co.in** as per format of **Form 10 of Section VI**
	2.3 C. PREPARATION OF BIDS
ITB.1.15.8	Price Adjustment is not applicable.
ITB.16.0	Period of validity of bids: As per NIT
ITB.1.18	Validity of Bid Security : As per NIT
	2.4 D. **SUBMISSION OF BIDS**
ITB.1.19.1 ITB.1.19.2	Bids should be submitted online through the portal **https://wbtenders.gov.in**
ITB 1.20.4	Submission of original Bid Security **(EMD) (Offline Submission)** an amount**: Rs. 403.94 Lakh** (Rupees four hundred and three lakh and ninety four thousand only). **Place of Submission** **To** **The General Manager(M&C) ,** The West Bengal Power Development Corporation Ltd. Bidyut Unnayan Bhaban, Plot No. 3/C LA-Block, Sector-III, Bidhannagar,Kolkata-700 106 **Telephone: 0091 – 033 2339 3621,** **Email: s.dass@wbpdcl.co.in** **Date & Time : As per NIT**
ITB. 1.26	**Time to complete the Works from the Date of LOA:-** As per NIT
	Detailed Master Network for different activities **[To be submitted by successful vendor/contractor]**
	The Master Network shall include the major activities listed below showing their inter-relationship and duration so as to meet the schedule dates mentioned above: 1. Kick off Meeting 2. Start of engineering

	3. Completion of engineering 4. Start of manufacturing/fabrication 5. Completion of manufacturing/fabrication 6. Commencement of supplies 7. Supplies all items 8. Completion of site delivery of spares 9. Commencement & completion of civil works (wherever applicable) 10. Commencement and completion of erection of equipment/materials. 11. Readiness of the system 12. PG test completion 13. Completion of Works
	The master schedule and the key milestone dates will be discussed with the successful bidder and agreed upon before the issue of LOA. Engineering Drawing and Data Submission Schedule shall also be discussed and finalised before the issue of LOA.
	After the LOA, the Contractor shall plan the sequence of work of manufacture, supply and erection to meet the above stated dates of successful completion of Works and shall ensure all work, manufacture, shop testing, inspection and shipment of the Equipment/Materials in accordance with the required erection sequence.

SECTION-III

GENERAL CONDITION OF CONTRACT (GCC)

A. CONTRACT AND INTERPRETATION

3.1. DEFINITION OF TERMS

Unless the context otherwise requires, the following terms whenever used in this document have the respective meaning:

3.1.1 **"Purchaser"** shall mean the "**The West Bengal Power development Corporation Limited(WBPDCL)**", having its Office at Bidyut Unnayan Bhaban, Plot No. 3/C LA-Block, Sector-III, Bidhannagar, Kolkata-700 106 and shall include its successors and assigns.

3.1.2 "**Contract**" means all the Contract Agreement(s) entered into between the Purchaser and the Contractor, together with the Contract Documents referred to therein; they shall constitute the Contract and the term Contract shall in all such documents be construed accordingly.

3.1.3 "**Contract Price**" means the sum total of contract price stated in all the Letter of Award(s) as payable to the Contractor for supply, execution and commissioning of the entire Works under the scope of Contract subject to such addition & adjustments thereto or deductions there from as may be made pursuant to the Contract(s). In cases where separate identifiable Works can be completed and taken over by the Purchaser and for which separate completion schedule is provided in the Contact, in relation to such Works, the Contract Price shall mean the price related to such Works completed and taken over by the Purchaser.

3.1.4 "**Contractor**" means the successful bidder whose bid has been accepted by the Purchaser, named as such in the Contract Agreement and included its legal successors and permitted assigns.

3.1.5 "**Bidder**" shall mean Bidding Company or a Bidding Consortium (formed through a memorandum of understanding) or any other person submitting the Bid. Any reference to the Bidder includes Bidding Company / Bidding Consortium / Member of a Bidding Consortium includes its successors, executors and permitted assigns and Lead Member of the Bidding Consortium jointly and severally, as the context

may be.

3.1.6 "**Bidding Consortium**" shall mean a maximum of three(3) Bidding Companies who have signed a memorandum of understanding collectively submitted the Bid in accordance with the provisions of this RFQ cum RFP.

3.1.7 "**Project Manager**" means the person appointed by the Purchaser in the manner provided in GCC.3.20.1 hereof and named as such in the SCC.4.1.5 to perform the duties delegated by the Purchaser.

3.1.8 "**Letter of Award**" shall mean intimation in writing by WBPDCL placing award of contract upon the successful bidder towards execution of the contract on acceptance of the bid offered by the bidder following terms and conditions as enumerated in the tender document. "**Price Schedule"** me**ans the schedu**les or any part or individual schedule thereof, submitted by the bidder with his bid and forming a part of the Contract Documents

3.1.9 The '**Engineer-in-Charge'** shall mean the General Manager (Projects), Corporate of the Company

3.1.10 The "**Controlling Officer'** shall mean the General Manager/Project In-charge of the respective Power Plants.

3.1.11 '**WBPDCL's representative'** shall mean any person or persons or consulting firm appointed/authorized by the Company to supervise, inspect, test and examine workmanship and materials of the work under this scope

3.1.12 The '**Sub-Contractor'** shall mean any person/agency to whom any part of the contract has been sublet by the contractor with the consent in writing of the Company and will include the legal representatives, successors and permitted assigns of such persons/agency.

3.1.13 '**Equipment/materials'** shall mean and include all type of construction equipment & materials etc. required for true and satisfactory completion of the work under this contract.

3.1.14 Workmanship' shall mean the method/manner in which the jobs of the different items, whether included in the schedule or not but are required for true & satisfactory completion of the work under this contract, are executed.

3.1.15 "Contractor's Equipment" means all appliances or things of whatsoever

nature required for the purposes of execution of work and which are to be provided by the Contractor but does not include any Equipment/ Materials intended to form part of Works.

3.1.16 'Specifications' shall mean collectively all the terms and stipulations contained in this document including the conditions of contract, technical provisions and attachments thereto and list of corrections and amendments. **Drawings' means** collectively all the accompanying general drawings as well as all detailed drawings, which may be used from time to time or desired by WBPDCL.

3.1.17 'Approval' shall mean the written approval of WBPDCL and/the statutory authorities, wherever such authorities are specified by any codes or otherwise.

3.1.18 'Manufacturer' shall refer to the party proposing to design/engineering and construct in complete or in part a particular job/work at their works/premises.

3.1.19 'Labourer' shall mean all categories of labour engaged by the Contractor, his sub- contractors and his piece workers for work in connection with the execution of the works covered by the specifications. All these labourers will be deemed to be employed primarily by the Contractor.

3.1.20 'Plant'/'Equipment'/'Stores' means and include plant and machineries to be provided under the contract.

3.1.21 'Delivery of Plant'/'Delivery of Equipment' shall be deemed to take place on delivery of the plant/equipment in accordance with the terms of the contract complete in all respect after approval by WBPDCL.

3.1.22 'Tests on Completion' shall mean all such tests as are prescribed by the specification to be made by the Contractor to the satisfaction of WBPDCL before the plant and equipment are taken over by WBPDCL and this also includes those tests not specifically mentioned in the specification but required under various BIS codes and relevant Electricity Acts and Rules.

3.1.23 'Commissioning' shall mean the satisfactory, continuous and uninterrupted operation of the equipment/work as specified after all necessary initial tests, checks and adjustments required at site for a period of at least 15 (fifteen) days to the satisfaction of WBPDCL.

3.1.24 "Completion of Facilities" means that all the Facilities (or a specific part

thereof where specific parts are specified in the SCC) have been completed operationally and structurally as per Technical Specifications and put in a tight and clean condition and that all work in respect of Pre-commissioning of the Facilities or such specific part thereof has been completed and Commissioning has been attained as per Technical specifications.

3.1.25 **'Urgent Works'** shall mean any urgent measures, which in opinion of the Engineer–in- Charge, become necessary at the time of execution and/or during the progress of work to obviate any risk of damage to the structure, or required to accelerate the progress of work or which become necessary for security or for any other/reason WBPDCL may deem expedient.

3.1.26 "**MNRE**" shall mean Ministry of New and Renewable Energy, Government of India;

3.1.27 "**kWp**" shall mean Kilo-Watt Peak;

3.1.28 **"Pond"** shall mean Water Ponds Raw Water Pond 1 & 2 at BKTPS, Raw Water Pond 2 & Dutta Bandh at STPS & Raw Water Pond #5 at SgTPP WBPDCL .

3.1.29 **Month'/'Calendar month'** means not only the period from the first of a particular month, but also any period between a date in a particular month, and the date previous to the corresponding date in subsequent month unless specifically stated otherwise.

3.1.30 **'Week'** means seven consecutive calendar days.

3.1.31 **'Writing'** shall include any manuscript, type written, printed or other statement reproduced in any visible form.

3.1.32 **"Site"** means the place or places, where Works are to be executed by the Contractor or to which Equipment machinery are to be delivered, together with so much of the area surrounding the same as the Contractor shall with the consent of the Purchaser, use in connection with the work other than merely for the purposes of access.

3.1.33 The term '**Services'** shall mean all works to be undertaken by the contractor as laid down under the head "Scope of work" or elsewhere in the specification enclosed. When the words "approved", "subject to Approval". "As directed", "Accepted", "Permitted" etc. are used, the approval, judgment, direction etc. are understood to be a function of Company.

3.1.34 **'General Conditions'** shall mean all the clauses of General conditions of the proposed contract stated hereinafter. The specification shall mean the specification annexed to or issued with the General Conditions and shall include the schedule and drawings attached thereto

3.1.35 **'Date of Contract'/'Commencement Date'** shall mean the date on which Letter of Award will be issued.

3.1.36 **'Zero Date'** will be started from the date of issuance of Letter of Award (LOA).

3.1.37 "**Program**" means the Program to be submitted by the Contractor in accordance with GCC and any approved revisions thereto.

3.1.38 "**GCC**" means the General Conditions of Contract hereof.

3.1.39 **"SCC"** means the Special Conditions of Contract.

3.1.40 **"Trial run"** means the first continuous operation of the complete Plant & Equipment including all systems & sub-systems in the of mode Remote operation from SCADA for three (03) days with continuous daily operation, trial shall necessarily include steady operation of the plant at its evacuation capacity successfully without any unforeseen/spurious tripping of any running equipment.

3.1.41 **"BkTPS"** means Bakreswar Thermal Power Station, PO: BkTPP, District: Birbhum- 721137, West Bengal.

3.1.42 **"STPS"** means Santaldih Thermal Power Station, PO: Santaldih TP, District: Purulia- 723146, West Bengal.

3.1.43 "**SgTPP**" means Sagardighi Thermal Power Project, PO: Monigram, District: Murshidabad- 742237, West Bengal.

3.2. CONTRACT DOCUMENTS

3.2.1. The following conditions and documents in indicated order of precedence(higher to lower)shall be considered an integral part of the contract, irrespective of whether these are not appended/ referred to in it. Any generic reference to 'Contract' shall imply reference to all these documents as well:

a. Amendments, Clarifications, Corrigendum including minutes of meetings, Record notesand corresponding issued between issuance of NIT and LOA.

b. the Agreement consisting of the initial paragraphs, recitals and other clauses set forth immediately before the General Conditions of Contracts(GCC) and

including the Description of job, Contract Price, the Bid Forms(including Price Bid) submitted by the Contractor and signatures of Purchaser-;

c. the Letter of Award (LoA)

d. Final written submissions made by the contractor during negotiations, if any;

e. the SCC

f. the GCC

g. the contractor's bid;

h. any other document listed in the SCC as forming part of this Contract.

i. Integrity Pact, if any.

3.2.2. a) If any of the contract provisions must be modified after the contract documents have been signed, the modifications shall be made in writing and signed by the Purchaser, and no modified provisions shall be applicable unless such modifications have been done. No variation in or modification of the contract terms shall be made except by a written amendment signed by the Purchaser. Requests for changes and modifications may be submitted in writing by the contractor to the Purchaser. At any time during the currency of the contract, the Purchaser may suo-moto or, on request from the contractor, by written order, amend the contractby making alterations and modifications within the general scope of the Contract.

b) If the contractor does not agree to the suo-moto modifications/amendments made by the Purchaser, he shall convey his views within 14 days from the date of amendment/ modification. Otherwise, it shall be assumed that the contractor has consented to the amendment.

c) Any verbal or written arrangement abandoning, modifying, extending, reducing, or supplementing the contract or any of the terms thereof shall be deemed conditional and shall not be binding on the Purchaser unless and until the same is incorporated in a formal instrument and signed by the Purchaser, and till then the Purchaser shall have the right to repudiate such arrangements.

3.2.3. If the successful bidder is a Bidding Consortium then the award of this three contract will be conferred on the Lead Member. But all the member of the consortium shall be severally and jointly liable and responsible for execution of the contract. In the event of failure on the

part of the second member of the consortium to perform its obligation, then the Lead member of the consortium shall be solely responsible to fulfil the remaining obligations of its partner for the purpose of completion of contract including statutory obligations (**refer Clasuse-3.50**).

3.2.4. Subject to Sl no.2 of the Contract Agreement(Annexure-1), all documents forming part of the Contract (and all parts thereof) are intended to be correlative, complementary and mutually explanatory. The Contract shall be read as a whole.

3.2.5. Subsequent to signing of the Contract Agreement, the Contractor at his own cost shall provide the Purchaser with at least **six (6) copies** of the Contract Documents within **seven (07)** days after signing of the Contract Agreement.

3.2.6. The Contractor shall provide free of cost to WBPDCL all the engineering data, drawings and descriptive materials submitted with the bid, complete set of his bid and bidding documents, copies of all the correspondence with WBPDCL, etc. in at least **four (4)** copies to form a part of the Contract Documents after seven (07) days of the Letter of Award (**LOA**).

3.2.7. **Endorsement of Terms**

The failure of either party to endorse at any time any of the provisions of the Contract or any rights in respect thereto or to an option herein provided shall in no way be construed to be a waiver of such provisions, rights or option or in any way to effect the validity of the Contract. The exercise by either party of any of his rights herein shall not preclude or prejudice either party from exercising the same or any other right it may have hereunder.

3.2.8. **Effect**

The Contract shall be considered to come into force on the date of issuance of LOA by PURCHASER to the Contractor which may be in the form of a fax, E-MAIL or a Letter of Award.

However, start date of the project will be mentioned in the LOA which will be not less than 15 days from the date of LOA. The Time for Completion shall be reckoned from that date.

3.2.9. All Contract Documents, all correspondence and communications to be given, and all other documentation to be prepared and supplied under the Contract shall be written in English, and the Contract shall be construed and interpreted in accordance with that language. If any of the Contract Documents, correspondence or communications are prepared in any language other than the governing language under this clause, the English translation of such documents, correspondence or communications shall prevail in matters of interpretation.

3.3. NOTICE

3.3.1. Notices shall be deemed to include any approvals, consents, instructions, orders

and certificates to be given under the Contract. Unless otherwise stated in the Contract, all notices to be given under the Contract shall be in writing, and shall be sent by personal delivery, Registered post or e-mail followed by post confirmation to the address of the relevant party as mentioned in SCC

3.3.2. Any notice sent by registered post or speed post shall be deemed (in the absence of evidence of earlier receipt) to have been delivered **ten (10) days after dispatch**. In proving the fact of dispatch, it shall be sufficient to show that the envelope containing such notice was properly addressed, stamped and conveyed to the postal authorities for transmission by airmail or registered post.

3.3.3. Any notice delivered personally or sent by registered post shall be deemed to have been delivered if the same is properly received by the other party.

3.3.4. Either party may change its address at which notices are to be received by giving ten (10) days' notice to other party in writing.

3.4. INTERPRETATION

3.4.1. Singular and Plural

The singular shall include the plural and the plural the singular, except where the context otherwise requires.

3.4.2. Headings

The headings and marginal notes in the General Conditions of Contract are included for ease of reference, and shall neither constitute a part of the Contract nor affect its interpretation.

3.4.3. Persons

Words importing persons or parties shall include firms, corporations and government entities.

3.4.4. INCOTERMS

Unless inconsistent with any clause of the Contract, the meaning of any trade term and the rights and obligations of parties there under shall be as prescribed by the Incoterms.

Incoterms means international rules for interpreting trade terms published by the International Chamber of Commerce (latest edition), 38 Cours Albert 1er, 75008 Paris, France.

3.4.5. Entire Agreement

Subject to **GCC.3.2.,** the Contract constitutes the entire agreement between the Purchaser and Contractor with respect to the subject matter of Contract and supersedes all communications, negotiations and agreements (whether written or oral) of parties with respect thereto made prior to the date of Contract..

3.4.6. Independent Contractor

The Contractor shall be an independent Contractor (if JV/Consortium then Lead

Member) performing the Contract.

The Contractor shall be solely responsible for the manner in which the Contract is performed. All employees, representatives or Sub-contractors engaged by the Contractor in connection with the performance of the Contract subject to approval of WBPDCL shall be under the complete control of the Contractor and shall not be deemed to be employees of the Purchaser, and nothing contained in the Contract or in any subcontract awarded by the Contractor shall be construed to create any contractual relationship between any such employees, representatives or Sub-contractors and the Purchaser.

3.4.7. Non-Waiver

Any waiver of Purchaser's/bidder's rights, powers or remedies under the Contract must be in writing, must be dated and signed by an authorized representative of the Purchaser/bidder granting such waiver, and must specify the right and the extent to which it is being waived.

Subject to above, no relaxation, forbearance, delay or indulgence by either party in enforcing any of the terms and conditions of the Contract or the granting of time by either party to the other shall prejudice, affect or restrict the rights of that party under the Contract, nor shall any waiver by either party of any breach of Contract operate as waiver of any subsequent or continuing breach of Contract.

3.4.8. Severability

If any provision or condition of the Contract is prohibited or rendered invalid or unenforceable, such prohibition, invalidity or unenforceability shall not affect the validity or enforceability of any other provisions and conditions of the Contract.

3.5. GOVERNING LAW

The Contract shall be governed by and interpreted in accordance with laws in force in India including any such Laws passed or made or coming into force during the period of the Contract. The Courts of Kolkata under the superintendence of High Court of Calcutta shall have exclusive jurisdiction in all matters arising under the Contract.

3.6. SATTLEMENT OF DISPUTE

3.6.1 If any dispute(s) or difference(s) of any kind whatsoever arise between the parties hereto in connection with or arising out of any contract, the parties hereto shall negotiate with a view to its amicable resolution and settlement. In the event no amicable resolution or settlement is reached within a period of 30 (thirty) days from the date on which the dispute(s) or difference(s) arose, either party shall give a notice to the other party, of such intention to invoke Arbitration within 14 (fourteen) days from the expiry of the aforesaid period of 30 (thirty) days within

which amicable resolution could not be reached.

Such dispute(s) or difference(s) shall be referred to and settled by an Arbitral panel comprising of 3 (three) arbitrators. Both the parties shall appoint one arbitrator each. The third Arbitrator shall be appointed by both the Arbitrators who shall act as the Presiding Arbitrator.

3.6.2 If the appointed Arbitrators fail to agree upon the Presiding Arbitrator within 30 (thirty) days from the date of their appointment, the appointment of Presiding Arbitrator shall be made upon request of either party by, the Hon'ble High Court, Kolkata, West Bengal.

3.6.3 The Arbitration clause can be invoked at any time during the currency of the contract or after the expiry/ termination or closure of the contract.

3.6.4 The arbitration proceedings shall be in accordance with the prevailing Arbitration laws of India as amended or enacted time to time

3.6.5 The existence of any dispute(s) or difference(s) or the initiation or continuance of the Arbitration proceedings shall not permit the parties to postpone or delay the performance by the parties of their respective obligations pursuant to the Contract.

3.6.6 The seat of arbitration shall be Kolkata, West Bengal, India.

3.7. COMPLIANCE WITH LAWS

3.7.1 Compliance with Laws, statutes, regulations

The Contractor shall, in all matters arising in the performance of the Contract, comply with in all respects, give all notices and pay all fees required by the provisions of any national or state statute, ordinance or other law or any regulation or bye-law of any duly constituted authority.

3.7.2 Statutory Obligations

The Contractor shall adhere to the statutory provisions under Payment of Minimum Wages Act, Contract Labour (Regulation & Abolition) Act-1972, Employee's Provident Fund & Miscellaneous Provisions Act-1952, Employers' Compensation Act-1923, ESI Act 1998 and other available relevant statutes. The Contractor shall also be responsible and liable for such statutory compliance as stated hereinabove in respect of the Sub Contractors engaged by them. At any point of time non-compliance of the statutory provisions in respect of contract labour engaged in the job by the contractor/sub-contractors may attract penal action against Contractor from the law enforcing authorities. All liabilities arising out of the non-compliance of the Law of the land will have to be borne by the Contractor and PURCHASER will not be responsible in any manner whatsoever for the same.

3.7.3 The Contractor shall indemnify and hold harmless the Purchaser from and

against any and all liabilities, damages, claims, fines, penalties and expenses of whatever nature arising or resulting from the violation of such laws by the Contractor or its personnel, including the Sub-contractors and their personnel, but without prejudice to **GCC 3.10** hereof.

B. SUBJECT MATTER OF CONTRACT

3.8. SCOPE OF WORKS

3.8.1 Unless otherwise expressly provided in the Technical Specifications, the Contractor's obligations cover the provision of all Equipment/ Materials including spares and the performance of all services required for the design, the manufacture (including quality assurance, construction, installation, associated civil, structural and other construction works and delivery) of the Equipment/Materials and the installation, commissioning, completion of the Works and carrying out completion tests for the Works in accordance with the plans, procedures, Specifications, drawings, codes and any other documents as specified in the Technical Specifications. Such Specifications include, but are not limited to, the provision of supervision and engineering services; the supply of labour, materials, Equipment, spare parts (as specified in **GCC 3.8.3**) and accessories; Contractor's Equipment; construction utilities and supplies; temporary materials, structures and facilities; transportation (including, without limitation, unloading and hauling to, from and at the Site), insurance and storage, except for those supplies, works and services that will be provided or performed by the Purchaser.

3.8.2 The Contractor shall, at no extra cost to the Purchaser, unless specifically excluded in the Contract, perform all such Works and/or supply all such items and materials not specifically mentioned in the Contract but that can be reasonably inferred from the Contract as being required for attaining successful completion of the Works as if such Works and Materials were expressly mentioned in the Contract.

3.8.3 The Contractor agrees to supply spare parts required for the operation and maintenance of the Works as per provision of subsequent sub clauses of **GCC 3.8.3.**

3.8.3.1. All the spares for the Equipment/material under the Contract will strictly conform to the Specification and other relevant documents and will be identical to the corresponding main Equipment/Materials supplied under the Contract and shall be fully interchangeable.

3.8.3.2. All the spares covered under the Contract shall be manufactured along with the main Equipment/ Materials as a continuous operation and the delivery of the spares will be effected along with the main Equipment/ Materials in a phased

manner and the delivery would be completed by the respective dates for the various categories of Equipment/ Materials as per the agreed Program.

3.8.3.3. The Contractor will provide the Purchaser with the manufacturing drawings, catalogues, assembly drawings and any other document required by the Purchaser so as to enable the Purchaser to identify the spares. Such details will be furnished to the Purchaser during design and drawing approval.

3.8.3.4. In addition to the spares covered in the Scope of Work, if the Purchaser further identifies certain items of spares, the Contractor will submit the prices and delivery quotation for such spares within thirty (30) days of receipt of such request with a validity period of six (6) months for consideration by the Purchaser and placement of order for additional spares, if the Purchaser so desires.

3.8.3.5. The quality plan and the inspection requirement finalized for the main Equipment/ Materials will also be applicable to the corresponding spares.

3.8.3.6. The Contractor will provide the Purchaser with all the addresses and particulars of his Sub-contractors while placing the order for Equipment/ Materials covered under the Contract and will further ensure with his vendors that the Purchaser, if so desires, will have the right to place order for spares directly on them on mutually agreed terms based on offers of such vendors.

3.8.3.7. The Contractor shall guarantee the long-term availability of spares to the Purchaser for the full life of the Equipment/ Materials covered under the Contract. The Contractor shall guarantee that before going out of production of spare parts of the Equipment/ Materials, he shall give the Purchaser at least twelve (12) months advance notice so that the latter may order his bulk requirement of spares, if he so desires. The same provision will also be applicable to Sub-Contractor of any spares by the Contractor or his Sub-Contractors. Further, in case of discontinuance of manufacture of any spares by the Contractor or his Sub-Contractors, the Contractor will provide the Purchaser, two (2) years in advance, full manufacturing drawings, material specifications and technical information required by the Purchaser for the purpose of manufacture of such items..

3.8.3.8. In case the Contractor fails to supply the spares in the terms stipulated above, the Purchaser shall be entitled to purchase the same from the alternate sources at the risk and the cost of the Contractor and recover from the Contractor, the excess amount paid by the Purchaser, if any, over the rates worked on the above basis. In the event of such risk purchase by the Purchaser, the purchases will be as per the Policy and Procedures of the Purchaser prevalent at the time of such purchases and the Purchaser at his option may include a representative from the Contractor in finalizing the purchases.

3.8.3.9. It is expressly understood that the final settlement between the parties , in terms of relevant clauses of the Contract Documents shall not relieve the Contractor of any of his obligations under the provision of long term availability of spares unless otherwise discharged expressly in writing by the Purchaser.

3.8.3.10. The Contractor shall warrant that all spares supplied will be new and in accordance with the Contract Documents and will be free from defects in design, material and workmanship

3.8.4 COMPREHENSIVE OPERATION AND MAINTENANCE

Maintenance contract shall be commence after final commissioning of the plant. 05 (five) years comprehensive operation & maintenance of the plant shall also be the scope of work. The contractor needs to submit 03 (three) sets of comprehensive user's manual and 02 (two) sets of Operation and Maintenance manual book after commissioning of the plant.

The scope of maintenance shall include supply of spare parts, replacement of all damaged equipment and accessories with new one within the price of yearly maintenance charge.

Time for repair/ replacement of equipment or any works in case of any major failure will be granted by the Controlling Officer considering the type of failure and receiving written prayer from the contractor for the same. But in general the downtime will be 72 hours.

The period of unavailability of Grid & Force Majeure Conditions will not be considered as downtime.

Arrangement of security (Minimum 02 nos. of security personnel in each of the three shifts) shall be a scope of the operation and maintenance.

The contractor shall arrange sufficient transportation arrangement (24X7) for the operation and maintenance purpose. The maintenance includes Routine and preventive, Breakdown and Capital Maintenance which shall be but not limited to the following.

3.8.4.1. **Routine and preventive maintenance:**

This shall include:

i. Regular cleaning of PV modules.
ii. Checking & tightening of all electrical connections and mechanical fittings.
iii. Checking and restoring of earthing system.
iv. Cleaning of Inverter and other electrical equipment.
v. Routine maintenance as recommended by the original equipment manufacturer.

The contractor shall be responsible to carry out routine and preventive maintenance and replacement of each and every damaged/faulty component/

equipment of the power plant and he shall provide all labour, material, consumables etc for routine and preventive maintenance at his own cost.

3.8.4.2. **Breakdown maintenance:**

Breakdown maintenance shall mean the maintenance activity including repairs and replacement of any component or equipment of the power plant which is not covered by routine and preventive maintenance and which is required to be carried out as a result of sudden failure/breakdown of that particular component or equipment while the plant is running. The supplier shall be responsible to carry out breakdown maintenance of each and every component of the power plant and he shall provide the required manpower, materials, consumables, components or equipment etc. for breakdown maintenance at his own cost irrespective of the reasons of the breakdown/failure.

3.8.4.3. **Capital maintenance:**

Capital Maintenance shall mean the major overhaul of any component or equipment of the power plant which is not covered by routine, preventive and breakdown maintenance which may become necessary on account of excessive wear & tear, aging, which needs repair/replacement. The capital maintenance of power plant and all civil structures shall normally be planned to be carried out on an annual basis. For this purpose a joint inspection by the supplier and WBPDCL shall be carried out of all the major components of the power plant, about two months in advance of the annual maintenance period, in order to ascertain as to which components of the power plant require capital maintenance. In this regard the decision of WBPDCL will be final and binding.

However, if the condition of any plant component wants its capital maintenance at any other time, a joint inspection of WBPDCL and supplier shall be carried out immediately on occurrence of such situation and capital maintenance shall be carried out by arranging the shutdown of the plant/part of the plant, if required, in consultation with concerned authorities. The decision of WBPDCL shall be final and binding to the contractor.

The capital maintenance also includes painting of mechanical & civil structures etc.

The contractor shall undertake necessary maintenance /troubleshooting work of the Solar PV Power Systems. Down time shall not be more than 72 hours from time of occurrence of such faults. Adequate measures should be taken for prevention of wear and tear of the machines. Solar PV Power System is to be designed to operate with a minimum of maintenance.

The scope of support service provides preventive maintenance as & when necessary within the contract period and break down maintenance in the event of

malfunctions, which prevent the operation of the power system or part of it within the stipulated time period & free replacement of spares required for maintenance. he contractor will provide Spare parts & measuring instruments.

The contractor shall submit the detailed schedule for routine and preventive maintenance before final commissioning of the plant. The contractor shall also submit Detailed Report to WBPDCL for any capital or breakdown maintenance mentioning the cause of breakdown, actions taken to resolve that issue and preventive measures taken to avoid failure/damage/loss of generation due to similar incidents/accidents in future etc. within 07 (seven) days from the date of recovery.

3.8.4.4. **Operation & Maintenance Report:** Maintenance register / log book must be maintained at site. However, quarterly maintenance and monthly generation report of each location as per format duly approved by WBPDCL must be submitted in original by the contractor to WBPDCL with certification of WBPDCL by the contractor within 30 day of the following month. Failing of which maintenance service will be deemed to be not attended.

3.8.4.5. **Deployment of Competent Manpower:**

As the vendor is to satisfy the NMGG of the plant as per clause GCC.3.34, however deployment of man power shall be in line with Clause **4.10.1 of SCC.**

3.8.4.6. **Cost & Payment Terms for O&M Contracts:**

O&M contract value: **7.5%** of the Basic Project Cost (excluding GST) for 5(five) years.

Payment Terms:

The payment shall be made on monthly basis and the Eligible amount will be due for payment after the certification by the Controlling Officer within 45 (forty five) days from the end of each month subject to satisfactory performance and submission of maintenance report in regular basis as mentioned in Clause No. 3.8.4 of GCC. The total yearly amount payable shall be subject to following table and as per certification of the Controlling Officer.

O&M Operation Year end	**Amount of Payment**
1st Year	1.0% of the contract value
2nd Year	1.0% of the contract value
3rd Year	1.5% of the contract value
4th Year	1.5% of the contract value
5th Year	2.5% of the contract value

GST will be paid by WBPDCL at actual subject to submission of proper document.

3.9. VARIATION, ADDITIONS AND OMISSIONS

The Contractor shall not modify the scope of work except under direction in writing by the WBPDCL. The quantities provided in the schedule of works are fixed.

3.10. OBLIGATIONS OF THE CONTRACTOR

3.10.1 The Contractor shall, in accordance with the Contract, with due care and diligence, carry out the Works as necessary for successful completion of all the obligations, within the time for completion. All statutory norms has to be followed throughout the project and final NOC has to be obtained from site HR&A department of WBPDCL.

3.10.2 The Contractor confirms that it has entered into this Contract on the basis of a proper examination of the conditions and circumstances at the Site affecting the Contract Price, and on the basis of information that the Contractor could have obtained from a visual inspection of the Site including existing roads and bridges and other means of access to the Site, presence of obstructions on the Site. The Contractor acknowledges that any failure to acquaint itself with all such data and information shall not relieve its responsibility for properly estimating the difficulty or cost of successfully performing the Works

3.10.3 The Contractor shall acquire in its name all permits, approvals and/or licenses from all local, state or national government authorities or public service undertakings in the country/ state where the Site is located that are necessary for the performance of the Contract.

The Contractor shall also facilitate and co-ordinate the acquiring of all permits, approvals and/or licenses which are required to be taken in the name of the Purchaser, from all local, state or national government authorities or public service undertakings in the country/ state that are necessary for the performance of the Contract.

3.10.4 The Contractor shall arrange/ construct at his own cost any storage/access, structures, bridges and approach to the work sites from public roads as may be required for execution of Works.

3.10.5 Contractor shall be responsible for all necessary statutory compliance in respect of the employees deployed by them or by the sub-contractor(s) to execute the contract. However, Form no. V for obtaining labour license under the contract labour (R&A) act , 1970 and rules framed there under shall only be issued to the Contractor.

3.10.6 The Bidder shall provide sufficient, properly qualified operating and maintenance personnel; shall supply, other materials and facilities and shall perform work and services of whatsoever nature for properly carry out Commissioning, Trial run and Guarantee Tests at or before the time specified in the Program furnished by the Contractor under GCC 3.22 hereof and in the manner thereupon specified or as otherwise agreed upon by the Bidder and make available all raw materials, utilities, lubricants, chemicals, catalysts etc. at site.

3.11. OBLIGATIONS OF THE PURCHASER

3.11.1 The Purchaser shall provide the contractor physical possession of the Site and access thereto except where providing access is included in the scope of work of the Contractor on or after the date(s) of issuance of LOA.

3.11.2 Without prejudice to the obligations of the Contractor under the Contract Agreement, if requested by the Contractor, the Purchaser shall use its best endeavours to assist the Contractor in obtaining in a timely and expeditious manner all permits, approvals and/or licenses necessary for the execution of the Contract from all local, state or national government authorities or public service undertakings that such authorities or undertakings require the Contractor or Sub-contractors or the personnel of the Contractor or Sub-contractors, as the case may be, to obtain.

C. PAYMENT

3.12. CONTRACT PRICE

3.12.1 The Contract Price shall be specified in the Contract Agreement.

3.12.2 Subject to **GCC 3.11.1** hereof, the Contractor shall be deemed to have satisfied itself as to the correctness and sufficiency of the Contract Price, which shall, except as otherwise provided for in the Contract, cover all its obligations under the Contract.

3.12.3 No interest shall be paid by WBPDCL for delay in making payment.

3.13. TERMS AND PROCEDURE FOR PAYMENT

The payments to the Contractor for the performance of the Contract will be made by the Purchaser as per terms and conditions specified in **SCC.4.3.3**. No payment made by the Purchaser herein shall be deemed to constitute acceptance by the Purchaser of the Works or any part thereof. The currency of payment shall be Indian rupees**.** All service invoices shall be released subject to submission of 'No objection Certificate' from WBPDCL HR&A department of respective sites both for Project invoices and O&M invoices.

3.14. SECURITIES

3.14.1 Mobilisation Advance Payment

20 % of the Contract Price (Supply & Erection contract) will be paid as Mobilization advance to the contractor against submission of BG (**Annexure-3**) equivalent to 110 % of the Mobilization Advance. The mobilization advance will be interest free for the scheduled Completion period from the date of LOA of the Project against 110% unconditional BG with a claim period of 90 days initially. The payment of mobilization advances shall be subject to deduction of taxes at sources as per law. The unadjusted Mobilization advances of Mobilization advance if any after the schedule completion period, will be recovered with interest at the rate of 8.5% p.a.

This Bank Guarantee shall be returned to the Contractor after full recovery of advance with interest if any and against request by the Contractor. The validity of Bank Guarantee would require to be extended by the Contractor, if so required by the Purchaser. The details terms and Condition of the Mobilisation Advance has been specified in Clause No. **4.3.3.2**.

3.14.2 Contract Performance Bank Guarantee(PBG)

3.14.2.1 The Contractor shall furnish an unconditional and irrevocable Bank Guarantee in favour of the Purchaser as per **Annexure-2** of **Section VII**, towards Performance guarantee for faithful and due fulfilment of all obligations under the Contract after placement of LOA. Bank Guarantee shall be furnished for an amount equal to **three percent (3%)** of the Project cost plus GST, from a Scheduled commercial Bank in India. The Bank Guarantee shall be valid for Seventy Two (72) months subject to satisfactory completion of Defect Liability Period (Five year) with further claim period for ninety (90) days thereafter. The value of the Bank Guarantee is not to be construed as limiting the damages under Defects Liability Period. The Purchaser reserves the right to verify the authenticity of the Bank Guarantee from the issuing bank.

3.14.2.2 The Contract Performance Bank Guarantee is liable to be invoked on demand of PURCHASER, for any breach under the Contract irrespective of any dispute or difference between PURCHASER and the Contractor, pending before any court, tribunal or any other authority,

3.14.2.3 The Performance Bank Guarantee shall be returned to the Contractor within ninety (90) days after receipt of application for release of Performance Bank Guarantee along with certification regarding completion of Defects Liability Period and O&M period. No claim shall be made against the Performance Guarantee after the issue of Defects Liability Certificate. However, no costs shall be paid for the Bank Guarantee by the Purchaser, irrespective of date of release.

3.15. TAXES, DUTIES AND OTHER LEVIES

3.15.1 Except as otherwise specifically provided in the Contract, the Contractor shall bear and pay all the applicable taxes and duties (**GST**, **Custom related Duties**, **BOCW Labour welfare cess as per laws** and other Govt. Tax or Levies) and charges assessed on the Contractor, its Sub-contractors in connection with this Works. Except GST all applicable taxes, duties and levies, (Customs related Duties, BOCW, entry tax etc.) where applicable and payable on Equipment/Materials, components, sub-assemblies, raw materials and any other item required for manufacture of finished Equipment/Material or completion of Works shall be deemed to have been included in base price.

3.15.2 The Contractor shall be solely responsible for the taxes that may be levied on the Contractor's persons or on earnings of any of his employees and shall hold the Purchaser indemnified and harmless against any claims that may be made against the Purchaser. The Purchaser does not take any responsibility whatsoever regarding taxes under Indian Income Tax Act, for the Contractor or his personnel. If it is obligatory under the provisions under the Indian Income Tax Act, deduction of Income Tax at source shall be made by the Purchaser.

3.15.3 Bidder shall submit the base price and GST in their Bid as per clause 3.15.1 & 3.15.4.

3.15.4 GST will be paid at actual by the WBPDCL to the successful bidder. GST shall be considered according to the rate applicable during actual execution time.

3.15.5 Customs Duty (if Applicable)

3.15.5.1. The Contractor will be asked to identify the value of imported components, if any, and its price and corresponding the customs duty (other than those subsequently recoverable by the entity from the taxing authorities) should be included as base price / mentioned separately in the price bid.

3.15.5.2. In case of any upward revision of basic customs duty (other than those subsequently recoverable by the entity from the taxing authorities) during the currency of the contract, necessary reimbursement will be made on increased part only subject to submission of documentary evidence in support of the related import. In case of downward revision of basic customs duty benefit of the same will be passed on to the PURCHASER.

3.15.5.3. All taxes and duties payable outside India shall be borne and paid by the contractor. No claim will be entertained by the PURCHASER whatsoever on this account.

3.15.6 Advance Payment

The GST payable, if any, in respect of advance payment may be paid to the contractor by the PURCHASER in addition to the amount of advance, subject to providing appropriate documentary evidence that GST on advance has been paid

by the contractor.

3.15.7 Tax Deduction at Source (TDS) towards Income Tax/Other Taxes

Deduction of Tax at source at prevailing rate shall be effected by the PURCHASER before payment as a statutory obligation wherever applicable. Income tax and all other taxes as applicable as per statutory obligation/s enactments shall be progressively deducted from the payments released to the Contractor, by the PURCHASER, for depositing with the Income tax as per Income Tax Act /other Tax authorities.

TDS on Works Contract shall be deducted at source by the PURCHASER as per statutory provisions. However, if tax is to be deducted at reduced rate necessary certificate is to be furnished from the Tax Authorities by the Contractor.

3.15.8 Personal Income Tax & Cess

Income Tax and cess, if any payable by the Contractor's/ Sub-contractor's employees shall be paid by the said employees directly, and the PURCHASER shall not be liable to pay the income tax & cess payable by the employee of the contractor/sub-contractor and the purchaser is not responsible for filing the tax returns of contracts employees/experts.

3.15.9 Reverse Charge Mechanism

In case the liability to discharge GST is on the employer under reverse charge mechanism, then the said fact should be clearly mentioned on the face of the invoice. Further, GST should not be charged by the vendor in such cases.

3.15.10 It shall be responsibility of the Contractor to comply with all the requirements prescribed in the GST Act and Rules as may be applicable in respect of the activities/supply made by them under the contract to enable the PURCHASER to avail entire input tax credit on timely basis. It is the responsibility of the vendor to comply with the following key compliance requirements, failing which the Contractor shall be responsible of any loss of tax credit or any other cost including interest, penalty, etc that may levied or recovered from the employer.

i. The contractor shall issue a proper tax invoice containing all the particulars as prescribed in the GST Invoice.
ii. The Contractor shall deposit the GST amount due to the Government on a timely basis.
iii. The Contractor shall file the periodic statements/returns as per the provisions of GST Law on a timely basis and include therein details of all the invoices raised during the relevant month under the present contract.
iv. The Contractor shall support WBPDCL on a best effort and timely basis to

sort out the discrepancies communicated by GSTIN, if any.

3.15.11 Under GST regulation, taxes are levied on deductions under Liquidated Damage (LD). Such taxes will be charged extra by WBPDCL. The rate of such tax on LD would be as per laws applicable at the time of imposition of LD when a Debit Note/Invoice is raised by WBPDCL. This is because LD is a post-delivery/performance event & is not part of initial price bid.

D. INTELLECTUAL PROPERTY

3.16. PATENT RIGHTS & ROYALTIES

3.16.1 Royalties and fees for patents covering Equipment/Materials, articles, apparatus, devices or processes used in the Works shall be deemed to have been included in the Contract Price. The Contractor shall satisfy all demands that may be made at any time for such royalties or fees and he alone shall be liable for any damages or claims for patent infringements and shall keep the Purchaser indemnified in that regard.

3.16.2 The Contractor shall, subject to the Purchaser's compliance with GCC 3.16.3, indemnify and hold harmless the Purchaser , his successors or assignees ,its employees and officers from and against any and all suits, actions or administrative proceedings, claims, demands, losses, damages, costs, and expenses of whatsoever nature, including attorney's fees and expenses, which the Purchaser may suffer as a result of any infringement or alleged infringement of any patent, utility model, registered design, trademark, copyright or other intellectual property right registered or otherwise existing at the date of the Contract by reason of : (a) the installation of the Works by the Contractor or the use of the Works in the country where the Site is located; and (b) the sale of the products produced by the Works in any country. Such indemnity shall not cover any use of the Works or any part thereof other than for the purpose indicated by or to be reasonably inferred from the Contract, any infringement resulting from the use of the Works or any part thereof, or any products produced thereby in association or combination with any other Equipment/ Materials not supplied by the Contractor, pursuant to the Contract Agreement.

3.16.3 If any proceedings are brought or any claim is made against the Purchaser arising out of the matters referred to in **GCC 3.16.2**, the Purchaser shall promptly give the Contractor a notice thereof, and the Contractor may at its own expense and in the Purchaser's name conduct such proceedings or claim and any negotiations for the settlement of any such proceedings or claim. If the Contractor fails to notify the Purchaser within thirty (30) days after receipt of

such notice that it intends to conduct any such proceedings or claim, then the Purchaser shall be free to conduct the same on its own behalf. Unless the Contractor has so failed to notify the Purchaser within the thirty (30) day period, the Purchaser shall make no admission that may be prejudicial to the defence of any such proceedings or claim.

3.16.4 The Purchaser shall, at the Contractor's request, afford all available assistance to the Contractor in conducting such proceedings or claim, and shall be reimbursed by the Contractor for all reasonable expenses incurred in so doing.

3.16.5 All design and drawings submitted by the Contractor will be the property of Purchaser. The Purchaser reserves the right to use the same in its future project without any further reference and additional charges to the Contractor for such use.

3.16.6 The Purchaser's Drawings, Specification and other information submitted by the Purchaser to the Contractor shall remain the property of the Purchaser. They shall not, without the consent of the Purchaser, be used, copied or communicated to a third party by the Contractor unless necessary for the purposes of the Contract. Any error in any such drawing/Specification etc. shall not absolve the Contractor of his responsibility.

3.17. CONFIDENTIAL INFORMATION

3.17.1 The Purchaser and the Contractor shall keep confidential and shall not, without the written consent of the other party hereto, divulge to any third party any documents, data or other information furnished directly or indirectly by the other party hereto in connection with the Contract, whether such information has been furnished prior to, during or following termination of the Contract. Notwithstanding the above, the Contractor may furnish to its Sub-Contractor(s) such documents, data and other information it receives from the Purchaser to the extent required for the Sub-contractor(s) to perform its Works under the Contract, in which event the Contractor shall obtain from such Sub-contractor(s) an undertaking of confidentiality similar to that imposed on the Contractor under this Clause GCC 3.17.

3.17.2 The obligation of a party under GCC 3.17.1 above, however, shall not apply to that information which

a. now or hereafter enters the public domain through no fault of that party
b. can be proven to have been possessed by that party at the time of disclosure and which was not previously obtained, directly or indirectly, from the other party hereto
c. otherwise lawfully becomes available to that party from a third party that has no obligation of confidentiality

3.17.3 The above provisions of this Clause GCC 3.17 shall not in any way modify any undertaking of confidentiality given by either of the parties hereto prior to the date of the Contract in respect of the Works or any part thereof

3.17.4 The provisions of this Clause GCC 3.17 shall survive termination, for whatever reason, of the Contract.

3.18. BLACKLISTING POLICY

3.18.1 For suspension / blacklisting/ debarring, procedures as laid down under the WBPDCL's Policy & Procedure of Blacklisting and Debarment of Agencies from Business Dealings shall be followed.

3.18.2 Agency blacklisted by any government department / PSU /Government agency shall not be allowed to participate in our tender process if effect of such debarment subsists at the time of submission of the bid. The bidder shall furnish a declaration in this regard provided in Annexure-14 in Section-VII.

3.19. ADVERTISING

Any advertising stating the subject of this Contract by the Contractor in India or in foreign countries shall be subject to approval of the Purchaser prior to the publication. Publication of approved articles, photographs and other similar materials shall carry acknowledgment to the Purchaser.

E. WORK EXECUTION

3.20. PURCHASER'S REPRESENTATIVE

3.20.1 The PURCHASER shall appoint an experienced engineer designated as the **Project Manager** who shall carry out the functions and obligations of the Purchaser under the Contract.

3.20.2 The PURCHASER may from time to time appoint some other person as the Project Manager in place of the person previously so appointed, and shall give a notice of the name of such other person to the Contractor without delay. The PURCHASER shall take reasonable care to see that no such appointment is made at such a time or in such a manner as to impede the progress of Works. The Project manager shall represent and act for the Purchaser at all times during the currency of the Contract.

3.20.3 Any decision, instruction or approval given by the Project Manager to the Contractor shall have the same effect as if it had been given by the Purchaser.

3.20.4 All notices, instructions, orders, certificates, approvals and all other communications under the Contract shall be given by the Project Manager, except as herein otherwise provided.

3.20.5 The Project Manager may authorize his representative as site-in-charge for the

Works. The Project Manager will also be the consignee officer for the Works.

3.21. CONTRACTOR'S REPRESENTATIVE

3.21.1 If the Contractor's representative is not named in the Contract, then the Contractor shall appoint the Contractor's representative and shall request the Purchaser in writing to approve the person so appointed. If the Purchaser makes no objection to the appointment within 7 days, the Contractor's representative shall be deemed to have been approved. If the Purchaser objects to the appointment within fifteen (15) days giving the reason thereof, then the Contractor shall appoint a replacement of such objection, and the foregoing provisions of this Sub-Clause GCC 3.21.1 shall apply thereto.

3.21.2 The Contractor's representative shall represent and act for the Contractor at all times during the currency of the Contract and shall give to the Project Manager all the Contractor's notices, instructions, information and all other communications under the Contract.

3.21.3 Any instruction or notice which the Purchaser gives to the Contractor's representative(s) shall be deemed to have been given to the Contractor. An instruction book shall be kept at Site to record instruction of the Purchaser or his representative at the time of Site visit.

3.21.4 The Contractor shall not revoke the appointment of the Contractor's representative without the Purchaser's prior written consent, which shall not be unreasonably withheld. If the Purchaser consents thereto, the Contractor shall appoint some other person as the Contractor's Representative, pursuant to the procedure set out in GCC 3.21.1

3.21.5 The Contractor's representative may, subject to the approval of the Purchaser within 7 days, at any time delegate to any person any of the powers, functions and authorities vested in him or her. Any such delegation may be revoked at any time. Any such delegation or revocation shall be subject to a prior notice signed by the Contractor's representative, and shall specify the powers, functions and authorities thereby delegated or revoked. No such delegation or revocation shall take effect unless and until a copy thereof has been delivered to the Purchaser and the Project Manager. Any act or exercise by any person of powers, functions and authorities so delegated to him or her in accordance with this Sub-Clause GCC 3.21.5 shall be deemed to be an act or exercise by the Contractor's representative.

3.21.6 The Contractor shall in addition to a Contractor's representative, employ one or more competent representative(s) to superintend the carrying out of the Works at Site. Such representative shall be fluent to communicate in local language for day to day work. Their names and contact addresses shall be communicated in

writing to the Purchaser before commencement of Works.

3.21.7 The Purchaser may, by notice to the Contractor, object to any representative or person employed by the Contractor in the execution of the Contract ,who, in the reasonable opinion of the Purchaser, may behave inappropriately, may be incompetent or negligent, or may commit a serious breach of the Site regulations provided under GCC.3.27.6. The Purchaser shall provide evidence of the same, whereupon the Contractor shall remove such person from the Site.

3.21.8 If any representative employed by the Contractor is removed in accordance with GCC 3.21.7 the Contractor shall, where required, promptly appoint a replacement

3.22. MILESTONE OF PROJECT

The whole work must be completed within **time as specified below** days from the date of issuance of 'Letter of Award'. The duration of milestone will be calculated from the date of Letter of Award'.

Milestone for 10MW Project at BkTPS		
Sl. No.	**Description**	**Completion Time from date of LOA**
1.	Approval of Detailed Design Report	45 Days
2.	Finalizations of Plant layout (including Modules, Floaters cable routes, inverter Control Room)	4 Months
3.	Completion of construction of Inverter & Switchgear cum Control Room	6 months
4.	Completion of Supply of Floaters & Modules	10 Months
5.	Completion of Modules & Electrical Equipment Erection	11 Month
6.	Complete installation of all Inverter transformers and its testing	11 Months
7.	Full capacity Evacuation of Power	12 Months
Milestone for 7.5MW Project at STPS		
1.	Approval of Detailed Design Report	45 Days
2.	Finalizations of Plant layout (including Modules, Floaters cable routes, inverter Control Room)	4 Months

3.	Completion of construction of Inverter & Switchgear cum Control Room	6 months
4.	Completion of Supply of Floaters & Modules	10 Months
5.	Completion of Modules & Electrical Equipment Erection	11 Month
6.	Complete installation of all Inverter transformers and its testing	11 Months
7.	Full capacity Evacuation of Power	12 Months
Milestone for 5MW Project at SgTPP		
1.	Approval of Detailed Design Report	45 Days
2.	Finalizations of Plant layout (including Modules, Floaters cable routes, inverter Control Room)	4 Months
3.	Completion of construction of Inverter Room	5 months
4.	Completion of Supply of Floaters & Modules	8 Months
5.	Completion of Modules & Electrical Equipment Erection	9 Month
6.	Complete installation of all Inverter transformers and its testing	9 Months
7.	Full capacity Evacuation of Power	10 Months

Detailed time schedule for the site work has to be prepared based on the aforesaid milestones. Bidder has to submit the Detailed Design Report with complete time schedule within the milestones aforesaid. At the time of execution if delay occurs time extension may be allowed on the basis from request from Bidder. However, all such time extension order shall be without prejudice to the terms and condition of the contract.

WBPDCL shall have the right, without prejudice to any other clauses, to terminate contract forthwith and to take possession of the balance work/materials and have the same allotted to any other agency and the contractor shall be liable to compensate the loss that may be occasioned to the WBPDCL on that account. Any letter in writing by the Controlling Officer shall be treated as conclusive on behalf of the Company.

3.23. SUBMISSION OF DETAILED DESIGN REPORT

The contractor shall submit 03 (three) sets of the Detailed Design Report along with editable soft copy in a compact disk for approval from WBPDCL. Draft Detailed design report shall contain all requisite documents as mentioned in the 'Scope of Work'. The contractor should submit the same within 30 (Thirty) days from the date of issuance of 'Letter of Award'.

The contractor shall submit 05 (five) sets of the finalized Detailed Design Report along with editable soft copy in a compact disk to the Executive Director(Project & Planning), WBPDCL within 45 (Forty Five) days from the date of issuance of 'Letter of Award' to carry out further course of action.

3.24. PROGRAMME

3.24.1 The Contractor shall supply to the Purchaser and the Project Manager a chart showing the proposed organization to be established by the Contractor for carrying out the Works. The chart shall include the identities of the key personnel together with the curricula vitae of such key personnel to be employed after placement of LOA. The Contractor shall promptly inform the Purchaser and the Project Manager in writing of any revision or alteration of such an organization chart.

3.24.2 The Contractor shall submit to the Purchaser for his approval the Program schedule in the form of **MS Project Network**, within fifteen(15) days of placement of LOA, with respect to Contract ,where such programme schedule is required, which shall, interalia, contain the following:

a. the order in which the Contractor proposes to carry out the Works (including but not limited to design, engineering, manufacture, supply, finalization of Sub-contractors , Quality plans, transport, delivery to Site, assemble, erection, testing and commissioning),

b. the date(s) by which the Contractor reasonably requires that the Purchaser shall have fulfilled its obligations under the Contract so as to enable the Contractor to execute the Contract in accordance with the Program and to achieve Completion and conductance of guarantee test of the Works in accordance with the Contract

c. the times of submission and approval of the Contractor's Drawings

3.24.2.1. The Program so submitted by the Contractor shall be in accordance with the Time Schedule mentioned above and any other dates and periods specified in the Contract. The Contractor shall update and revise the Program as and when appropriate or when required by the Project Manager, but without modification in the Time for Completion of the milestone and any extension granted in accordance with GCC 3.47 and shall submit all such revisions to the Project

Manager.

3.24.2.2. This Program shall show clearly all activities and its duration along with earliest and latest dates and the first and last dates of submission of the drawings and each date of shop inspection by the Purchaser and critical path for the Works. The Program approved by the Purchaser shall form part of the Contract.

3.24.2.3. The approval by the Purchaser of the Program shall not relieve the Contractor from any obligation under the Contract towards timely completion of Works.

3.24.2.4. Once the programme schedule has been finalized, no revision shall normally be permitted as long as the scope of work remains unchanged. However, in cases of increase in quantities, while executing the work as per original scope; suitable adjustments may be made without affecting the time for completion. The revision in programme schedule, for aforesaid reasons, shall be done with the approval the Purchaser.

3.24.2.5. If the scope of work undergoes changes during execution stage resulting into additional scope over that originally provided, for which the Contractor insists extension in time for completion, such extension shall be granted while ordering additional scope of work. Contractor shall submit revised programme schedule for approval of the Purchaser.

3.24.2.6. In case the scope of work does not change but the time for completion is extended because of delayed commencement of the work on account of non fulfilment of obligations by Purchaser or because of any other reasons not attributable to Contractor, programme schedule shall be suitably revised as per the extended time for completion. Once the time for completion has been extended with the approval of Purchaser, Contractor shall submit revised programme schedule for the approval of Purchaser.

3.24.3 Progress Report

The Contractor shall monitor progress of all the activities specified in the Program referred to in GCC 3.24.2**,** and supply a progress report to the Project Manager every month, with a copy to officials as mentioned in the SCC. Guarantee

2.23.3.1. The progress report shall be in a form acceptable to the Project Manager and shall also indicate: (a) percentage completion achieved compared with the planned percentage completion for each activity; and (b) where any activity is behind the Program, giving comments and likely consequences and stating the corrective action being taken.

3.24.4 Progress of Performance

If at any time the Contractor's actual progress falls behind the Program referred

to in GCC 3.24.2, or it becomes apparent that it will so fall behind, the Contractor shall, at the request of the Purchaser or the Project Manager, prepare and submit to the Project Manager a revised Program, taking into account the prevailing circumstances, and shall notify the Project Manager of the steps being taken to expedite progress so as to attain Completion of the Works within the Time for Completion as stated in SCC, or within such extended time to which the Contractor shall be entitled under GCC 3.47.2

3.25. DESIGN AND ENGINEERING

3.25.1 The Contractor shall submit to the Purchaser for approval:
Within the time given in the Contract or in the Program such documents including drawings, samples, models or information as may be called for therein, and in the numbers therein required, in a sequential order of execution and during the progress of the Works, such documents of the general arrangement and details of the Works as specified in the Contract. The Purchaser shall signify his approval or disapproval as detailed in the schedule and procedure of documents approval indicated below.

3.25.2 The Contractor shall prepare (or cause its Sub-contractors to prepare) and furnish to the Project Manager the documents, including Manufacturing Quality Plan and Field Quality Plan wherever required or review as specified and as in accordance with the requirements of GCC 3.24.2.

3.25.3 Any part of the Works covered by or related to the documents to be approved by the Purchasers Representative shall be executed only after the Project Manager's approval thereof

3.25.4 The Contractor shall supply additional copies of approved documents in the format and numbers stated in the Contract.

3.25.5 The Schedule and Procedure of Documents Approval shall be finalised at the **Kick off** meeting and also Contract Coordinate Procedure (**CCP**) shall be prepared.

3.25.6 If any dispute or difference occurs between the Purchaser and the Contractor in connection with or arising out of the disapproval by the Project Manager of any document and/or any modification(s) thereto that cannot be settled between the parties within a reasonable period, then such dispute or difference may be settled in accordance with **GCC 3.6** thereof.

3.25.7 The Project Manager's approval, with or without modification of the document furnished by the Contractor, shall not relieve the Contractor of any responsibility or liability imposed upon it by any provisions of the Contract except to the extent that any subsequent failure results from modifications required by the Project Manager.

3.25.8 Approval of any documents by the Purchaser shall not relieve the Contractor of his responsibility for the accuracy thereof or modification required during actual execution or for any deviation in scheme from Technical Specification with accepted deviations if there be any

3.25.9 Approval of Design and Drawing:

The contractor shall have to prepare and submit the designs and drawings associated with civil, mechanical, electrical and other work which includes design of foundation, structure cable sizing, fabrication work, layout design, wiring diagram etc. and obtain approval prior to the execution of work and for this purpose the contractor shall submit Detailed Design Report for obtaining approval from WBPDCL. The contents of the Detailed Design Report shall be as mentioned in the scope of work (Clause no. GCC 3.25.10).

Materials: Contractor shall obtain prior approval for the materials deliverable under the project from WBPDCL as mentioned in the technical specification.

3.25.10 Detailed Design Report (DDR)

Contractor shall prepare and submit the Detailed Design Report to WBPDCL which must contain site meteorological data considered with necessary supporting documents, calculations for annual energy generation, schedule of site works (L1 & L2 network), Design of modules layout with Floaters and associated calculations for selection of different major equipment for the plant based on the site location and relevant code of practice. Design calculation of Solar Plant shall be submitted in latest version of PVsyst software.

The Detailed Design Report shall contain detailed Billing Breakup (BBU) for supply as well as Erection of Plant.

3.26. PROCUREMENT

3.26.1 The Contractor shall manufacture or procure and transport all the Equipment/Materials in an expeditious and orderly manner to the Site.

3.26.2 Defective Material

If in the opinion of the Engineer, any of the machineries/ equipment/ materials etc. brought to the site for use are not of the quality or kind specified in the contract and/or are unfit for the work, he shall be at liberty to order the removal of the said items and the contractor shall remove the same within twenty four (24) hours after notice has been given to him and if he fails to remove them within the time the engineer may cause them to be removed anywhere at the risk of the Contractor and any cost incurred in so doing shall be deducted from the dues to the contractor under the contract. In such case, items as prescribed by the Controlling Officer or his representative are to be substituted immediately.

3.26.3 Transportation.

3.26.3.1. The Contractor shall at its own risk and expense transport all the Equipment/Materials and the Contractor's Equipment to the Site by the mode of transport that the Contractor judges most suitable under all the circumstances

3.26.3.2. Unless otherwise provided in the Contract, the Contractor shall be entitled to select any safe mode of transport operated by any person to carry the Equipment/Materials and the Contractor's Equipment.

3.26.3.3. Upon dispatch of each shipment of the Equipment/ and the Contractor's Equipment, the Contractor shall notify the Purchaser by courier, email, post or by fax followed by post confirmation of the description of the Equipment/Materials and of the Contractor's Equipment, the point and means of dispatch, and the estimated time and point of arrival at the Site. The Contractor shall furnish the Purchaser with relevant shipping documents to be agreed upon between the parties

3.26.3.4. The Contractor shall be responsible for obtaining, if necessary, approvals from the authorities for transportation of the Equipment/ Materials and the Contractor's Equipment to the Site. The Purchaser shall use its best endeavors in a timely and expeditious manner to assist the Contractor in obtaining such approvals, if requested by the Contractor. The Contractor shall indemnify and hold harmless the Purchaser from and against any claim for damage to roads, bridges or any other traffic facilities that may be caused by the transport of the Equipment/ Materials and the Contractor's Equipment to the Site.

3.26.3.5. **Transit Damages:** In the event of receipt of goods in damaged condition or having found them so upon opening of packages at site, Contractor shall make good of all such damages within a reasonable time from such intimation by WBPDCL.

3.27. CONTRACTOR'S CONSTRUCTION MANAGEMENT:

3.27.1 Setting Out

The Contractor shall be responsible for the true and proper setting-out of the Works in relation together, reference marks and lines provided to it in writing by or on behalf of the Purchaser.

The Contractor shall set out the Works in relation to original points, lines and levels of reference given by the Purchaser in writing and provide all necessary instruments, appliances and labour for such purposes. If at any time during the execution of Works, any error appears in the positions, levels, dimensions or alignment of the Works, the Contractor shall rectify the error at his cost. The

checking of any setting-out by the Purchaser shall not relieve the Contractor of his responsibility for the accuracy thereof.

3.27.2 Contractor's Supervision

The Contractor shall give or provide all necessary superintendence during the installation of the Works, and the Contractor's representative(s) shall be constantly on the Site to provide full-time superintendence of the installation. The Contractor shall provide and employ only technical personnel who are skilled and experienced in their respective callings and supervisory staff who are competent to adequately supervise the Works

3.27.3 Labour

3.27.3.1 The Contractor shall provide and employ on the Site in the installation of the Works such skilled, semi-skilled and unskilled labour as is necessary for the proper and timely execution of the Contract. The Contractor is encouraged to use local labour that has the necessary skills

3.27.3.2 Unless otherwise provided in the Contract, the Contractor shall be responsible for the recruitment, transportation, accommodation and catering of all labour, local or expatriate, required for the execution of the Contract and for all payments in connection therewith.

3.27.3.3 The Contractor shall be responsible for obtaining all necessary permit(s) and/or visa(s), if required, from the appropriate authorities for the entry of all labour and personnel to be employed on the Site.

3.27.3.4 The Contractor shall at its own expense provide the means of repatriation to all of its and its Sub-contractor's personnel, employed on the Contract, at the Site to their various home countries. It shall also provide suitable temporary maintenance of all such persons from the cessation of their employment on the Contract to the date programmed for their departure.

3.27.3.5 The Contractor shall at all times during the progress of the Contract use its best endeavours to prevent any unlawful, riotous or disorderly conduct or behaviour by or amongst its employees and the labour of its Sub-contractors.

3.27.3.6 The Contractor shall, in all dealings with its labour and the labour of its Sub-contractors currently employed on or connected with the Contract, pay due regard to all recognized festivals, official holidays, religious or other customs and all local laws and regulations pertaining to the employment of labour.

3.27.4 Contractor's Equipment

3.27.4.1 The Contractor shall provide all erection Equipment haulage & power if necessary to complete the Works as per Time for completion, including transport at his own cost. The Contractor shall provide additional manpower as well as haulage and other erection equipment as necessary for maintaining the

Time schedule of completion.

3.27.4.2 Contractor's all equipment shall, when brought to the Site, be deemed to be exclusively intended for the execution of Contract. The Purchaser shall have lien on all such Equipment brought to Site for the purpose of erection, testing and commissioning of the Equipment/Materials.

3.27.4.3 The Contractor shall not remove from the Site any such Equipment, except when it is no longer required for the completion of the Works, or when the Purchaser has given his consent.

3.27.5 Purchaser's Equipment

The Contractor shall pay hire charges as may reasonably be levied for the Purchaser's equipment, if used, and also provide the transport, haulage, power etc. thereof at his own cost.

3.27.6 Site Regulations and Safety

The Purchaser and the Contractor shall establish Site regulations setting out the rules to be observed in the execution of the Contract at the Site and shall comply therewith. The Contractor shall prepare and submit to the Purchaser, with a copy to the Project Manager, proposed Site regulations for the Purchaser's approval, for which approval shall not be unreasonably withheld.

Such Site regulations shall include, but shall not be limited to, rules in respect of security, safety of the Works, gate control, sanitation, medical care, and fire prevention. Details are mentioned in **SCC.4.8**.

3.27.7 Environment & Social Policy and Procedures (ESPP) of Purchaser

The Contractor shall make himself aware of the ESPP of the Purchaser and shall execute the scope of work under the Contract in compliance with the said provisions.

3.27.8 Watching and Lighting

The Contractor shall provide and maintain at its own expense all lighting, fencing, and watching when and where necessary for the proper execution and the protection of the Works, or for the safety of the Purchasers and occupiers of adjacent property and for the safety of the public.

3.27.9 Clearance of Site

The Contractor shall, from time to time during the progress of the Works clear away and remove all surplus/ rejected materials and debris from Site. On completion of the Works, the Contractor shall remove all Contractors' Equipment and leave the whole of the Site clean and in a workmanlike condition to the satisfaction of the Purchaser.

3.27.10 Communication

The Contractor may require the Purchaser to confirm in writing any decision or

instruction of the Purchaser which is not in writing. The Contractor shall promptly notify the Purchaser of such requirement.

3.27.11 Authority of Access

No persons other than the employees of the Contractor or his authorised representative shall be allowed at the Site. Purchaser or his representative shall have access to the work sites at any time.

3.27.12 Emergency work

3.27.12.1 If, by reason of an emergency arising in connection with and during the execution of the Contract, any protective or remedial work is necessary as a matter of urgency to prevent damage to the Works, the Contractor shall immediately carry out such work.

3.27.12.2 If the Contractor is unable or unwilling to do such work immediately, the Purchaser may do or cause such work to be done, as the Purchaser may determine it necessary in order to prevent damage to the Works. In such event the Purchaser shall, as soon as practicable after the occurrence of any such emergency, notify the Contractor in writing of such emergency, the work done and the reasons thereof. If the work done or caused to be done by the Purchaser is such that the Contractor was liable to do at its own expense under the Contract, the reasonable costs incurred by the Purchaser in connection therewith shall be paid by the Contractor to the Purchaser.

3.28. INSPECTION & TESTING

3.28.1 Inspecting Agency

The Purchaser may delegate inspection and testing to an outside agency in place of personnel of PURCHASER with due notice, not less than Twelve (12) days, to the Contractor. Any such outside agency shall be considered as a **Project Manager**

3.28.2 Inspection and Testing During Manufacture

3.28.2.1 The Purchaser or his designated representative shall be entitled during manufacture to inspect, examine and test the materials and workmanship and check the progress of manufacture of all Equipment to be supplied under the Contract. This shall take place on the Contractor's premises during working hours.

3.28.2.2 No such inspection, examination or testing shall relieve the Contractor of his obligation under the Contract regarding quality of material and soundness of manufacture.

3.28.2.3 No inspection call will be valid before drawings are approved under approval category without comments.

3.28.3 Dates for Inspection and Testing

After getting the related drawings approved under approval category, the Contractor shall give the Purchaser notice of inspection along with factory test results in writing of the date and the place at which any Equipment/Materials will be ready for testing as provided in the Contract. The Purchaser shall attend at the place so named within twelve (12) days of the date which the Contractor has stated in his notice. The Purchaser shall give the Contractor notice, in writing, of his intention to attend the tests. The above notices shall be given at first by the quickest possible means and confirmed later in writing. The Contractor shall render all possible assistance in carrying out inspection in time

3.28.4 Facilities for Testing

3.28.4.1 Where the Contract provides for tests on the premises of the Contractor or Sub-contractor, the Contractor shall provide such assistance, labour, materials, electricity, fuel, stores, apparatus and instruments as may be necessary to carry out the tests efficiently without any extra charges. If the facilities are inadequate to carry out tests as per standard, the Contractor shall have to arrange suitable testing place having all such required facilities and the cost towards this will be on Contractor's account.

3.28.4.2 The Contractor shall be responsible for proper execution of the quality plans. The Works beyond Purchaser's hold points will progress only with Purchaser's prior written consent. The Purchaser may also undertake quality surveillance and quality audit of the systems and procedures and quality control activities. Any change in the Quality Plans shall be made only with Purchaser's prior written approval.

3.28.4.3 The Contractor shall provide the Purchaser with the necessary facilities for carrying out quality audit and quality surveillance of the Contractor's and its Sub-Contractors' Quality Assurance System and manufacturing activities

3.28.5 Routine and Acceptance Tests

All routine tests and acceptance tests shall be carried out at manufacturer's works or test site of the Contractor/Sub-contractor/test laboratory as per stipulation of relevant Indian Standard and relevant IEC in presence of Project Manager. All tests shall be carried out on every lot offered for inspection as per relevant I.S. and IEC.

3.28.6 Type Test

3.28.6.1 The successful bidder shall submit complete test reports of all tests (including type tests) as stipulated in the relevant I.S. and IEC and carried out in a Govt. recognized Test House or laboratory/NABL accredited laboratory on Equipment/ Materials of identical design conforming to our Technical Specification, along with submission of drawing during detailed engineering

stage

3.28.6.2 PURCHASER may also undertake Proto checking and quality approval of structural items (wherever applicable) before erection. Each type test report shall provide the following information with test results:

Complete identification, date and Serial No.

Method of application where applied, duration and interpretation of each test.

3.28.7 <u>Repetition of Tests</u>

If any of the type tests, routine or acceptance tests fails to pass, the Contractor shall arrange for repetition of the tests, after rectification or replacement, at his own cost and expenses. If, however, the tests fail for the 2nd time, the related Sub-contractor shall be rejected immediately and the Contractor will be required to furnish the name of another Sub-contractor immediately either from the already approved list of Sub-contractor for that particular Equipment/Materials, or any new Sub-contractor along with submission of all relevant documents in support, towards approval of the new Sub-contractor as stated in this tender document.

3.28.8 <u>Reports of Inspection and Tests</u>

After the factory tests have been completed at the Contractor's or Sub-contractor's works, the Contractor shall submit **three (3) copies** of Test Reports for approval of Purchaser. The Purchaser in turn will approve the same on being satisfied. The Contractor shall provide the Purchaser with **four (04) copies** of Approved Reports of all inspection and tests.

3.28.9 If the Purchaser or his designated representatives fails to attend the test and/or inspection or if it is agreed between the parties that such persons shall not do so, then the Purchaser may advice the Contractor in writing to proceed with the test and/or inspection in the absence of such persons. The Contractor should provide the Purchaser with a certified report of the results thereof.

3.28.10 Covering Up

3.28.10.1 The Contractor shall give the Purchaser full opportunity to examine, measure and test any work on Site which is about to be covered up or put out of view.

3.28.10.2 The Contractor shall give due notice to the Purchaser whenever such work is ready for examination, measurement or testing.

3.28.10.3 The Purchaser shall then notify the Contractor within **seven (07) days** that the Purchaser shall carry out the examination, measurement or testing. Unless it is notified specifically the Contractor may proceed with the work as per Programme submitted.

3.28.11 Uncovering Works

If so instructed by the Purchaser, the Contractor shall expose any parts of the

Works. The Contractor shall reinstate and make good such parts to the Purchaser's satisfaction at the risk, cost and responsibility of the Contractor

3.29. TESTS ON COMPLETION.

3.29.1 Notice for Tests on Completion

The Contractor shall give to the Purchaser seven (07) days' notice of the date after which he will be ready to conduct the Tests on Completion. Unless otherwise agreed upon, the Tests shall be carried out as per agreed schedule.

3.29.2 Delayed Tests

If the tests are being unduly delayed by the Contractor, the Purchaser may, by notice, require the Contractor to make the tests within twenty one (21) days after the receipt of such notice. If the Contractor fails to make the tests **Fifteen (15) days** of such notice, the Purchaser may himself proceed with the tests. All tests so made by the Purchaser shall be at the risk and cost of the Contractor and cost thereof shall be deducted from the Contract Price. The tests shall also be deemed to have been made in the presence of the Contractor and shall be accepted as accurate and no claim whatsoever in this respect of the Contractor shall be entertained.

3.29.3 Facilities for Tests on Completion

The Contractor, except where otherwise specified, shall arrange such labour, material, fuel, water, stores and testing apparatus as may be reasonably required to carry out such tests efficiently, without any extra charge

3.29.4 Re-testing

If the work or any portion thereof fails to pass the Tests, the Purchaser or the Contractor may require such tests to be repeated on the same terms and conditions. All costs of such retesting will be borne by the Contractor.

3.29.5 Consequences of Failure to Pass Tests on Completion

If the Works or any portion thereof fails to pass the tests or the repetition thereof under GCC.3.29, the Purchaser, after due consultation with the Contractor, shall be entitled to order one further repetition of the Tests under the conditions of GCC 3.27, or Reject the Works or portion thereof in which event the Purchaser shall have the same remedies against the Contractor as are provided under GCC 3.28 or Issue a Taking-Over Certificate, if the Purchaser so wishes, not withstanding that the Works are not complete. The Contract Price shall then be reduced by such amount as may be agreed by the Purchaser and the Contractor or, failing agreement, as may be determined under GCC 3.6. As soon as the work or any portion thereof has passed the tests, the Purchaser shall issue a Completion certificate to the Contractor to that effect.

3.30. REJECTION

Purchaser may not accord approval to test results if those results are not in conformity with Guaranteed Technical Particulars with given tolerable limits as per relevant standard or the results and procedure followed are found not in line with standard. The results may be rejected even if the Project Manager had witnessed the test. On approval of Test results only, Material Inspection Clearance Certificate will be issued by the Purchaser. Approval of Test results will not relieve the Contractor of its obligation as regards quality, standard and suitability of the Equipment/ Materials.

3.31. PERMISSION TO DELIVER

3.31.1 The Contractor shall apply in writing to the Purchaser for permission to deliver any Equipment / Materials to the Site. No Equipment/ Materials shall be delivered to the Site without the Purchaser's written permission

3.31.2 The Contractor shall make arrangement for receipt of all Equipment/ Materials delivered to Site under the scope of Contract besides all other Equipment/Materials required for the purpose of execution. Upon arrival at Site, the Contractor shall give a notice to the Purchaser when and where materials has arrived and been stored.

3.32. COMPLETION OF WORKS

3.32.1 As soon as execution of the Works or any part for which a separate completion schedule is provided in the Contract has, in the opinion of the Contractor, been completed operationally and structurally and put in tight and clean condition as specified in the Technical Specifications, excluding minor items not materially affecting the operation or safety of the Works, the Contractor shall so notify the Purchaser in writing within **seven (7) days** of the date of completion.

3.32.2 If, for reasons not attributable to the Contractor, the Works cannot be completed in next six (6) months, the Purchaser at, its discretion, may take up the inspection of the portion of the Works already completed, the balance payment due to the Contractor can be released against Bank Guarantee of equivalent amount. The Bank Guarantee validity shall be initially for a period of twelve (12) months or until three (3) months after expected date of commissioning, whichever is earlier. If the completion and thereafter commissioning does not take place within the validity period of the Bank Guarantee, the validity shall be extended from time to time up from the date from which the concerned work was held up on aforesaid account. The Contractor shall also be required to extend the validity of the Contract Performance Guarantee.

3.32.3 For 'Works' not involving Commissioning

3.32.3.1 Within **fifteen (15) days** of intimation from the Contractor regarding completion of Works, the Project Manager shall cause to inspect the Works to verify the completion status, in presence of the Contractor's representative.

3.32.3.2 If the Works are found to be completed and acceptable in all respects (except for minor defects and deficiencies, if any), Completion Certificate (**Annexure-6**) / Taking over Certificate (TOC) shall be issued by the Purchaser after the Contractor's intimation. The Completion certificate shall generally contain the following details: (a) Date of completion; (b) Defects to be rectified; (c) Items not conforming to Specification but can be accepted at a reduced rate; (d) items not acceptable at all and need to be re-done

3.32.3.3 If, on inspection, Works are not found to be completed or rectification of major nature is required, the Purchaser shall, within twenty-one (21) days of Contractor's intimation, inform the incomplete works/ defects & deficiencies to the Contractor in writing advising him to take necessary action and to inform PURCHASER after completion/ rectification. The Purchaser shall give reasonable time to the Contractor for remedying the defects/ deficiencies. However, if the Contract specifies separate completion period for different parts of works for the purpose of taking over also, Completion certificate/ TOC shall be issued in respect of portion of works that are completed and are acceptable.

3.32.3.4 The provisions contained in GCC 3.32.3.1 to GCC 3.32.3.3 shall also be applicable in relation to a part of the Works for which separate schedule of completion has been provided in the Contract and such part of Works can be taken over independently

3.33. TAKING OVER

3.33.1 The Works shall be taken over by the Purchaser after completion, either in full or in part (where for part completion, separate completion schedule has been provided in the Contract), upon successful erection, testing and commissioning of Works at Site by the Contractor in accordance with provisions of Contract.

3.33.2 On successful completion of Works or any part thereof as provided in GCC 3.33.1 and upon request of the Contractor for taking over the Works and issuance of TOC, the Purchaser shall, within forty-five (45) days after the receipt of the Contractor's application, or within fifteen (15) days from the date of actual handing over of relevant Works, either issue the TOC or reject the application giving his reasons and specifying the work required to be done by the Contractor to enable the TOC to be issued

3.33.3 Notwithstanding the above mentioned provisions, the issuance of TOC shall not be held up for delay in completion/ rectification of works of minor nature that

do not affect the performance/ use of the building/installation/ equipment/sub-system/system at rated voltage. In such a case the Contractor shall however be required to give an undertaking that in case he fails to complete/rectify within a mutually agreed period, the Purchaser shall be at liberty to carry out the work at his risk and cost, and deduct an amount as may be considered appropriate by the Purchase.

3.33.4 Issuance of such certificates shall not relieve the Contractor of any of his obligations which otherwise comes under the terms and conditions of the Contract.

3.33.5 Issuance of TOC for any part of the Works is only for the purpose of facilitating the Contractor to receive the payment for part of the Works completed and for determination of liquidated damages in respect thereof and shall not relieve the Contractor of his responsibilities under the Contract towards other parts of the Works.

3.33.6 TOC is issued to the Contractor on stating the date on which the Works or any part thereof were complete and ready for taking over, after ascertaining the following:

a. The Works under the Contract have been satisfactorily completed by the Contractor as per the provisions of Contract.

b. Submission of required number of reproducible of approved as-built drawings (hard copies & soft copy in CDs), design documents duly authenticated by Purchaser, O&M manuals, data sheets, test reports, pamphlets and manuals of spares, maintenance and testing equipment by the Contractor.

c. The Contractor has cleared the Site of all the surplus materials, removed all scaffoldings, shuttering materials, labour huts/ sheds, cleaned the dirt from part of building, sanitary arrangement, water supply connection and all electrical gadgets/ equipment/ switches, wiring, any wood work or any such item, to the satisfaction of the Project Manager, except those required for carrying out rectification works.

d. All the defects have been rectified to the complete satisfaction of the Project Manager

3.33.7 Notwithstanding the above mentioned provisions, the issuance of TOC shall not be held up for delay in completion/ rectification of works of minor nature that do not affect the performance/ use of the building/installation/ equipment/sub-system/system at rated voltage. In such a case the Contractor shall however be required to give an undertaking that in case he fails to

complete/rectify within a mutually agreed period, the Purchaser shall be at liberty to carry out the work at his risk and cost, and deduct an amount as may be considered appropriate by the Purchaser.

F. GUARANTEES AND LIABILITIES

3.34. NET MINIMUM GUARANTEED GENERATION (NMGG)

Contractor shall have to ensure Net Minimum Guaranteed Generation as per below table for the first year after final commissioning and at a reduced rate of 0.7% per year for subsequent years. Initially, the above Guarantee shall be required for the 5 years i.e. in the O&M period. The same guarantee shall continue for extended O & M period, if agreed on mutual terms & conditions. The Contractor shall design their plant to achieve the Net Minimum Guaranteed Generation.

Project Location	NMGG target for 1st year
BkTPS	15.20 MU from 10 MW (AC)
STPS	12.52 MU from 7.5 MW (AC)
SgTPP	7.6 MU from 5 MW (AC)

Generated Energy Measurement at following location after deducting the auxiliary LT load for the solar plant under scope i.e. the Net Minimum Guaranteed Generation will be calculated without considering the Auxiliary Load:

Project Location	Sent out energy measurement (Details mentioned in the Section V)
BkTPS	Evacuation point at 33 kV Switchyard new Metering panel under this project
STPS	5 MW : Evacuation point at new 12.5 MVA, 132/33 kV Outdoor transformer at existing 33 kV Bhojudih Switchyard inside Santaldih TPS under this Project.
	2.5 MW: It will be evacuated through Solar Substation of WBSEDCL / any suitable location shown by STPS authority.
SgTPP	Evacuation point at new 33 kV Indoor switchgear panel under this Project.

The bidder shall submit a declaration for the Net Minimum Guaranteed Generation with their bid (**Form-13**). Non-submission of the document will entail for disqualification of the bidder.

- If contractor is not responsible for non-availability of Grid hours subject to submission of proper documentary evidence with due signature of WBPDCL official then said hours may be considered for finalization of NMGG calculation if it satisfies following condition:

a) Grid outage where contractor is not responsible.

b) If outages occur only during the daytime (daytime shall be considered as per data available in WMS).

c) MW reduction calculation for grid outage for above two reasons:

i) **If grid outage for few hours :**

The average generation of that particular day (MWHr/generation Hr) X number of hours of Grid outage (supporting document)

ii) **If Grid outage for days:**

Average generation of that week (MWHr/days generation) X number of days grid outage (supporting document)

d) All the above records shall need to be accepted and signed by the WBPDCL site authority.

3.35. LIQUIDATED DAMAGES

3.35.1 **LD for Time Delay:**

Compensation of loss on account of late delivery/completion (notionally/actually) where loss is pre-estimated and mutually agreed to is termed as LD. Law allows recovery of pre-estimated loss provided such a term is included in the contract and there is no need to establish actual loss due to late supply/execution of work. Time schedule of delivery/completion shall be essence of the order. If the contractor fails to execute the order in full or part thereof within the fixed period or any time repudiate the contract before the expiry of such period, the Corporation may, without prejudice to any other right or remedy available, recover damages for breach of contract and to safe-guard its interest.

'In the event of any delay in the supplies of ordered materials/execution of works beyond the stipulated delivery/completion schedule including any extension permitted in writing, the Corporation reserves the right to recover from the contractor a sum equivalent to 0.5% of the value of delayed supply/work for each week of delay and part thereof subject to a maximum of 10% of the Project cost plus GST if applicable***.'***

3.35.2 **LD for Milestone Delay**

Delay in attaining the milestones by the contractor shall lead to imposition of intermediary Liquidated damages @0.25% per week of delay upto the maximum extent of 5(Five) Percent of the Project cost plus GST if applicable.

Intermediary Liquidated damages shall be calculated based on the following Milestones.

Sl. No.	Description	Completion Time from date of LOA	% of LD
Milestone LD for 10MW BkTPS Project			
1.	Approval of Detailed Design Report	45 Days	0.25
2.	Finalizations of Plant layout (including Modules, Floaters cable routes, inverter Control Room)	4 Months	0.75
3.	Completion of construction of Inverter & Switchgear cum Control Room	6 months	0.75
4.	Completion of Supply of Floaters & Modules	10 Months	1.00
5.	Completion of Modules & Electrical Equipment Erection	11 Month	1.5
6.	Complete installation of all Inverter transformers and its testing	11 Months	0.50
7.	Full capacity Evacuation of Power	12 Months	0.25
Milestone LD for 7.5MW STPS Project			
1.	Approval of Detailed Design Report	45 Days	0.25
2.	Finalizations of Plant layout (including Modules, Floaters cable routes, inverter Control Room)	4 Months	0.75
3.	Completion of construction of Inverter room for Raw Water Pond and & Switchgear cum Control Room at Dutta Bandh	6 months	0.75

4.	Completion of Supply of Floaters & Modules	10 Months	1.00
5.	Completion of Modules & Electrical Equipment Erection	11 Month	1.5
6.	Complete installation of all Inverter transformers and its testing	11 Months	0.50
7.	Full capacity Evacuation of Power	12 Months	0.25
Milestone LD for 5MW SgTPP Project			
1.	Approval of Detailed Design Report	45 Days	0.25
2.	Finalizations of Plant layout (including Modules, Floaters cable routes, inverter Control Room)	4 Months	0.75
3.	Completion of construction of Inverter Room	5 months	0.75
4.	Completion of Supply of Floaters & Modules	8 Months	1.00
5.	Completion of Modules & Electrical Equipment Erection	9 Month	1.5
6.	Complete installation of all Inverter transformers and its testing	9 Months	0.50
7.	Full capacity Evacuation of Power	10 Months	0.25

3.35.3 The total/aggregate LD (LD for Time Delay + LD for Milestone Delay) leviable for this contract shall not exceed **10 (Ten) Percent o**f the Contract price.

However no LD for milestone delay will be charged if the project is completed within the stipulated time provided such milestone delay does not hamper scheduled execution of any other related projects/activities thereby causing loss or damage to the Purchaser

3.36. DEFECTS LIABILITY

3.36.1 The Contractor warrants that the Works or any part thereof shall be free from defects in the design, engineering, materials and workmanship of the

Equipment/Materials supplied and of the work executed.

3.36.2 The Defect Liability Period shall be as specified in the SCC. Where any part of the Works is taken over separately, the Defects Liability Period for that part shall commence on the date it was taken over.

3.36.3 If during the Defect Liability Period any defect should be found in the design, engineering, materials and workmanship of the Equipment/Materials supplied or of the work executed by the Contractor, the Contractor shall promptly, in consultation and agreement with the Purchaser regarding appropriate remedying of the defects, and at its cost, repair, replace or otherwise make good (as the Contractor shall, at its discretion, determine) such defect as well as any damage to the Works caused by such defect.

3.36.4 The Contractor shall not be responsible for the repair, replacement or making good of any defect or of any damage to the Works arising out of or resulting from any of the following causes:

a. improper operation or maintenance of the Works by the Purchaser
b. operation of the Works outside Specifications provided in the Contract
c. normal wear and tear

3.36.5 The Purchaser shall give the Contractor a notice stating the nature of any such defect together with all available evidence thereof, promptly following the discovery thereof. The Purchaser shall afford all reasonable opportunity for the

3.36.6 The Purchaser shall afford the Contractor all necessary access to the Works and the Site to enable the Contractor to perform its obligations under this Clause GCC 3.35. The Contractor may, with the consent of the Purchaser, remove from the Site any Equipment/Materials or any part of the Works that are defective, if the nature of the defect and/or any damage to the Works caused by the defect is such that repairs cannot be expeditiously carried out at the Site

3.36.7 If the repair, replacement or making good is of such a nature that it may affect the efficiency of the Works or any part thereof, the Purchaser may give to the Contractor a notice requiring that tests of the defective part of the Works shall be made by the Contractor immediately upon completion of such remedial work, whereupon the Contractor shall carry out such tests.

If such part fails the tests, the Contractor shall carry out further repair, replacement or making good (as the case may be) until that part of the Works passes such tests. The tests, in character, shall in any case be not inferior to what has already been agreed upon by the Purchaser and the Contractor for the original part of the Works.

3.36.8 If the Contractor fails to commence the work necessary to remedy such defect or any damage to the Works caused by such defect within a reasonable time

(which shall in no event be considered to be less than fifteen (15) days), the Purchaser may, following notice to the Contractor, proceed to do such work, and the reasonable costs incurred by the Purchaser in connection therewith shall be paid to the Purchaser by the Contractor or may be deducted by the Purchaser from any money due to the Contractor or claimed under the Performance Securities.

3.36.9 If the Works or any part thereof cannot be used by reason of such defect and/or making good of such defect, the Defect Liability Period of the Works or such part, as the case may be, shall be extended by a period equal to the period during which the Works or such part cannot be used by the Purchaser because of any of the aforesaid reasons.

At the end of the Defect Liability Period, the Contractor's liability ceases except for latent defects. The Contractor 's liability for latent defects warranty for the Equipment/Materials, including spares, shall be limited to a period of five (5) years from the end of Defect Liability Period of the respective Equipment/Materials, including spares. For the purpose of this clause, the latent defects shall be the defects inherently lying within the material or arising out of design deficiency which do not manifest themselves during the Defect Liability Period as defined in this Clause GCC 3.36 but later.

3.36.10 Except as provided in Clauses GCC 3.36 and GCC 3.41, the Contractor shall be under no liability whatsoever and howsoever arising, and whether under the Contract or at law, in respect of defects in the Works or any part thereof, the Equipment/Materials, design or engineering or work executed that appear after Completion of the Works or any part thereof, except where such defects are the result of the gross negligence, fraud, criminal or wilful action of the Contractor

3.36.11 In addition, the Contractor shall also provide an extended warranty for any such component of the Works and for the period of time as may be specified in the SCC. Such obligation shall be in addition to the defect liability specified under GCC 3.36.2

3.36.12 Defects Liability Certificate and No-Claim Certificate

When the Defects Liability Period for the Works or any part thereof has expired and the Contractor has fulfilled all his obligations under the Contract for defects in the Works or the part, the Purchaser shall issue to the Contractor a Defects Liability Certificate to that effect within next twenty-eight (28) days. A No-Claim Certificate should be furnished by the Contractor for contract closure before the issuance of the final Defects Liability Certificate by the Purchaser. Such No-claim certificate shall be furnished by the Contractor as per Annexure of Section VIII. The Contractor is expected to complete all formalities for closure of

Contract including their final claims relating to the Contract. All claims will be deemed to be settled and no further claims of the Contractor will be entertained after the furnishing of the No-Claim Certificate by the Contractor.

3.37. LIMITATIONS OF LIABILITY

3.37.1 Liability after Expiry of Defects Liability Period

The Contractor shall have no liability to the Purchaser for any loss of or damage to the Purchaser's physical property which occurs after the expiry of the Defects Liability Period unless caused by Gross Misconduct of the Contractor provided that this exclusion shall not apply to any obligation of the Contractor to pay Liquidated Damage to the Purchaser.

The aggregated liability of the Contractor to the Purchaser under the Contract shall not exceed the Contract Price provided that this limitation shall not apply to any obligation of the Contractor to the cost of repairing or replacing the defective Equipment/ Materials or to indemnify the Purchaser with respect to patent infringement

3.37.2 Mitigation of Loss or Damage

In all cases the party claiming a breach of Contract or a right to be indemnified in accordance with the Contract shall be obliged to take all reasonable measures to mitigate the loss or damage which has occurred or may occur

G. RISK DISTRIBUTION

3.38. TRANSFER OF PURCHASERSHIP

3.38.1 Purchasership of the Equipment/Materials (including spare parts) procured from within/outside the country shall be transferred to the

Purchaser when the Equipment/Materials (including spare parts) are loaded on to the mode of transport to be used to convey the Equipment/Materials (including spare parts) from the works to the Site and upon endorsement of the dispatch documents in favour of the Purchaser.

3.38.2 Purchasership of the Contractor's Equipment used by the Contractor and its Sub-Contractors in connection with the Contract shall remain with the Contractor or its Sub-contractors.

3.38.3 Notwithstanding the transfer of Purchasership of the Equipment/Materials, the responsibility for care and custody thereof together with the risk of loss or damage thereto shall remain with the Contractor pursuant to GCC 3.40 hereof until Completion of the Works or the part thereof in which such Equipment/Materials are incorporated

3.38.4 Indemnity by Contractors: As this is a turnkey project and the contractor is fully responsible for handling, erection and commissioning of the equipment

and materials so for executing the work, the Contractor shall execute an Indemnity Bond in favour of the Purchaser for keeping the equipment in safe custody and to utilize the same exclusively for the purpose of the said Contract. The Indemnity Bond shall be furnished as per proforma in **Annexure-5** of Section VII. The Purchaser shall also issue a separate Authorization Letter to the Contractor to enable him to take physical delivery of Equipment/ Materials from the Purchaser as per proforma enclosed in **Annexure-11** of Section VII.

3.38.5 After material reached at site contractor shall apply for gate pass to enter the material as per the **Annexure-10B** in the Purchser's site. The Materials reached at site will be in the custodian of the Contractor.

3.38.6 The Purchaser will issue a Materials Receipt Certificate (MRC) as per **Annexure-12** after receiving the materials and equipment at site.

3.39. RISK AND RESPONSIBILITY

3.39.1 Allocation of Risk and Responsibility

The Risks of loss of damage to physical property and of death and personal injury which arise in consequence of the performance of the Contract shall be allocated between the Purchaser and the Contractor as follows

a. the Purchaser: the Purchaser's Risks as specified in GCC 3.39.2
b. the Contractor's Risks as specified in GCC 3.39.3

3.39.2 Purchaser's Risks

a. War and hostilities (whether war be declared or not), invasion, act of foreign enemies,
b. revolution, insurrection, military or usurped power or civil war,
c. use or occupation of the Works or any part thereof by the Purchaser,
d. the use or occupation of the Site or any part thereof, for the purposes of the Contract, or interference, whether temporary or permanent with any right-of-way, any easement, way leave or right of a similar nature which is inevitable result of the construction of the Works in accordance with the Contract.
e. the right of the Purchaser to construct the Works or any part thereof on, over, under, in or through any land,
f. damage (other than that resulting from the Contractor's method of construction) which is the inevitable result of the construction of the Works in accordance with the Contract,
g. the act, neglect or commission or breach of Contract or of statutory duty of the Purchaser

3.39.3 Contractor's Risks

The Contractor's Risks are all risks other than those identified as the

Purchaser's Risks.

3.40. CARE OF WORKS

3.40.1 Contractor's Responsibility for the care of Works, man and Materials/Equipment

The Contractor shall be responsible for the care of Works, man and materials/equipment from the Commencement Date until the Risk Transfer Date applicable thereto under GCC 3.40.2

3.40.2 Risk Transfer Date

The Risk Transfer Date in relation to the Works is the date of occurrence of any of the following

a. the date of issue of the TOC, or
b. the date of expiry of the notice of termination when the Contract is terminated by the Purchaser or the Contractor in accordance with these Conditions

The risk of loss or damage to the Works shall pass from the Contractor to the Purchaser on the Risk Transfer date applicable thereto.

3.40.3 Making Goods Damage
After risk transfer date

To making good forthwith loss or damage caused by the Contractor prior to the completion of the Defects Liability period

3.40.4 Till such time the system is not commissioned or taken over by PURCHASER, its custody and watch and ward shall remain with Contractor who shall accordingly be required to maintain a skeleton establishment at Site. Charges towards insurance cover for Contractor supplied Equipment /Material shall be paid by the Contractor till completion of the defect liability period.

3.41. ACCEDENT OF INJURY

Damage to property and injury to persons, accident or injury to workers

3.41.1 Contractor's liability

Except as provided under GCC 3.44 the Contractor shall be liable for and shall indemnify the Purchaser against all losses, expenses and claims in respect of any loss of or damage to physical property (other than Works), death or personal injury to the extent caused by :

a. defective design, material or workmanship of the Contractor, or
b. negligence or breach of statutory duty of the Contractor, his Sub-contractors or their respective employees and agents

3.41.2 Accidents

The Contractor shall be liable for and shall indemnify the Purchaser against all losses, expenses or claim arising in connection with the death of or injury to

any person employed by the Contractor or his Sub-contractors for the purposes of the Works.

The Contractor/Sub-contractor shall obtain necessary insurance coverage under the Employees compensation Act-1923 to cover the risk of payment of compensation in case of injury/death arising in course and out of employment to any employee.

3.42. INSURNCE

3.42.1 The Contractor at his own cost shall arrange, secure and maintain all insurances as may be pertinent to the Works and obligatory in terms of law to protect his interest and interests of the Purchaser against all perils detailed herein in the type and up to the limit of such insurance as defined herein together with the underwriter in each case shall be acceptable to the Purchaser. The identity of insurers and the form of policies shall be subject to the approval of Purchaser which shall not be unreasonably withheld. However, irrespective of such acceptance, the responsibility to maintain adequate insurance coverage at all times during the period of Contract including the extended period of Contract shall be of Contractor alone

3.42.2 Any loss or damage to the Equipment/ Materials during transportation, handling, storage, erection, putting into satisfactory operation and all activities to be performed till the successful completion of commissioning of the Equipment and handed over to the Purchaser shall be to the account of the Contractor. The Contractor shall be responsible for preference of all claims and make good the damages or loss by way of repairs and/or replacement of the Equipment/ Materials, damaged or lost. The transfer of title shall not in any way relieve the Contractor of the above responsibilities during the period of Contract. The Contractor shall provide the Purchaser with copy of all insurance policies and documents taken out by him in pursuance of the Contract. Such copies of documents shall be submitted to the Purchaser immediately after such insurance coverage. The Contractor shall also inform the Purchaser in writing at least sixty (60) days in advance regarding the expiry/cancellation and/or change in any of such documents and ensure revitalization, renewal etc. as may be necessary well in time at his cost, risk and responsibility.

3.42.3 The perils required to be covered under the insurance shall include, but not be limited to fire and allied risks, miscellaneous accidents (erection risks), workman compensation risks, loss or damage in transit, theft, pilferage, riot and strikes and malicious damages, civil commotion, weather conditions, accidents of all kinds, terrorist attacks, war risks etc. The scope of such insurance shall be adequate to cover the replacement/ reinstatement cost of the

Equipment/Materials for all risks up to and including delivery of goods on ex-works basis and shall also cover transportation and other costs till the Equipment/ Materials are delivered, erected and installed. Notwithstanding the extent of insurance cover and the amount of claim available from the underwriters, the Contractor shall be liable to make good the full replacement/ rectification value of all Equipment/Materials and to ensure their availability as per project requirements at its cost.

3.42.4 The Contractor shall ensure that for all activities to be performed under the Contract viz. transportation, storage, erection, testing, commissioning etc. till the Works are handed over to the Purchaser; the insurance cover shall only be taken from Indian Insurance Companies

3.43. CHANGE IN LAWS AND REGULATIONS

If, after the date seven (7) days prior to the last date of bid submission, in the country where the Site is located, any law, regulation, ordinance, order or bye-law having the force of law is enacted, promulgated, abrogated or changed (which shall be deemed to include any change in interpretation or application by the competent authorities) that subsequently affects the costs and expenses of the Contractor and/or the Time for Completion, the Contract Price shall be correspondingly increased or decreased, and/or the Time for Completion shall be reasonably adjusted to the extent that the Contractor has thereby been affected in the performance of any of its obligations under the Contract. However, these adjustments would be restricted to direct transactions between the Purchaser and the Contractor and shall also not be applicable on the bought out items despatched directly by Sub-contractor(s) to Site. Notwithstanding the foregoing, such additional or reduced costs shall not be separately paid or credited if the same has already been accounted for in the price adjustment provisions where applicable.

3.44. FORCE MAJEURE

3.44.1 “Force Majeure" shall mean any event beyond the reasonable control of the Employer or of the Contractor, as the case may be, and which is unavoidable notwithstanding the reasonable care of the party affected.

3.44.2 In the event of either party being rendered unable by Force Majeure to perform any obligation required to be performed by them under this Contract, relative obligation of the party affected by such Force Majeure shall be treated as suspended during which the Force Majeure clause last.

3.44.3 The term "Force Majeure" shall herein mean riots (other than among the Contractors employee), Civil commotion, War (whether declared or not),

invasion, act of foreign enemies hostilities, civil war, rebellion, revolution, insurrection, military coup, damage from aircraft, embargoes, quarantines, acts of god such as earthquake, floods, fires not caused by Contractor's negligence and other causes which the Contractor has no control. Normal climatic conditions such as rainy season, monsoons, storms, etc., are not to be considered as Force Majeure.

3.44.4 Upon occurrence of such causes, the party claiming that it has been rendered unable as aforesaid, thereby, shall notify the other party in writing by registered notice within 10 (Ten) days of the beginning of the event thereof giving full particulars and satisfactory evidence in support of its claim.

3.44.5 The burden of proof as to occurrence of the event of Force Majeure and its effect shall be upon the party claiming the Force majeure event and such claim shall be supported by documentary evidence in the form of a Certificate Issued by a recognized Chamber of Commerce or any other local, state or national authority.

3.44.6 Time for Performance of the relative obligation suspended by the event of force majeure shall stand extended by the period for which such clause lasts.

3.44.7 If works are suspended by Force Majeure conditions lasting for more than two months leading to prolonged force majeure, the parties shall hold consultation to find a solution/resolve the problem satisfactorily. Provided, The Employer shall reserve the right to cancel the Order/Contract, wholly or partly, in order to meet the overall project schedule and make alternative arrangement for completion of delivery and other schedules.

3.44.8 The Contractor shall not claim any compensation for Force Majeure conditions and shall take appropriate steps to insure men and materials utilized by it under the Contract well in advance.

3.45. WAR RISKS

3.45.1 War risks shall mean any of the following events occurring or existing in or near India:

a. war, hostilities or warlike operations (whether a state of war is declared or not), invasion, act of foreign enemy and civil war
b. rebellion, revolution, insurrection, mutiny, usurpation of civil or military government, conspiracy, riot, civil commotion and terrorist acts, and
c. any explosion or impact of any mine, bomb, shell, grenade or other projectile, missile, munitions or explosive of war

3.45.2 Notwithstanding anything contained in the Contract, each party to the Contract shall bear its own costs for any loss or damages as may be incurred on accounts of war risks with respect to:

a. destruction of or damage to Works or any part thereof to the extent not taken over by the Purchaser shall be the Contractor's risk and for those taken over by the Purchaser, it shall be the Purchaser's risk.

b. injury or loss of life of its personnel

H. CHANGE IN CONTRACT ELEMENTS

3.46. CHANGE IN THE FACILITIES

3.46.1 WBPDCL shall have the right to propose, and subsequently require, that the Engineering-in-charge order the Contractor from time to time during the performance of the Contract to make any change, modification, addition, deletion to, or in the form of facilities (herein after called "Change") provided that such change falls within the general scope of the Facilities and does not constitute unrelated work and that is technically practicable taking into account both the state of advancement of the facilities and the technical compatibility of the Change envisaged with the nature of the Facilities as specified in the contract.

e Purchaser may, by an written order to the Contractor, at any time before the Works are taken over, instruct the Contractor to alter, amend, omit, add any part of the Works. The Contractor shall not vary or alter any of the Works without the prior written permission of the Purchaser.

3.46.2 No alterations, amendments, omissions, additions, subtractions, or variations of the work (hereinafter referred to as "variation") under the contract shall be made by the Contractor except as directed by WBPDCL.

3.46.3 The Contractor may also from time to time during its performance of the Contract propose to WBPDCL (copy marked to Engineering-in-charge) any change that the Contractor considers necessary or desirable to improve the quality, efficiency or safety of the facilities. WBPDCL may at its discretion approve or reject any change proposed by the Contractor.

3.46.4 Changes originating from WBPDCL

In the event of WBPDCL requiring any variations, reasonable and proper notice "Request for Change Proposal" shall be given to the Contractor, to enable it to make arrangements accordingly, and in cases where goods or materials are already prepared/procured, or any designs, drawings or patterns made or work done that require to be altered, a reasonable sum in respect thereof shall be allowed by WBPDCL.

3.46.5 In every case in which the contractor shall receive instructions from WBPDCL for carrying out any work, which either then or later, will in the opinion of the Contractor involve a claim for additional payment, the Contractor shall as soon

as reasonably possible after the receipt of such instructions, inform in writing WBPDCL of such claim for additional payment.

3.46.6 The pricing of any change (differences in cost), if any, occasioned by such variations, shall be added to or deducted from the Contract Price, as the case may be in accordance with the rates and prices included in the Contract. If the rates and prices of any change are not available in the Contract, the parties thereto shall agree on specific rates for the valuation of the Change.

If the parties fail to agree on specific rates for the valuation of the Change, the price variation (addition/reduction of the price as the case may be) shall be evaluated by an independent valuer selected by the owner acceptable to the contractor.

3.46.7 Changes Originating from Contractor

If the Contractor proposes a Change pursuant to GCC Sub-Clause 3.46.3, the Contractor shall submit to the Engineering-in-charge written "Application for Change Proposal" giving reasons for the proposed change.

Upon receipt of the Application for Change proposal, parties shall follow the procedures outlined in GCC Sub-clauses 3.46.4 to 3.46.6.

3.46.8 Pursuant to GCC Sub-clause 3.46.4 and 3.46.7, if any change is necessary under the contract, such changes shall be limited to 5% of the contract price.

3.47. EXTENSION OF TIME FOR COMPLETION

3.47.1 Delivery and installation of Equipment/Materials as per requirement of work Program shall be made by the Contractor in accordance with Time Schedule pursuant to the SCC or within such extended time to which the Contractor shall be entitled under **GCC 3.47.2**

3.47.2 <u>Reasons for Extension of Time for Completion</u>

The Contractor may seek an extension of the Time for Completion if he is or will be delayed in completing the Works by any of the following reasons:

a. extra or additional work ordered in writing under GCC 3.46.
b. the delay in completion of Works caused for no fault on the part of the Contractor due to orders/instructions issued by the Purchaser
c. Force Majeure as per GCC 3.44.
d. any changes in laws and regulations as provided in GCC 3.43.
e. any other matter specifically mentioned in the Contract

3.47.3 The Contractor shall give notice to the Purchaser of his intention to make a claim for an extension of time within fifteen (15) days of the occurrence of any of the above cause(s). The notice shall be followed as soon as possible by the claim

with full supporting details.

3.47.4 The Contractor shall demonstrate to the Purchaser's satisfaction that it has used its best endeavour to avoid or overcome such causes for delay and the parties will mutually agree upon remedies to mitigate or overcome causes for such delays.

3.47.5 Notwithstanding the provisions of clause **GCC 3.47.4**. the Contractor shall not be entitled to an extension of time for completion, unless the Contractor, at the time when circumstances specified in **GCC 3.47.2** arises, has immediately notified the Purchaser in writing that it may claim such extension as caused by such circumstances. The Purchaser on receipt of such notice may agree to extend the Contract completion period as may be reasonable and mutually agreed but without prejudice to other terms and conditions of the Contract.

3.47.6 **Earlier Completion:**

The Purchaser may require completion of the Works or part thereof earlier than the Time for Completion, as mutually agreed between the Purchaser and the Contractor. The earlier completion date so agreed, if not achieved, shall not be considered for the purpose of levy of Liquidated damages.

3.48. TERMINATION

3.48.1 Termination for Purchaser's Convenience

3.48.1.1 The Purchaser may at any time terminate the Contract for any reason by giving the Contractor a notice of termination that refers to this sub-clause **GCC 3.48.1**.

3.48.1.2 Upon receipt of the notice of termination under **GCC 3.48.1.1**, the Contractor shall either immediately or upon the date specified in the notice of termination

a. cease all further work, except for such work as the Purchaser may specify in the notice of termination for the sole purpose of protecting that part of the Works already completed, or any work required to leave the Site in a clean and safe condition

b. terminate all subcontracts, except those to be assigned to the Purchaser pursuant to paragraph (d)(ii) of sub-clause GCC 3.48.2.

c. remove all Contractor's Equipment from the Site, repatriate the Contractor's and its Sub-contractors' personnel from the Site, remove from the Site any wreckage, rubbish and debris of any kind, and leave the whole of the Site in a clean and safe condition

d. In addition, the Contractor, subject to the payment specified in **GCC 3.48.3**, shall

i deliver to the Purchaser the parts of the Works executed by the Contractor up to the date of termination

ii to the extent legally possible, assign to the Purchaser all right, title and benefit of the Contractor to the Works as at the date of termination, and, as may be required by the Purchaser, in any subcontracts concluded between the Contractor and its Sub-contractors

iii deliver to the Purchaser all non-proprietary drawings, Specifications and other documents prepared by the Contractor or its Sub-contractors as at the date of termination in connection with the Works

3.48.1.3 **Risk Purchase Clause:** In case of failure of supplier, WBPDCLL at its discretion may make purchase of the materials / services NOT supplied / rendered in time at the RISK & COST of the supplier. Under such situation, the supplier who fails to supply the goods in time shall be wholly liable to make good to WBPDCL any loss due to risk purchase.

In case of items demanding services at site like erection and commissioning, vendor should send his servicemen /representatives within 7 days from the service call. In case a vendor fails to attend to the service call, WBPDCL at its discretion may also make arrangements to attend such service by other parties at the RISK & COST of the supplier. Under such situation the supplier who fails to attend the service shall be wholly liable to make good to WBPDCL any loss due to risk purchase / service including additional handling charges due to the change.

3.48.1.4 In the event of termination of the Contract under **GCC 3.48.1.1**, the Purchaser shall pay to the Contractor the following amounts:

a. the Contract Price, properly attributable to the parts of the Works executed by the Contractor as of the date of termination

b. the costs reasonably incurred by the Contractor in the removal of the Contractor's Equipment from the Site and in the repatriation of the Contractor's and its Sub-contractors' personnel

c. any amounts to be paid by the Contractor to its Sub-contractors in connection with the termination of any sub-contracts, including any cancellation charges

d. costs incurred by the Contractor in protecting the Works and leaving the Site in a clean and safe condition pursuant to paragraph (a) of **GCC. 3.48.1.2**

the cost of satisfying all other obligations, commitments and claims that the Contractor may in good faith have undertaken with third parties in connection with the Contract and that are not covered by paragraphs (a) through (d) above

3.48.2 Termination for Contractor's default

3.48.2.1 The Purchaser, without prejudice to any other rights or remedies it may

possess, may terminate the Contract forthwith in the following circumstances by giving a notice of termination and its reasons thereof to the Contractor, referring to this **GCC 3.48**:

a. if the Contractor becomes bankrupt or insolvent, has a receiving order issued against it, compounds with its creditors, or, if the Contractor is a corporation, a resolution is passed or order is made for its winding up (other than a voluntary liquidation for the purposes of amalgamation or reconstruction), a receiver is appointed over any part of its undertaking or assets, or if the Contractor takes or suffers any other analogous action in consequence of debt

b. if the Contractor assigns or transfers the Contract or any right or interest therein in violation of **GCC.3.49** if the Contractor, in the judgment of the Purchaser has engaged in corrupt or fraudulent practices in competing for or in executing the Contract

For the purpose of this Clause:

"**corrupt practice**" means the offering, giving, receiving or soliciting of anything of value to influence the action of a public official in the process or in Contract execution.

"**fraudulent practice**" means a misrepresentation of facts in order to influence a process or the execution of a Contract to the detriment of the Purchaser and includes collusive practice among bidders (prior to or after bid submission) designed to establish bid prices at artificial non-competitive levels and to deprive the Purchaser of the benefits of free and open competition.

3.48.2.2 **If the Contractor:**

a. has abandoned or repudiated the Contract
b. has without valid reason failed to commence Works promptly
c. persistently fails to execute the Contract in accordance with the Contract or persistently neglects to carry out its obligations under the Contract without just cause
d. refuses or is unable to provide sufficient materials, services or labour to execute and complete the Works in the manner specified in the Program furnished under GCC.20 (at rates of progress that give reasonable assurance to the Purchaser that the Contractor can attain Completion of the Works by the Time for Completion as extended.

Then the Purchaser may, without prejudice to any other rights it may possess under the Contract, give a notice to the Contractor stating the nature of the default and requiring the Contractor to remedy the same. If the

Contractor fails to remedy or to take steps to remedy the same within fifteen (15) days of its receipt of such notice, then the Purchaser may terminate the Contract forthwith by giving a notice of termination to the Contractor that refers to this clause GCC 3.47.2.

3.48.2.3 Upon receipt of the notice of termination under **GCC 3.47.1** or **GCC 3.47.2** the Contractor shall, either immediately or upon such date as is specified in the notice of termination

a. cease all further work, except for such work as the Purchaser may specify in the notice of termination for the sole purpose of protecting that part of the Works already executed, or any work required to leave the Site in a clean and safe condition
b. terminate all subcontracts, except those to be assigned to the Purchaser pursuant to paragraph (d) of GCC 3.47.2.3
c. deliver to the Purchaser the parts of the Works executed by the Contractor up to the date of termination
d. to the extent legally possible, assign to the Purchaser all right, title and benefit of the Contractor to the Works and to the Equipment/Materials as at the date of termination, and, as may be required by the Purchaser, in any subcontracts concluded between the Contractor and its Sub-contractors
e. deliver to the Purchaser all drawings, Specifications and other documents prepared by the Contractor or its Sub-contractors as at the date of termination in connection with the Works

3.48.2.4 The Purchaser may enter upon the Site, expel the Contractor, and complete the Works itself or by employing any third party. The Purchaser may, to the exclusion of any right of the Contractor over the same, take over and use with the payment of a fair rental rate to the Contractor, with all the maintenance costs to the account of the Purchaser and with an indemnification by the Purchaser for all liability including damage or injury to persons arising out of the Purchaser's use of such Equipment/ Materials, any Contractor's Equipment owned by the Contractor and on the Site in connection with the Works for such reasonable period as the Purchaser considers expedient for the supply and installation of the Works.

3.48.2.5 Upon completion of the Works or at such earlier date as the Purchaser thinks appropriate, the Purchaser shall give notice to the Contractor that such Contractor's Equipment will be returned to the Contractor at or near the Site and shall return such Contractor's Equipment to the Contractor in accordance with such notice. The Contractor shall thereafter without delay and at its cost

remove or arrange removal of the same from the Site.

3.48.2.6 The Purchaser shall not be liable to make any further payments to the Contractor until the costs of execution and all other expenses incurred by the Purchaser in completing the Work or its turnkey work Package, as the case may be, have been ascertained.

If the Cost of Completion when added to the total amounts already paid to the Contractor as at the date of termination exceeds the total amount which would have been payable to the Contractor for the execution of the Work or work Package, as the case may be, the Contractor shall upon demand, pay to the purchase the amount of such excess. Any such excess shall be deemed a debt due by the Contractor to the Purchaser shall be recoverable accordingly. If there is no such excess the Contractor shall be entitled to be paid the difference (if any) between the value of the Work or its work package and the total of all payment received by the Contractor as a the date of termination

3.48.2.7 If the Purchaser completes the Works, the cost of completing the Works by the Purchaser shall be determined.

If the sum that the Contractor is entitled to be paid, pursuant to **GCC 3.48.2.6** , plus the reasonable costs incurred by the Purchaser in completing the Works, exceeds the Contract Price, the Contractor shall be liable for such excess.

The Purchaser and the Contractor shall agree, in writing, on the computation described above and the manner in which any sums shall be paid.

3.48.2.8 No account shall be taken of any increased cost which results from the Contractor's default or negligence.

3.48.3 In this clause **GCC.3.48**, the expression “Works executed” shall include all work executed, Installation Services provided, any and Equipment/ Material acquired (or subject to a legally binding obligation to purchase) by the Contractor and used or intended to be used for the purpose of the Works, up to and including the date of termination.

3.49. ASSIGNMENT & SUB-CONTRACTING

3.49.1 The whole of the works included in the Contract shall be executed by the contractor and the contractor shall not directly or indirectly transfer, assign or underlet the contract or any part, share or interest therein without the written consent of the Purchaser.

3.49.2 No sub-contracting shall relieve the Contractor from the full and entire responsibility of the Contract or from the active superintendence of the work during their progress.

3.49.3 The contractor has to engage specialized agencies / personnel depending upon the nature and complexity of the work with the prior approval of the Purchaser. To this regard, the contractor has to submit the completion certificates / required documents of similar type of works executed by the subcontractor/ specialized agencies to establish the sub-contractor's/specialized agencies' workmanship. Also the contractor has to submit drawings done by the specialized agency for approval of Purchaser before procuring and installing the item. This does not in any way relieve the contractor of his obligations to get the quality work and architectural design as desired by the Purchaser.

3.50. JOINT AND SEVERAL LIABILITY

3.50.1 If the Contractor has formed a Consortium of not more than 3 (three) persons for implementing this Solar Power Project:

(a) These persons shall, without prejudice to the provisions of this Agreement, be deemed to be jointly and severally liable to the WBPDCL for the performance of the Agreement; and

(b) The Contractor shall ensure that no change in the composition of the Consortium is effected without the prior consent of the WBPDCL

3.50.2 In case of Consortium, without prejudice to the joint and several liability of all the members of the Consortium, the Lead Member shall represent all the members of the Consortium and shall at all times be liable and responsible for discharging the functions and obligations of the Contractor. The Contractor shall ensure that each member of the Consortium shall be bound by any decision, communication, notice, action or inaction of the Lead Member on any matter related to this Agreement and the WBPDCL shall be entitled to rely upon any such action, decision or communication of the Lead Member only. The WBPDCL shall have the right to release payments solely to the Lead Member and shall not in any manner be responsible or liable for the inter se allocation of payments among members of the Consortium.

If member of the consortium fails to perform satisfactorily then the Lead Member will be liable and responsible for completion of the project.

3.50.3 Issue of LOA and Contract agreement will be conferred with the Lead Member only.

SECTION –IV

SPECIAL CONDITION OF CONTRACT (SCC)

The following Special Conditions of Contract are supplementary, to the General Conditions of Contract. Whenever there is a conflict, the provisions herein shall prevail over those in the General Conditions of Contract.

4.1 DEFINITION

4.1.1. Purchaser means The West Bengal Power Development Corporation Limited (WBPDCL).

4.1.2. Site means the project site. The details of the site is shown below:

BkTPS:

Capacity of the Plant	10MW (AC)
Selected Location	Bakreswar Thermal Power Station, in Bakreswar, Birbhum District, West Bengal.
Latitude:	23.83°N
Longitude:	87.44°E
Altitude:	63 meters
Nearest Major Towns	Suri
Nearest police station:	Sadaipur PS (Approx. 1000 m from site)
Nearest hospital:	Suri Sadar Hospital (Approx. 10 km from site)
Seismic Zone	Zone-III as per IS 1893-1984.
Access by Road	Dubrajpur-Suri (NH-60)
Nearest Rail Station	Chinpai.
Access by Sea	Nearest port is Kolkata.
Access by Air	Durgapur

STPS:

Capacity of the Plant	7.5MW (AC)
Selected Location	Santaldih Thermal Power Station, in Purulia District, West Bengal.
Latitude:	23.6005°N
Longitude:	86.4765°E
Altitude:	155 meters
Nearest Major Towns	Santhaldih
Nearest police station:	Santhaldih PS (500m from site)
Nearest hospital:	Raghunathpur (27 km from site)
Seismic Zone	Zone-III as per IS 1893-1984.
Access by Road	State Highway No.8
Nearest Rail Station	Santhaldih.
Access by Sea	Nearest port is Kolkata.

Access by Air	Durgapur

SgTPP:

Capacity of the Plant	5 MW (AC)
Selected Location	Sagardighi Thermal Power Station, in Murshidabad District, West Bengal.
Latitude:	24° 36′ North
Longitude:	88° 11′ East
Altitude:	37 meters
Nearest Major Towns	Ajimganj, Jangipur, Raghunathganj
Nearest police station:	Sagardighi PS (10 km from site)
Nearest hospital:	Raghunathganj (14 km from site)
Nearest substation of SEB	Raghunathganj (5 km from site)
Seismic Zone	Zone-III as per IS 1893-1984.
Access by Road	From National Highway (NH-34).
Access by Rail	Manigram R.S. on Bandel-Ajimganj branch line.
Access by Sea	Nearest port is Kolkata.
Access by Air	Durgapur

4.1.3. Engineer In Charge

The General Manager (Projects), WBPDCL Corporate office, Kolkata or his authorised Engineer will be Engineer in Charge.

4.1.4. Controlling Officer

a) The General Manager of BkTPS or his authorized Engineer will be Controlling Officer for 10 MW Floating Solar Plant at BkTPS;

b) The General Manager of STPS or his authorized Engineer will be Controlling Officer for 7.5 MW Floating Solar Plant at STPS;

c) The General Manager of SgTPP or his authorized Engineer will be Controlling Officer for 5 MW Floating Solar Plant at SgTPP;

4.1.5. Project Manager

Project Manager will be selected from the Corporate office and will be finalized in the kick off meeting at the Corporate office of WBPDCL.

4.1.6. Paying Officer

The Deputy General Manager (F&A), WBPDCL Corporate office, Kolkata

4.1.7. LOA or Material/Service Contract

4.1.7.1 LoA of Material/ Service Contract for Project Job

i. After reverse auction, selected L1 bidder will submit the revised BOQ in line with the clause **ITB-1.19.3.2,** which is the total price of the 22.5MW floating solar PV Project at BkTPS, STPS and SgTPP.

ii. WBPDCL shall be placed three separate LoA or Material/Service contracts to the successful bidder by dividing the revised BOQ price into **10 : 7.5 : 5** ratio for 10MW BkTPS, 7.5MW STPS & 5MW SgTPP projects as contract price respectively.

iii. Contract price for the three project job shall be calculated as per the following table

Sl. No.	Item Description	Quantity	Units	Revised Basic cost to after Reverse Auction	Basic Contract Price for BkTPS Project	Basic Contract Price for STPS Project	Basic Contract Price for SgTPP Project
1	2	4	5	13			
1	**Supply Schedule**						
1.01	Cost in Rs. for 22.5 MW Grid connected Floating Solar PV plants for Supply of Materials as per Clause No: 1.3.2 (a, b &c) & 1.19.3.2 of the NIT.	1.000	Lot	**P**	**10P/22.5**	**7.5P/22.5**	**5P/22.5**
1.02	Supply of **Pvsyst Software** as per 1.3.2 (b)	1.000	Lot	**Q**	**10Q/22.5**	**7.5Q/22.5**	**5Q/22.5**
1.03	Mandatory spares as per list – Clause-5.15.30 of Section V and as per Clause No: 1.3.2 © & 1.19.3.2 of the NIT.	1.000	Lot	**R**	**10R/22.5**	**7.5R/22.5**	**5R/22.5**
2	**Erection & Commissioning**						

	Schedule						
2.01	Cost in Rs. for 22.5 MW Grid connected Floating Solar PV plants for Installation Service as per Clause No: 1.3.3 & 1.19.3.32 of the NIT	1.000	Lot	**S**	**10S/22.5**	**7.5S/22.5**	**5S/22.5**
2.02	Cost in Rs. for 22.5 MW Grid Connected Floating Solar PV plants for Testing and Commissioning as per Clause No: 1.3.3 & 1.19.3.2 of the NIT	1.000	Lot	**T**	**10T/22.5**	**7.5T/22.5**	**5T/22.5**
2.03	Cost in Rs. of Material used for civil items used for Erection & Commissioning for 5 MW Grid Connected Floating Solar PV plants as per Clause No: 1.3.3 & 1.19.3.2 of NIT	1.000	Lot	**U**	**10U/22.5**	**7.5U/22.5**	**5U/22.5**
	Total			X_T	X_{BkTPP}	X_{STPS}	X_{SgTPP}

iv. After finalization of the contract price on the above criteria the bidder shall have to submit the Billing Breakup (BBU) of all line items matching with the above defined cost.

v. Final LOA or Material/Service Contracts shall be placed with all the BBU price inclusive of applicable GST.

4.1.7.2 LoA of Material/ Service Contract for 5 Yrs Comprehensive O&m Contacts:

i. WBPDCL shall be placed three separate LoA or Material/Service contracts for 5 years comprehensive O&M to the successful bidder after successful completion of the projects with a price of 7.5% of the total basic price of first contracts.

ii. For example the three projects O&M cost shall be as per the following:

Project	Basic O&M Contract Price for **BkTPS** Project	Basic O&M Contract Price for **STPS** Project	Basic O&M Contract Price for **SgTPP** Project
5 years comp. O&M contract price excluding GST	**7.5% of X_{BkTPP}**	**7.5% of X_{STPS}**	**7.5% of X_{SgTPP}**

4.2 CONTRACT PERFORMANCE GUARANTEE

4.2.1. Within fifteen days (15) from date of LOA, the Contractor shall furnish Performance Guarantee to the Purchaser amounting to 3% of the accepted Project Cost Plus GST in the form of Bank guarantee from nationalized bank. The (Earnest Money Deposit) EMD shall be returned on submission of the Performance Guarantee of success full bidders.

4.2.2. **Release of Contract Performance Bank Guarantee (PBG):** 100% after the successful completion of defect liability period i.e. 5 years after successful commissioning of the Project.

4.2.3. Contract agreement will be executed after submission of PBG, deposited EMD shall be returned.

4.3 PAYMENTS

Following terms of payment shall be applicable –

4.3.1. Performance Security:

5% of contract value will be retained and it will be released in five equal installments every year in the defect liability period subject to compliance of following conditions by the contractor:

Integrated project performance of **Net Minimum Guaranteed** Generation (NMGG) solar energy at rate of as per table below annually **with degradation of 0.7%** for any reason, from second year onwards. If generated units fall short, then **Rs.4.00** per unit of short fall will be deducted from WBPDCL payments every year up to 5th year. Maximum cap of penalty for shortfall in NMGG shall be 5% of Project Cost plus GST.

Project Location	NMGG target for 1st year
BkTPS	16.39 MU from 10 MW (AC)
STPS	12.52 MU from 7.5 MW (AC)
SgTPP	8.29 MU from 5 MW (AC)

4.3.2. Total Integrated System Warranty/Contract Performance Guarantee

a. After completion of the project the 3% contract performance bank guarantee (CPBG) will be the total integrated System warrantee.

b. CPBG will be returned to the contractor after successful completion of the defect liability period including O&M period.

4.3.3. PAYMENT TERMS

4.3.3.1 Within forty-five (45) days after receiving an application for payment, duly complete in all respects, the Purchaser shall pay the amount certified after issue of each certificate of payment to the Contractor at his principal place of business. However, delay in making payment by the owner to the contractor shall not attract any interest on the due and payable amount.

4.3.3.2 Mobilization Advance:

i. 20 % of the Contract Price (Supply & Erection contract) will be paid as interest bearing Mobilization advance to the contractor against submission of Mobilisation Advance Bank Guarantee (**ABG-Annexure-3**) equivalent to 110 % of the Mobilisation Advance, subject to the conditions mentioned below. Unconditional acceptance of the LOA.

ii. Taking over of site from WBPDCL

iii. Execution of Contract Agreement

iv. Submission of Performance Bank Guarantee

v. Submission of duly authenticated Activity Schedule in MS Project showing the entire execution of work and approval of L1 network.

vi. The Bank Guarantee shall be valid for a total period of 12 (twelve) months plus a claim period of 3 (three) months from the bid opening date.

vii. Submission of PVSyst Premium Licensed version software, Clause-1.3.2(b).

viii. Mobilization advance, so paid shall be recovered as mentioned in the **Payment Schedule (clause SCC 4.3.3.6)**.

ix. Bank Guarantee submitted for mobilization advance will be released after full recovery of the mobilization advance and on receipt of written request of the contractor for release of the same.

The mobilization advance will be interest free for the scheduled Completion period from the date of LOA of the Project against 110 % unconditional BG

with a claim period of 90 days initially. However, in case of there is delay in completion of the facilities covered under the package, the validity of this Bank Guarantee shall be extended by the period of such delay along with 90 (ninety) days' claim period.

However, after completion of scheduled completion period, Mobilization Advance shall be recovered with an interest at the Rate of 8.5% p.a. on the balance unrecovered advance. The interest shall be applicable from the date of completion of scheduled completion period (i.e. 12 calendar months from the date of LOA) for computation of interest on the unrecovered balance advance amount.

4.3.3.3 Supply of Materials:

Payment for supply of material at site will be given as per the **Payment Schedule (clause SCC 4.3.3.6)** given below after satisfactory acceptance by Purchaser of the supplied materials along with the relevant following documents mentioned:

I. **Deduction:-**

a) Statutory deductions like TDS, GST if any shall be deducted.

b) Adjustment of any excess / short payment made in the earlier bills, at the time of making payments.

c) Electricity and Water charges will be recovered as per tender terms.

d) Value of chargeable materials if any issued by the Purchaser.

e) Any other recovery if due as per tender terms & conditions.

f) 5% of the bill value as Security Deposit.

II. **Documents:-**

a) Computerized detailed measurements, Running Accounts Bills and Final Bill will be Prepared by contractor and submitted to WBPDCL for verification and approval.

b) Document for claiming subsidy from MNRE should be submitted to WBPDCL for release of first RA bill.

c) WBPDCL gate entry documents./MRC(Material Receive at Certificate)

d) Relevant test, type test, joint inspection reports warranty and guarantee Certificate for the items supply as per quality criteria mentioned in tender document.

e) Copy of Performance guarantee for contract execution from nationalized bank valid till completion of work for 3% of purchase order value.

f) Labor License (as per statutory requirements).

g) EPF Code Registration number with RPFC.

h) Insurance – Contractor's All Risk (CAR) Policy.

i) Workmen compensation policy, Proof for PF deduction and remittance.

j) Third Party Liability Insurance for four consecutive occurrences each occurrence of 5.0 lakh.

k) GST or Other tax invoice, Service Tax registration number.

l) Indemnity Bond (ANNEXURE-5) in standard pro forma to indemnify the Purchaser against all risks arising during the performance of the contract.

m) Proof of deployment of project engineers as specified in SCC.

n) Challans / receipts of taxes paid to statutory authorities i.e., GST, Custom duties etc.

o) A Certificate towards the effect that minimum Technical and Safety man power was employed for the work execution Certified by the WBPDCL representative as per the Tender Clauses.

p) Undertaking for compliance of all labor laws.

4.3.3.4 Payment of Bills for installation, erection, testing, integration, successful commissioning of integrated system in total and ready for handing over to WBPDCL

Payment for the Bill amount for the materials quoted will be paid as per the **Payment Schedule (clause SCC 4.3.3.6)** after joint inspection / measurements by the Purchaser for installation, erection, testing, integration, successful commissioning of integrated system in total and ready for handing over to WBPDCL by the contractor and submission of following document :

I. Deduction:-

a) Deduction of the Value of chargeable materials if any issued by the Purchaser.

b) Statutory deductions like TDS, GST, Custom duties if any.

c) Charges for Electricity and Water charges provided by WBPDCL.

d) Any other recovery if due as per tender terms & conditions.

e) 5% of the bill value as Security Deposit.

f) Adjustment towards any excess / short payment made in the earlier bills.

II. Document:-

a) Relevant test, type test, joint inspection reports warranty and guarantee Certificate for the items installed, integrated & commissioned as per quality criteria mentioned tender document.

b) WBPDCL gate entry documents if any.

c) Proof of deployment of project engineers as specified in SCC.

d) Challans / receipts of taxes paid to statutory authorities i.e., GST, Customs Duties etc

e) A Certificate towards the effect that minimum Technical and Safety man power was employed for the work execution Certified by the WBPDCL representative as per the Tender Clauses.

f) Undertaking for compliance of all labor laws.

g) Valid Indemnity Bond in standard pro forma indemnifying the Purchaser against all risks arising during the performance of the contract.

h) Valid Workmen compensation policy, Proof for PF deduction and remittance.

i) Valid Insurance – Contractor's All Risk (CAR) Policy.

j) Valid Labor License (as per statutory requirements).

k) MNRE–Govt of India format project complication certificates / documents to WBPDCL.

l) Computerized detailed measurements, Running Accounts Bills and Final Bill will be prepared by contractor and submitted to WBPDCL for verification and approval.

m) A Certificate issued by the WBPDCL that total supply and erection works are complete in all aspects.

4.3.3.5 Payment of Bill – Performance testing of total integrated system – final Payment / bill:

Payment for materials bill shall be paid as per the **Payment Schedule as per clause SCC 4.3.3.6** after performance testing of total integrated system for two

months in all respect. The final bill complete in all respect shall be submitted by the contractor within 60 days from the completion of the work. The bill should be accompanied with the following documents.

I. Deduction:-

a) Statutory deductions like GST and other tax and duties if any shall be deducted WBPDCL reserves the right to adjust any excess / short payment made in the earlier bills, at the time of making payments.

b) Adjustment of any excess / short payment made in the earlier bills, at the time of making payments.

c) Electricity and Water charges will be recovered as per tender terms.

d) Value of chargeable materials if any issued by the Purchaser.

e) LD if any and other recovery if due as per tender terms & conditions.

II. Document:-

a) Computerized detailed measurements, Running Accounts Bills and Final Bill will be Prepared by contractor and submitted to WBPDCL for verification and approval.

b) Validated of Total Integrated System Warranty PBG/Contract PBG valid for 72 months with additional claim period of 90 days upto successful completion of O&M period for the value equivalent to 3% of the total project cost plus GST value from nationalized bank.

c) Proof of project completion and relevant documents as per MNRE format for release of subsidy by MNRE, Govt of India to WBPDCL.

d) Job completion certificate by WBPDCL (**Annexure-6**).

e) No claim certificate on Purchaser's prescribed pro forma - if any deduction is to be made for short fall, Purchaser shall record the same in this document.

f) Site clearance certificate by WBPDCL.

g) Indemnity certificate towards labor payment and all statutory payments.

h) Copy of the insurance policy. (Workmen compensation act and contractors all risk policy).

i) Operation and Maintenance manuals and testing and commissioning reports with Guarantee and Warranty certificates.

j) Statutory Compliance certificate towards payment of insurance, GST and other taxes if any applicable.

k) A compliance Certificate should be submitted towards deployment of Technical & Safety man power as per the relevant Tender Clauses.

l) Proof of deployment of annual maintenance & operation manpower for operation of the plant.

m) Valid Workmen compensation policy, Proof for PF deduction and remittance for AMC personal.

n) Valid Insurance – Contractor's All Risk (CAR) Policy for AMC personnel.

o) Valid Labor License (as per statutory requirements) for AMC personnel.

p) Relevant test, type test, joint inspection reports warranty and guarantee Certificate for the items installed, integrated & commissioned as per quality criteria mentioned tender document.

q) WBPDCL gate entry documents if any.

r) Undertaking for compliance of all labour laws.

s) Valid Indemnity Bond (ANNEXURE-5) in standard pro forma indemnifies the Purchaser against all risks arising during the performance of the contract.

t) Final acceptance certificate issued by WBPDCL /Purchaser.

4.3.3.6 Payment Schedule:

Sl. No.	Work Head	Pattern of Release of Billing Amount
1	**Mobilization Advance**	**20%** of the total contract price of Supply and Erection & Commission (excluding quoted price of Mandatory spare) will be paid as Mobilization advance to the contractor against submission of Mobilisation Advance Bank Guarantee (**ABG**) equivalent to 110 % of the Mobilization Advance, subject to the conditions mentioned in the Clause No. SCC **4.3.3.2** above. The mobilization advance will be recovered as per the sub clause mentioned in Sl. No. 2 (i) & 3(i) below. NOTE:- (1) For **supply of material**, submission of Mobilisation Advance Bank Guarantee

Sl. No.	Work Head	Pattern of Release of Billing Amount
		(**ABG**) should be equivalent to 110 % of the Mobilization Advance **excluding GST**. (2) For **Erection & Commissioning**, submission of Mobilisation Advance Bank Guarantee (**ABG**) should be equivalent to 110 % of the Mobilization Advance **including GST**. However, after completion of scheduled completion period, Mobilization Advance shall be recovered with interest at the Rate of 8.5% on remaining advance amount. In case of time extension without prejudice to the original contract, said BG shall have to be extended by the contractor upto the given extension period with an additional 90 days of claim period.
2	**Contract for Supply of Material**	i. 70% of the contract value will be given on prorated basis after material received at site (Mobilization Advance paid and interest as per **Clause 4.3.3.2** will be recovered proportionately from bills under this phase of payment).
		ii. 10% of the contract value will be paid prorated basis after completion of the erection of the material
		iii. 5% of the contract value on prorated basis after successful completion of the commissioning and testing.
		iv. 10% of the contract value after successful completion of PG test.
		v. 5% of the Contract value will be retained for Performance warranty as per clause no. SCC 4.3.4. However, 5% of retention amount shall be released against submission of 5 numbers unconditional BG of equivalent amount i.e. 1% each of Basic project cost plus GST after completion of Project and before start of comprehensive O&M contract. 5 nos. BG shall be submitted with different validity period upto successful completion of O&M contract with a claim period 90

Sl. No.	Work Head	Pattern of Release of Billing Amount
		days. Penalty due to NMGG if any shall be recovered from these BG during O&M period. vi. Details of BG validity is mentioned under clause no. SCC 4.3.4.
3	**Contract for Erection & Commissioning**	i. 65% of the contract value will be given prorate basis after erection of the material (Mobilization Advance paid and interest as per Clause 4.3.3.2 will be recovered proportionately from bills under this phase of payment).
		ii. 15% of the contract value will be paid prorata basis after completion of the Testing and Commissioning of the material
		iii. 10% of the contract value after successful completion of PG TEST.
		iv. 5% of the contract value after successful completion of all facilities and Final Acceptance Certificate of project.
		v. 5% of the Contract value will be retained for Performance warranty as per clause no. SCC 4.3.2.
4	**Supply of Mandatory spares**	70% of the Supply price of Mandatory spare will be given on prorata basis on production of invoices, satisfactory evidence of shipment including Insurance and Material Dispatch Clearance Certificate (MDCC) issued by WBPDCL.
		ii) 30% of the Supply price of Mandatory spare will be given on prorata basis on receipt and storage at site and on physical verifications by WBPDCL Site Official of having received and stored the spares at site.

4.3.4. Performance Penalty:

a) Integrated project performance of minimum solar energy to be generated as per table mentioned in Cl. No. 3.33 annually with degradation of 0.7% for any reason, from second year onwards. If generated units fall short, then Rs.4.00 per unit of short fall will be deducted from WBPDCL

payments every year up to 5th year upto 1% maximum of Project cost plus GST per annum.

b) Penalty will be deducted from retained amount against Performance warranty maximum 5% of Project cost plus GST.

c) WBPDCL reserves the right to adjust any excess / short payment made in the earlier bills, at the time of making payments.

d) d) However retention amount i.e. 5% of Project cost plus GST per annum shall be released against submission of 5 numbers unconditional BG of equivalent amount i.e. 1% each of project cost plus GST after completion of Project and start of comprehensive O&M contract. 5 nos. BG shall be submitted with different validity period upto successful completion of O&M contract with a claim period 90 days. Penalty due to NMGG if any shall be recovered from these BG during O&M period.

BG validity:

1. 1% of Project cost plus GST: validity period of One year from O&M start date plus additional claim period of 90 days.
2. 1% of Project cost plus GST: validity period of Two years from O&M start date plus additional claim period of 90 days.
3. 1% of Project cost plus GST: validity period of Three years from O&M start date plus additional claim period of 90 days.
4. 1% of Project cost plus GST: validity period of four years from O&M start date plus additional claim period of 90 days.
5. 1% of Project cost plus GST: validity period of five years from O&M start date plus additional claim period of 90 days.

4.3.5. Defects Liability Period:

Defect liability period is 60 calendar months from the date of Issue of Final completion certificate/Acceptance of work by WBPDCL.

4.3.6. INCREASE IN COST:

Quoted prices are firm and no escalation charges on any account are allowed in this work. No claim will be entertained on this account in future.

4.3.7. DISALLOWANCE OF PAYMENT:

If payment has been made for any item but later on some defect is noticed, Purchaser is authorized to disallow payment of the subsequent bill till rectification /replacement of the item.

4.4 ESCALATION

No Escalation shall be paid on any accoun.

4.5 LIQUIDATED DAMAGES

a) **Time Delay:** 0.5 % of the Project cost plus GST for per week delay or part there of subject to a maximum of 10% of the Project cost plus GST.

b) **Milestone Delay:** Delay in attaining the milestones by the contractor shall lead to imposition of intermediary Liquidated damages of delay (as per GCC.3.35) upto the maximum extent of 5(Five) Percent of the Project cost plus

c) However, if bidder shall complete the dependent subsequent milestone within the scheduled time, earlier penalty due to milestone delay if any shall be waived off. This condition shall not relief the bidder from the other stipulations mentioned in the NIT.

d) Total LD value (LD for Time Delay + LD for Milestone Delay) shall not exceed 10% of total Project cost plus GST.

4.6 NOTICES

For the purpose of all notices, the following shall be the address of the Purchaser and the Contractor.

PURCHASER:

The General Manager (Solar Cell)
The West Bengal Power Development Corp. Ltd.
Bidyut Unnauan Bhaban, Plot No. 3/C LA-Block,
Sector-III, Bidhannagar,Kolkata-700 106

CONTRACTOR:

_____

_____

(To be filled in at the time of Signing of the Contract)

4.7 LABOUR

4.7.1. The Contractor shall make his own arrangements for the engagement of all staff and labor, local or other, and for their payment, housing, food, transport etc. No labor to stay at site.

4.7.2. The Contractor shall, if required by the Purchaser deliver to the Purchaser a return in detail, in such form and at such intervals as the Purchaser may prescribe, showing the staff and the numbers of the several classes of labor from time to time employed by the Contractor on the Site and such other information as the Purchaser may require.

4.7.3. Compliance with labor regulation: During continuance of the contract, the Contractor shall abide at all times by all existing labor enactments and rules made there under, regulations, notifications and bye-laws of the State or Central Government or local authority and any other labor law (including rules), regulation by laws that may be passed or notifications that may be issued under any labor law in future either by the State or the Central Government or the local Authority. The Contractor shall keep the Purchaser indemnified in case any action is taken against the Purchaser by the competent authority on account of contravention of any of the provisions of any Acts or rules made there under, regulation or notifications including amendments. If the Purchaser is caused to pay or reimburse, such amount as may be necessary to cause or observe, or for non-observance of the provisions stipulated in the notifications/bye laws/Acts/Rules /regulations including amendments, if any, on the part of the Contractor, the Purchaser shall have the right to deduct from any money due to the Contractor including his amount of performance security. The Purchaser shall also have right to recover from the Contractor any sum required or estimated to be required for making good the loss or damage suffered by the Purchaser

4.7.4. The employees of the Contractor and the Sub-Contractor in no case shall be treated as the employees of the Purchaser at any point of time.

4.7.5. No labor shall stay at site. Temporary storage space provision should be made by contractor.

4.7.6. The rates shall be complete in all respects i.e. inclusive of all taxes, local taxes, work contract tax, Insurance charges nothing on any account shall be paid over the approved rate.

4.7.7. All specialized and specific jobs shall be carried out by approved agencies/vendors only.

4.7.8. The Contractor shall arrange temporary drinking water and sanitation facilities for his workmen.

4.7.9. Minimum Wage as applicable

i. The contractor shall pay not less than fair wages to laborers engaged by him on the work.

ii. "Fair" wages means wages whether for time or piecework notified by the Government from time to time for the locality of work.

iii. The contractor shall not-with-standing the revisions of any contract to the contrary cause to be paid to the labor directly engaged on the work including any labor engaged by the sub-contractor in connection with the said work, as if the laborers had been directly employed by him.

iv. In respect of labor directly or indirectly employed in the works for the purpose of the contractors part of the agreement the contractor shall comply with the rules and regulations on the maintenance of suitable records prescribed for this purpose from time to time by the Government. He shall maintain his accounts and vouchers on the payment of wages to the laborers to the satisfaction of the Purchaser.

v. The Purchaser shall have the right to call for such record as required to satisfy himself on the payment of fair wages to the laborers and shall have the right to deduct from the contract amount a suitable amount for making good the loss suffered if any by the worker or workers by reason of the "fair wages" clause to the workers.

vi. The contractor shall be primarily liable for all payments to be made and for the observance of the regulations framed by the Govt., from time to time without prejudice to his right to claim indemnity from his sub-contractors.

vii. As per contract labor (Regulation and abolition) Act.1970 the contractor has to produce the license obtained from the licensing officers of the labor department along with the tender viii. Any violation of the conditions above shall be deemed to be a breach of his contract.

viii. Equal wages are to be paid for both men and women if the nature of work is same and similar.

ix. The contractor shall arrange for the recruitment of skilled and unskilled labor local and imported to the extent necessary to complete the work within the agreed period as directed by the Purchaser.

x. The Contractor/Sub-contractors) to be engaged by the contractor subsequently, must have its own PF & ESI Code.

4.8 SAFETY MEASURES

The contractor shall take necessary precautions for safety of the workers and preserving their health while working in such jobs, which require special protection and precautions. The Purchaser has standard safety guidelines for the Contractor. The Contractor is to be followed the above guidelines which will be provided with placement of the Award of Contract.

SECURITY SERVICES:

The contractor has to arrange proper security system round the clock including deputation of security personnel at his own cost for the check vigil for the Solar Power Plant for BkTPS, STPS & SgTPP for the complete scope of works including comprehensive O&M period.

The security staff may be organized to work on suitable shift system; proper checking & recording of all incoming & outgoing materials vehicles shall be maintained. Any occurrence of unlawful activities shall be informed to Employer immediately. A monthly report shall be sent to WBPDCL on the security aspects.

4.9 FIRE FIGHTING MEASURES

i. The contractor shall provide and maintain adequate firefighting equipment and take adequate fire precaution measures for the safety of all personnel and temporary and permanent works and shall take action to prevent damage and destruction by fire of trees shrubs and grasses.

ii. Separate payment will not be made for the provision of fire prevention measures.

4.10 DEPLOYMENT OF MANPOWER

The contractor shall deploy the following minimum man power at site to take instructions from WBPDCL Staff & Report the site activities on day to day basis execution of quality work and maintain all statutory records as per Govt. norms/as directed by the Purchaser.

4.10.1 Deployment of Competent Manpower during O&M period at each plant:

i) Graduate Engineer with 1 years' experience in Solar Plants and SCADA operation under payroll of the successful bidder - 1no.

ii) Junior Engineer (Diploma in electrical) with 2 years' experience in solar plants– 1 no.

iii) ITI grade in electrical with 2 years' experience – 2 nos.

iv) Other skilled manpower as per the requirement of the contractor to meet NMGG requirement.

4.10.1.1 All relevant statutory compliances also to be fulfilled during O&M period.

4.10.1.2 No objection certificate for HR obligation from BkTPS, STPS & SgTPP HR&A department for the billed months.

4.10.1.3 For day to day operation the contractor shall furnish the name, bio data, experience of the personal intended to be posted at site at the start of work. Site Engineers are to be deployed irrespective of the Contractor or the Director / Manager of the contracting company being an Engineer himself. Attendance register should be kept at the office of WBPDCL designated engineer.

4.10.1.4 The Contractor shall maintain supervisor staff to Labor ratio as per standard government / CPWD norms.

4.10.1.5 The Contractor may employ more number of site Engineers other than above mentioned Engineers to get quality workmanship and maintain all statutory.

4.10.1.6 However, the site-incharge must be on payroll of the EPC vendor during entire tenure of Project and comprehensive O&M period upto completion of defect liability.

4.11 QUANTITY OF WORK

The quantities of work shall be mentioned in the LOA.

4.12 PROJECT MANAGEMENT

4.12.1. CONTRACTOR'S ORGANISATION

The Contractor shall supply to the Purchaser and the Project Manager a chart showing the proposed organization to be established by the Contractor for carrying out work on the Facilities within twenty-one (21) days of the Effective Date. The chart shall include the identities of the key personnel and the curricula vitae of such key personnel to be employed shall be supplied together with the chart. The Contractor shall promptly inform the Purchaser and the Project Manager in writing of any revision or alteration of such an organization chart.

4.12.2. PROGRESS REPORT

Monthly progress report of the previous month along with photographs of work progress shall be submitted to the Purchaser before the 7th day of every month. Format for the monthly report will be finalized in the .Kick Off meeting.

4.12.3. PROJECT REVIEW MEETING

Progress of the project will be evaluated in the Project Review Meeting (PRM) in every month. Date of the PRM will be informed by the Purchaser to the entire contractor.

4.12.4. SPECIAL PROJECT REVIEW MEETING

Special Project Review Meeting (SPRM) will be held after completion of the each milestone mentioned in the data sheet (approved network by the Purchaser). In this meeting the total time taken for complete the milestone will be finalized/evaluated and if any delay occurs then delay contribution will be calculated and minuted by both Contractor as well as Purchaser.

4.13 ACCIDENT OR INJURY TO WORKMEN

4.13.1. WBPDCL shall not be responsible for any injury or loss of life of any worker of the contractor that may take place while on work. Any compensation or expenditure towards treatment for such loss of life or injury shall be the sole responsibility of the contractor.

4.13.2. The contractor is solely responsible for any damage injury or accident that may occur to any of his personnel working under this contract. He will not claim any compensation from WBPDCL.

4.14 REGULATIONS & STANDARDS

The installation shall confirm in all respects to the Indian Standard Code of Practice for Electrical Installations. It shall also be in conformity with the current Indian Electricity Rules and Regulations and requirements of the local Electric Supply Authority in so far as these become applicable to the installation. Wherever the specifications of this tender document calls for higher standard of material and/or workmanship than those required by any of the above codes and regulations then this specifications shall take precedence over the said regulations and standards.

4.15 INSPECTION AND TESTING

4.15.1. Required Inspection charges at the Factory are under scope of Contractor.

4.15.2. Inspection & Testing for items like Inverters, Floaters, modules, Battery and charger, SCADA, 33 kV HT switchgear, RMU etc. may be done at Manufacturer local testing facilities / at the works of the contractor in India as desired by the contractor. In such case the contractor shall provide full set up for inspection and routine test of the item.

4.16 DESIGN AND ENGINEERING

4.16.1. The optimum system design and sizing of the equipment of the PV power plants shall be done by using design software PV- Syst /PV–Sol or any other modern tools by using the meteorological data base of Meteonorm.

4.16.2. The contractor shall develop the general layout drawing of Array Yard, Inverter, AJB, Grid Interfacing panel, Single line diagram and other drawing as may be required. All designs & drawings are to be developed based on specification given in the tender, relevant BIS unless otherwise specified.

4.16.3. The Power Plants shall have to be designed considering optimal usage of space without compromising the effect of shadow, cooling, accessibility, losses, protection, security and safety etc.

4.16.4. Document to be submitted during approval of the Design and Drawing:

During approval of drawing and design of the PV Power Plant the documents have to be submitted by the contractor which shall be includes but not limited as follows:

1) Power plant design document
2) PV Array and other component layout drawing of the PV Power Plant
3) Drawing of different equipment of PV power Plant
4) Design and drawing of PV Module mounting floater along with the anchoring arrangement of PV array as per technical specification.
5) List of Equipment and Component and its capacity and manufacturer name to be used in the PV Power Plants
6) Type test report of PV Module mounting floater, Inverters, PV Module, Cables , Components of Array JB, Inverter LT Panel, Grid Inter facing Pants etc
7) Original Technical Manual of the Equipment and Component.

4.17 COMPLETION OF WORK

The Contractor shall assist the beneficiaries and liaison with the DISCOMs if necessary for installation of Net Meter by the DISCOM and complete the formalities for availing net metering benefit to make the power plant is operational from the date of commissioning.

4.18 TRAINING OF OWNER'S ENGINEER

Contractor will arrange for training on Manufacturing, Erection, Operation and Maintenance of owner's engineer at STPS site on following equipment:

i) Inverter;

ii) Solar Module;

iii) SCADA;

iv) Floaters;

Bidder shall provide minimum Thirty-Two man days (eight man for four days) training at site along with study material. The Contractor will also arrange for training at site for the end users.

4.19 TAKING OVER

4.10.1 OPERATIONAL ACCEPTANCE FOR EACH PHASE:

i) All As-Built Drawings & Design of the power plant in Six (06) sets and two sets soft copy in two separate Pen Drives.

ii) Detailed Engineering Document with detailed specification, schematic drawing, Design and test results, manuals for all deliverable major items, Operation, Maintenance & Safety Instruction Manual and other information about the project in Six (06) sets and two sets soft copy in two separate Pen Drives.

iii) Commissioning & completion of trial run certificate;.

The project completion certificate issued by WBPDCL upon successful completion of all the facilities including successful PG test pertaining to the scope of work. Contractor shall approach WBPDCL in writing for "final completion of project work" of the plant. On receipt of such request, WBPDCL shall issue to the contractor a Project completion certificate as a proof of the of the system other than successful completion of defect liability period including comprehensive O&M. Such certificate shall not relieve the Contractor of any of his obligations which otherwise survive, by the terms and conditions of the Contract after issuance of such certificate.

4.19.2 HAND-OVER OF PROJECT:

During handing over of the complete project work, the contractor will submit the followings for considering final payment.

a) Bill of materials

b) Site wise documentation as per MNRE GoI Format.

c) Performance Guarantee Certificate of PV modules from the original manufacturer (**Cl. No. 4.22 & 4.23**).

d) Handover of all Mandatory spares at WBPDCL store.

e) Completion certificate as per prescribed format provided by WBPDCL

f) Approved PG Test reports and yearly NMGG reports.

g) NOC from WBPDCL HR&A department of respective site (BkTPS, STPS & SgTPP).

h) Site maintenance logbook.

i) Handover of Insurance policies.

4.20 COMPREHENSIVE MAINTENANCE

Comprehensive Maintenance during defect liability period

4.20.1. All the equipment to be installed for commissioning of each of the grid connected solar PV power plant and the power plant in whole shall be under Comprehensive Maintenance Contract within the scope of the tender for 5(five) years from the date of commissioning. The equipment or components, or any part thereof, so found defective during Comprehensive Maintenance Contract period will be forthwith repaired or replaced within the scope of guarantee obligation to the satisfaction of the Purchaser.

The maintenance of grid connected solar PV power plant include routine & periodic maintenance, overhauling, breakdown maintenance, and repairing or replacement of defective PV modules, invertors, and other components, providing of consumables. The Down-Time of PV system should not be more than 72 hours (03 days). Details of the maintenance scope are mentioned in the clause no. **GCC 3.8.4.**

4.20.2. **Routine maintenance:**

In order to carry out routine maintenance of the power plant, the contractor will provide all labour, material, consumables etc. within the scope of maintenance service. Recommended tusks under the scope of routine maintenance will include but not limited to the followings:

Sl No.	Type of Routine Maintenance
01	Checking and tightening of all electrical connections
02	Checking and tightening of mechanical fittings
03	Checking and restoring of earthing system
04	Dusting and cleaning of Inverter and other electrical equipment
05	Routine maintenance as recommended by the Original Equipment Manufacturer (OEM)
06	Other details are specified in "**COMPREHENSIVE OPERATION & MAINTENANCE OF WBPDCL Floating Solar PV Power Plant at different Water Ponds of WBPDCL**"

4.20.3. **Rental and Other Periodic Charges**

The contractor shall pay the rental charge of the SIM / Telephone Bill web connectivity in order to transfer of data related to Web Based Remote Monitoring System. The contractor shall also pay the rental charges for server of the web based remote monitoring system for storing and access the data till the defect liability period is over. The Contractor shall also pay necessary charges periodically for refilling of the Fire Extinguisher till defect liability period is over.

4.20.4. Comprehensive maintenance shall be the integral part of the contract. **5%** of the total order value (Supply and service) shall be retained and shall be released after successful completion of project and submission of 5 nos. of BG. This is apart from the **3%** Contract Performance Guarantee (CPG). The Comprehensive maintenance shall be included the rental charges mentioned under **SCC.4.20.3** The payment towards Operation & Maintenance shall be made on yearly basis on submission of bills in triplicate to WBPDCL along with a copy of the maintenance report during the claimed period which will already to be submitted on quarterly subject to satisfactory performance as per Clause no: **SCC.4.3.2** and its sub clauses on submission of maintenance report on regular basis.

4.21 FUNCTIONAL WARRANTIES

All the Floating Solar project shall be implemented through a turnkey EPC contract including O&M and comprehensive warranties of 5 years from the date of acceptance of commercial operations including successful completion of trial run. The project warranties shall essentially include but will not be limited to:

4.21.1 DEFECTS WARRANTY

The EPC contract shall provide five (5) years comprehensive warranty for the entire SPV Floating Solar Plants from PV modules up to the point of interconnection and metering. The Contractor shall warrant the Solar PV projects are free from any and all defects including unseen and latent in all project components and workmanship.

In case of any manufacturing defect or underperformance of any project component, the Contractor shall guarantee supply, installation, testing and commissioning of replacement Project component/s replacing the corresponding defective Project component/s at no cost to the Employer.

In case of defects due to improper handling of Project components by the Contractor's O&M team, the Contractor shall be responsible for repairing any

/ all defects. The Employer shall reserve the right to get monetary compensation for loss of energy generation caused due to plant unavailability.

Any replacement made or component repaired by the Contractor shall continue to be in warranty for the balance warranty period along with an additional extended warranty for 12 months with no charge to the Employer.

The contractor shall warrant that all equipment, hardware and accessories are new, unused, most recent or current models and incorporate all recent improvements in design and in accordance with the contract documents and free from defects in material and workmanship. The contractor shall also guarantee for defect free operation of the materials supplied and workmanship towards erection for a period of **sixty (60) calendar** months commencing immediately upon date of TOC.

4.21.2 PROJECT COMPONENTS WARRANTY

Project components warranty can essentially be construed as guarantees I warranties provided by the project component manufacturers beyond the defects liability period, performance warranty period and extended warranties.

Key components will be factory tested according to the approved Quality Assurance Plan before shipping to ensure their compliance with the technical specifications. The Draft Quality Assurance Plan has to be developed and submitted by the Contractor for approval by the Employer.

Warranties and condition thereof for key project components are separately specified in the general technical specification of key project components presented below.

Any and all such warranty for any of the project components shall be transferred to the Employer after completion of the O&M period.
The Employer shall reserve the right to call for extended warranties from the manufactures; same shall be agreed by the Contractor and product manufacturer.

4.21.3 MANUFACTURER WARRANTY CERTIFICATE

The manufacturer should warrant the supplied equipment, hardware and accessories free from the defects and/or failures specified below from the official start date of comprehensive O&M activity.

If any equipment fails to conform to this warranty, the manufacturer will replace the equipment, at the Purchaser's sole option.

The contractor has to submit the Guarantee Certificate issued by the Equipment Manufacturer to WBPDCL against delivery of each lot. The Guarantee Certificate issued by the contractor must comprise order no. of WBPDCL, name of the project, Name of EPC vendor.

The contractor should submit the warrantee certificate issued by the original Equipment manufacturer to WBPDCL after delivery of every lot. The warrantee shall include but not limited to the following:

a. Capacity and model of the Equipment,
b. Equipment serial no.
c. Warrantee period:
d. Name of WBPDCL (as principal purchaser)
e. Order reference of WBPDCL
f. Order reference & name of the of vendor

4.22 PERFORMANCE GUARANTEE OF PV MODULE

i) The manufacturer should warrant the output of Solar Module(s) for at least 90% of its rated power for initial 10 years & 80% of its rated power upto 25 years from the official start date of comprehensive O&M activity. The contractor shall collect the Warranty Certificate for performance of the modules from the manufacturer and submit the same to WBPDCL prior to delivery of the products to the respective sites.

ii) The modules shall be warranted, against all material/ manufacturing defects and workmanship for minimum of 5 years from the start date of Comprehensive O&M activity.

If, Module(s) fail(s) to exhibit such power output in prescribed time span, the Contractor will bound to either deliver additional PV Module(s) to compensate the shortfall power output with no change in area of site used with no extra cost claimed.

The contractor has to transfer Performance Guarantee Certificate of the module from the original manufacturer to the Purchaser for subsequent arrangement after completion of the guarantee period i.e. successful completion of Defect liability period.

4.23 KICK OFF MEETING

Project Kick Off meeting to be held within 15 days of the placement of LOA and venue of the kick off meeting will be the Corporate Office of WBPDCL.

4.24 CLEAN-UP AND WASTE DISPOSAL

Contractor shall keep the power project site reasonably clean and otherwise free from accumulation of waste materials, rubbish and other debris resulting from performance of the EPC Contractor's obligations. Contractor shall be maintained project site at hygienic standards and shall be kept reasonably free from debris, litter and malodour on or before Final Performance Acceptance. The EPC Contractor shall remove from the power plant site area all petroleum, waste materials, rubbish and other debris, as well as all tools, construction equipment, machinery and surplus material which the Client does not hold title, and shall make the power plant area in a neat, clean and usable condition. The EPC Contractor shall remove, transport and dispose-off hazardous material transported into the power plant site or any subcontractor or created, used or handled as part of contractor's or any subcontractor's construction activities at the power plant site.

The EPC Contractor shall notify Purchaser immediately upon the discovery of presence of any hazardous material on, or the release of hazardous material on or from, the power plant site. All clean up and disposal activities of contractor (including, without limitation, the transportation and disposal of any hazardous materials taken from the power plant site) shall be conducted in accordance with all Applicable Laws and Applicable Permits. All these shall be applicable during the O&M period also in mutatis mutandis.

4.25 CO-ORDINATION WITH STATUTORY BODIES AND OUTSIDE AGENCIES.

The Bidder shall be fully responsible for carrying out all co- ordination and liaison work with Electrical Inspectors, Factory Inspector, and other statutory bodies for implementation of the work including all the licence fees, statutory fees etc. Applications on behalf of the Owner, for submission to the Electrical Inspector and other statutory bodies along with necessary drawings complete in all respects shall be prepared by the Bidder. Approved drawings and certificates

shall be submitted to the Owner/Consultant well ahead of schedule so that the actual commissioning of equipment does not get delayed for want of inspection and approval by the Inspector and other statutory bodies. The actual inspection work by the Electrical Inspector shall be arranged by the Bidder and necessary coordination and liaison work in this regard shall be the responsibility of the Bidder.

Bidder has to comply with all the latest statutory requirements including CEA grid connectivity standards, technical standards, plant and equipment safety standards, MNRE guidelines/OM/Advisory/Clarifications. All equipment, materials and services whether explicitly stated in Technical Specifications or otherwise and that are necessary for the successful commissioning of Solar Plant as per latest statutory regulations/procedures issued by bodies like MNRE, SERC, SLDC, Orders of Govt. of WB and other Ministry etc. shall be deemed to be included in the scope of work of the Contractor.

4.26 PERFORMANCE GUARANTEE (PG) TEST

4.26.1. The final acceptance test as to prove the Performance Guarantee shall be conducted at Site by the Contractor in presence of the Employer. The PG test shall be conducted on the basis of PG test procedure to be submitted by the contractor and approved by WBPDCL. This test shall be binding on both the parties of the Contract to determine compliance of the equipment with the functional guarantee. Any special equipment, instrumentation tools and tackles and manpower, required for the successful completion of the Performance Guarantee Test shall be provided by the Contractor free of cost. The accuracy class of the instrumentation shall be as per the relevant clause of documents.

4.26.2. PG Test Procedure:

i. For PG test demonstration, data collection shall be done by any consecutive three months period which shall be mutually discussed and agreed between WBPDCL and the bidder.

ii. Monthly generation with corresponding Global Horizontal Insolation(GHI) has been given below for the three project sites which shall be considered as reference “Target Generation” for calculation of NMGG and PG Test.

Month	GHI kWhr / (m^2 x Month)	Target Generation (kWh)
Target Generation for 10 MW (AC) at BkTPS Project		
January	122.2	1,178,392

Month	GHI kWhr / (m² x Month)	Target Generation (kWh)
February	137.2	1,300,433
March	182.5	1,686,735
April	189.2	1,722,462
May	183.5	1,674,972
June	149.8	1,378,043
July	137.3	1,273,161
August	143.1	1,329,373
September	135.9	1,266,181
October	142.8	1,337,235
November	124.1	1,173,425
December	111.5	1,069,588
Total yearly Generation	**1759**	**16,390,000**
Target Generation for 7.5MW(AC) at STPS Project		
January	128.5	926,855
February	141.7	999,120
March	187.2	1,279,136
April	197.8	1,321,933
May	190.7	1,279,652
June	154.7	1,056,121
July	134.7	936,166
August	140.6	978,045
September	137.7	959,314
October	147.0	1,029,348
November	128.2	909,098
December	117.7	845,210
Total yearly Generation	**1806.4**	**12,520,000**
Target Generation for 5MW(AC) at SgTPP Project		
January	123.8	5,92,514
February	133.2	6,03,347
March	173.3	7,38,523
April	180.8	7,31,458
May	192.2	7,59,717
June	158.3	6,30,664
July	145.6	5,87,333
August	147.6	6,00,992
September	139.6	5,85,449
October	137.9	6,02,405
November	126.9	5,87,333
December	120.9	5,80,265
Total yearly Generation	**1780.1**	**76,00,000**

iii. The value of the target generation and corresponding Global Horizontal Insolation(GHI) shall be on pro-rata basis in case the PG test does not start from the first day of the month.

iv. In addition to the two pyranometers to be supplied under the scope of work, the contractor shall install one calibrated pyranometers at horizontal plane during PG test at locations mutually agreed by Contractor and PURCHASER. The additional pyranometer shall be free of cost on returnable basis after completion of PG test.

v. Contractor shall also install data logger to store all the pyranometers data during test period. A valid test reports for the installed pyranometers shall be submitted by the Contractor for approval to WBPDCL. The output of both pyranometers mounted on horizontal plane shall be made available at SCADA during the complete PG test duration i.e. three month period.

vi. During the PG test period, the module tilt shall be kept as per approved schedule.

vii. Actual energy exported from the plant shall be recorded for three consecutive month period. For this purpose, the net energy exported after auxiliary consumption shall be recorded and pyranometers reading shall be noted at agreed frequency on daily basis for entire PG test period.

viii. This measured value of energy at step 5. shall be compared with "Target Generation" for the PG test given in Table above(4.27.2.(ii).

ix. Following factors shall be considered for computing the "target Generation"

a) Effect of any meteorological parameters shall not be considered except of solar radiation.

b) Variation of PG on account of Generation loss due to grid outage (or power evacuation system which is not in the scope of the Bidder): The measured global solar radiation of the period of the outage of the power evacuation system shall be excluded to calculate the cumulative global Insolation for the month. Under such situation, the radiation corresponding to the warm-up time of inverter as per data sheet shall also be adjusted to arrive at the cumulative global insolation for the month.

x. If the difference of reading between the two horizontally mounted pyranometers exceeds more than 2%, the test shall be halted and

resumed only after rectification of errors which has led to mismatch. The data of that particular day(s) shall be discarded and test period shall be extended by same numbers of day(s).

xi. If bidder is not able to demonstrate PG test during these three (03) months he will be given one more chance within **15 (Fifteen) days** to demonstrate the PG test after incorporation of suitable corrective measures. In that case the steps for PG test shall be repeated again as above.

xii. The test shall be repeated in case of outage of following equipment for more than 7 days.

a) Converter transformer
b) Power Conditioning Unit
c) SCADA and data logger combined
d) Both pyranometers.

Further, if the plant is not able to achieve the target generation as per the PG procedure during the test period, then an amount of penalty equivalent to a rate of **Rs. 37.60** for per unit of shortfall generation shall be deducted. Penalty for per unit shortfall has been shown in the sample calculation.

xiii. LD limit for Performance shortfall in PG shall be 5% of the Total Project cost plus GST.

A sample description for shortfall calculation in energy generation for period from 16th February to 17th May, for determination of LD for the project of **BkTPS** is given in the next page.

A sample calculation for 10 MW Floating Solar BkTPS project PG Test Report

Month	Global Solar Insolation of the month (kWhr/(m^2x day) (Data provided by WBPDCL)	Target Generation (KWhr) (Data provided by WBPDCL)	No of test days of the month	Reference Solar Insolation	Modified Target Generation of the month kWhr	Measured Global Horizontal Solar Insolation (kWhr/m2)	Corrected Target Generation (kWhr)	Measured Generation at outgoing panel after APC (kWhr)	Shortfall in energy for PG Test (kWhr)
	(a)	**(b)**	**(c)**	**(d)=(a) x(c)/N**	**(e)**	**(f)**	**(g)=(e) x (f)/(d)**	**(h)**	**(g-h)**

				dm					
Feb	137.2	1300433.2	12.0	58.8	557328.5	71.7	679433.3	700589.0	-21155.7
Mar	182.5	1686734.5	31.0	182.5	1686734.5	180.2	1665789.6	1652678.0	13111.6
Apr	189.2	1722462.5	30.0	189.2	1722462.5	190.6	1734783.0	1722127.0	12656.0
May	183.6	1674972.2	17.0	100.7	918533.2	114.4	1043710.2	1044854.0	-1143.8
					48,85,059				3468.1

*** Ndm= Nos of days in the month**
**** Test is assumed to start from 16th February till 17th May**
 # -ve value denotes excess generation

Total Short fall in Energy for the Test Period kwhr **(ΔGTP)**	Modified Target Generation of the month (KWhr) **GTP**	Target yearly generation(kWhr) **(GY)**[1]	Yearly shortfall in generation(kWh) **(ΔGY)** = GY x ΔGTP / GTP	Applicable LD for complete life of plant (in INR) **LD = ΔGY x R**
3468.1	4885059	16390000	(16390000 x 3468)/ 4885059 = 11636	11636 x 37.60= Rs. 4.37 Lakhs

Where LD for per unit shortfall in generation (**R**) = Rs.37.60/kWhr

4.26.3. Methodology for Calculation of penalty during O&M:

LD calculation for shortfall of generation during Operation & Maintenance Period.

Initial Target Gen(kWh)	Reference GoHI (kWh/m2)	Measured Generation (kWh)	Measured GoHI (kWh/m2)	Modified target generation (kWhr)	Shortfall in generation in kWhr:	Penalty due to shortfall in generation(IN Rs)
G1	**H1**	**G2**	**H2**	**Gm=(H2/H1) x G1 x MPDF**	**ΔG= (Gm - G2)**	**LD= ΔG x T**

- Amount of Penalty for per unit of Generation Shortfall(T)=Rs.4.00
- Where, **MPDF**: Module performance degradation factor per year: (1-Year of operation completed x 0.007),
- MPDF is 1 for the 1st year of O&M as year of operation completed is 0. For 2nd year MPDF shall be 0.993 as year of operation completed is 1 and so on.
- If Gm < or = G2, then no penalty for the corresponding O&M period.

Example of LD calculation for shortfall of generation during completion of **2nd year** of Operation & Maintenance Period for **10MW BkTPS Project**.

[1] Clause 4.24.2(ii) for BkTPS

Reference Target Gen(kWh)	Reference GoHI (kWh/m2)	Measured Generation (kWh)	Measured GoHI (kWh/m2)	Modified target generation (kWhr)	Shortfall in generation in kWhr:	Penalty due to shortfall in generation(INRs)
G1	**H1**	**G2**	**H2**	**Gm=(H2/H1) x G1 x MPDF**	**ΔG= (Gm - G2)**	**LD= ΔG x T**
16390000	1759	15690000	1685	15700483	10483	41932

- Reference data have been taken from the clause 4.26.2(ii) of BkTPS project.
- So, MPDF=0.993, as the operation period is 2nd year
- Measured Generation and Measured GoHI have been assumed
- All penalty will be inclusive of GST (if applicable).
- Only philosophy of sample calculation shall be followed.
- Penalty calculation for PG test & NMGG shall be done separately for each plant considering their respective LOA

SECTION –V

TECHNICAL SPECIFICATION

A. GENERAL REQUIREMENTS:

5.1 NAME OF THE WORK:

Setting up 22.5 MW Grid connected Floating Solar Photovoltaic Power Plants on different Water Pond of BkTPS, STPS & SgTPP of WBPDCL, West Bengal.

5.2 SCOPE OF THE WORK:

Design & Engineering, Manufacture / Procurement, Supply, Erection, Testing and Commissioning of 22.5 MW Grid Connected Floating Solar Photovoltaic Power Plant on different Water Ponds of BKTPS, STPS & SgTPP of WBPDCL including warrantee obligation with 05 (Five) years comprehensive Operation and Maintenance.

5.3 PROJECT SCHEDULE:

Zero date: Date of issue of LOA
Total time for competition: Specified in Bid Information Sheet & GCC.3.21 from zero date.

5.4 MODE OF EXECUTION

The entire work shall be executed on Lump sum turnkey basis. Any item(s) not included in the specification / schedule but required for completion of the work shall have to be carried out/supplied without any extra cost. Such works, not listed in the schedule of works but elaborately described to perform or to facilitate particular operation(s) required for completion of the project shall be deemed to have been included in the scope of this work and the bidder shall supply, install the same without any extra cost to WBPDCL.

The work shall be executed in conformity with the relevant standard of Bureau of Indian Specification (or equivalent International Standard), Indian Electricity Rules, 1956 (as amended up to date), Indian Electricity Act 2003 (as amended up to date), BARC/DAE rules, Explosive Act 1948, Petroleum Act 1934, National Building Code and relevant Rules in vogue at the time of execution including operation & maintenance period.

The bidder shall comply with all applicable laws or ordinances, codes, approved standards, rules, and regulations and shall procure all necessary Panchayat / Municipal and Government permits & licenses etc at his own cost.

All sub systems / components such as cables, connectors, Junction boxes, surge protection devices, etc., shall conform to the relevant international and national standards for electrical safety besides that for Quality required for ensuring Expected service life and Weather resistance.

The bidder to provide full time round the clock watches and ward to protect the material from theft and pilferage.

5.5 SITE INSPECTION

The bidder is advised to visit and examine project site and its surroundings and obtain for himself, on his own responsibility, all information that may be necessary for entering into contract. The bidder will assess and satisfy himself as to the adequacy of the local conditions such as approach roads to the site, adequacy of existing culverts/bridges/roads for the expected traffic, water and power supply, nature of ground and sub soil condition, water table level, accommodations required during the contract, climatic conditions, local terrain, availability of labour and construction materials, details of taxes, duties and levies as applicable and any other information required. The cost of visiting the site shall be at the bidder's own expenses.

5.6 FACILITIES AT SITE

The Bidder will be provided with maximum 100 A capacity 415V, 3 Phase, 50 HZ power sources at two different points near each project i.e, for BkTPS, STPS & SgTPP for construction and fabrication purpose. However supply of cable, laying of cable, testing, termination etc. need to be borne by the Bidder at his own cost. In addition, control, metering and distribution inside the solar power plant area for construction shall be made by the bidder at his own cost also. Cost of the construction power will be charged basis with the rate of WBSEDCL.

Water supply shall be arranged from the lake by the contractor for construction and maintenance purpose of floating solar PV power plant. The Bidder shall arrange for pumps and distribution piping to various locations within the solar power plant depends on the requirement.

B. SYSTEM DESCRIPTION:

5.7 LAYOUT:

a) **Capacity of the Plant**: 22500kW (AC) considering BkTPS, STPS & SgTPP.

b) **Capacity of the Pond:**

Approximate pond water surface area and expected estimated power plant capacity:-

BkTPS:

Pond	Capacity (SqM)	Capacity (MW) AC
Raw Water Pond #1	119000	10
Raw Water Pond #2		

STPS:

Pond	Capacity (SqM)	Capacity (MW) AC
Raw Water Pond #2 (Rectangular)	60000	5
Dutta Bandh	32000	2.5

Bidder may change the individual capacity of Solar Plant of Raw Water Pond #2 and Dutta-bandh keeping total capacity i.e. 7.5 MW (AC) of STPS and other NIT conditions are same.

SgTPP:

Pond	Capacity (SqM)	Capacity (MW) AC
Raw Water Pond #5 (Rectangular)	70000	5

c) **Topography of the Site:**

Please refer NIT drawings.

d) **Pond details:**

i. BkTPS:

Total depth of the Raw Water Reservoirs is 4.5 m with a free board of 500mm. Top of Embankment level is 156.5 M. Raw Water Bottom Level is 151.0 M. However Minimum water level is 152.0 Mtr. As this is a reservoir of power plant so generally fixed water level is maintained for whole year but water level may be reduced if scarcity of water from

ii. STPS:

a. **Raw Water Pond 2**: Total depth of the Raw Water Reservoirs is 4.5 m with a free board of 500mm. Top of Embankment level is 156.5 M. Raw

Water Bottom Level is 151.0 M. However Minimum water level is 152.0 Mtr. As this is a reservoir of power plant so generally fixed water level is maintained for whole year but water level may be reduced if scarcity of water from Damodar arises.

b. **Dutta Bandh**: Please refer NIT Drawing

iii. SgTPP:

Total depth of the Raw Water Reservoirs is 7.2 m with a free boat of 750mm. As this is a reservoir of power plant so generally fixed water level is maintained for whole year but water level may be reduced if scarcity of water from Ganges arises. Maximum of water level is 7.5 mtrs and minimum of water level is 1.25 mtrs. Pond boundary is lined earthen embankment.

e) **FLOTATION UNIT FOR MOUNTING OF SOLAR MODULE**

The module mounting structure (flotation structure) shall be installed over an appropriately designed modular and pre-fabricated flotation device with appropriate buoyancy to support the weight of at least one solar panel and one person can easily walk through the walkway of the plant. All the Floating plants (cumulative capacity 22.5 MW) to be installed in the centre of the each pond in a continuous manner.

f) **MOORING AND ANCHORING SYSTEM**

Depending upon the water level variation and prevailing wind speed mooring and Anchoring system will be selected during designing. Water level variation may be considered up to ground level.

(Note: Except STPS Dutta bandh, bottom anchoring is not allowed for other Water ponds of BkTPS, STPS and SgTPP under this NIT.)

g) **WALKWAY**

In any condition, in between two dedicated walkways for personal movement along with equipment, there will be maximum four rows of module of the floating plant. Number of rows of modules may be lower than four in between two dedicated walkways as per design requirement keeping all other NIT conditions of floaters are same.

Other requirements:

- Width of walkway along entire periphery of solar power plant shall be not less than 400 mm on outside / waterside of the plant.
- Width of the walkway from embankment to be Floating plant shall be not less than 800 mm with 1200 mm hand railing arrangement on both the sides of the walkway.
- Cable route shall be separately provided with arrangement of cable dressing and binding. Walkways shall not be used for cable laying.

h) **INVERTERS/POWER CONDITIONING UNIT (PCU)**

The DC power shall be converted to AC by PCU to supply AC loads. Sizing of Inverter of the Plant will be decided during designing & engineering.

i) **SWITCHGEAR CUM CONTROL ROOM**

Number of Switchgear room shall be considered as per this table:

Project Area	Location	Switchgear room
BkTPS	Raw Water Pond 1 & 2 at BkTPS	• Switchgear cum control room near Raw Water Ponds: 1 no. • Relay and Control panel room at switchyard : 1 no. • Inverter Room as per detail engineering.
STPS	Raw Water Pond 2 at STPS	Inverter cum Switchgear room: 1 no.
	Dutta Bandh at STPS	• Switchgear cum control room: 1 no. • Relay and control panel room: 1 no.
SgTPP	Raw Water Pond 5 at SgTPP	• Inverter Room (Please refer NIT drawing). • Control Room adjacent to Existing Solar Main Control Room near Raw Water Pond #3.

This Switchgear cum control room building shall be two parts, one part for Equipment Room for housing Switchgear, electrical equipment/panels and other part for Control Room for Control operation, office cum meeting or conference room and equipment room. Both control room and conference room require AC environment for the operation & maintenance of Solar Plant. Capacity of the AC system shall be as per design of the room. SCADA panel, UPS and UPS DB etc. shall be placed inside the Control room.

Outdoor type oil filled inverter transformers (400 V/33kV) to be placed near to the Inverter room.

In Equipment Room at least the following electrical equipment shall be present-

i. HT & LT switchgear

ii. AC Distribution Panel, LP,

iii. 220 V DC Battery and Battery Charger, DCDB;

iv. UPS Battery and

v. Other equipment which are required for better operation of the Plant.

Equipment Room to be designed in such a way that HT/LT Switchgear could accommodate the future extension.

Space provision for additional one number equivalent extension panel for future project to be considered on both the sides of each 33 kV Indoor HT panel for each project.

LT switchgear shall have atleast 2.5 mtr. additional space to be kept apart from its original size for future use. Details are mentioned elsewhere in the Specification and tender drawing.

In the Control Room at least the following electrical equipment and furniture should be present-

i. Computer table and chair with capacity of at last three persons.

ii. One Meeting or conference room having large table for minimum eight persons.

iii. Engineering Work Station

iv. UPS

v. DCS / PLC

vi. Others equipment which requires AC environment

j) **GRID CONNECTIVITY**:

Power shall be evacuated at following location:

BkTPS	33 kV spare bay at BkTPS existing switchyard. All equipment's of 33 kV bay need to be installed under this package. Cable from 33 kV Indoor switchgear shall also to be laid for evacuation of Solar Power. a) 33 kV Isolator & VCB under this project at the Existing

	Switchyard will be controlled from existing Grid Control Room (GCR). Necessary retrofitting shall have to be done at existing Control and Relay Panel installed at GCR. Bidder has to change Numerical relay and necessary all the wiring as per scheme shown in the Amendment. Make of Numerical relay shall be from SIEMENS-SIPROTEC / ABB REF/ALSTOM-MICOM considering other NIT conditions. b) Status contact of 33 kV Isolators & VCB shall be given to the Solar Control Room near BkTPS Raw Water pond. c) LT cables must be laid through existing race-way arrangement wherever existing cable trestle is available from • Solar Switchgear cum control room to Switchyard evacuation bay and • from existing Grid Control Room to Evacuation Bay. Rest of cable supply and laying shall be as per NIT conditions. d) Additional one no. 415 V AC source of 250A capacity shall be provided at nearby AC MCC of 500 Mrs distance. Bidder shall arrange a additional 250 A incoming MCCB feeder at LT Switchgear. Supply, laying, termination etc. of this LT cable from this feeder to LT Switchboard in the scope of the contractor.
STPS	Bidder shall install one no. Inverter room along with necessary Inverters, ACDB, DCDB, lighting panels etc. Power shall be evacuated from the 5.5 MVA Inverter Transformer of this project and Power is to be evacuated from a new 33 kV indoor switchgear which to be placed at in the new floating solar plant control room. Power shall be ultimately evacuated through STPS 33 kV Bhojudih switchyard located approximately 1200m (approx) from the project site. Supply, Installation and readiness of new 33 kV extension bay along with one 12.5 MVA, 132/33 kV Transformer etc. are under bidders scope.
	Dutta Bandh: WBSEDCL 33 kV switchyard around 500 mtrs from Pond. Cable from 33 kV Indoor switchgear shall also to

	be laid for evacuation of Solar Power / any suitable location shown by STPS authority.
SgTPP	33 kV Switchgear panel at existing 33 kV Indoor switchgear of Main Switchgear Cum control room near Raw Water Pond 3. Cable to be laid from the New RMU panel to the 33 kV Swichgear panel.

Note: *Supply, laying, termination, charging etc. of 33/33 kV cable is also under the scope of the Package.*

k) **THREE WINDING TRANSFORMER**

Two/Three winding outdoor type oil filled step up transformer (0.4kV/33kV) for these ponds shall be connected to the outputs of one/two inverters as input and the 33kV HV output sides will be connected to the new 33kV bus of HT switchgear present in the equipment room of Floating Solar Inverter cum Control room through Protection system, VCB etc.

l) **STATION AUXILIARY TRANSFORMER(SAT)**

33kV/415V outdoor Oil type Station transformer having minimum capacities i.r.o. BkTPS (250 KV two numbers), STPS (400 KVA for 1 no.) has to be considered for light and other auxiliary purposes. HT side of the transformer shall be connected to the 33 kV Bus through a VCB and LT side shall be terminated to the Station Service Board (SSB)/415 V LT Switchgear.

m) **HT SWITCHGEAR**

Following HT switchgear of minimum capacity to be supplied and installed at the respective projects:

Location	33 kV Indoor feeder
BkTPS:	• Incomer feeder from Inverter Transformers: As per detail engineering; • One Incomer feeder spare of equivalent capacity. • Outgoing feeder 15 MW (AC) capacity : 1 no. • Outgoing feeder for SAT : 2 nos + 1 Spare. • Line PT, Bus PT : 1no. each
STPS: RW Pond 2	• Incomer feeder from Inverter Transformers: As per detail engineering; • One Incomer feeder spare of equivalent capacity. • Outgoing feeder : 1 no. • Outgoing feeder for SAT : 2 nos + 1 Spare. Power transmission/evacuation capacity should be minimum 12.5 MW AC plus 10% higher margin, so bidder has to design the system accordingly. Outgoing evacuation cable should have 12.5 MVA plus 10% design margin.

	Incomer power connectivity to the existing 33kV buses should be balanced and protected. Spare feeder should be equipped with all existing facility like protection, control, and indication etc of active breaker. Other details are described in the relevant section of 33 kV Switchgear.
Dutta Bandh:	• Incomer feeder from Inverter Transformers: As per detail engineering; • One Incomer feeder spare of equivalent capacity. • Outgoing feeder : 1 no. for Power evacuation and 1 no for SAT • Line PT, Bus PT : 1no. each
SgTPP:	As per Tender drawing

Other details are described in the relevant section of 33 kV Switchgear and tender drawing.

n) **LT SWITCHGEAR:**

Each LT Switchgear and ACDB should have two additional MCCB's with 150 A capacity for future use.

(A) For STPS:

Raw Water Pond: One number indoor type 415V LT switchgear has been considered for supply of 415 V (3 phases, 1 neutral and single phase for lighting etc). The said LT bus has to be made with proper protection system where Incomer shall be ACB of similar rating. One spare out going feeder of capacity 100A MCCB also to be considered under this LT Board. All ACB Control Voltage shall be 220 V DC.

Bidder shall consider following Air Circuit Breaker feeders:

Sl. No	Description	Quantity
1.	Incomer feeder	Two (02 nos.) (630 A capacity each)
2.	Bus coupler	One (01 no.) (630 A capacity)
3.	160 kW Motor feeder	Two (02 nos.)

Two Incomers and one Bus-coupler with a castle key interlock and all ACB shall be equipped with numerical relay for protection.

Dutta Bandh:

Indoor type 415V LT ACDB has been considered for supply of 415 V (3 phases, 1 neutral and single phase for lighting etc) for following locations. The said LT bus has to be made with proper protection system where Incomer shall be ACB of similar rating. Control Voltage 220 V DC.

For detail please refer NIT **clause no. 5.13.9.**

For BkTPP & SgTPP:

Indoor type 415V LT switchgear has been considered for supply of 415 V (3 phases, 1 neutral and single phase for lighting etc) for following locations. The said LT bus has to be made with proper protection system where Incomer shall be ACB of similar rating. Control Voltage 220 V DC.

For detail please refer NIT **clause no. 5.13.9.**

(**Note:**

Bidder shall arrange all the following Auxiliary supplies to complete the project from their scope, if anything is not explicitly mentioned in the tender document:

i) Redundant 415 V AC;

ii) Redundant 220 V DC;

iii) Redundant UPS;)

c. TECHNICAL SPECIFICATION (CIVIL)

5.8 TECHNICAL SPECIFICATION FOR CIVIL JOB

5.8.1 MODULE MOUNTING STRUCTURE

5.8.1.1 SCOPE

This section covers activities related to Design, Manufacturing, Testing, Supply, Insurance, Transportation and Delivery at project site, Storage, Erection, testing of module mounting structure and anchoring the system. The module mounting structure shall be installed over an appropriately designed modular and pre-fabricated flotation device with appropriate buoyancy to support the weight of at least one solar panel and one person per Mounting Structure. Total designing and engineering for floating and anchoring technology to be provided by the module mounting structure manufacturer.

5.8.1.2 STANDARD:

The PV module mounting structure must conform to the latest edition of any of the following IEC / equivalent BIS Standards for floater design qualification and type approval:

SL NO	Standards	Description
1.	ASTM D1693	Test for Environmental Stress Cracking of HDPE
2.	ISO16770	Stress cracking resistance of HDPE

3.	IS 15410:2003	Test for drinking water compatibility, Material safe for drinking water
4.	RoHS directive 2002/ 95/EC	Test for Restriction of Hazardous Substances
5.	ASTM D5397	Standard Test Method for Evaluation of Stress Crack Resistance
6.	IS800:1984	Code of practice for general construction of steel
7.	IS875: Part 2	Code of practice for Buildings & structure
	IS875: Part-3	Code of practice for Buildings & structures-Wind Loads
8.	IS1893:2002	Criteria for earthquake resistant design of structures-General Provisions and buildings
9.	IS3043:1987	Grounding of mounting structures
10.	IS 4759	Hot dip Zinc coating on structural steel and other allied products.
11.	IS4736	Hot dip Zinc coating on mild steel tubes
12.	IS2062	Hot Rolled Medium and High Tensile structure steel.
13.	ASTM D790, ISO 178	Standard Test methods for Flexural properties of Unreinforced and Reinforced Plastics and Electrical Insulating Materials
14.	ASTM D638, ISO 527	Standard test method for Tensile Properties of Plastics
15.	ASTM D695, ISO 604	Standard test method for compressive strength properties of plastics
16.	ISO16770	Full Notch Creep Test (FNCT)
17.	ASTM D2565, ISO 4892-2	Standard practice for Xenon-arc exposure of plastic intended for outdoor applications
18.	ASTM D4329, ISO 4892-3	Standard practice for fluorescent ultraviolet (UV) lamp apparatus exposure of plastics
19.	ASTM G7/G7M-11	Standard practice for atmospheric environmental exposure testing of non-metallic

5.8.1.3 TECHNICAL REQUIREMENTS

- **FLOTATION DEVICE:**

a) The module structure design shall be appropriate and innovative. It must follow the existing water profile.

b) The flotation unit shall be prefabricated and designed for simple on-site installation. There shall be minimum requirement of welding, masonry or use of complex machinery at the installation site. The floatation unit shall be modular in nature to facilitate the ease of assembly / disassembling and provision to be scaled up. Each module / combination of maximum two modules should support at least one solar panel. All modules should be standardized and independently created. Walk way should be provided to access the flotation device.

c) The flotation device should be manufactured from HDPE with UV stabilizer. The design of the floatation device should have satisfactory rigidity, flexural strength (ASTM D790, ISO 178), tensile strength (ASTM D638,ISO 527) and compressive strength (ASTM D695,ISO 604) while loaded with maximum load under extreme environmental conditions. The grade of thermoplastic used should be tested under extreme weather conditions if sunlight, UV, heat, air, and water (ASTM D2565, ASTM D4329, ASTMG7/G7M-11), good environmental stress crack resistance and a combination of hardness and impact strength (ASTM D5397, ASTM D1693). The thermoplastic used should be safe for use when in contact with water. (Above points to be confirmed by Manufacturer's data sheet and test certificates).

d) Stability of floating device should be maintained. No colour variation after UV exposure equivalent to 10 years under 150 kilo-Langley / Year irradiation. Third party testing or witness is required by purchaser.

e) The flotation device shall have minimum strength at ambient temperature of the site location or minimum range of (+) 50 to (-) 10 Deg C, while it shall be designed to have safety factor of minimum 1.15 on extreme conditions.

f) The flotation device should be passed the Full notch creep test (ISO16770).

g) On the date of bid opening, the floater vendor should have proven experience and the agency should have supplied floater to any project in MW range, which is working successfully at least for a period of one (01) year under Govt./Quasi Govt./Reputed Private Organization (Listed companies).

h) The bidder has to ensure that the supplier of floater should not be more than one.

i) PV fixation system shall be of proven design and subjected to Mechanical test to withstand unit failure conditions under static and fatigue conditions for wind speeds to withstand the maximum wind speed of the area.

j) The materials used shall be halogen, silicon free conforming to RoHS directive 2002/95/EC. (Same to be confirmed by Manufacturer's data sheet and test certificates)

k) The floatation device should be chemically resistant to acid, lye, petrol and mineral oil and partially resistant to benzene.

l) The floatation device should pass the different HDPE material test from Central Institute of Plastics Engineering & Technology (CIPET) or reputed labs from India with may be inspected by the purchaser.

m) The floatation device used should be safe for use when in contact with drinking water and meet requirements stipulated in standard IS 15410:2003.

n) The min. thickness of thermoplastic used for floatation device should be 3 mm.

o) The floatation device, when installed in the raw water reservoir, should not restrict the process of gas exchange across the air water interface. More specifically, the water plane area (WPA) does not allow the transmission of sunlight into the water and the transfer oxygen across the air-water interface. In order to facilitate this, the design of the floatation device should be such that appropriate voids, greater than at least 30% of all area covered by the floatation device.

p) The floatation device should be designed such that it arrests evaporation and facilitates in evaporation loss mitigation. Vendor should provide appropriate cover by flotation device and solar panel and total coverage of water body should not more than 70% of the Raw Water Pond and water body. Appropriate vapour escape vents should be provided for each floatation device and solar panel assembly for the purpose of maintaining BOD of the water body.

q) The design of the flotation device should incorporate appropriately sized walking platform for regular maintenance and inspection. The row alleys platform should be for both column and row alleys.

r) The design of the floating device should incorporate appropriately sized walking platform for regular maintenance and inspection. The walking platform should have a continuous uninterrupted surface with the minimum width of at least 400 mm excluding cable laying arrangement. Walkable floater pathway shall be provided after consecutive two strings of modules. The complete floating system shall have at least 400 mm walking corridor all along the periphery comprising of module floaters and / or walkway floater to prevent water splash.

s) In order to increase longevity and prevent unexpected loss of buoyancy, the floating unit shall have a minimum material thickness of 3mm, with moisture retention of less than 5%. (Detailed buoyancy calculation to be submitted along with the drawings at the time of drawing approval).

t) Float system should be designed to withstand the maximum wind speed (200km/hr) as per IS 875: Part-3-2015 and shall be able to withstand the weight of one O&M personal of 80Kg apart from carrying tools, equipment like Module, SMB, DC cables, module cleaning machine etc.

u) Flexible mooring system shall be designed to keep the platform position to adopt waves, wind and water level variation.

v) The array structure should be so designed that it will occupy minimum space without sacrificing the output from SPV panels.

w) In case, Switch Monitoring Board (SMB) mounted on floaters, bidder to take into consideration the load of SMB during design of floaters and suitable supporting arrangement for mounting the SMB of floaters.

x) The floatation modules once assembled together should form an integrated structure and relative alignment of the flotation modules subsequent to complete installation (installing module mounting structure and solar PV modules) shall not misalign the solar panels and adversely affect their power generation capability.

y) In order to address the proper handling of panel mounting system during the severe weather conditions, floating vendor should have proper expansion capability for panel mounting system.

z) The floatation device should be re-processable and recyclable at the end of its useful life.

aa) Each floatation module should have its appropriate drainage facility such that there is no water logging on the floating module.

bb) Big wind tunnel test for the structures in all wind directions (real scale, real angle) for at least 2x4 configurations to be done.

However, (on physical prototype or mathematical) study of the individual unit & entire arrangement including Module, Module supporting structure, Floaters, mooring & anchoring system etc. to be conducted from a reputed / approved institute (like IIT's). The testing institute should have experience of conducting similar study to establish serviceability & stability of the floating system under cyclonic wind (upto 200 KMPH) from any direction.

cc) The clearance between lowest part of the module structure and the water level shall normally not be more than 250mm.

dd) The module alignment and tilt angle, in case of floating SPV power plant, shall be between 1 degree to 18 degrees. It shall be mounted facing south and tilted to an angle within the range of 1 degree to 18 degrees for optimum performance and appropriate wind resistance that must be mentioned in engineering drawing for approval of WBPDCL with documentary proof.

ee) Mountability of solar panel by the floatation device should be maximum 2 panels per unit.

ff) The flotation device should balance the thermal expansion so that PV panel not stretched by thermal expansion.

gg) Min. guaranteed life of the floatation device/ unit floater should be 15 years.

hh) The design of complete system, including CFD modeling, comprising of Floating unit, MMS and anchoring and mooring system, shall be verified by suitable third party NABL accredited agency/ reputed institutions like IITs and submitted for employer's approval.

ii) The flotation device should be manufactured locally (in India) only, to ensure safe work practice, genuine process is followed & transparent quality checks by WBPDCL at manufacturing premises any time.

jj) Side /corner Mooring and anchoring may be done from pond embankment subject to approval during detail engineering and proven design of the Floater OEM.

❖ **MODULE MOUNTING STRUCTURE:**

a) The array structure shall be so design that it will occupy minimum space without sacrificing the output from SPV panels.

b) The structure shall be designed to allow easy replacement of any module by authorized personnel and shall be in line with the site requirements.

c) The array structure for metallic structure (if used) shall be made of anodized aluminium (aluminium alloys) / SS 304 or SS better grade, of suitable thickness size. (Same to be confirmed by suitable test report and material composition report) having sufficient strength and suitable size to mount/ support all the PV panel/ accessories/ equipment required for the plant. (To be supported by structural analysis report). All design shall be submitted during drawing approval with suitable test reports.

d) The complete support structure, design shall normally be designed to withstand wind speed up to 200km/hr (to be confirmed by suitable third party test report).

e) The complete plant is to be designed with proper anchorage system so as to withstand the wind pressure at maximum 200km/hr.

f) In general bolts, nuts, shims and other hardwires should be Zinc plated. Fasteners visible outside shall be of stainless steel SS 304. The generally applicable engineering principle will be the fasteners shall be equal to or of

greater corrosion resistance than the most corrosion resistance metals being fastened.

g) Dedicated floating approach walkways to be provided from the end of the water body to each block of the plant with suitable railing on both sides. The block size of the floating system depends on the array layout optimization. The same shall be finalized during detailed engineering.

❖ **ANCHORING AND MOORING SYSTEM:**

The water level variation and prevailing wind speed are the primary safety consideration, to be taken into account, while designing the plant such that the plant has no impact on the reservoir. The mooring system thus needs to be designed that it not only restricts the lateral movement of the proposed plant but also accommodates the water level variability. In addition the mooring system should also have minimal impact on the overall ecosystem of the reservoir.

a) The minimum designed life of the entire floater assembly including floater unit and Anchoring mooring system should be 25 years. However, this design shall be checked and approved from reputed and experienced Government approved Institute / lab. like Indian Institute of Technology.

b) The materials used in the anchoring system shall not contaminate the water of or affect the aquatic life.

c) The design of mooring system shall permit minimal lateral movement of the plant in case of maximum wind loads (As per IS 875-3). Anchoring design report for the project showing that the system could support the maximum wind load on site shall be submitted to employer.

d) Placement of Plant: The placement of the plant in the water body shall be decided during detail engineering after conducting bathymetric survey, topographical survey, hydro graphic and hydrological studies and geo-technical assessment of the site.

e) Prevailing wind load: The mooring system should be designed for worst case scenario; for a wind load of 200km/hr. The design of the mooring should prevent the lateral movement of the plant in case of maximum wind loads.

f) Water variability: The mooring system should accommodate fluctuations in water level. Further the orientation of the plant needs to be maintained; hence fluctuations in water level should not result in lateral movement of the plant.

g) The mooring system should minimize its impact on the reservoir and thus as far as possible pilings or movement of mooring system of the reservoir bed should be avoided.

h) Suitable wind breakers should be provided.

5.8.1.4 PERFORMANCE WARRANTY

The manufacturer should warrant the Module Mounting Structure and Anchoring system to be free from the defects and/or failures specified below for a period not less than **fifteen (15)** years from the date of completion of successful trial run of the project (i.e. from EPC Contractor).

i. Defects and/or failures due to manufacturing
ii. Defects and/or failures due to quality of materials
iii. Non conformity to specifications due to faulty manufacturing and/or inspection processes.

If the Solar Module Mounting Structure and Anchoring system fails to conform to this warranty, the manufacturer will repair or replace the Solar Module Mounting Structure and Anchoring system, at the Purchaser's sole option. The contractor shall be responsible to contact with the supplier if any of the above mentioned cases occurred.

5.8.1.5 APPROVAL

- Successful Bidder must take prior approval from WBPDCL before placement of their internal Order for Floaters. WBPDCL's acceptance of such makes shall be based on its prior performance and relevant credentials (as stated in NIT-Sec :V, clause no: 5.8.1.3)

- Design, drawings, specifications of all components with material selected & installation details shall also be included with Detailed Design Report.

- Joint inspections and testing will be done by WBPDCL and the authorized representatives of the contractor at the manufacturer's workshop on regular basis for quality assurance and testing. Acceptance Tests as per relevant Standard shall be carried out at the module Mounting Structure's workshop.
- Approval of the Engineer in charge should be taken before execution of the work at site.

The contractor shall deliver the product to the site only after receipt of such approval against their prayer in writing from WBPDCL.

5.9 SWITCHGEAR CUM CONTROL BUILDING:

New Switchgear cum Control Room building is required to be constructed for housing the electrical equipment/ panel, HT LT Switchgears and office cum store room and other daily requirements, Local Lighting panel, Local UPS cum-UPS DB, NI-Cd battery, Fire Fighting System, 220 V DC battery, CCTV etc other daily requirements for the operation & maintenance of Solar Photovoltaic Power Plant. The building shall be constructed with conventional RCC framed structure with brick partition walls for equipment and operations room. Equipment room shall be designed as per the OEM recommendations to ensure desired life of equipment. Bidder shall furnish the drawing of the proposed buildings to the Employer for approval, prior to construction. The construction of the same shall be as under-

5.9.1 EQUIPMENT ROOM LAYOUT:

Flexibility shall be kept for handling of equipment without obstruction both during erection and maintenance. Adequate handling facilities, space, door/ rolling shutter of adequate width and height shall be provided for the purpose. The followings specification shall be followed for designing the Equipment cum Control Building:

a) Minimum clearance between two switchgear panels, facing each other shall be maintained as 2200 mm. These distances shall be maintained for all other panels located inside the room.

b) 33 kV Switchgear Front side and rear side shall be with minimum 3 mtrs and 2 mtrs gap from Wall/Panel. Each 33 kV Indoor switchgear shall be kept with a minimum one additional space to install one breaker on either side other than the specified requirement.

c) Clearance from any obstruction like column, wall, and vertical raceway on back side of switchgears shall be maintained as 1200mm (minimum) for single front panel / 1500mm (minimum) for double front panel and shall also comply with manufacture's standard. Minimum Space between the sides of two switchgears or between any two panels or between switchgear and the wall shall be 1200 mm. Where access is not envisaged, clearance shall be 200 mm.

d) All electrical room shall be provided with 2 doors in addition to the shutters provided for handling transformer, switchgear, panels etc.

e) Switchgear room/MCC/Control room shall be pressurized above the atmospheric pressure to prevent ingress of dust.

f) Switchgear/MCC room shall have a minimum clear height of 4 m above floor level. All electrical equipment shall be located above the highest flood level. Cable cellar room shall be located above around to prevent ingress of water inside.

g) Control room shall be separated from switchgear /MCC room.

h) Inverters shall be placed inside RCC covered (RCC roof) / PEB room with a clear height of 4 mtrs. Inverter shall have **open air ventilation / forced ventilation** (as per the OEM's requirements) where air circulation shall be done through large windows with MS grill arrangement. Rest of the cover area (other than equipment foundation/ cable trenches) should be paved with RCC using nominal reinforcement.

i) Clearance from inverter to wall / grill /column shall be minimum 1500 mm.

j) Existing Control room floor level shall be lifted and matching with the elevated floor level so that 33 kV breaker truck shall be removed smoothly.

5.9.2 ROOFING

The roof of the building shall be insulated and waterproofing shall be done as per relevant IS standard.

5.9.3 PLINTH PROTECTION

Plinth protection 1000mm wide minimum shall be provided around all the buildings including PEB, sloped towards side drains.

Plinth Protection shall be 75mm mm thick PCC 1:3:6 (1cement : 3 coarse sand : 6 graded stone aggregate 20 mm nominal size) laid over well compacted 75mm well grades brick ballast base.

5.9.4 WHITE WASHING & COLOUR WASHING

White washing and colour washing work shall be conforming to IS 6278.

- Internal walls - Acrylic distempering as per IS 427.
- External walls – Heat reflective synthetic enamel as per IS 428.

For cement painting IS 5410 shall be followed.

For painting of steel doors, ventilators IS 2338, IS 1477 (Part I & II) shall be followed.

5.9.5 ROLLING SHUTTERS

Rolling shutters made of cold rolled strips shall conforming to IS 4030 with approved gauge thickness shall be provided with all fixtures, accessories, painting all etc. complete.

5.9.6 RCC WORKS

All RCC works shall be as per IS 456 and the materials used viz. Cement, reinforcement steel etc. shall be as per relevant standards.

5.9.7 BRICK WORKS

Brick works in cement mortar (CM) 1:6 for 9" thick and 4½" thick wall respectively. All brick works shall be using 1st class bricks of approved quality as per IS 3102.

5.9.8 DOORS & WINDOWS

Steel framed doors, Windows and ventilators shall conform to IS – 1081 with necessary glass panels including of all fixtures and painting etc. complete. Doors and windows shall be made of aluminum sections. All sections shall be 20 microns anodized. Sections of door frame and window frame shall be adopted as per industrial standards. Door shutters shall be made of aluminum sections and combination of compact sheet and clear float/ wired glass. The control room shall require a number of windows/ louvers to provide ventilation/ fresh air circulations.

5.9.9 PLASTERING

Plastering in cement mortar 1:5, 1:6 and 1:3 shall be applied to all internal, external walls and ceiling of slab respectively as per IS 1542.

5.9.10 FLOORING

Flooring shall be of cement flooring in concrete mix 1:2:4 using 10 mm aggregates as per IS 2571. Flooring for control room, equipment room and other places, shall be of vitrified tiles 8 mm. For toilet area, the floor shall be of ceramic tiles 8 mm thicknesses. The floor finishing must include skirting up to a suitable height. The wall tiles, if proposed, shall be glazed tiles of 6 mm thickness and provided up to lintel level. Flooring before the Indoor HT switchgear should be matched with the panel base in such a way that all the VCB trucks shall be racked outside smoothly.

5.9.11 WATER SUPPLY

GI pipes of Medium quality conforming to IS 1239 (Part I) and IS 1795 for Mild Steel pipes shall be used for all water supply and plumbing works.

5.9.12 PLUMBING AND SANITARY

Sanitary fittings, which include water closet (EWC/IWC), wash basins, sink, urinal fitting including flushing tank, and necessary plumbing lines shall be provided for office cum stores building and Security house.

5.9.13 ELECTRIFICATION OF BUILDING

Electrification of buildings shall be carried out as per IS 732 and other relevant standards. The lighting design of the buildings shall be carried out as per IS 3646. The building shall be provided with adequate quantity of light fittings, 5A/15A 1 phase sockets; Supply air fans, exhaust fans etc., controlled by required ratings of MCCBs and DBs. Operation room cum PLC room must be fitted with suitably sized 100 % standby HVAC system. Battery room also have 100% redundant exhaust fans. Battery room shall be provided with non-corrosive paints, light fitting, wiring and exhaust fans with acid proof tiles. It is encouraged that bidder shall use the latest energy efficient equipment for the electrification and illumination.

5.9.14 TOILET

Toilet shall be designed for 5 persons; and constructed with following finish

- Floor: Vitrified tiles/ ceramic tiles
- Door window: made out of aluminium sections, 6mm float glass
- Ventilators: Mechanical exhaust facility
- Plumbing fixtures: Repute make
- Sanitary ware: Repute make
- EWC: 390 mm high with health facet, toilet paper roll holder and all fittings
- Urinal (430 x 260 x 350 mm size) with all fittings.
- Wash basin (550 x 400 mm) with all fittings.
- Bathroom mirror (600 x 450 x 6 mm thick) hard board backing
- CP brass towel rail (600 x 20 mm) with C.P. brass brackets
- Soap holder and liquid soap dispenser.
- GI pipes (B class) of reputed makes
- Overhead water tank equivalent of 700 litre capacity

5.9.15 Drainage for Toilets:

Drainage pipes shall be of PVC (6 kg/cm2) Supreme, Prince or equivalent make. Gully trap, inspection chambers, septic tank for 5 person and soak well to be constructed for abovementioned requirement.

5.9.16 WATER SUPPLY & CLEANING

Suitable arrangement of water shall be ensured to cater the day-to-day requirement of drinking water and other use of Control Room.

5.9.17 CIVIL WORK

i) Land development, area grading etc. including removal of demolished sections are under bidders scope i.r.o installation of Inverter Room, Transformer Yard, Outdoor Switchyard near raw water pond#5 and control room near raw water pond#3.

ii) The bidder is responsible for making the site ready and easily approachable by clearing of bushes, etc., leveling of ground (as required) etc. for commencing the project. It shall be ensured that the land grading and leveling is done properly to ensure for free flow of surface run-off naturally and the grade levels shall be fixed with respect to high flood level at site, drainage pattern and system requirements. If the land pocket needs any filling, it is to be ensured that the filled earth must be well compacted as per the relevant IS standards and to be done in layers not more than 150mm of compacted thickness compaction up to 95% (proctor density). In case the filled earth is brought out from outside the plant, the bidder shall arrange the same as per the direction of WBPDCL site authority.

iii) On the other hand, surplus earth, if any, must be disposed of properly at the location shown by the WBPDCL site representative. Bidder shall properly dress & level the disposed area after filling. Necessary safety precautions to be ensured by the bidder.

The area at and around all buildings/ plinth for installations (like Inverter Control Room, Control Room etc.), transformer yard and switch-yard shall be uniformly leveled at suitable RL (i.r.o. FGL) to be finalized considering topography and HFL at site.

Name of Plant	HFL above MSL	FGL above MSL
BKTPS	67.25	71.5
STPS	151.5	160.0
SgTPP	22.8	34.20

iv) The minimum plinth level of all buildings/ open installations shall be 600mm above FGL. Top of transformer foundation pedestal shall be min, 500mm above the FGL.

v) A detailed drawing for site leveling and grading of aforesaid location shall be submitted by the Bidder before civil erection.

vi) Gravels (150 mm thick), in which 100 mm gravel of 40 dia. and 50 mm gravel of 20 dia. shall be laid in 33 KV Switchyard as required over lean concrete.

All civil works shall conform to the latest Indian standards, codes etc as where applicable or to equivalent applicable international standards approved by the engineer-in-charge. Civil works include but not limited to the following items whichever necessary for implementation of the Solar PV Project.

5.10 PV ARRAY O&M MAINTENANCE ARRANGEMENT

Equipment which are required for day to day cleaning of the solar panels and for O&M of the solar plant shall be in the scope of the bidders and accordingly the bidder has to provide all the necessary equipment, accessories, tool & tackles, boat, piping arrangement which as may be required for the same. Bidder shall have to provide a paddle boat and motor boat for each pond for O&M activities with carrying capacity of minimum four persons. However contractor shall arrange sufficient number of boats for installation purpose of floaters separately for each pond.

5.11 APPROCH ROAD FOR SOLAR POWER PLANT

Suitable approach road from Control Building to Solar Plant to carry safe and easy transportation of equipment and material at the project site shall be made. The road should provide easy and fast approach to each location of the plant. Roads are to be constructed with sufficient width (minimum 3.75m) followed by 0.5m well compacted shoulders on each side. The road must be well compacted as per the relevant IS standards and MORTH updated till date. All peripheral roads and pathways from central road to Inverter room road shall be Concrete road. Also, all cable crossings and other crossings shall be provided with GI/ Hume pipes. Bidder please provides concrete road upto each entrance and exists of the Inverter cum control room building.

Bidder shall have to construct suitable approach step / ramp from embankment to inverter cum control room along with road connectivity with 3mtrs wide concrete road.

5.12 WATCHMEN / SECURITY CABIN

Contractor shall provide prefabricated Watchman's portable cabin at each corner of Ponds and strategic locations surrounding of the plant. The Minimum size of watchmen's (Security Cabin) cabin is 1.2 metre x 1.8 metre size and height of 2.4m with appropriate roof at the top. Location of the watch Cabin (Security Cabin) will be as directed by the Purchaser. The Prefabricated Security Cabin of size 3 metre x 3 metre at the main entrance gate shall be designed and constructed by the Successful Bidder keeping in view the safety and security of the power plant. All Watchman /Security cabins shall having separate light, fan and 5 pin plug with individual switches.

5.13 TRANSFORMER YARD

Transformer Yard shall be constructed adjacent to each Inverter Cum control Room near each pond for installation of Inverter Transformer. Transformer Yard is including transformer foundations, Fire walls, transformer oil collection drain pit (if applicable) and intermediate pits as required, fencing, cable trench etc. Transformer Yard will be paved with reinforced cement concrete. Switchyard area shall be filled with 150 mm thick layer of 20 mm to 40 mm size gravel / ballast over a layer of 100 mm thick lean concrete (M10).

5.14 MODULE WASHING SYSTEM:

a) The Contractor shall design and install the effective module cleaning system.

b) The Bidder shall do the cleaning the photovoltaic modules at least once in every week in order to operate the plant at its guaranteed plant performance i.e. NMGG stipulation. All necessary arrangement for wet cleaning of the solar panels shall be in the scope of the bidders and accordingly the agency has to provide suitable portable manual operated cleaning equipment with all the necessary accessories, tool & tackles, pumps, tankers, small water storage, piping arrangement etc. which as may be required for the same.

c) PV module cleaning purpose shall be of potable quality and fit for cleaning the modules with TDS generally not more than 75 PPM. However, water with TDS more than 200 PPM shall not be used directly for module cleaning without suitable treatment to control the TDS within acceptable limits. The water must be free from any grit and any physical contaminants that could damage the panel surface. Module cleaning procedure and pressure requirement at discharge point shall be as per the recommendation of PV module manufacturer. However, discharge pressure at outlet shall not be less than 50 kg/cm^2 (5 MPa) or as per the OEM written recommendation of Module.

At least two complete sets of following equipment shall be provided for each pond of BkTPS, STPS & SgTPP:

i) Portable Pumps.

ii) Portable hand driven equipment with accessories for module cleaning system.

iii) Sufficient length of flexible hose pipes and accessories, so that cleaning can be done considering entire stretch of the plant.

- **Additional requirement:**

- The peripheral road around the inverter cum control room will be of minimum 3.75 m in width and 1 M shoulder on each side. The road will of rigid pavement. (Concrete road with reinforcement).
- The cable crossing across the embankment will be of reinforced concrete box culvert with sufficient spacing as per the electrical requirements.
- The cable will be on cable tray when laid over the reservoir embankment slope.
- Cable from toe of embankment to inverter room will be on pedestal/ rack.
- All road crossing for DC cable will be on reinforced concrete box culvert with sufficient spacing from electrical and serviceability considerations. However for HT cable, road boaring shall be used with GI pipes with a minimum thickness of 5mm & depth of 1 mtrs from the top of Road.
- If, any of the existing structure is damaged or required to be dismantled for convenience of the erection, the same has to mend good as per the original.
- Existing drainage system must have to be maintained. If, any cable crossing is required to cross over the existing toe drain of the reservoir, the same has to be properly blocked with RCC wall and drainage to be restored to the original.

D. TECHNICAL SPECIFICATION FOR ELECTRICAL

5.15 SPECIFICATIONS FOR SUPPLY MATERIAL

5.15.1 PV MODULE:

5.15.1.1 SCOPE

This section covers activities related to design, manufacturing, testing at works, supply, insurance, transportation and delivery at Project site, storage, erection, testing, commissioning of solar modules as detailed hereunder.

a. Solar Mono C-Si PERC modules having capacity minimum 500 Wp shall be used for the project for 22.5 MW Solar PV Power Plant each at Pond. However the make, capacity, technical specification and the model no. of each module connected with an individual inverter should be the same.

b. Total capacity of the Solar PV modules shall be designed to ensure **22.5 MW AC with minimum 20% overloading on DC capacity** and the net minimum guaranteed generation mentioned in the **clause no. 3.33 of GCC** of this tender document. **DC to AC ratio of each plant is 1.2.**

The scope of supply shall also include spare modules (at least 100 Nos) required for any normal or breakdown maintenance and special tools & plants required for erection & maintenance for each project. Corresponding parts of all the equipment & spares shall be of the same specification & workmanship and shall be interchangeable. All the material & workmanship shall be of reputed make as have proven successful in their respective uses in similar services & under similar condition.

5.15.1.2 STANDARDS

The PV modules must conform to the latest edition of any of the following IEC / equivalent BIS Standards for PV module design qualification and type approval:

Sl. No.	Standards	Description
1	IEC: 61215/IS: 14286	Terrestrial Photovoltaic (PV) Modules – Design qualification and type approval Part 1 – Test Requirements
		Terrestrial Photovoltaic (PV) Modules – Design qualification and type approval Part 1 – Test Requirements Section 1- Special requirements for testing of crystalline silicon photovoltaic (PV) modules
		Crystalline silicon terrestrial photovoltaic modules – Design qualification and type approval.
2	IEC: 61730 – Part 1	Photovoltaic (PV) module safety qualification – Requirements for construction.
3	IEC: 61730 – Part 2	Photovoltaic (PV) module safety qualification – Requirements for testing.
4	IEC: 61701/IS: 61701	Salt Mist Corrosion Testing of the module.
5	IEC: 62804	Test method for detection of Potential Induced Degradation of photovoltaic (PV) modules.

The proposed PV Module must be enlisted in the latest ALMM (Approved List of Module Manufacturer) of MNRE as stipulated by Ministry of New and Renewable Energy, Government of India.

The PV Module shall have the Test Certificate issued from accredited test laboratories of Ministry of New and Renewable Energy, Government of India.

The manufacturers should get their samples tested as per the new format/ procedure/Official memorandum i.e. latest ALMM list from MNRE, Govt. of India shall be followed.

5.15.1.3 IDENTIFICATION AND TRACEABILITY

Each PV module must use a RF identification tag (RFID), which must contain the following information:

i. Name of the manufacturer of PV Module
ii. Name of the Manufacturer of Solar cells
iii. Month and year of the manufacture (separately for solar cells and module)
iv. Country of origin (separately for solar cells and module)
v. I-V curve for the module
vi. Peak Wattage, I_m, V_m and Fill Factor for the module
vii. Unique Serial No and Model No of the module
viii. Date and year of obtaining IEC PV module qualification certificate
ix. Name of the test lab issuing IEC certificate
x. Other relevant information on traceability of solar cells and module as per ISO 9000 series.

RFID for each solar module shall be provided inside or outside of the module and must be able to withstand environmental conditions and last the lifetime of the solar module as per MNRE norms which is effective from 1st April 2013.

5.15.1.4 AUTHORIZED TESTING LABORATORIES/ CENTERS

PV modules must qualify (test reports/ certificate from IEC/NABL accredited laboratory should be enclosed) as per the relevant IEC standard. Additionally the performance of PV modules at STC conditions must be tested and approved by one of the IEC / NABL Accredited Testing Laboratories including Solar Energy Centre (SEC).

5.15.1.5 PERFORMANCE WARRANTY

A. **Material Warranty:** The manufacturer should warrant the Solar Module(s) to be free from the defects and/or failures specified below for a period not less than five (05) years from the date of sale to the original customer (i.e. EPC Contractor) for each Project.

i. Defects and/or failures due to manufacturing
ii. Defects and/or failures due to quality of materials
iii. Non conformity to specifications due to faulty manufacturing and/or inspection processes.

If the solar Module(s) fails to conform to this warranty, the manufacturer will repair or replace the solar module(s), at the Purchaser's sole option. The contractor shall be responsible to contact with the contractor if any of the above mentioned cases occurred.

B. Performance Warranty: The manufacturer should warrant the output of Solar Module(s) for at least 90% of its rated power upto initial 10 years & 80% of its rated power upto 25 years from the completion of trial run at site/date of final commissioning. The contractor shall collect the Warranty Certificate for performance of the modules from the manufacturer and submit the same to WBPDCL prior to delivery of the products to the respective sites.

If, Module(s) fail(s) to exhibit such power output in prescribed time span, the Contractor will bound to either deliver additional PV Module(s) to replace the missing power output with no change in area of site used or replace the PV Module(s) with no extra cost claimed at Purchaser 's sole option.

Manufacturer of proposed PV modules must have the ISO 9001:2008 or ISO 14001 Certification for their manufacturing unit for their said manufacturing item.

Note: Only indigenously manufactured PV modules should be used in Grid Connected Floating Solar PV Power Plants under this scheme. However, other imported components can be used, subject to adequate disclosure and compliance to specified quality norms and standards and approval of the Purchaser**.**

Bidder shall please refer Cl. No 4.22 of Section IV.

5.15.1.6 TECHNICAL REQUIREMENTS

- Modules should be Mono C-Si PERC type having capacity of minimum 500 Wp. Higher capacity Solar PV modules will be preferred. (more than 500 Wp).

- All the modules in the PV plant should be arranged in a way so as to minimize the mismatch losses.
- Module shall be uniformly laminated without any lamination defects.
- The module frame shall be made of aluminium or corrosion resistant material (minimum thickness 15 micron), which shall be electrically compatible with the structural material used for mounting the modules. Grounding / Earthing provision shall be provided.
- Solar module shall be laminated using lamination technology using established polymer (EVA: Ethylene-vinyl acetate).
- The back sheet used in the crystalline silicon based modules shall be of 3 layered structures. Outer layer of fluoropolymer, middle layer of Polyester (PET) based and Inner layer of fluoropolymer or UV resistant polymer. Back sheet with additional layer of Aluminium also will be considered. The thickness of back sheet should be of minimum 300 microns with water vapour transmission rate less than 3g/m2/day. The Back sheet shall have voltage tolerance of more than 1000 V.
- The EVA used for the modules should be of UV resistant in nature. No yellowing of the back sheet with prolonged exposure shall occur.
- The sealant used for edge sealing of PV modules shall have excellent moisture ingress protection with good electrical insulation (Break down voltage >15 kV/mm) and with good adhesion strength.
- The solar modules shall have suitable encapsulation and sealing arrangements to protect the silicon cells from the environment. The arrangement and the material of encapsulation shall be compatible with the thermal expansion properties of the Silicon cells and the module framing arrangement/material. The encapsulation arrangement shall ensure complete moisture proofing during the whole life of the solar modules.
- The Module shall be made of high transmittance glass front surface giving high encapsulation gain. The glass used to make the crystalline silicon modules shall be toughened low iron glass with minimum thickness of **3.2 mm**. The solar cell shall have surface anti-reflective coating to help to absorb more sunlight in all weather conditions. The glass used shall have transmittance of above 90% and with bending less than 0.3% to meet the specifications.

- Module rating is considered under standard test conditions, however Solar Modules shall be designed to operate and perform as per installation site condition.
- The peak-power point voltage and the peak-power point current of any supplied module and/or any module string (series connected modules) shall not vary by more than 2 % (two percent) from the respective arithmetic means for all modules and/or for all module strings, as the case may be.
- All materials used shall be having a proven history of reliable, light weight and stable operation in external outdoor applications and shall have service life of 25 years.
- The modules should be 100% PID (Potential Induced Degradation) tolerant and should comply with IEC 62804.
- Solar PV Module design shall conform to following requirement:
  - Weather proof DC rated MC connector and a lead cable coming out as a part of the module, making connections easier and secure, not allowing for any loose connections. If Solar module layout on landscape orientation, the interconnection of solar module ensure to connect without any additional cable joint or through MC4 connector as it was observed that the solar module cable length is 500mm each positive and negative terminal.
  - Resistant of water, abrasion, hail impact, humidity & other environment factor for the worst situation at site.
  - The PV Junction Box shall confirm IP 65 and shall have sufficient bypass diodes to avoid shadowing effects.
- Modules shall perform satisfactorily in relative humidity up to 95% and temperature between -10^{0}C and 85^{0}C (module temperature).
- The PAN file of the solar module should be validated by Third party.
- The developer shall arrange for the details of the materials along with specifications sheets of from the manufacturers of the various components used in solar modules along with those used in the modules sent for certification. The Bill of materials (BOM) used for modules shall not differ in any case from the ones submitted for certification of modules.
- The I-V characteristics of all modules as per specifications to be used in the systems are required to be submitted at the time of supply.

- SPV module shall have module safety class as per MNRE standard and should be highly reliable, light weight and must have a service life of more than 25 years .

5.15.1.7 SPECIFICATION OF THE PV MODULES

Desired specification of the PV Module shall be as mentioned hereunder:

SI. No.	Item	Description
1	Type	Crystalline Silicon – Mono C-Si PERC
2	Efficiency of module	Minimum 19 % at STC
3	Cell efficiency (Type of Cell : Only Class A)	Minimum 20 % at STC
4	Fill Factor	Minimum 78 %
5	No. of cells per module	At least 72
6	Module Frame	Non-corrosive and electrolytically compatible with the structural material, preferably anodized Aluminium (not less than 15 micron).
7	Termination box	Thermo-plastic, IP 67, UV resistant
8	Blocking diodes	Schottky type
9	Bypass Diode	Yes, as required
10	Power Rating	The nominal power of a single PV module shall be minimum 500 Wp
11	Power tolerance	upto +5 %
12	Temperature co-efficient of power	Less than - 0.40% / °C
13	Glass	High transmittance glass with Anti Reflective Coating (ARC)
14	RF Identification tag for each solar module	Shall be provided inside or outside the module and must be able to withstand environmental conditions and last the lifetime of the solar module as per MNRE Norms.

5.15.1.8 APPROVAL, TESTING & INSPECTION

- The Detailed Design Report Submitted by the contractor to WBPDCL must contain but not limited to the following details of the solar modules:
    - Detailed specification

- Necessary Drawings
- Type Test Report and Necessary MNRE Certificates (for DCR in case of Module) etc.

PRE-DISPATCH INSPECTION PROCEDURE

1. OBJECTIVE:

The objective of this document is to establish General inspection protocol with objectivity for verification of Quality Parameters of Solar Modules by the customer (or its authorized inspection agency) prior to dispatch. The decision rules and procedure specified herein seek to uphold quality standards based on industry best practices and technical specifications laid out in tender documents as well as to control risks associated with item procurement.

2. STANDARDS AND CODES:

1. Sampling for determining Acceptance Quality Level (AQL) shall follow ISO 2859-1: 1999.

2. IEC TS 60904-1-2:2019 - Photovoltaic devices - Part 1-2: Measurement of current voltage characteristics of bifacial photovoltaic (PV) devices

3. DEFINITIONS:

1. Lot: All products/items manufactured in one batch.

Notwithstanding the aforementioned definition, the customer or authorized inspection agency can lay down alternate/additional criteria for determining a lot at appropriate time.

2. Major Defect: A defect that reduces the usability or causes the product to fail to fulfil its nominal characteristic function.

3. Minor Defect: A defect that does not reduce the usability of the product, but does not meet the quality standard.

4. INSPECTION SCHEDULE:

Customer representative shall propose the schedule for Pre-despatch Inspection of Finished Goods to the Customer well in advance, and in no case less than 3 working days prior to commencement of Inspection at a location within India and 7 days in case of a foreign country.

5. SCOPE OF INSPECTION:

Supplier representative will accompany the Inspector while doing the inspection which shall typically consist of 2 steps for clearance of each Lot: BOM verification: To be conducted prior to the commencement of production.

The details of materials used will be verified from the ERP/Manufacturing data and corroborated with the Construction Data Form (CDF). This shall include verification of following:

Item	Method of Verification
Shelf life of the following BOM items: • EVA • PV Module Back sheet • Sealant and potting material (Silicone)	Verify the expiry date/shelf life and storage conditions The PV Module manufacturer shall submit all required information to prove that materials being used are within their shelf life.

Note : Contractor shall provide the necessary documents for approval of BOM as per IEC standards and tender Technical Specifications.

Witness Tests:

Manufacturer shall assist the Inspecting agency to witness following checks, the details of which are provided elsewhere in this document:

I. Flash test- As per sampling Plan

For Bifacial Modules, Measurement of current-voltage characteristics shall be done as per IEC TS 60904-1-2:2019 - Photovoltaic devices - Part 1-2

II. Visual Inspection- As per sampling Plan

III. EL Inspection-As per Sampling Plan

IV. Electrical Characteristics (Other than Flash Test)- As per Sampling Plan

Note: The Supplier shall furnish soft and hard copy of the Production Quality Plan prior to commencement of the Inspection.

6. SAMPLING PROCESS:

a. Supplier shall provide the list of modules in a lot ready for dispatch, along with flash test data (Measured Electrical Data, Pmax) prior to commencement of Inspection tests.

Note: Smallest lot size for Inspection: 20% of the capacity as per the PO.

b. Supplier will arrange to move the PV Modules from FG to Inspection area.

c. Same samples shall be used for all Witness Tests stated at 5.2 above.

d. Inspector shall commence Inspection process by randomly selecting samples from the list of serial nos. (pallet-wise) provided by Supplier as per ISO 2859: Single Sampling Plan for Normal Inspection, General Inspection plan level-I. However, the Inspector shall reserve the right to switch to tightened or reduced level of Inspection as per the lot quality.

7. DECISION RULES FOR ACCEPTANCE/REJECTION

Following is a summary of Decision Rules for Acceptance/Rejection of a given Sample in a lot offered for Inspection:

Table 1: AQL Levels

Defect Type	AQL (%)
Major (Ma)	2.5

Minor (Mi)	4

Table 2: Inspection Levels

Inspection steps	**Inspection item**	**Inspection level**
1	Flash Test	General inspection level I
2	Visual	General inspection level I
3	EL	General inspection level I
4	EC (Other than Flash Test)	10 Nos. per lot

8. INSPECTION PROCESS

a. Electrical Inspection – Flash Tests

For Electrical inspection following preparation will be done:

• Module Temp Stabilization: Modules will be kept in controlled environmental condition till it reaches 25 ± 2^0 C

• Calibration of Sun-simulator: Sun-simulator will be calibrated as per Calibration Reference. Reference should calibrated against Calibration Reference tested from reputed testing lab TUV / Fraunhofer etc. Testing of modules will be done at STC condition, AM=1.5

Note:

(i) All modules selected for sampling inspection will be re-tested in the sunsimulator.

A P_{max} retest (repeatability test) variation of ± 2 % on actual flash

P_{max} value will be acceptable. (ii) The Supplier shall provide a valid calibration certificate of the apparatus used.

b. Visual Inspection:

• Customer representative will verify the module visual characteristics as per the Visual Acceptance norms.

• The Visual Inspection shall be carried out in a well-lit room. It shall be the responsibility of the Supplier to ensure adequate brightness in the room.

c. Electroluminescence (EL) Inspection:

• The EL image shall have sufficient resolution for analysis of defects.

• Hi-pot test shall be done as per IEC procedure. The Supplier shall provide a valid calibration certificate of the apparatus used.

9. RE-INSPECTION AND REVIEW

In case of minor non-conformities like cleaning issues, label mismatch, etc. which can be easily reworked, Supplier shall rework/replace the modules and offer them for re-inspection to Inspector.

10. INSPECTION SUMMARY:

Once the inspection is completed Customer Representative will compile his Inspection Summary Report and share with Supplier and give necessary recommendation on despatch depending upon the audit findings based on the observations made. This report shall be provided within same day of inspection (Format Attached).

11. DISCLAIMER:

Inspection by WBPDCL does not absolve the responsibility of the Supplier/vendor to ensure quality during production of the material and its transport to site. Any damages during transport/ handling shall be replaced before erection at site as directed by Engineer-in-charge without any extra cost to the purchaser.

5.15.1.9 ACCEPTANCE CRITERIA:

- 25 no modules to be carried out all the type tests as per IS from NISE, Delhi or MNRE accredited test centers.
- For the above (i.e. 25 no. modules) special packing if required may be done to shift the panels from manufactory site to testing lab as directed by WBPDCL.
- Sufficient competent man power to be deployed at test centre for sufficient days to unpack and repack the modules after the test.
- Contractor has to coordinate with WBPDCL for all the testing activity.

5.15.1.10 TRANSPORTATION, HANDLING, STORAGE AND INSTALLATION

- Transportation, handling, storage and installation of modules shall be in accordance with the manufacturer manual so as not to breach warranty conditions. The Standard Operating Procedure (SOP) for the same shall be shared by the Contractor prior to dispatch.
- It is required to construct a temporary platform (graded) while keeping the modules at least above the highest flood level. If the contractor schedules/ plans to mount the modules immediately after the receipt at site, then the modules shall be kept in common storage area with proper arrangement.

The modules shall be stacked as per the manufacturer's recommendation only and shall be covered with tarpaulin sheet in case the PV Modules are required to be stored at site for more than one month. In any case, the

temporary platform for keeping the modules shall be treated with anti-termite treatment.

5.15.2 GRID CONNECTED INVERTERS

5.13.2.1 SCOPE

This section covers the activities related to design, manufacturing, testing at works, supply, insurance, transportation and delivery at project site, storage, erection, testing, commissioning of Solar Inverters/Power Conditioning Unit (PCU) as detailed hereunder.

a. Adequate number of Indoor Solar Central Inverter of minimum capacity 500 kW having high quality, high efficiency and reliable operation. Total inverter capacity should not be less than 10000 kW(AC), 7500 kW (AC) & 5000 kW (AC) respectively for BkTPS, STPS & SgTPP.

b. The scope of supply shall also include necessary spares, if any, required for normal or any breakdown maintenance for at least 05 (five) years and special tools & plants required for erection & maintenance. Corresponding parts of all the equipment & spares shall be of the same specification & workmanship and shall be interchangeable.

All the material & workmanship shall be of reputed make as have proven successful in their respective uses in similar services & under similar condition.

The solar inverter/power conditioning unit shall be suitable for interfacing with SCADA system and all necessary transducers shall be included under the scope of supply.

5.13.2.2 STANDARDS

The equipment and materials covered by this specification shall conform to the latest edition of following Indian Standards or equivalent IEC standards except where specified otherwise in this specification:

Sl. No.	Standards	Description
1	IEC/IS: 61683	Photovoltaic systems – Power Conditioners – Procedure for measuring efficiency
2	IEC 62093	Balance-of-system components for photovoltaic systems – Design qualification natural environments
3	IEC 60068-2-1:2007	IEC 60068-2-1:2007 Environmental testing - Part 2-1: Tests - Test A: Cold
4	IEC 60068-2-2:2007	Environmental testing - Part 2-2: Tests -

		Test B: Dry heat
5	IEC 60068-2-14:2009	Environmental testing - Part 2-14: Tests - Test N: Change of temperature
6	IEC 60068-2-30:2005	Environmental testing - Part 2-30: Tests - Test Db: Damp heat, cyclic (12 h + 12 h cycle)
7	IEC 62116 / IEEE 1547/UL 1741/ equivalent IS standard	Islanding Prevention Measurement
8	IEC 61727 Relevant CEA/ CERC regulation and grid code (amended up to date)	Interfacing with utility grid
9	IEC 61000-6-2 Ed. 2	Electromagnetic compatibility (EMC) - Part 6-2: Generic standards - Immunity standard for industrial environments
10	IEC 61000-6-4 Ed. 2.1	Electromagnetic compatibility (EMC) - Part 6-4: Generic standards - Emission standard for industrial environments
11	IEC 62109 (1&2), EN 50178 or equivalent	Safety of power converters for use in photovoltaic power systems - Part 1: General requirements
12	IEC 62109 (2), EN 50178 or equivalent	Safety of power converters for use in photovoltaic power systems - Part 2: Particular requirements for inverters
13	IEC 62093 or equivalent	Reliability test standard
CEA Technical Standards for Connectivity to the Grid Regulations 2007 with 2013 Amendment		
As per the Solar Photovoltaics, Systems, Devices and Components Goods (Requirements for Compulsory Registration) Order, 2017, Inverters used in the grid connected solar power projects shall be registered with BIS and bear the Standard Mark as notified by the Bureau of Indian Standards.		

Solar Inverters should have certificate and approval from VDE, IEC etc. The inverters should have CE conformity according to LVD (Low Voltage Directive) and EMC (Electro Magnetic Compatibility) Directive for safety purpose.

Type test certificate issuing authorities should be any NABL/IEC Accredited Testing Laboratories or MNRE approved test centers.

Equipment meeting with other authoritative standards which ensure an equal or better quality is also acceptable. Where the equipment conforms to any other authoritative standard, the salient points of difference between the standard adopted and IS/IEC shall be clearly brought out by the contractor.

- **Inverter rating:** The continuous combined MW rating at all PCU/Inverters at 0.95 power factor and at 1 pu voltage at Inverter terminal at ambient temperature of 50 deg C shall not be less than Plant MW capacity.

  In addition, Inverter shall be able to maintain its performance specified above even with voltage variation of upto ± 5% at Inverter Terminal.

5.13.2.3 TECHNICAL REQUIREMENTS

- The inverter should be 3-Φ static solid state type power conditioning unit.
- Inverter/PCU shall be centralized grid tied in nature, shall consist of MPPT controller. Inverter shall be selected based on array design. Associated control and protection devices shall be an integrated part of the PCU.
- Degree of protection of the Outdoor Inverters shall confirm at least IP-65. For PEB it shall be IP-55.
- The inverters shall be built in with data logging system for remote monitoring of the plant performance through external PC. (PC shall be provided as a part of the Solar PV Plant).
- The dimension, weight, foundation details etc. of the PCU shall be clearly indicated in the technical specification to be submitted with the detailed design report.
- The PCU shall be capable of complete automatic operation, including wake-up, synchronization & shut down independently & automatically. Inverters / PCU shall operate in sleeping mode when there will no power connected.
- The Inverter shall have internal protection arrangement against any sustained fault in output line and lightning in the grid. AC protection boxes shall be provided at the inverter output which shall include over current, under voltage protection etc.
- Both AC & DC lines shall have suitable fuses & surge arrestors and contactors to allow safe start up and shut down of the system (Type-I & II DC side and Type-II AC side).
- PCU shall be capable to synchronize independently & automatically with grid power line frequency to attain synchronization and export power generated by solar plant to grid.

- In case of grid failure, the PCU shall be re-synchronized with grid after revival of power supply. Bidder to furnish the time taken by PCU to be re-synchronized after restoration of grid supply during detailed engineering.
- Inverters shall have the features like Low Voltage Ride through (LVRT), High Voltage Ride through (HVRT) etc. for grid support and connection.
- Inverters should run in synchronized manner, effect of one inverter should not be reflected to the others. The PCU shall be capable of operating in parallel with the grid utility service and shall be capable of interrupting fault line currents, line to ground fault currents and short circuit currents.
- The PCU shall be able to withstand an unbalanced load conforming to related IEC standard (+/- 5% voltage). The PCU shall include appropriate self-protective and self-diagnostic features to protect itself and the PV array from damage in the event of PCU component failure or from parameters – beyond the PCU's safe operating range due to internal or external causes. The self-protective features shall not allow signals from the PCU front panel to cause the PCU to be operated in a manner which may be unsafe or damaging. Faults due to malfunctioning within the PCU, including commutation feature, shall be cleared by the PCU protective devices and not by the existing site utility grid service circuit breaker.
- Operation outside the limits of power quality as described in the technical data sheet should cause the power conditioner to disconnect the grid. Additional parameters requiring automatic disconnection are over current, earth fault, short circuit and reverse power.
- The inverter itself shall consist of one circuit breaker for isolation from the circuit during any fault or maintenance purpose.
- PCU shall have active power limit control, reactive power and power factor control feature. Plant operator shall be able to provide (manual intervention) Active power, reactive power and power factor control/limit set point through SCADA HMI and local control display unit (or Laptop computer). PCU shall be provided with remote start and stop facility from SCADA HMI. All required hardware and software required for this purpose shall be provided by Bidder.
- PCU shall have necessary limiters in build in the controller so as to ensure safe operation of the PCU within the designed operational parameters.

- The Contractor shall ensure by carrying out all necessary studies that the PCU will not excite any resonant conditions in the system that may result in the islanded operation of PV plant and loss of generation. In case there is excitation of any resonant condition in the system during PV plant operation that may result in the islanding/tripping of the PV plant and affect the power transfer, it shall be the responsibility of contractor to rectify the design and carryout required modification in the equipment of his supply.
- PCU shall be provided with Mobile user interface facility for monitoring of inverter by plant O&M personal for better O&M and highest yield from the PV plant. In case PCU does not have this facility, then Bidder can provide the same facility through plant SCADA system.
- PCU shall have AC and DC side monitoring capability and reporting to SCADA system (measured analog and digital value measured within PCU). Any special software if required for this purposes shall be provided for local and remote monitoring and report generation.
- All-important alarm and trip signals shall be configured in the PCU and their corresponding modbus address shall be provided for SCADA configuration. Signal shall necessarily be included such as LVRT/HVRT in action & trip operated, islanding protection operated, over current operated, Inverter cabinet temperature high alarm and all other important signals.
- DC Overloading:- Maximum PCU DC overload loading shall be limited to its design PV Array Power to PCU nominal AC power ratio. Bidder needs to submit all the relevant technical document/test report from PCU manufacturer (OEM) during details engineering stage in support of declared PCU design DC overloading capacity.
- The inverters shall operate satisfactorily within the operating ambient temperature range of -15°C to +60°C. The contractor shall assure that the inverter should not de-rate upto 50°C ambient temperature. Humidity: 95 % non-condensing.
- To take care of PID (Potential Induced Degradation), the inverters should have active negative grounding kit.
- **EARTHING OF INVERTERS-** The PCU shall be earthed as per manufacturer recommendation (OEM). The Bidder needs to submit the details earthing arrangement of PCU and system earth pit requirement

during detail engineering stage. The detail specification for panel earthing for safety has been mentioned elsewhere in this specification

5.13.2.3.1 OPERATING MODES OF PCU

- **Low Power Mode:-** The PCU shall be able to wake-up automatically when PV array open circuit voltage value is equal/more than preset value in the PCU program. Once its start generation the PCU shall automatically enter maximum power mode.

- **Maximum Power Point Tracking (MPPT):-** In order to maximized the energy collection from solar PV array, the PCU shall have inbuilt maximum power point tracker (MPPT) controller and MPPT shall be able operate the PV array at its maximum power point by adjusting output voltage of PV array system according to atmospheric condition. PCU MPPT controller shall ensure that it operate the PV array system at its global maximum power point and it shall not trapped into PV array local maximum power point during cloudy atmospheric condition.

- **Sleep Mode :-** PCU shall automatically go into sleep mode when the output voltage of PV array and/or output power of the inverter falls below a specified limit. During sleep mode the inverter shall disconnect from grid. Inverter shall continuously monitor the output of the PV array and automatically start when the DC voltage rises above a pre-defined level.

- **Standby Mode:-** In standby mode the PCU DC & AC contactor are open, inverter is powered on condition and waiting for start command.
- String Monitoring facility:- PCU shall be provided with current monitoring transducer at incoming DC cables from each string combiner box (SCB) for PV array zone monitoring purpose. The current transducers used for this purpose shall have accuracy of 1.0 class or better.
- The PCU should be designed for parallel operation through galvanic isolation. Solid state electronic devices shall be protected to ensure smooth functioning as well as ensure long life of the inverter. Parallel operated PCU system are also accepted subjected to recommendation of PCU manufacturer. In such case, PCU design shall also ensure that no abnormal interaction shall take place among the PCU unit during any grid operating condition which may result in outages.

- Bidder may offer liquid cooling system subject to WBPDCL approval. In case Liquid cooled inverters are offered, Bidder to ensure that coolant is used in closed cycle. Complete inverter along with cooling system shall be of proven design.
- The Inverter shall have suitable arrangement for negative grounding of solar PV array system and the ground current shall be limited to safe limit. Ground current shall be measured continuously and alarm shall be generated in case ground current reaches to predefined set value. Inverter shall trip in case ground current more than safe operating limit.
- Inverter shall have emergency stop push button for tripping of inverter with complete DC & AC electric isolation.
- Following protections shall be provided with the inverter.
    - Over voltage and under voltage both at input & output
    - Over current both at input & output
    - Over/under grid frequency
    - Heat sink over temperature
    - Cooling system failure protection
    - PV array ground fault monitoring & detection
    - PV array insulation monitoring
    - LVRT protection
    - Anti-islanding protection
    - Over temperature protection.
    - Short circuit
    - Protection against lightning
    - Surge arrestors to protect against Surge voltage induced at output due to external source
    - Direct earth fault protection and body earthing
    - Set point pre-selection for VAR control
    - Synchronization loss protection
    - Grid monitoring
    - Any other protections required
- Inverters should have user friendly LED/LCD or touch display for programming and view on line parameters in LED/LCD as well as in SCADA. These parameters are:
    - Inverter per phase Voltage, current, kW, kVA, frequency and power factor.

- 15 minute, Daily, monthly & Annual energy generated by the solar system(kWh)
- Solar system temperature
- Ambient temperature
- Grid Voltage, frequency and power factor
- AC and DC side voltage and current
- Power factor on AC side
- DC injection into the grid
- Inverter Import export kWh summation
- Solar kWh summation
- Inverter ON/OFF
- Grid ON/OFF
- Inverter under voltage/over voltage
- Inverter over load
- Inverter over temperature etc.
- Total Current Harmonics distortion in the AC side
- Total Voltage Harmonic distortion in AC side
- Efficiency of the inverter
- Solar system efficiency
- Display of I-V curve of the solar system
- Fault details with time when occur.
- Any other parameter considered necessary by supplier of the solar PV system based on prudent practice.

5.13.2.4 SPECIFICATION

SI. No.	Operating Parameter	Desired specification
1	Input (DC)	
	PV array connectivity capacity	As per site requirement
	MPPT Voltage range	Compatible with the array voltage
	Number of MPPT Channel	Number of MPPT channel shall be minimum one. One spare MPPT channel shall be provided.
2	Output (AC)	
	Nominal AC Power output	500 kW (minimum)
	Number of Grid Phase	3
	Adjustable AC voltage range	+/- 10%
	Nominal output voltage frequency	50Hz

SI. No.	Operating Parameter	Desired specification
	Continuous operating frequency range	47.5 Hz to 52 Hz
	Frequency range	+/- 5%
	Operating power factor range	Operating power factor (adjustable) shall be 0.8 Lead to 0.8 Lag.
	AC wave form	Sine wave
	THD	Less than 3%
	Switching	H.F. transformer/transformer less
3	General Electrical data	
	Efficiency	97.5 % (minimum)
	VAR Control	The PCU shall be capable of supplying reactive power as per grid requirement. PCU shall have night SVG function (Q at night).
	No load loss	< 1% of rated power
	Maximum loss in sleep mode	< 0.05% of rated power
4	Protection	
	DC Side	As mentioned in the Technical Requirement
	AC side	As mentioned in the Technical Requirement
	Isolation Switch	PV array Isolation switch (DC)
	Ground fault detection device (RCD)	To be provided
5	Display	
	Display type	LED/LCD or touch display
	Display parameter	
	DC	As mentioned in the Technical Requirement
	On grid connected mode	As mentioned in the Technical Requirement
9	Interface (Communication protocol)	Suitable port must be provided in the inverter for i. On site upgrade of Software ii. On site dumping data from the memory iii. Plant based remote monitoring system
10	Storage of Data	At least for 1 year. Separate data logger may be provided to meet the criteria.
11	Monitoring	Matched with the monitoring and data logging system (SCADA)
12	Mechanical Data	
	Protection Class	As mentioned in the Technical Requirement
	DC Switch	Integrated
	Operating ambient temperature	-15° C to 60° C
	Relative Humidity	15 to 95 %
	Noise Emission	Less than 75 dB (A) @ 1 meter (indoor)
	Cooling	Forced cooling

5.13.2.5 Communication interface

The project envisages a communication interface which shall be able to support:

- Real time data logging
- Event logging
- Supervisory control
- Operational modes
- Set point editing

5.13.2.6 COMMUNICATION SYSTEM

Communication System shall be an integral part of inverter. All current values, previous values up to 40 days and the average values of major parameters shall be available on the digital bus.

5.13.2.7 DATA LOGGER SYSTEM

Data logger system (Hard ware) and the software for study of effect of various environmental & grid parameters on energy generated by the solar system and various analyses would be required to be provided.

The communication interface shall be suitable to be connected to local computer and also remotely via the Web using either a standard modem or a GSM / WIFI modem.

PCU shall have suitable communication card (Modbus TCP/IP) for networking and SCADA integration and same shall support dual master communication. PCU shall include all important measured & internal calculated analog values and alarm & trip signals for remote monitoring, storing and report generation purpose in SCADA system. Details list of above such parameters shall be provided along with their Modbus address during detail engineering stage

5.13.2.8 APPROVAL

The Detailed Design Report Submitted by the contractor to WBPDCL must contain but not limited to the following details of the Solar Inverter/Power conditioning Unit:

- Detailed technical description of the complete unit
- Necessary Drawings
- Type Test Report etc.

Joint inspections and testing will be done by WBPDCL and the authorized representatives of the contractor at the manufacturer's workshop on regular basis

for quality assurance and testing. Acceptance Tests as per relevant Standard shall be carried out at the module manufacturer's workshop. Following tests shall be carried out on certain number of Inverters from a lot (decided by WBPDCL) as acceptance tests of Solar Inverters:

- Visual Inspection
- Performance Test and measurement of AC & DC parameters
- DC reverse polarity protection
- Islanding Protection
- Over Voltage & Under Voltage withstand
- Over Frequency & Under Frequency withstand
- Night consumption
- Any other test as desired by WBPDCL

Arrangements for the aforesaid testing and inspection at manufacturer's end are to be provided by the contractor.

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

- Guarantees
- Instructions for installation and operation, manual
- Safety precautions
- Test reports for routine tests and acceptance tests etc.

The contractor can deliver the product to the site only after receiving such approval against their prayer in writing from WBPDCL.

5.13.2.9 Acceptance:

Type test:

During detailed engineering, the contractor shall submit all the type test reports including temperature rise test and surge withstand test carried out within last five years from the date of LOA of this project for Owner's approval. These reports should be for the test conducted on the equipment similar to those proposed to be supplied under this contract and the test(s) should have been either conducted at an independent laboratory or should have been witnessed by a client.

However if the contractor is not able to submit report of the type test(s) conducted within last ten years from the date of techno-commercial bid opening, or in the case of type test report(s) are not found to be meeting the specification requirements, the contractor shall conduct all such tests under

this contract at no additional cost to the owner either at third party lab or in presence of client/owners representative and submit the reports for approval.

Routine tests:

Routine tests to be conducted as per IEC norms in the presences of WBPDCL staff along with warranty & guarantees certificates.

5.15.3 PV ARRAY

Desired specification of the PV Array shall include but not limited to the following:

Sl No	Item	Description
1.0	PV Module interconnection connector	MC-4 / Tyco
2.0	PV Module interconnection cable and array cable	PV 1-F standard /NEC standard "USE-2 or RHW-2" type (double insulated)
3.0	PV array String Voltage	Compatible with the MPPT Channel of the inverter

DC CABLES (Interconnecting SPV MODULES and from SPV Modules TO SCB)

i) Cables used for inter-connecting SPV modules as well as Modules to SCB's shall conform to the requirements of EN 50618:2014 applicable for DC cable for photovoltaic system.

ii) In addition to manufacturer's identification on cables as per EN50618, following marking shall also be provided over outer sheath.

(a) Cable size and voltage grade

(b) Word 'FRNC' at every 5 metre

(c) Sequential marking of length of the cable in metres at every one metre

iii) Type test, routine, acceptance tests requirements for these cables shall be as per EN50618:2014. All test charges shall be deemed to be included in the cable price. Sampling for acceptance tests will be as per IS 7098.

iv) A maximum of 8 Cables (4 Circuits) shall be laid in one HDPE Pipe for DC Cable from Module to string monitoring box (if applicable). The fill factor of the pipe should not be more than 40%.

5.15.4 STRING MONITORING BOX (SMB)

5.13.4.1 SCOPE

This section covers activities related to design, manufacturing, testing at works, supply, insurance, transportation and delivery at Project site, storage, erection, testing, commissioning of array junction box as detailed hereunder.

a. Adequate number of String Monitoring Boxes shall be provided for termination of array string with inverter.

b. The number and specification of PV String Monitoring Box will be as per plant configuration.

The String Monitoring Boxes shall be suitable for interfacing with SCADA system and all necessary transducers shall be included in the scope of supply.

5.13.4.2 STANDARDS

The String Monitoring Boxes shall conform to the latest edition of following Standards except where specified otherwise in this specification:

Sl. No.	Standards	Description
1	IS 13703: Part 1	Low voltage fuses for voltage not exceeding 1000V AC or 1500V DC: General Requirements
2	IEC 60269: Part 4 /IS 13703: Part 4	Low-voltage fuses: Supplementary requirements for fuse-links for the protection of semiconductor devices
3	IEC 60269-4: Part 6	Low-voltage fuses: Supplementary requirements for fuse-links for the protection of solar photovoltaic energy systems
4	VDE 0636	Low-voltage fuses

Equipment meeting with other authoritative standards which ensure an equal or better quality is also acceptable. Where the equipment conforms to any other authoritative standard, the salient points of difference between the standard adopted and IS/IEC shall be clearly brought out in the tender. Complete set of documents and standards in English shall be supplied by the bidder without any extra charge. It shall, however, be ensured that equipment offered comply with one consistent set of standards except in so far as they are modified by the requirement of this specification.

5.13.4.3 TECHNICAL REQUIREMENTS

- The junction Boxes shall have suitable arrangement for the followings (typical):
  - Combine groups of modules into independent charging sub-arrays that will be wired into the controller.
  - Provide arrangement for disconnection for each of the groups.
  - Provide a test point for each sub-group for quick fault location finding.
  - To provide group array isolation.

- The string monitoring box shall be dust, vermin, and waterproof and made of Polycarbonate Plastic.
- The string monitoring box shall be of IP 65 or better.
- The terminal will be connected to bus-bar arrangement of proper size. The junction boxes shall have suitable cable entry points fitted with cable glands of appropriate sizes for both incoming and outgoing cables.
- Suitable markings shall be provided on the bus-bars for easy identification and Cables shall be fitted at the cable termination points as per appropriate polarity.
- Each String shall be terminated through Fuses of required current rating
- The string monitoring box shall be provided with suitable Surge Protection Device (SPD).

5.13.4.4 APPROVAL

The Detailed Design Report Submitted by the contractor to WBPDCL must contain but not limited to the following details of the String Monitoring Boxes:

- Detailed specification
- Necessary drawings etc.

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

- Guarantees
- Instructions for installation and operation, manuals
- Necessary test certificates

The contractor shall deliver the product to the site only after receiving such approval against their prayer in writing from WBPDCL.

5.15.5 THREE WINDING TRANSFORMER (INVERTER DUTY TRANSFORMER)

5.13.5.1 SCOPE:

This section covers the activities related to design, manufacturing, testing at works, supply, insurance, transportation and delivery at Project site, storage, erection, testing, commissioning of step up transformers and associated equipment as detailed hereunder.

a. Requisite number of 3-Φ, three winding, oil filled, ONAF/ONAN type cooled transformers per pond with suitable capacity (not less than 10% higher margin as per NIT) shall be provided to step up voltage from 3-Φ, Grid tied Solar

Inverter output to 33 kV voltage level for feeding the generated power to the 33 kV switchyard (or as per stipulation of the NIT) for BkTPS, STPS & SgTPP.

b. Two LV winding of the three winding transformer will be connected to the outputs of two inverters and the HV sides will be connected to the 33 KV line through VCB, Isolator etc. Three winding transformer will be Oil Type and placed outside of Inverter cum control room.

c. Supply, laying, termination, testing, charging of 33/33 kV grade cable from respective Transformer to 33 kV Indoor switchgear at Main Switchgear & Control room near Water Pond for all the Projects (Refer NIT Drawing) is under bidder's scope.

The scope of supply shall also include necessary spares required for normal operation & maintenance of transformers for a period of 5 (five) years & special tools & plants required for erection & maintenance. Corresponding parts of all the equipment & spares shall be of the same material & dimensions, workmanship & finish and shall be interchangeable. All the material & workmanship shall be of suitable commercial quality as have proven successful in their respective uses in similar services & under similar condition.

The transformers and associated equipment shall be suitable for interfacing with SCADA system and all necessary transducers shall be included in the scope of supply.

5.13.5.2 STANDARDS

The equipment and materials covered by this specification shall conform to the latest edition of following Indian Standards or equivalent IEC standards except where specified otherwise in this specification:

Sl. No.	Standards	Description
1	IS: 2026 (Part I to IV), IS:6600, IEC: 60076	Power Transformer
2	IS: 2099, IEC:60137, IS:3347, IS 12676	Transformers bushings
3	IS: 2705, IEC 60185	Current transformers
4	IEC 60296	Transformer oil
5	IS: 3637	Gas and oil operated relay
6	IS: 5120	Fittings and accessories for power transformers
7	IS: 6088	Dimensions for porcelain transformer bushings
8	IS: 3347	Loading guide for oil-immersed transformers
9	CBIP No. 295	CBIP Manual on Transformers

		Publication

Equipment meeting with other authoritative standards which ensure an equal or better quality is also acceptable. Where the equipment conforms to any other authoritative standard, the salient points of difference between the standard adopted and IS/IEC shall be clearly brought out in the tender. Complete set of documents and standards in English shall be supplied by the contractor without any extra charge. It shall, however, be ensured that equipment offered comply with one consistent set of standards except in so far as they are modified by the requirement of this specification.

5.13.5.3 TECHNICAL REQUIREMENTS

The transformers shall be three winding, ONAF/ONAN, oil filled, 3-Φ, Step Up transformers.

Sl. No.	Standards	Description
1	Type	Three Winding
2	No. of phases	Three
3	Duty, Service, Application & Installation	Continuous Solar Inverter application and converter duty (Outdoor), Outdoor on rails/channel
4	Rated continuous MVA at maximum ambient temperature of 50^{0}C	As required according to Solar Inverter capacity
5	% Impedance at 75°C, rated current & frequency	As per system requirement & as per Inverter manufacturer recommendation.
6	Type of cooling	ONAN & ONAF
7	Winding material	Copper
8	Connection	
	HV	Delta
	LV	Star-Star
9	Vector group	As per system requirement
10	Voltage	
	HV	33 kV
	LV	As per Solar Inverter Output Voltage
11	Rated Frequency	50 Hz
12	Type of Bushing	
	HV Winding	Porcelain/ XLPE bushing
	LV Winding	Porcelain bushing
13	Insulation level (impulse withstand)	
	HV	170kV (Peak)
	LV	NA
14	Insulation level (Power freq. withstand)	
	HV	70 kV (rms)
	LV	3 kV (rms)
15	Tapping	OCTC

Sl. No.	Standards	Description
	Range	+5% to -5% @ 2.5% (Min.)
16	Temperature rise over an ambient temperature of 50°C (irrespective of taps)	
	a) Top Oil	50°C
	b) Winding	55°C
17	Hot spot temperature over a maximum yearly weighted average ambient temperature of 32 °C	105°C
18	Short circuit current for 1 sec. on HV side	25 kA
19	Short circuit withstand time (thermal)	2 sec
20	Insulation	
	HV winding	Class A (Winding insulation shall be able to withstand 33 kV continuously)
	LV winding	Class A (Uniformly insulated)
21	Voltage withstand capacity during sudden disconnection of load	1.4 times the rated voltage for 5 sec. 1.25 times the rated voltage for 1 min. 1.1 times the rated voltage for continuous operation.
22	Noise level	As per NEMA TR-1 standard
23	Cooling medium	Mineral oil (as per IS 335)
24	Earthing	LV neutrals solidly earthed through neutral CT, HV side should also be earthed.
25	Minimum efficiency	98%

5.13.5.4 DESIGN CRITERIA

- The rating of the Transformers shall be sufficient to evacuate generated power from the Solar Inverter under full load conditions. The Transformers shall be able to evacuate generated power under all conditions of ambient temperature, frequency and voltage variations.
- The transformers will have Off Circuit Tap Changer (OCTC) with tap ranging +5% to -5% in steps of 2.5 % at HV side. The transformers will operate without injurious heating at the rated capacity at any voltage within +/-10% of the rated voltage of that particular tap. The transformer will be designed to deliver rated MVA continuously even at the lowest tap without exceeding specified temperature rise.
- HV line terminals shall be brought out through 33 kV class weather proof shaded porcelain bushing.
- Ambient air temperature for the transformer

- Maximum ambient air temperature: 50^0 C
- Minimum ambient air temperature: 5^0 C

- Inverter Transformer shall have copper/Aluminum Shield winding between LV & HV windings. Each LV winding must be capable of handling non-sinusoidal voltage with voltage gradient as per relevant applicable standards and Inverter manufacturer recommendation. Also each shield winding shall be taken out to tank with two separate connection from shield to bushing with proper support with 2 nos. 3.6 kV shield bushings and same shall be brought down along with support insulator from tank & copper flat up to the bottom of the tank for independent grounding.
- Harmonic Factor as per Inverter manufacturer recommendation must be taken into account while designing the transformer. The extra no load loss due to voltage harmonics and load and stray load loss due to current harmonics (as applicable) and must be taken into consideration in transformer design. In addition, the dc bias component of 0.5% of rated Inverter output current is to be accounted for its effect on the transformer design.
- The thermal design of Inverter Transformer needs to consider the temperature dependent performance of the Inverter. It is to in accordance with Inverter output and under worst condition it should not limit Inverter output.
- The three winding transformer needs to be designed for long term operating conditions with asymmetrical load on LV side i.e., in this case three winding design, the transformer needs to operate reliable with only one Inverter supplying power to only one LV winding.
- For three winding transformer, it is recommended to have close coupling and equal impedances on each of LV winding to HV winding and to have high enough impedance (8% min. based on one LV winding rating) between two LV windings in order to decouple these windings.

- The transformer shall be capable of withstanding the short circuit stresses 25 KA due to a terminal fault on one winding with full voltage maintained on the other winding for minimum period of two (2) seconds. This capability shall be demonstrated by type test report.
- Neutral Grounding Resistor (NGR) (if applicable):
  - The resistor element shall be made of non-aging stainless steel having high electrical resistivity and low temperature co-efficient of resistant. Group of resistor elements shall be mounted together between end plates to form a bank. Banks are then to be connected in series-parallel combination to

provide the current and ohmic value required. Adjacent banks shall be insulated from each other and the metal frame.

- Each neutral grounding resistor shall have structural work enclosed on all sides and also on top by sheet steel. Suitable ventilating louvers shall be provided on sides to ensure proper ventilation. The louvers shall be provided with fine wire mesh to make it vermin proof. Protection class shall be IP55 or better.
- Each cubicle shall be complete with two (2) nos. ground pads, tapped holes and bolts suitable for connection of 75 x 10 mm galvanised steel flats.

- Transformer neutral shall be grounded through NGR. The Neutral Grounding Resistor (NGR) shall be used for non-effective grounding of HV System of the plant. NGR shall be connected between the equipment neutral point and earth.
- Neutral Grounding Resistor shall be used to limit the magnitude of earth fault current so that damage of Electrical equipment is reduced, safety of personnel is increased and sensitive / selective earth fault protection can be provided.
- The transformers will be capable of being loaded in accordance with IS 3347 - loading guide for oil immersed power transformers. The transformers shall also be designed for operation at unbalanced loading conditions.
- The transformers shall be suitable for co-ordination and integration with SCADA System and necessary contacts and/or ports for the purpose shall be provided.
- Earthing arrangement of the transformers shall be provided as per the relevant Indian Standard.
- Necessary protection arrangement should be provided in the transformer.
- Construction of different parts of the transformer shall conform to the latest edition of IS 2026.
- Fittings and accessories as per relevant Indian Standard shall be provided within the scope of the work.
- Oil pit with sump pump arrangement to be provided if oil capacity of the transformer is more than 2000 l. Capacity of oil pit shall be minimum 1.25 times of total oil capacity of transformer.
- **Insulating oil**
  - The transformer shall be filled with mineral insulating oil suitably inhibited to prevent sludging.

- First filling of oil along with 10% excess shall be furnished for each transformer. Oil shall be supplied in non-returnable containers suitable for outdoor storage.
- Oil preservation shall be by means of bellows/ diaphragm sealed conservator tank with silica gel breather to avoid direct connection between atmosphere and transformer oil. It shall be complete with level gauges, pipes, drain valve, buchholz relay with shut-off valves at both sides etc. The level gauges shall be so placed that same can be readable standing from ground. Necessary device shall be kept to provide annunciation in the event of rupturing of bellow.
- Oil sample requirement for all Inverter duty transformers:

Sl. No.	Parameters	Before filling in main tank & tested for	Prior to energization for following properties & acceptance norms:
i)	BDV	60 kV (min)	60 kV (min)
ii)	Moisture content	10 ppm (max.)	10 ppm (max.)

5.13.5.5 General Construction

Transformer shall be constructed in accordance to IS: 2026 and IS: 3639 or equivalent to any other international standard. Transformer shall be complete & functional in all respect

i) The Transformer tank and cover shall be fabricated from high grade low carbon plate steel of tested quality. The tank and the cover shall be of welded construction and there should be provision for lifting by crane.

ii) A double float type Buchholz relay conforming to IS: 3637 shall be provided.

iii) All bolted connections to the tank shall be fitted with suitable oil-tight gaskets which shall give satisfactory service under the operating conditions for complete life of the transformer if not opened for maintenance at site

iv) Suitable Inspection hole(s) with welded flange(s) and bolted cover(s) shall be provided on the tank cover. The inspection hole(s) shall be of sufficient size to afford easy access to the lower ends of the bushings, terminals etc.

v) The transformer shall be provided with conventional single compartment conservator. The top of the conservator shall be connected to the atmosphere through indicating type cobalt free silica gel breather (in transparent enclosure). Silica gel shall be isolated from atmosphere by an oil seal.

vi) Transformer shall have Oil Temperature Indicator and Winding temperature Indicator with accuracy class of +/-2 deg.

vii) Radiators shall be detachable type, mounted on the tank with shut off valve at each point of connection to the tank, lifts, along with drain plug/valve at the bottom and air release plug at the top.

- **Marshalling box:**
  - A sheet steel, weatherproof, IPW55, marshalling box shall be provided for the transformer. The box shall contain all auxiliary devices except those which must be located directly on the transformer.
  - All terminal blocks for cable connection shall be located in this box.
  - The marshalling box shall be provided with cubicle lamp with door switch, space heater with thermostat and removable cable gland plate.
- **Windings**
  - The Bidder shall ensure that windings of all transformers are made in dust proof & conditioned atmosphere.
  - The conductors shall be of electrolytic grade copper/Aluminum free from scales & burrs.
  - All windings of the transformers shall have uniform insulation.
  - Tapping shall be so arranged as to preserve the magnetic balance of the transformer at all voltage ratio.
- **Core**
  - The core shall be constructed from non-ageing, cold rolled, super grain oriented silicon steel laminations equivalent to M4 grade steels or better.
  - Core isolation level shall be 2 kV (rms.) for 1 minute in air.
  - Adequate lifting lugs will be provided to enable the core & windings to be lifted.
- **Bushing CTs**

  Shall be of adequate rating for protection (differential and others if any) as required, WTI etc. All CTs (except WTI) shall be mounted in the turret of bushings, mounting inside the tank is not permitted.

  All CT terminals shall be provided as fixed type terminals on the M. Box to avoid any hazard due to loose connection leading to CT opening. In no circumstances Plug In type connectors shall be used for CT.
- **Valves**

All valves up to and including 50 mm shall be of gun metal or of cast steel. Larger valves may be of gun metal or may have cast iron bodies. Sampling & drain valves should have zero leakage rate.

- **Gaskets**

  - Gasket shall be fitted with weather proof, hot oil resistant, rubberized cork gasket.
  - If gasket is compressible, metallic stops shall be provided to prevent over compression.
  - The gaskets shall not deteriorate during the life of transformer if not opened for maintenance at site. All joints flanged or welded associated with oil shall be such that no oil leakage or sweating occurs during the life of transformer. The quality of these joints is considered established, only if the joints do not exhibit any oil leakage or sweating during the guarantee period. In case any sweating / leakage is observed, contractor shall rectify the same & establish for a further period. If it is not established during the guaranteed period, the guaranteed period shall be extended until the performance is established.

  - **Painting:**

Parts name	Type of Paint	No. of coats	Total DFT
Inside of tank and accessories (except M Box)	Oil & heat resistant fully glossy white	One coat	Atleast 30 micron
External Radiator surface	Anticorrosive primary paint followed by high quality full glossy outer finish paint (RAL 5012 Blue)	Two coats each	Atleast 100 micron
External surface of transformer and accessories including M Box (except radiators)	Chemical resistant epoxy zinc phosphate primer, MIO (Micaceious iron oxide) as intermediate paint followed by polyurethane finish paint (RAL 5012 Blue)	One Coat each	Atleast 100 micron
Internal Radiator surface	Hot oil proof, low viscosity varnish and subsequent flushing with transformer oil		
Internal surface of M Box	Chemical resistant epoxy zinc phosphate primer followed by chemical and heat resistant epoxy enamel white paint	Two coats each	Not less than 100 micron

- **Cable boxes & disconnecting chamber (Disconnecting chamber applicable for Inverter Transformer 33kV side)**

- 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 33 kV and above side).
- Cable boxes shall have bus bars / suitable terminal connectors of adequate size & bolt holes to receive cable lugs. The degree of protection of cable boxes shall be IP 55W.
- A suitable removable gland plate of non-magnetic material drilled as per the Employer's instruction shall also be provided in the cable box The support from base for the cable box (for 33 kV and above side) shall be of galvanized iron
- The contractor shall provide earthing terminals on the cable box, to suit GI flat.
- The minimum length provided for terminating 33 kV, XLPE cable shall be 1000 mm (for 33 kV) 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.
- 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).

- **FITTINGS**

Following fittings shall be provided with Transformers

i)	-Conservator for main tank shall be provided with MOG with low oil level alarm contact, drain valve & indicating type free Cobalt free breather with transparent enclosure (maximum height 1400 mm above ground level) etc.
ii)	- Buchholz relay, double float type with alarm and trip contacts, along with suitable gas collecting arrangement.
iii)	- For Inverter transformer and transformers with rating 2 MVA & above, shall be provided with minimum two numbers of spring operated PRD (with trip contacts) with suitable discharge arrangement for oil shall be provided. - For Auxiliary transformers, diaphragm type explosion vent shall be provided.
iv)	OTI & WTI shall be 150 mm dial type with alarm and trip contacts with max. reading pointer & resetting device (maximum height 1500 mm above ground level).

	For Inverter Transformers, WTI shall be provided at least for all LV windings.
v)	Top & bottom filter valves with threaded male adapters, bottom sampling valve, drain valve/sludge removal valve at the bottom most point of the tank.
vi)	Air release plug, bushing with metal parts & gaskets, terminal connectors on bushings (as applicable).
vii)	Prismatic/toughened glass oil gauge for transformers.
viii)	Bolts & nuts (exposed to atmosphere) shall be galvanized steel/SS.
ix)	Bi-directional wheel/skids, M.Box, OCTC, Bushing CTs (as applicable), Insulating Oil, Cooling equipment.
x)	Rain hoods to be provided on Buchholz, MOG & PRD. Entry points of wires shall be suitably sealed.
xi)	Cover lifting eyes, transformer lifting lugs, jacking pads, towing holes and core and winding lifting lugs, inspection cover, Bilingual R&D Plate, Terminal marking plates, two nos. earthing terminals etc.
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.	

5.13.5.6 TESTS AND INSPECTION

- **TYPE TEST**

In case the bidder/contractor has conducted type test(s) within last ten years, he may submit the type test reports to the owner for waiver of conductance of such type test(s). These reports should be for the tests conducted on the equipment similar to those proposed to be supplied under this contract and test(s) should have been either conducted at an independent laboratory or should have been witnessed by a client.

In case the Bidder is not able to submit report of the type test(s) conducted within last ten years from the date LOA of this project, or in case the type test report(s) are not found to be meeting the specification requirements, the Bidder shall conduct all such tests under this contract at no additional cost to the Employer and submit the reports for approval.

- **ROUTINE TESTS**

Following tests to be performed:

- All routine tests shall be carried out in accordance with IEC 60076 (part 1 to 3).
- Measurement of No load current with 415 V, 50 Hz AC supply.
- Load Loss & Short Circuit Impedance Measurement on principal & Extreme Taps.
- Measurement of capacitance & tan delta to determine capacitance between winding & earth.
- Repeat No load current/loss & IR after completion of all electrical test
- Oil leakage test on completely assembled transformer along with radiators (as per relevant clause of this sub section).
- Jacking test followed by D.P. test

- **Leakage test on assembled Oil filled Transformer (ROUTINE TEST)**

All tank & oil filled compartment shall be tested for oil tightness by being completely filled with oil of viscosity not greater than that of specified oil at the ambient temperature & applying pressure equal to the normal pressure plus 35 KN/sq. m measured at the base of the tank. The pressure shall be maintained for a period of not less than 6 hours during which time no sweating shall occur. Bidder can perform this test at site depending upon urgency subjected to WBPDCL approval.

Suitable Fire Fighting arrangements for Oil filled Transformers shall be provided if applicable as per Tariff Advisory Committee (TAC)/statutory requirements. Firewall & soak pit as applicable (as per statuary requirement/TAC/IS 10028 / IS 1646) shall be provided of minimum 230 mm thickness of RCC wall or 355 mm thick fire resisting brick wall subject to WBPDCL approval.

5.13.5.7 APPROVAL

The Detailed Design Report Submitted by the contractor to WBPDCL must contain but not limited to the following details of the transformers:

- Detailed specification including Fittings and Accessories
- Necessary Drawings shall contain but not limited to the following:
  - Outline dimension drawings of transformers and fittings/accessories
  - Assembly drawings and weight of main components.
  - Transport drawings, showing main dimensions and weight of each package.
  - Foundation details
  - Tap-changing equipment
  - Name-plate diagrams

- Necessary test certificates and type test reports.

A joint inspection and testing will be done by WBPDCL and the authorized representatives of the contractor at the manufacturer's workshop. Testing and inspection of the transformers will be carried out as per relevant Indian Standard. Arrangements for the aforesaid testing and inspection at manufacturer's end are to be provided by the contractor.

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

- Guarantees
- Instructions for installation and operation, manual
- Safety precautions
- Test reports for routine tests and acceptance tests etc
- Detailed schematics of all power instrumentation and control equipment and subsystems along with their interconnection diagrams. Schematics shall indicate wiring diagrams, their numbers and quantities, type and ratings of all components and subsystems etc.

The contractor can deliver the product to the site only after receiving such approval against their prayer in writing from WBPDCL.

5.15.6 33kV INDOOR SWITCHGEAR & POWER EVACUATION

5.13.6.1 SCOPE

Proposed plant evacuation voltage level is 33kV. This specification covers the design, manufacture, testing at manufacturer's works before dispatch, supply, delivery at site, transit insurance, storage at site, erection, testing & commissioning of 36KV, 3 phase, 50 Hz air insulated Metal clad indoor VCB type switchgear & Power Evacuation System unit with horizontal draw out horizontal isolation circuit breaker as per IS 13118 (1991)/IEC-60056 and other standards for satisfactory operation of 22.5 MW Solar PV Power Plant in BkTPS, STPS & SgTPP, West Bengal though **the bas bar capacity of the 33kV switchgear shall be capable of handling following power including 10% higher margin**.

a) BkTPS: 15 MW (AC) capacity;

b) STPS: 15 MW (AC) capacity for Raw Water Pond 2 and 3 MW capacity for Dutta Bandh location.

c) SgTPP: 15 MW (AC) capacity.

Corresponding parts of all the equipment & spares shall be of the same material & dimensions, workmanship & finish and shall be interchangeable. All the

material & workmanship shall be of suitable commercial quality as have proven successful in their respective uses in similar services & under similar condition.

The design of the switchgear shall be based on safety to personnel and equipment during operation and maintenance, reliability of service, ease of maintenance, mechanical protection of equipment, interchangeability of equipment and ready addition of future loads.

Power shall be evacuated from new 33 kV Indoor Switchgear installed at Control Room for Floating Solar near all the Water Ponds. The technical details of the said switchgear are mentioned in this specification.

Necessary space provisions of at least one similar panel at each side need to be kept during layout finalization. The following equipment shall be supplied for the extension of this 33kV switchgear:

a. **33kV incoming feeder:**

As per table below.

b. **33kV Outgoing Feeder for Power Evacuation:**

As per table below.

c. **Outgoing feeder Station Auxiliary Transformer (SAT):**

As per table below.

d. **BUS PT & LINE PT**:

As per table below.

Table for new 33 kV panel for BkTPS, STPS & SgTPP :

BkTPS:

Sl. No.	Description	Quantity
1	Incoming feeder from each Floating Solar Inverter Transformer (from Pond no. 1& 2)	2 Nos. (Min.) or as per detail engineering
2.	Outgoing feeder with separate Line PT (Evacuation of Power), capacity 15.0 MW	1 No.
3.	Outgoing feeder for Minimum 250 KVA SAT	2 Nos.
4	One Spare feeder for Incoming capacity	1 No.
5	Bus PT	1 No.

6	LINE PT	1 No.

STPS:

a) Raw Water Pond 2:

Sl No.	Description	Quantity
1	Incoming feeder from Floating Solar Inverter Transformer (from Pond no. 2)	1 Nos. (Min.) or as per detail engineering
2.	Outgoing feeder with separate Line PT (Evacuation of Power), capacity 15 MW upto Floating Solar Plant Switchgear Room	1 No.
3.	Outgoing feeder for minimum 400 KVA SAT	1 No.
4	One Spare feeder for Incoming capacity	1 No.
5	Bus PT	1 No.
6	LINE PT	1 No.

Dutta bandh (RMU):

Sl No.	Description	Quantity
1	Incoming feeder with separate Line PT (Evacuation of Power), capacity 3.0 MW	1 Nos. (Min.)
2.	Outgoing feeder with separate Line PT (Evacuation of Power), capacity 3.0 MW	1 No.
3.	Outgoing feeder for minimum 80 KVA SAT	1 No.
4	One Spare feeder for Incoming capacity	1 No.
5	Bus PT	1 No.
6	LINE PT	1 No.
7	Outdoor 33 kV switchyard considering 4 pole structures, Isolators, VCB, CT, PT, CR panel room with CR panel etc.	1 Set

SgTPP:

Outdoor 33 kV switchyard considering 4 pole structures, Isolators, VCB, CT, PT, CR panel room with CR panel etc. (Please refer NIT Drawing)

33 kV Transformer Feeder has to be considered aa extension panel at Main Control Room near Raw Pond #3. Inverter, Inverter Transformer etc. shall be placed near Raw Water Pond #5. 33 kV Cable to be laid from the Outdoor switchyard near Raw Water Pond #5 to the extension panel under this project Indoor 33 kV Switchgear Room to Main Switchgear cum control room.

Sl. No.	Description of extension panel	Qty (no.)
1	33 kV, 1250 A capacity Indoor Switchgear Extension panel to be connected with the existing BHEL make 33 kV Indoor switchgear at Main Control Room Near Raw Water Pond 3. For evacuation of power from RMU near Raw Water Pond #4 to 33 kV existing Indoor Switchgear	1 no [Capacity 10 MW with 10% higher margin]
2	33 kV, 1250 A capacity Indoor Switchgear Extension panel to be connected with the existing BHEL make 33 kV Indoor switchgear at Main Control Room Near Raw Water Pond 3. For 100 kVA 33 kV/415 V Auxiliary Transformer near Raw Water Pond #3	1 no

Details of the Electrical Layout is shown in the attached tender drawing for ready reference of the bidder.

STANDARDS

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

Sl. No.	Standards	Description
1	IS: 5	Colors for ready mixed paints & enamels
2	IEC-62271-100,200; IEC-600298 / 600694; IS-3427	AC metal enclosed switchgear & control gear for rated voltages above 1 kV & up to & including 52 kV.
3	IS: 13947/ IEC 60529	Degree of protection provided by enclosures for switchgear.
4	IS: 1901	Specification for visual indication lamps
5	IEC-60056 / IS 13118 /IEC	High Voltage Alternating current Circuit Breakers
6	IS: 2705 - (Part I -	Current Transformers

Sl. No.	Standards	Description
	IV)/ IEC 60185	
7	IS: 3156 - (Part I - IV)/ IEC 60186	Voltage Transformers
8	IEC: 60694	Common clauses for high voltage switchgear & control gear
9	IS: 1248	Indicating Electrical measuring instruments
10	IS: 8084	Inter connecting Bus bars for AC voltage between above 1 kV up to and including 36 kV
11	IS-3231 & 3842 / IEC 60255	Electrical relays for Power Systems
12	IEC: 62271-102/ IEC 60129	Alternating current disconnectors and earthing switches
13	IEC-99-4	Metal oxide surge arresters without gates for A.C. systems

Equipment meeting with other authoritative standards which ensure an equal or better quality is also acceptable. Where the equipment conforms to any other authoritative standard, the salient points of difference between the standard adopted and IS/IEC shall be clearly brought out in the tender. Complete set of documents and standards in English shall be supplied by the contractor without any extra charge. It shall, however, be ensured that equipment offered comply with one consistent set of standards except in so far as they are modified by the requirement of this specification.

5.13.6.2 SPECIFIC TECHNICAL REQUIREMENTS/PARAMETERS:

All indoor switchgear panels shall have minimum technical parameters for design consideration as mentioned hereunder:

BUS BARS/CUBICLE:

SI. No.	Description	Requirement
1	Nominal/Highest System Voltage	33 kV/33 kV
2	Type of Installation	Indoor
3	Max. Ambient Temp. and Temp. Rise	As per IS/IEC
4	Min. Clearances in air (Phase to Phase and Phase to Earth)	As per IS/IEC
5	Degree of protection	IP 52
6	Continuous current rating	As per system design which is capable of handling specified MW power
7	Short Time Current Rating for 1 sec	25 kA
8	Rated Power Frequency withstand voltage	70 kV (rms)
9	Rated Lightning Impulse Withstand Voltage	170 kV (peak)

SI. No.	Description	Requirement
10	Cable Entry	From bottom

CIRCUIT BREAKERS:

SI. No.	Description	Requirement
1	Type	Vaccum
2	No. of Poles	3
3	Nominal/Highest System Voltage	33 kV/36 kV
4	Type of Installation	Indoor
5	Duty Cycle	O- 0.3 sec-CO-3 min-CO
6	Operating cycles	Min. 10000
7	Control Voltage	220 V DC (10% to -15%)
8	Short Time Current Rating for 3 sec	25 kA
9	Continuous current rating	As per system design
10	Symmetrical Breaking Current Capacity	25 kA (rms)
11	Short Circuit Making Current	62.5 kA
12	Degree of protection	IP 55
13	Operating mechanism	Spring Charged

CURRENT TRANSFORMER

SI. No.	Description	Requirement
1	Type	Cast Resin Type
2	Nominal/Highest System Voltage	33 kV/36 kV
3	Short Time Current Rating for 1 sec	25 kA
4	No. of Phases	Single
5	Insulation Class	Class B or better
6	Rated Power Frequency withstand voltage (Primary/secondary)	70 kV (rms)/3 kV (rms)
7	Rated Lightning Impulse Withstand Voltage	170 kV (peak)
8	Protection Class	5P20
9	Diff./REF Protection Class	PS
10	Metering Class	Class 0.2 and ISF <=5

POTENTIAL TRANSFORMER

SI. No.	Description	Requirement
1	Type	Cast Resin Type
2	Nominal/Highest System Voltage	33 kV/36 kV
3	Short Time Current Rating for 1 sec	25 kA

SI. No.	Description	Requirement
4	No. of Phases	Single
5	Insulation Class	Class B or better
6	Rated Power Frequency withstand voltage (Primary/secondary)	70 kV (rms)/3 kV (rms)
7	Rated Lightning Impulse Withstand Voltage	170 kV (peak)
8	Accuracy Class	0.2 for metering and of 0.5 for other purposes.

ISOLATOR/DISCONNECTING SWITCH

SI. No.	Description	Requirement
1	Type	Cast Resin Type
2	Nominal/Highest System Voltage	33 kV/36 kV
3	Short Time Current Rating for 1 sec	25 kA
4	No. of Poles	3
5	Continuous current rating	As per system design which is capable of handling 20MW power
6	Short Time Current Rating for 3 sec	25 kA
7	Rated Power Frequency withstand voltage	
	a. To earth & between poles	70 kV (rms)
	b. Across isolating distance	80 kV (rms)
8	Rated Lightning Impulse Withstand Voltage	
	a. To earth & between poles	170 kV (peak)
	b. Across isolating distance	195 kV (peak)

SURGE ARRESTOR

SI. No.	Description	Requirement
1	Type	Metal Oxide Gapless
2	Rated Voltage	30 kV
3	Nominal Discharge Current	As per IS
4	Installation	Indoor
5	Rated Power Frequency withstand voltage	70 kV (rms)
6	Rated Lightning Impulse Withstand Voltage	170 kV (peak)

5.13.6.3 GENERAL REQUIREMENTS

The 33 kV Indoor Switchgear shall be designed considering the minimum general requirements as mentioned hereunder:

A. STRUCTURAL & MECHANICAL CONSTRUCTION

i. The Switchgear shall be factory assembled, totally enclosed, metal clad, dead front cubicle. It shall be of sheet Steel (preferably galvanized to avoid rusting) construction and shall be dust, moisture and vermin proof complying with degree of protection of not less than IP-4x as per IS-3427 (1997). The panels shall be of Metal Clad compartmentalized design with all the High Voltage compartments viz. Circuit Breaker, Bus Bar, Current Transformers and Voltage Transformers separated by metallic partitions. The switchgear panels shall be rigid without using any external bracing. The switchboard panels should comply with relevant ISS/IEC and revision thereof and shall be designed for easy operation maintenance and further extension. Bus bar, metering, circuit breaker chamber, cables and cable box chamber should have proper access for maintenance, proper interlocks should be provided. All instruments shall be non draw-out type and safeguard in every respect from damages. The switchgear shall be complete with all necessary wiring fuses, auxiliary contacts, terminal boards etc.

ii. The overall design of the switchboard shall be such that front access only is required. The panels shall be constructed from prime quality folded and bolted steel sheet of 2 mm thick or Al-Zn sheet steel. Only doors and end covers shall be painted with paint shade as specified.

The observation window on the CB compartment door shall be provided. Observation window shall be of same material and construction as the type tested design/construction.

The design of the panels shall be such that no permanent or harmful distortion occurs either when being lifted by eyebolts or when moved into position by rollers or transpallets.

The switchgear and control gear should have the minimum degree of protection (in accordance with IEC 60529)

- IP 4X for the enclosure for rated current up to 1250A

- IP 3X for the enclosure for rated current up to 2500A

- IP 2X for the partition between compartments

The switchgear must be readily extendable in either direction.

iii. For Seismic Applications: The switchboard may be subject to seismic disturbance, hence the switchgear supplier shall provide proof by type test

or calculation according to IEEE 693 standards, documentation to support the offered equipment.

iv. Each cubicle shall be equipped with anti-condensation heater controlled by thermostat.

v. Assembly of all current carrying parts shall be such that they shall be easily accessible for inspection and maintenance.

vi. Switchgear cubicles shall be satisfied the requirement of IEC:62271-200, IEC:60298, IEC:60694.

vii. Switch gear shall be supplied with basic operating tools.

viii. The switchgear and control gear shall be suitable for continuous operation under the basic service conditions indicated below.

Ambient temperature °C	- 5 to + 50
Relative humidity	up to 95%
Altitude of installation	up to 1000m, IEC120.

B. BUS BARS AND CONNECTORS

Bus bars and all other electrical connections between various components shall be made of Electrolytic copper of adequate cross-section. The bus bar section shall be of ample capacity to carry the rated current for 10MW power for BkTPS, 15 MW power for STPS Raw Water Pond & 2.5 MW for STPS Dutta bandh, 5 MW RMU for SgTPP with 10% higher margin, continuously without excessive heating and for adequately meeting the thermal and dynamic stresses in the case of short circuit in the system up to full fault MVA.

All bus bars shall be rigidly and firmly mounted. Spacious bus bar chamber shall be provided with use of tubular busbar design and free from any high voltage stresses by avoiding all sharp edges and bringing them to uniform potential. Bus bar shall be sleeved for full voltage. Sleeve shall be heat shrinkable BTPM type of Raychem make. **No PVC sleeve in bus bar for 36KV is acceptable.**

Bus bar shall be located in a separate metal clad chamber and shall be air insulated. It shall be adequately supported on insulators or integral epoxy spouts to withstand dynamic stress due to the short circuit current as specified.

Bus bar shall be extensible on either side to make it in switch board configuration in future.

C. CIRCUIT BREAKER

a) The Circuit Breaker shall be drawing out type suitable for installation in the switchgear cubicle. The breakers shall comply with IS-13118 / IEC-60056 conforms to latest amendment thereof.

b) The Circuit Breaker shall be spring operated, DC Motor charged, manually released spring closing mechanism with three pole simultaneous operation. The indicating device shall show the OPEN and CLOSE position of breaker visible from front of the cubicle. The spring charging time of the motor shall not exceed 15 sec. The "TRIP" and "CLOSE" coils shall be of reliable design and low consumption preferably less than 300W. It shall be possible to manually charge the circuit breaker operating spring in case of auxiliary supply failure.

c) The breakers shall be capable of Making & Breaking the short time current in accordance with the requirement of ISS 13118 / IEC 60056 conform to latest amendment thereof and shall have 3 phase rupturing capacity of 31.5KA at 33KV. The continuous current rating of breaker shall not be less than 1250A for all items.

d) The circuit breaker shall be isolated by horizontal racking and positively fixing the unit into any one of the following positions:,

- **Service position**; main and auxiliary circuits connected
- **Test position**; main circuits disconnected auxiliary circuits connected. Circuit breaker in its isolated position shall be completely contained in the apparatus compartment with shutters on main circuit closed and compartment front door closed.
- **Withdrawn position**; main circuits and auxiliary circuits disconnected. Circuit breaker is removed out of the cubicle.

e) Locking of circuit breaker in the test position shall be possible by means of key lock on the earth switch mechanically.

f) A position indicator switch or viewing window must be provided for visual indication of the circuit breaker position.

g) Comprehensive interlocking system to prevent any dangerous or inadvertent operation shall be provided. Isolation of circuit breaker from bus bar or insertion into bus bar shall only be possible when the breaker is in the "OPEN" position.

h) Each circuit breaker shall be provided with following accessories.

i) ON-OFF indicator for indicating circuit breaker position.

ii) Trip push button.

iii) Shunt trip coil operating between 70% - 110% of rated control voltage.

iv) Close coil, operating between 85% - 110% of rated control voltage.

v) Spring charge motor, operating between 90% - 110% of rated control voltage.

vi) Two trip coils and one closing coils shall be provided in all the breakers.

vii) Metering with higher class of accuracy (Class 0.2 and ISF <=5 for metering.)

i) The switchgear shall be provided with facilities for full operation from a remote point. In case of Local Operation of circuit breakers, Control switch of Circuit Breaker shall be located at such a height so that a man can operate standing on ground/floor. It shall be possible to trip the circuit breaker locally by mechanical means.

j) The circuit breaker truck shall ensure earth in both connected and disconnected positions.

k) An electro-mechanical device shall be provided to ensure the auxiliary circuits have been securely connected between the fixed and moving portions of the switchgear, before allowing closing operation of the circuit breaker. The voltage rating of the device shall be the same as the voltage used for the closing circuit.

l) Tripping and/or release coils shall be continuous rated to ensure longer life but rating should not exceed 300 W each. The electrical tripping device shall be of a type which acts directly on the circuit breaker mechanism and shall give positive operation for a supply voltage of 70% of nominal at DC control voltage.

m) Circuit breakers will be provided with at least one spare normally-open and one spare normally-closed contact, each wired out to terminals for the connection of external wiring.

n) Each circuit breaker shall be interlocked to prevent:

- the breaker being inserted into service position unless it is open
- the breaker being withdrawn from the service position unless it is open
- the breaker being closed unless it is fully in the service or test position
- remote operation whilst in the service position and/test position

o) Circuit breakers shall be mechanical latching and electrical and mechanical tripping. The operating mechanism shall be trip-free and shall include an anti-pumping device.

p) Shutters: Circuit breaker compartment should have nonmagnetic nonferrous automatic safety shutters, which shall be opened and closed by the mechanical drive of the circuit breaker. The bus bar and circuit spout covers shall be operated independently of each other. Padlock facilities can be provided on the metal shutters.

q) INTERLOCKING Isolation and connection of the circuit breaker shall be carried out inside the compartment with the door closed. The following mechanical interlocks shall be provided for service safety:

- Interlocking which prevents racking-in and racking-out of the circuit breaker when closed
- interlocking which prevents manual or electrical closing of the circuit breaker in the intermediate positions between connected or isolated.

D. CURRENT TRANSFORMER :

The CT shall be mounted in a manner to make it very easy for fitting / replacement at site. It shall be designed with built in adjustable cable holding clamps, makes it very easy for removal/sturdy fitting of power cables and to prevent any swing due to forces encountered during short circuit. P1 of primary side of the in-built CT shall be at bus side of all the panels.

E. POTENTIAL TRANSFORMER

Three numbers Single phase draw out type PT of ratio 33000/√3; 110/√3 Volts with HT/LT fuses mounted on an independent trolley housed at the bottom in

the same feeder/transformer panel or separately vertical housed . This Line PT shall not get disconnected along with the Circuit Breaker in case the breaker is drawn out from 'SERVICE' position. Arrangement shall be made in such a way so that PT primary fuse can be replaced without switching OFF the breaker.

F. AUXILIARY/CONTROL WIRING

All the secondary wiring in the panel shall have high quality PVC insulation 1100 volts grade and the same shall be of standard Copper Conductor of size not less than 2.5 sq. mm. for control circuit and 4 sq. mm. for CT circuits. Colours of the secondary / auxiliary wiring should confirm to ISS 375/1963 conform to latest amendments thereof. All wiring shall be neatly run and group of wiring shall be securely fixed with clips so that wiring can be checked without necessity of removing the clamps. Ferrules with number shall be provided on both end of the wiring.

G. PAINTING The Panels shall be pre-treated using 7-Tank process and then Epoxy Powder Coated with Paint shade of RAL 7032.

H. EARTHING

a. An earth bus of size minimum 40 mm x 6 mm or equivalent copper shall be provided and shall be extended throughout the length of the switch board with a provision to extend further on both sides of the end switchboard for future extension of switchboards.
b. It shall be possible to connect each circuit of the switchgear to earth, through earthing switches suitable for fault make current.
c. Earthing switch shall be mechanically interlocked with the associated breaker as per interlock requirement.
d. Earthing circuit shall be suitable for testing at 25 KA for 3.0 sec.
e. Breaker compartment shall have scrapping earth bar and spring load finger shall be provided in withdrawal truck.
f. Provision of Busbar earthing at both side of Bus-Coupler is to be provided.

I. TEST:

- **TYPE TESTS**

All equipment to be supplied shall be of type tested design. During detailed engineering, the bidder shall submit following Type test reports (not more than five year old from the date of bid opening) to prove the capability and suitability of his offered switchgear. These reports should be for the test

conducted on the equipment similar to those proposed to be supplied under this contract and the test(s) should have been either conducted at an independent laboratory or should have been witnessed by a client.

i. Short Time Current Test on circuit breaker mounted inside the panel along with CTs, bushing and separator for 25KA for 3 second.

ii. Short Circuit Test duties on Circuit Breaker mounted inside the panel along with CTs, bushing and separator.

iii. Lightning Impulse withstands Test mounted inside the panel.

iv. Power Frequency withstands Test mounted inside the panel.

v. Temperature rise test on breaker and panel together.

If bidder fails to provide test report they have to do the type test without any price implication before delivery of equipment.

- **ROUTINE TESTS**

  All acceptance and routine tests as per the specification and relevant standards IEC 62271-200 & IEC 62271-100 shall be carried out. Charges for these shall be deemed to be included in the equipment price

5.13.6.4 OTHER SOME GENERAL REQUIREMENTS:

- The switchgear shall be indoor, free standing, sheet metal clad, draw out type and shall be fully compartmentalized.
- The Switchgear enclosures shall be totally enclosed design, dust tight and vermin proof.
- Each panel shall be equipped with space heaters to prevent moisture condensation within the enclosure and shall be complete with MCB, thermostats and auxiliary relay (if required).
- Switchgear design shall comprise of fully compartmentalized execution having separate vertical sections for each circuit.
- Structure, buses and control wiring shall be designed and arranged in such a manner so that future extension of the switchboard would readily be feasible.
- All corresponding components of the circuit-breakers and switchgear of same rating shall be fully interchangeable.
- From 33 kV indoor Switchgear of Floating Solar control room, the power shall be fed to 33 kV Inverter duty Transformer through 33 kV XLPE Cable.

- The disconnecting switches shall be provided with local electrical/manual control. The disconnecting switches shall be fitted with earthing link wherever required. The disconnecting switch shall be connected between the transformer and circuit breaker for the power incoming from solar PV and for synchronization between the bus bar and transmission line through breaker, at 33 kV. Details layout shown in the tender drawings
- The supplier shall ensure that the current transformers shall have adequate VA output for the type of protection & metering offered. The supplier shall also ensure that the current transformers quoted by him have adequate output for prescribed accuracy class and accuracy limit factor for the type of relays and instruments connected in their circuits. PS class CTs shall have low secondary resistance and high knee point voltage so as to avoid any possibility of CT saturation under through fault conditions.
- Three single phase voltage transformers shall be suitable for connecting in a bank of three phase voltage transformers for protection and measurement purpose for each incomer and outgoing feeders. Separate and dedicated voltage transformers shall be provided for synchronization.
- The lightning arrester & voltage transformer (LAVT) cubicles for 33 kV shall comprise of lightning arresters and capacitors (for surge protection) and voltage transformers. The LAVT & VT cubicles shall be dust tight, vermin-proof.
- Each cubicle shall be equipped with space heaters, thermostats, illumination lamps & 240 V AC, 5A receptacle.
- Suitable single compression type, heavy duty brass cable glands with check nuts, rubber sealing ring and brass washers mounted on a removable gland plate shall be supplied with the switchgear to support all power and control cables entering the switchgear.
- Cables for each equipment must be tagged with permanent metal tag of impregnated cable number as per drawings at MCC/switchgear end and equipment terminal end as well as in the mid portion of the cables at certain distances as instructed by the owner or his authorized representative.
- The relay for the switchgear units shall have all the features as specified under Cl. no. 5.13.11 of, Sec-V of the Technical Specification.
- The switchgear units shall have the remotely controlled.
- The accuracy class of indicating instruments shall be 1 or better as per IS. The accuracy class of meters for commercial metering shall be 0.2. All instruments shall have means for calibration, testing and adjustment at site.

- Three phase watt hour meters conforming to latest issue of relevant Indian standard shall be provided with test link for CTs & PTs. Meters shall be compensated for temperature errors and factory calibrated to directly read the primary quantities.
- Following equipment at 33 kV switchgear shall be monitored and control from OWS of SCADA/DCS:

  1) Circuit breaker - On/Off status & Control, Test, service, spring charged, Trip Circuit unhealthy, Lock out operated etc.

  2) Transformer - Winding temperature & Oil temperature, Bucchhlz etc Alarm status

  Through hardwire. IPR shall be placed at switchgear end.

  3) Energy meters through RS 485 network.

  4) Numerical Relays through RS 485 network.

  5) Voltmeters- from transducer as analogue signal.

  6) Ammeters- from transducer as analogue signal.

- The switchgear shall be capable of addition another two outgoing and two incoming feeder and separate line PT provision for future extension. Necessary space provision should be envisaged during control room design.

5.13.6.5 APPROVAL

The Detailed Design Report submitted by the contractor to WBPDCL must contain but not limited to the following details of the Ring Main Unit/Switchgear:

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

The successful bidder required to produce all necessary test certificates and approvals of the product as per relevant standard with the Detailed Design Report.

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

- Guarantees
- Instructions for installation and operation, manual
- Electrical diagrams
- Safety precautions

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

The contractor can deliver the product to the site only after receiving such approval against their prayer in writing from WBPDCL.

5.13.6.6 SPECIFICATION FOR 33KV RING MAIN UNIT

1. 33kV RING MAIN UNIT (If applicable)

Each Ring Main Unit shall have all the following major components in addition to the other items required for satisfactory performance of equipment:

a. Painted MS enclosure with steel base frame for Ring Main Unit suitable for outdoor installation.

b. 33 KV Ring Main Units, Non-extensible type along with requisite number of electrically operated breakers and manually operated Load break switches and earth switches as per Single line Diagram

c. Control protection and metering requirements as per system requirement and single line Diagram.

d. Internal cabling for connections between the equipment of Ring Main Unit, lighting & earthing system along with required hardware, gaskets, gland plates etc as required.

2. Technical requirements for RMU

CODES AND STANDARDS: IS: 13118, IEC: 62271-200

The equipment shall have the following features:

A. ELECTRICAL SYSTEM PARAMETERS		
i.	Nominal system voltage	33 kV
ii.	Highest system voltage	36 kV
iii.	Rated insulation level i) Impulse with stand voltage with 1.2 / 50 Micro second wave ii) One minute power frequency with stand voltage	 170 KV(Peak) 70 kV (RMS)
iv.	Rated short circuit breaking capacity at specified site conditions (Minimum)	As per system fault current (Refer Sub part 2-A of Part-A) with %age of DC component as per IEC-62271-100 corresponding to minimum operating time with operating conditions specified.

	Rated short circuit making current (Minimum)	2.5 Times of system fault current.
	Rated short time withstand capacity (Minimum)	**As per system fault current**
	Rated operating duty cycle	O-3 minute-CO-3 minute – CO
	Maximum temperature rise over & Ambient temperature of 50 deg.C	As per IEC : 62271-100
A. **RMU CONFIGURATION**		
i.	RMU Configuration	Two Nos. Load break switches (LBS) and transformer circuit breaker.
ii.	Load break switch, Circuit Breaker & earth switch in RMU panel	All shall be fixed (Non draw out) type
iii.	Insulation medium for panel/bus bar	SF6 gas or Dry air in sealed metallic tank
iv.	Breakers & load break switches	SF6 gas or Vacuum type (with Disconnector & earth switch)
v.	Internal Arc classified FLR	As per system fault current. (for min 1 sec)
B. **RMU CONSTRUCTIONAL FEATURES**		
i.	RMU Panel type	Metal enclosed panel Construction
ii.	Service Location	Outdoor
iii.	Mounting	Free Standing
iv.	Overall enclosure protection	IP54 minimum for MV Switchgear Compartments, Vermin proof
v.	Doors	Front access with anti-theft hinge
vi.	Covers	Bolted for rear access, with handles. All the accessible bolts / screws shall be vandal proof. One set of required Special tools per RMU shall be in the scope of supply.
vii.	Construction	Sheet metal 2 mm thick CRCA/Aluzinc/Stainless Steel (minimum) suitable for outdoor application.
viii	Base frame made of steel for RMU	Raised frame of 300 mm height
ix	Lifting lugs	Four numbers
x	Cable entry	Bottom
xi	Bus bar continuous rated current at designed 50 deg.C ambient temperature	As per system requirement.
xii	Bus bar short time withstand	As per system fault current

	capacity	(Minimum)
xiii	Maximum temperature rise above reference ambient 50 deg C	As per IEC reference standard
xiv	Earth bus bar	Aluminum sized for rated fault duty for 1 sec
xv	Cooling arrangement	By natural air (without fan)
xvi	Panel internal wiring	Stranded flexible color coded PVC insulated copper wire 2.5 sq mm.(min.), 1100 volt grade
xvii	Gasket	Neoprene rubber
xviii	Marshalling terminal blocks	2.5 Sq mm, Nylon 66 material, screw type + 20% spare in each row of TB.
xix	Padlock facility	Required for all earth switches & all handles
xx.	Explosion vents	To ensure operator's safety, design should ensure that gases / flames generated during flash over / blast in any of the compartment, must not come out from the front of RMU. Cable compartment & other compartments of the RMU should withstand Internal arc test for the indicated system fault current.
C. **Requirements of sealed housing live parts (RMU SF6 gas chamber)**		
i.	Enclosure	Stainless steel enclosure, IP67 Class
ii.	SF6 gas pressure low alarm	To be given
iii.	Provision for SF6 gas filling	To be given (For 'sealed for life' design of RMU, this is not applicable)
iv.	Provision for SF6 gas pressure measurement	Manometer with non-return valve indication
v.	Arc interruption method for SF6 breaker / Load break switch	Puffer type / rotating arc type
vi.	Potential free contacts for SF6 gas 1NO +1NC pressure low	1NO +1NC
vii.	Electrical Bushing	Preferably, Bushing should be suitable for replacement at site.
D. **LOAD BREAK SWITCH (LOAD BREAK ISOLATOR)**		
i.	Type	Three poles operated simultaneously by a common shaft
ii.	Arc interruption in dielectric Medium	SF6 or vacuum
iii.	Operating mechanism for close/ open	Electrically Operated through SCADA

iv.	Continuous current rating of LBS at design ambient temperature of 50 deg C	Minimum 100 Amps or As per system requirement
E. **CIRCUIT BREAKER**		
i.	Type	Three poles operated simultaneously by a common shaft
ii.	Arc interruption in dielectric medium	SF6 or vacuum
iii.	Operating mechanism	Electrically Operated.
iv.	Emergency trip / open push button	On panel Front
v.	Continuous current rating of Breaker at design ambient temp of 50 deg.C	100 Amps minimum or as per system requirement
vi.	Short time withstand capacity	As per system fault current
vii.	Breaker status auxiliary contact	2NO + 2NC wired to terminal Block
viii.	Current transformer Ratio	Suggestive rating: 100/1 A or as Per requirement Other ratings as per manufacturer's standard may also be adopted. Sufficient space must be provided both in horizontal & vertical directions for mounting of CT's. Additionally, some CAUTION marking (by sticker/ paint) should be there to avoid CT's installation above the screen of cable (i.e. earth potential point.)
ix.	CT accuracy class	Protection : 5P20, Metering : 0.5
x.	Potential Transformer (PT) ratio a Accuracy Class	33000/ √3 /110/ √3 Accuracy class : 0.5 suitable for converter duty application as mentioned elsewhere in the specification
xi.	Protections	Numerical relay as per requirements mentioned elsewhere in the specification. In addition to above Transformer protections like OTI, WTI, Buchholz, and Pressure Relief Valve (PRV) operated shall be suitably integrated in the protection circuit. Any AC/DC auxiliary supply requirement for the RMU shall be arranged as per requirement mentioned elsewhere in the specification.

xii.	Relay aux contacts for remote indication	1NO+1NC Potential free wired to TB
xiii.	Shunt trip (for door limit switch of enclosure or transformer) as per the adopted voltage	To be wired to terminal blocks
F. **EARTH SWITCH**		
i.	Type	Three poles operated simultaneously by a common shaft
ii.	Switching in dielectric medium	Dry air in sealed medium or SF6
iii.	Operating mechanism for Close/Open	Manual
iv.	Short time withstand capacity	As per system fault current
v.	Aux contacts	1NO+1NC free wired to TB
vi.	LBS Earth Switch close / Open	Potential free contacts wired to terminal block.
vii.	CB Earth Switch close/open	Potential free contacts wired to terminal block.
G. **INDICATION**		
i.	Cable charge status indication for all Load Break Switches & Circuit Breaker	Circuit breaker capacitor type voltage indicators with LED on all the phases (Shall be clearly visible in day light)
ii.	Spring charge status indication	On front for breaker
iii.	Earth switch closed indication (For Each LBS)	Front
iv.	Load break switch ON/OFF Indication	Green for OFF / Red for ON
v.	Circuit breaker ON/OFF indication	Green for OFF / Red for ON
vi.	Cable Fault Direction	Cable fault passage indicator.
	CB close / open	4NO + 4 NC minimum Potential free contacts wired to terminal block.
viii.	Protection relay operated	Potential free contacts wired to terminal block.
ix.	SF6 gas pressure low	Potential free contacts wired to terminal block.
H. **RMU OPERATIONAL INTERLOCK**		
i.	Interlock type	Mechanical
ii.	Load break switch &respective earth switch	Only one in 'close' condition at a Time
iii.	Circuit breaker & respective earth switch	Only one in 'close' condition at a Time
iv.	Prevent the removal of respective cable covers if load break switch or circuit breaker is 'ON'	Electrical / Mechanical
v.	Prevent the closure of load break switch or circuit breaker if	Electrical / Mechanical

	respective cable cover is open	
iv.	Cable test plug for LBS/CB accessible only if Earth switch connected to earth	Mechanical
I.	**MIMIC DIAGRAM, LABEL AND FINISH**	
i.	On panel front with description of function & direction of operation of handles/buttons	
ii.	Mimic diagram (Shall not be preferred with Stickers)	
iii.	Operating instruction chart and Do's & Don'ts to be displayed on left / front side of panel enclosure on Al Sheet, duly affixed on panel.	
iv.	Name plate on panel front	Fixing by rivet only
v.	Material	Anodized aluminum 16SWG / SS
vi.	Background	Satin Silver
vii.	Letters, diagram & border	Black
viii.	Name plate details	Month & year of manufacture, equipment type, input & output rating, purchaser name & order Number, guarantee period.
ix.	Labels for meters &indications	Anodized aluminum with white character on black background OR 3Ply lamicoid.
x.	Danger plate on front & rear side	Anodized aluminum with white letters on red background
xi.	Painting external finish	RAL 7032
xii.	Painting internal finish	Shade white

3. TESTS OF RMU

33 kV Ring Mains Unit shall be of type tested design. During detailed engineering, the contractor shall submit for Owner's approval the reports of all the type tests carried out within last ten years from the date of bid opening. These reports should be for the test conducted on the equipment similar to those proposed to be supplied under this contract and the test(s) should have been either conducted at an independent laboratory or should have been witnessed by a client.

However if the contractor is not able to submit report of the type test(s) conducted within last ten years from the date of bid opening, or in the case of type test report(s) are not found to be meeting the specification requirements, the contractor shall conduct all such tests under this contract at no additional cost to the owner either at third party lab or in presence of client/owners representative and submit the reports for approval.

All acceptance and routine tests as per the specification and relevant standards shall be carried out. Charges for these shall be deemed to be included in the

equipment price. The type test reports once approved for any projects shall be treated as reference. For subsequent projects of WBPDCL, an endorsement sheet will be furnished by the manufacturer confirming similarity and "No design Change". Minor changes if any shall be highlighted on the endorsement sheet.

5.15.7 33kV OUTDOOR SWITCHYARD

A. STPS Raw Water Pond 2:

OIL FILLED POWER TRANSFORMERS

5.13.7.1.1 SCOPE OF SUPPLY

This specification covers design, engineering, manufacture & assembly of 3-Phase, 132/36 KV 12.5 MVA, Power Transformer complete with all fittings and accessories required for efficient and trouble free operations of the transformer, testing at manufacturer's works and customer's premises, supply, loading at factory, delivery at site, unloading, handling, dragging for proper storage at site on the plinth of transformer after the same is ready at respective site, erection, site testing. Commissioning, charging etc. as per direction of customer. The MANUFACTURER / Bidder shall arrange for the services of their Supervisor/Engineer from the manufacturer during erection, testing and commissioning of the equipment at sites at free of cost as many time as required by WBPDCL.

Following transformers as stated below:
12.5 MVA, 132KV/ 36 KV 3 Phase, Auxiliary Transformer: One (01) no.

- MVA rating of the transformers, as indicated above, shall be considered as the minimum requirement for the project. Transformer offered by the bidder shall be sized according to the maximum demand at most stringent condition plus minimum 10 % margin.

- Each transformer shall be furnished complete with:

a) Fittings and accessories.
b) Auxiliary equipment.
c) First filling of oil including 10% extra.

- One set of special tools and tackles.
- Mandatory Spare parts.
- Recommended spare parts for three (3) years operation in addition to mandatory spares.

- All relevant drawings, data and instruction manuals.

The scope also include that this new 12.5 MVA 132/33 kV transformer shall have to be installed over existing Transformer foundation. Existing old 132/33 kV transformer shall have to be dismantled after removing all the existing connection. Necessary rectification, modification, strengthening of the existing transformer foundation is under bidder's scope. If it is found during detail engineering that the existing transformer foundation is not sufficiently strong or not matching with the proposed new transformer, the contractor has to install new transformer foundation in the available space of existing foundation. In this case, dismantle and cleaning of the existing space is also bidder's scope.

If, any of the existing structure is damaged or required to be dismantled for convenience of the erection, the same has to mend good as per the original. Existing drainage system must have to be maintained. If, any cable crossing is required to cross over the existing toe drain of the reservoir, the same has to be properly rectified & to be restored to the original.

5.13.7.1.2 CODES AND STANDARDS

- All equipment and materials shall be designed, manufactured and tested in accordance with the latest applicable Indian Standards (IS), IEC and CBIP Specifications except where modified and/or supplemented by this specification.
- Equipment and material conforming to any other standard, which ensures equal or better quality, may be accepted. In such case, copies of the English version of the standard adopted shall be submitted along with the bid.
- The electrical installation shall meet the requirements of Indian Electricity Rules as amended up to date and relevant IS Code of Practice. In addition, other rules and regulations applicable to the work shall be followed.

The Power Transformer covered under this specification shall comply with the requirements of the latest edition of following minimum Standards:

i) IS:2026 (Part I to IV) - Specification for Power Transformer

ii) IS:2099 & IS:3347 - Bushing for alternating voltage above 1000 volt

iii) IS : 6600 - Guide for loading of oil immersed transformer

iv) IS : 335 - Specification for transformer oil

v) CBIP - Manual on transformer.

vi) IEC-60076 - Power Transformer

vii) IEC-60214 - On Load Tap changer.

viii) IEC-354 - Loading Guide for Oil immersed Transformer

ix) IEC-551 - Tr. Sound Level.

5.13.7.1.3 DESIGN CRITERIA

- The transformer will be used to supply power for STPS Switchyard.
- The transformer will be installed in hot, humid and tropical atmosphere. All equipment, accessories and wiring shall be provided with tropical finish to prevent fungus growth.
- The transformer shall be capable of continuous operation at rated output under the following condition:

a)	Voltage variation	:	± 10%
b)	Frequency variation	:	± 5%
c)	Combined voltage and frequency variation	:	10% absolute sum)

- The transformer shall be so designed that it is capable of operation at 125% rated voltage for a period of one minute and 140% rated voltage for a period of five seconds due to sudden load throw off.
- The transformer shall be capable of withstanding the short circuit stresses due to a terminal fault on one winding with full voltage maintained on the other winding for minimum period of two (2) seconds.
- The transformer shall be free from annoying hum or vibration. The design shall be such as not to cause any undesirable interference with radio or communication circuits.
- The noise level shall be limited to the value specified by NEMA Standard Publication No. TR-1-1993 when measured in accordance with conditions outlines in ANSI/IEEE C57.12.90-1999/IS13964/CBIP publication.
- The Transformer and accessories shall be designed to facilitate easy inspection, cleaning and repairs. All fittings and accessories shall be designed to ensure satisfactory operation under worst conditions of load and voltage as may be met under working conditions in the system.
- All materials used shall be of best quality and of the class most suitable for working under the conditions specified. It shall withstand the variations of temperature and atmospheric conditions without undue stressing etc. i.e.

not affecting the workability/durability of the various parts of the transformer.

- All outdoor fittings and accessories, including bushings insulators with their mounting, shall be so designed as to avoid pockets in which water can collect. All electrical connections shall be of ample cross sections for carrying the specified currents continuously without undue heating. All fixing bolts and screws shall be reliable under worst conditions of operations.
- Transformers shall be suitable for continuous operation with a frequency of 50 Hz and variation of ± 5% without exceeding specified temperature rise.
- Clearances of line terminals in Air:

  The clearance of HV, IV & LV terminal shall be maintained as specified below :

Highest System voltage of equipment (KV rms)	Phase to Phase clearance (mm)	Phase to earth clearance (mm)
145	1220	1050
36	350	320

- Transformer with its winding and all its accessories including Bushing CTs etc. shall be design to withstand without injury, the mechanical and thermal effects and any external short circuit to earth and of short circuits at the terminals of any winding for a period of 3 Sec. The short circuit level of HV & IV system to which the subject transformer will be connected is 31.5 KA (Sym., rms, 3 Ph. fault on 132KV).

Transformer shall be capable of withstanding thermal and mechanical stresses caused by symmetrical or asymmetrical faults on any winding.

- For parallel operation with other transformers, necessary provision is to be kept in transformer RTCC panel for tap changing operation in any of Master/Follower/ Independent mode.
- THE LOADING GUIDELINE :

  Over loading of transformer shall be guided by latest IS-6600.

5.13.7.1.4 SPECIFIC REQUIREMENTS

a) Tanks

- Tanks shall be of all welded construction and fabricated from tested quality commercial grade low carbon steel of adequate thickness. All seams shall be double welded. All welding shall be stress relieved.

The tank wall shall be reinforced by stiffener to ensure rigidity so that it can withstand without any deformation (a) mechanical shock during transportation and (b) oil filling by vacuum.

- The tank wall shall be reinforced by stiffener to ensure rigidity so that it can withstand without any deformation (a) mechanical shock during transportation, (b) oil filling by vacuum, (c) Short circuit forces and (d) continuous internal pressure of 35 kN/m2 over normal hydrostatic pressure of oil.
- All removable covers shall be provided with weatherproof, hot oil resistant, resilient gaskets. The design shall be such as to prevent any ingress of water into or oil from the tank.
- The tank shall be provided with one set of bi-directional flanged wheels for rolling the transformer parallel to either canter line over 1676 mm rail gauge. In case more than two rails are required to be provided the rail gauge of 1676 mm shall be maintained between two adjacent rails
- Jacking pads, lifting eyes and pulling lugs shall be provided to facilitate movement of the transformer. All heavy removal parts shall be provided with eyebolt for ease of handling.
- Manholes/hand-holes of sufficient size shall be provided for access to leads, windings, bottom terminals of bushings and taps.
- Suitable guide shall be provided in the tank for positioning the core and coil assembly.
- The transformer tank shall be equipped with the following valves and plugs with standard screw connection for piping:

  1) Drain valve at the bottom

  2) Filter valve at top

  3) Filter valve at bottom

  4) Sampling valve at top

  5) Sampling valve at bottom

  6) Radiator shut off valve at top and bottom

  7) Buchholz relay shut off valve at both ends of the relay

  8) Air release plugs on tank.

  9) One no. oil inlet valve

Any other valves & plugs other than those mentioned above, are also to be provided as per requirement.

- For this two winding Transformer 4 no. thermometer pocket should be provided for WTI & 2 no. for OTI. Amongst 4 no. pocket for WTI, Two (2) will be used for direct connection with the WTI in MK of Transformer. Balance Two (2) shall be provided with PT 100 sensor and Current Converter Unit (CCU) at MK for WTI repeater at the RTCC panel to be installed in Control Room. Similarly amongst Two (2) no. pocket for OTI, one (1) will be used for direct connection with OTI in MK of Transformer. Balance one no. (1) shall be provided with PT 100 sensor and Current Converter Unit (CCU) at MK for OTI repeater at the RTCC panel to be installed in Control Room.
- Design shall be such that Tank cover can be lifted independently without lifting active part of core, winding etc.

b) Core & Coils

- The core shall be built up with high grade, non-aging, low loss, high permeability, grain oriented, cold-rolled silicon alloy of HI -B or its equivalent grade steel especially suitable for core material.

  The insulation of lamination shall be coated with oxide/silicate/phosphate coating or any coating inert to the action of hot transformer oil. The core should be bottom mounted.
- The coils shall be manufactured from electrolytic copper conductor and fully insulated for rated voltage. Insulation shall be of Class A.
- Insulating material shall be of proven design. Coils shall be so insulated that impulse and power frequency voltage stresses are minimum.
- Coil assembly shall be suitably supported between adjacent sections by insulating spacers and barriers. Bracing and other insulation used in assembly of the winding shall be arranged to ensure a free circulation of the oil and to reduce the hot spot of the winding.
- All leads from the windings to the terminal board and bushings shall be rigidly supported to prevent injury from vibration or short circuit stresses. Guide tube shall be used where practicable.
- The core and coil assembly shall be securely fixed in position so that no shifting or deformation occurs during movement of transformer or under short circuit stresses.

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

The insulation for the core to bolts and core to clamps shall be such as to withstand a test voltage of 2 (two) KV rms at 50 Hz for one minute.

The maximum flux density in any part of the core and yoke at the rated MVA, voltage & frequency shall be such that less than 10% continuous over voltage condition does not exceed 1.9 Tesla.

For consideration of over fluxing, the transformer shall be suitable for continuous operation for values of over fluxing at (i) 110% (ii) one minute for 125% and (iii) 5 seconds for 140% of rated voltage.

- The prime core materials are only to be used. Bidder's should furnish following document as applicable as a proof towards use of prime Core material to be submitted before the stage inspection:

(a) Invoice of supplier

(b) Mill's test certificate

(c) Packing List

(d) Bill of lading

(e) Bill of entry certificate by Custom.

(f) Description of material, electrical analysis, physical inspection, certificate for surface defects, thickness and width of the materials.

(g) Place of cutting of core materials

c) Tapping

- On load tap changer (OLTC) as specified in the annexure shall be provided on the high voltage winding.
- The transformer shall be capable of operation at its rated MVA on any tap provided the voltage does not vary by more than ±10% of the rated voltage corresponding to the tap.
- The winding including the tapping arrangement shall be designed to maintain electromagnetic balance between HV and LV windings at all voltage ratios.

d) WINDINGS

- The Material of winding conductor should be of electrolytic grade copper of minimum 99.90% purity and free from scales, spills, splits and other defects. The windings shall be so designed that all coil assemblies of identical voltage ratings shall be interchangeable and field repair is possible. The coils shall be supported between adjacent sections by insulating spacers, and the barriers. Bracing and other insulation used in the assembly of the windings shall be arranged to ensure a free circulation of the oil and to reduce hot spots in the windings. The stacks of windings shall receive adequate shrinkage treatment before final assembly and the same shall be assembled in dust controlled chamber.

  The insulation of the coils shall be such as to withstand the full electrical strength of the windings. All materials used in the insulation and assembly of the windings shall be insoluble, non-catalytic and chemically inactive in the hot transformer oil, and shall not soften or otherwise be adversely affected under the operating conditions. The dielectric strength of winding insulation shall confirm to values given in IS: 2026, as amended up to date, or as per specific Technical Parameters.

  All threaded connections shall be provided with locking facilities.

- All leads from the windings to the terminal board and bushings shall be rigidity supported to prevent injury from vibration. Guide tubes shall be used where practicable.
- The windings shall be clamped securely in place so that they will not be displaced or deformed during short circuits. The assembled core and windings shall be vacuum dried and suitably impregnated with insulating oil. The copper conductors used in the coil assembly shall be best suited to the requirements and all permanent current carrying joints in the windings and the leads shall be welded or brazed. Oil ducts shall be such as will not impede the free circulation of oil through windings assembly.

- The conductor shall be transposed at sufficient intervals in order to minimize eddy currents and to equalize the distribution of currents and temperature along the winding.

e) On-Load Tap Changer (OLTC)

- The OLTC switch contacts shall be located in a separate oil-filled chamber complete with its own oil preservation system, Oil Surge relay, shut-off valves, oil level gauge, gas vent etc.

- OLTC mechanism and associated controls shall be housed in an outdoor weatherproof cabinet. Internal illumination lamp and thermostat controlled space heater shall be provided in the cabinet.
- The tap change equipment shall be so designed that if the mechanism is stuck in an intermediate position, the transformer shall be capable of delivering full load without any injury.
- The OLTC gear shall be suitable for local and remote electrical control and local manual control. Further, there shall be provision of automatic operation through voltage sensing relay wherever specified.
- The hand cranking arrangement shall be such that it can be operated at standing height from ground level. Further the mechanism shall be provided with a tap position indicator and an operation counter.
- Interlock shall be provided to ensure the following :-

  a) Positive completion of tap changing step once initiated.

  b) Blocking of reverse tap change command during a forward tap change already in progress until the mechanism rests and vice-versa.

  c) Cutting out of electrical circuit during manual operation.
- The tap changing gear shall have local selector switches with RTCC-Local-Test-Central positions. Provisions of various modes of operation of the tap changers of transformers, like individual operation, remote/local operation; operation from voltage regulating relays (where specified), etc. and for various interlocks shall be kept in the Remote Tap Changer Cubicle (RTCC) as well as local OLTC cabinet. Necessary equipment switches, relays, etc., shall be provided in these panels. The following minimum components shall be provided in the RTCC panel. Any other feature desired for proper and safe operation of equipment shall be provided. All indicating lamps shall be LED type.

  a) Voltage regulating relay for auto operation where specified.

  b) Auto-manual selector switch where auto operation specified.

  c) Selector switch for master follower solo operation.

  d) Raise-Lower control switch

  e) Necessary relays and accessories.

  f) Tap position indicator

g) Indication lamps for "Tap change in Progress" and "Control supply healthy".

h) Red lamp to indicate master position

i) Winding & Oil temperature (0° –150° C) repeaters to be connected to winding and oil Temperature meter housed in the main Transformer Marshalling Box at outdoor. In addition to above necessary arrangements are to be made in RTCC panel for Hot spot temperature indication and alarm by optical sensor method.

j) Annunciations for:

k) Tap position in progress

l) Mechanism stuck

m) Control supply failure

n) Tap changer A.C. supply failure

o) Oil surge relay operated

- Provisions shall be kept in the RTCC for serial link communication with the plant SAS/SCADA.
- The construction and other details of the RTCC shall be similar to those described elsewhere in this specification. Remote Tap Changer Panel shall also be provided to be installed at our Control Room.
- An under voltage relay shall be incorporated to monitor the 2200 Volt DC control circuit voltage of tap changer. Audible Alarm and annunciation shall be provided for failure of control circuit supply, failure of 400 V AC supply to the motor. All the relays requisite for remote tap change operation shall be provided in RTCC panel. The OLTC should have been Type Tested.

f) Insulating oil

- The transformer shall be filled with mineral insulating oil suitably inhibited to prevent sludging.
- First filling of oil along with 10% excess shall be furnished for each transformer. Oil shall be supplied in non-returnable containers suitable for outdoor storage.
- Oil preservation shall be by means of bellows/ diaphragm sealed conservator tank with silica gel breather to avoid direct connection between atmosphere and transformer oil. It shall be complete with level gauges, pipes, drain valve,

buchholz relay with shut-off valves at both sides etc. The level gauges shall be so placed that same can be readable standing from ground. Necessary device shall be kept to provide annunciation in the event of rupturing of bellow.

- The oil shall comply in all respect with the provisions of the latest edition IS:335 (as amended up-to-date) of specification for New Insulation oils for transformers and switchgears. Particular attention shall be taken to deliver the oil free from moisture having uniform quality throughout in non-returnable steel drums. The quantity of oil for first filling of each transformer shall be stated in the offer.

The oil should have the following characteristics:

SL. NO.	CHARACTERISTICS	REQUIREMENT
1.	Interfacial tension at 27°C (min)	0.04 N/m
2.	Electrical strength (Breakdown voltage)	60 KV (rms) after treatment
3.	Resistivity at 90°C /27°C	35x1012 /1500x1012 Ohm-cm
4.	Dielectric dissipation factor (tan delta at 90°C max.)	0.002

- After site processing through filtration and before commissioning, the moisture content shall be as follows :

Sl. No.	Parameters	Before filling in main tank & tested for	Prior to energization for following properties & acceptance norms:
i)	BDV	60 kV (min)	60 kV (min)
ii)	Moisture content	10 ppm (max.)	10 ppm (max.)

g) Bushing

- Bushing shall have high factor of safety against leakage to ground and shall be so located as to provide adequate electrical clearances between bushing and grounded parts. Bushings of identical voltage rating shall be interchangeable. All bushings shall be equipped with suitable terminals of approved type and size and shall be suitable for bimetallic connection, if necessary. The insulation class of the high voltage neutral bushing shall be properly coordinated with the insulation class of the neutral of the high voltage winding.

All main windings, tertiary windings and neural leads shall be brought out to outdoor through bushings which shall be so located that the full flashover strength will be utilised and phase to phase and phase to earth clearance shall be more than minimum value specified below. Location and arrangement of bushing shall follow Indian Standards. Each bushing shall be so coordinated with the transformer insulation that flashovers will occur outside the tank. Bushing rated above 52KV voltage class shall be oil communicating type.

- Bushings shall be provided with terminal connectors of approved type and size. All porcelain used in the bushings shall be made of the wet process, be homogeneous and free from cavities or other flaws. The glazing shall be uniform in colour and free from blisters, burns, and other defects. Upper portion of Bushing made of Porcelain & lower portion made of Epoxy/porcelain is also acceptable.

  Bushings for 145 KV & 52 KV voltage class shall be Oil Filled Condenser type and shall be hermetically sealed. All OIP bushing shall have provision of measurement of capacitance and tan-delta without dismantling of the bushing. Rating plate of bushing shall be provided near each type of bushing with terminal marking and physical position as per IS:2026. Bushing for 36KV shall be Solid porcelain or oil communicating type.

  The electrical and mechanical characteristic of bushings shall conform to IS:2099 and IS:3347. The characteristic of the oil used in the bushing shall be the same as that of the oil in the transformer.

- The spacing between the bushings must be adequate to prevent flashover between phases under all conditions of operation. All bushings shall be suitable for heavily polluted atmosphere and minimum creepage distance shall be taken as 25 mm per KV.

h) Bushing Current Transformer:

i) Current transformer shall comply with IS:2705/IEC-185.

ii) It shall be possible to remove the turret mounted current transformers from the Tr. Tank without removing the tank cover. Necessary precautions shall be taken to minimize eddy currents and local heat generated in the turret.

iii) Current transformer secondary leads shall be brought out to a weather proof terminal box near each bushing. These terminals shall be wired out to cooler control cabinet/marshalling box using separate cables for each core.

iv) The voltage and current rating of the bushings shall be as follows :

Highest System Voltage (KVrms)	Current Rating (Amps.)
132(HV)	800
36 (LV)	1250
36 (Neutral)	1250

- 36 kV side of Transformer will be fitted with cable end box suitable for cable termination as per required size of cable. Cable box arrangement shall be with suitable type of bushing and dry type termination of suitable size & run for LV side of Transformer. The cable box entry shall be of suitable type and shall be designed such that it shall be able to withstand without any deformity the electrical, thermal and mechanical stresses & forces developed due to rated short circuit current during any terminal fault inside the cable box. The flange joints of cable boxes shall be secured with suitable & proper sized and nos. of stainless steel HTS nuts and bolts.

i) Terminal Arrangements

- The physical position of the terminals and the markings shall be as per relevant IS/IEC unless otherwise shown in the enclosed drawing. Each terminal (including the neutral) shall be distinctly marked on both the primary and secondary side in accordance with the diagram of connection supplied with the transformers.
- Vertical/horizontal/universal type bi-metallic, rigid connector for bushing stud shall be provided. Minimum thickness of Bimetal in bimetallic connection shall be 2mm.
- High voltage terminals shall be brought out thru' top cover mounted bushings with matching flanges around each bushing for connection to isolated phase bus. The Contractor shall furnish all necessary details in this connection for co-ordination with the bus duct and shall guarantee the matching dimensions within close tolerance.
- Low voltage terminals shall be brought out thru' sidewall mounted bushings. For bus duct connection, bushings shall have matching flange around. For

cable connection, a detachable type cable end-box with disconnect links shall be furnished.

- Low voltage winding neutral shall be brought out thru' sidewall mounted bushing to a detachable cable end-box with disconnect link.
- The cable end-box shall be self-supporting, weather-proof, air filled type, complete with all hardware such as gland plate, brass glands, tinned copper lugs, armour clamps etc.
- In general, the arrangement shall be such as to permit removal of transformer without dismantling the bus duct/cable connection.

j) Cooling System

- The cooling system shall comprise of 2 x 50% cooling units each complete with its radiator banks, AC 3 phase Motor driven fans and other accessories. The cooler system should be such that any fan in a bank can be used as standby.
- The design shall be such that rated transformer output under ONAF Condition can be maintained :

  a) For at least twenty (20) minutes in case of failure of fans associated with one cooler unit without the calculated winding hot spot temperature exceeding 140°C.

  b) For at least ten (10) minutes in case of failure of the complete cooling system without the calculated winding hot spot temperature exceeding 140°C.

  The radiators shall be detachable type with top and bottom isolation valves to permit the removal of the same without drainage of oil from the tank. Radiators shall be provided with drain and air release plug.

- The fans shall operate without any abnormal noise. They shall be fitted with guards of close mesh-wire-netting for safety. The terminal connections and the greasing caps of the fan motors shall be accessible without the need of removing any fan guard.
- Convenient means shall be provided to remove or replace any fan with the transformer in service. Fan shall be so located so that they are readily accessible for inspection and repair.

- Complete control for fan inclusive of all switches, fuses, starters, relays and wiring shall be furnished. Each motor circuit shall have over load, single phasing and short-circuit protection.
- Fan motor controls will be actuated automatically from winding temperature indicator contacts. Provision shall however be kept for manual control from and indication in both local and remote. Control selection switches shall be provided in the cooler control with arrangement for remote control and indications of all operations.
- Cooling fans shall not be directly mounted on radiator bank to avoid undue vibration on the same. These shall be located in such a manner as to prevent ingress of rain water. The exhaust air flow from cooling fan shall not be directed towards the main tank in any case.
- Each cooling unit shall be provided with a number of fans such that in the event of outage of one fan, rated output can be maintained within the specified temperature limit.

k) VALVES

(i) Two Nos. oil inlet valves located in suitable locations

(ii) One oil drain valve each suitably located at top and bottom

(iii) One filter valve suitably located near the top of the tank

(iv) One filter valve suitably located near the bottom of the tank

(v) One valve each for oil sampling suitably located at bottom and top

vi) Radiator shut off valve at top and bottom.

vii) Buchholz relay and oil surge relay shut-off valves at both ends of the relays

viii) Main Conservator – filter, drain, sample valve, air release valve, air release plug.

ix) OLTC Conservator – Oil filling valve, Drain valve, Suction valve

x) One drain valve for OLTC

xi) One oil inlet valve

xii) One no. Bleed valve with pet cock for Buchholz relay.

xiii) Any other valves other than those mentioned above for improvement of operation and maintenance facility if required & pointed during drawing approval stage shall also be within the scope of supply of manufacturer.

l) Remote Tap Changing Control Panel and Cooler Control panel

- The transformer cooler control panel shall be used for control, interlocking, metering and indication of cooler control system of transformer and shall be installed outdoor near the transformer coolers.
- Remote Tap Changing Control Panel (RTCC) shall be installed indoor.
- Control panels shall be of CRCA sheet steel construction with protection class of IP-52 for indoor and IP-55 for outdoor installation.
- The frames and load bearing panels shall be fabricated of not less than 2 mm thick sheet steel. The doors and covers shall not be less than 1.6mm thick. All access doors shall be provided with channel rubber/ neoprene gaskets all round.
- The operating height shall be limited from 750mm to 1800mm. The total height of the panel and its depth shall be matched with adjacent panel.
- The operating handle shall have locking arrangement. The panels shall be complete with floor channel sills, vibration damping pads and stainless steel kick plates.
- All instrument, relays, switches, etc. mounted on the front face of the panel shall be flush or semi flush type. Switch contacts shall be silver faced and rated at least 10 Amp at operating voltage. Push buttons shall have required number of contacts.
- Panel shall be provided with internal illumination lamp with door switch, space heater with thermostat one 5A, 3 pin receptacles with plug.
- The annunciation system shall be solid-state type with optical isolation for input signals. It shall be complete with its own power supply, audible alarms, acknowledge, reset, and test buttons and other necessary accessories.
- The control panels shall be fully wired up at factory. All spare contacts of relays and switches shall be wires up to the terminal blocks.
- The panel shall have provision of cable entry from bottom. Bottom gland plate shall be 3mm thick.
- 50 x 6 mm copper ground bus shall be provided on the panel extending along the entire length of the assembly. The ground bus shall have two-bolt drilling with GI bolts and nuts at each end to receive ground connection of 75x10 mm G.I. flat.

- Remote Tap Changing Control Panel and Cooler Control panel shall have (I/O) connection with Plant SAS/SCADA with necessary Control, Indication and annunciation.

m) Marshalling Box

A sheet steel, weatherproof, IPW55, marshalling box shall be provided for the transformer. The box shall contain all auxiliary devices except those, which must be located directly on the transformer.

All terminal blocks for cable connection shall be located in this box.

The marshalling box shall be provided with cubicle lamp with door switch, space heater with thermostat and removable cable gland plate.

n) Wiring

All control, alarm and indication devices provided with the transformer shall be wired upto the terminal blocks.

- Wiring shall be done with flexible, 650V/1100V grade PVC wires in conduit or PVC armored cable. Minimum wire size shall be 2.5-mm2 copper. Not more than two wires shall be connected to a terminal. 20% spare terminals shall be provided.
- Multi-way terminal block complete with mounting channel, binding screws and washers for wire connections and marking strip for circuit identification shall be provided for terminating the panel wiring. Terminals shall be stud type, suitable for terminating 2 nos. 2.5 mm2 stranded copper conductor and provided with acrylic insulating cover. Terminals for C.T. secondary leads shall have provision for shorting and grounding.
- All devices and terminal blocks shall be identified by symbols corresponding to those used in applicable schematic or wiring diagram. Each wire shall be identified, at both ends, with interlocking type permanent markers bearing wire numbers as per Contractor's Wiring Diagrams. AC / DC wiring shall have separate color-coding.
- Wire termination shall be made with crimping type connectors with insulating sleeves. Wires shall not be spliced between terminals.

o) Grounding

- The grounding pads, located on the opposite sides of the tank, shall be provided for connection to station ground mat.
- Grounding pad shall have clean buffed surface with two tapped holes, M10 G.I. bolts and spring washers for connection to 75x10 mm G.I. flat.
- Ground terminals shall be also provided on marshalling box to ensure its effective earthing.
- For continuity of earth connection, all gasketted joints shall be provided with braided copper wire jumpers. Bidder shall extend and connect the Transformer earthing mat (Minimum two connection at different location) with the existing station earth grid.

p) Auxiliary Supply

- A.C. supply will be made available to each transformer by two separate feeders one normal and the other standby.
- Isolating switch fuse unit shall be provided for each of the incoming supply along with automatic changeover scheme to switch on to the standby source in case of failure of the normal supply.

q) Auxiliary Equipment

Neutral bushing current transformers shall be furnished when specified in the annexure.

The arrangement shall be such that the C.T. can be removed from the transformer without removing the tank cover.

CT secondary leads shall be wired upto the terminal blocks.

r) Painting

- All steel surfaces shall be thoroughly cleaned by sand blasting or chemical agents as required, to produce a smooth surface free of scales, grease and rust.
- The internal surfaces in contact with insulating oil shall be painted with heat resistant insulating varnish which shall not react with and be soluble in the insulating liquid used.
- The external surfaces, after cleaning, shall be given a coat of high quality red oxide or yellow chromate primer followed by filler coats.

- The transformer shall be finished with two coats of battle ship grey (IS Shade # 632) synthetic enamel paint unless otherwise specified.
- The paints shall be carefully selected to withstand tropical heat, rain etc. The paint shall not scale off or crinkle or be removed by abrasion due to normal handling.
- Sufficient quantity of touch up paint shall be furnished for application after installation at site.
- If it is considered necessary, the transformer may be given a further coating at site by the Owner/Purchaser. The Bidder shall therefore indicate the type and quality of the paint with full specification for this purpose.
- All supporting structures and hardware shall be hot dip galvanized.

s) Transportation

- Transformer tank shall be dispatched filled with oil or pure dry inert Nitrogen gas depending upon the transport weight limitations. A positive pressure of 2 to 2.5 Psi at temperature of 36°C approximate shall be kept. In case the tank is filled with oil, sufficient space is left above the oil to take care of the expansion of the oil. The space is filled with pure dry air or inert gas under atmospheric pressure.
- The temperature and pressure at the time of gas filling shall be marked on a tag. A graph showing pressure vs. temperature shall be attached for reading pressures at different temperatures. Necessary valves, two-stage pressure regulators, filled up Nitrogen cylinder etc. along with other accessories required shall be provided with the tank for intermittent replenishment during transportation.
- Impact Recorder

  Impact recorder/indicator shall be provided to monitor the impact experienced by the transformer during transport.

5.13.7.1.6 TESTS

i) Routine Tests

- During manufacture and on completion, all transformers shall be subjected to the routine tests in accordance with latest IEC 60076 and its different parts.
- In addition, the following tests shall be performed on each transformer :

a) Transformer tank with coolers shall be tested for leaks with normal head of oil plus 35 KN/m2 for a period of 8 hours. If any leak occurs, the test shall be conducted again after all leaks have been repaired.

b) During fabrication stage, the tank shall be pressure tested with air at a pressure corresponding to twice the normal head of oil or normal pressure plus 35KN/m2 whichever is lower for a period of one hour. Also the tank designed for full vacuum shall be tested for maximum internal pressure of 3.33KN/m2 for one hour. The permanent deflection of flat plates shall not exceed CBIP specified figures on release of excess pressure of pressure test and on release of vacuum.

c) After assembly, each core shall be pressure tested for one minute at 2KV (r.m.s.) A.C. between all bolts, side plates, structural steel works and the core.

d) The wiring for auxiliary power and control circuitry shall be subjected to withstand one minute power frequency test with 2.0KV (r.m.s.) to earth.

e) Dielectric special tests as per IEC60076-3.

f) Determination of capacitances windings-to-earth and between windings.

g) Frequency Response Analysis test (This test shall also be undertaken by the manufacturer at site after transformer is installed.)

h) Measurement of acoustic sound level.

i) Measurement of power consumption of fans.

j) Measurement of zero sequence impedance(s) on three-phase unit.

k) Measurement of dissipation factor (tan delta) of insulation system capacitances.

ii) **Type Tests**

Following type tests shall be performed on one transformer in accordance with relevant standard:

a) Dielectric type test (IEC60076-3).

b) Temperature rise test.

c) Impulse test.

Cost of such tests, shall be included in the tender.

- Miscellaneous

All component parts and auxiliary equipment such as oil, bushings, C.Ts etc. shall be routine tested as per relevant Indian Standards.

- Test Witness

Tests shall be performed in presence of Owner/Purchaser's representative if so desired by the Owner/Purchaser. The Contractor shall give at least seven (7) days' advance notice of the date when the tests are to be carried out.

- Test Certificates

Certified reports of all the tests carried out at the works shall be furnished in six (6) copies for approval of the Owner/Purchaser.

The equipment shall be dispatched from works only after receipt of Owner/Purchaser's written approval of the test reports.

Type test certificates on any part of the equipment, if so desired by the Owner/Purchaser, shall be furnished. Otherwise the equipment shall have to be type tested, free of charge, to prove the design.

5.13.7.1.7 SPECIAL TOOLS & TACKLES

- A set of special tools & tackle which are necessary or convenient for erection, commissioning, maintenance and overhauling of the transformer and its accessories shall be supplied.
- The tools shall be shipped in separate containers, clearly marked with the name of the equipment for which they are intended.

5.13.7.1.8 DRAWINGS, DATA & MANUALS

Drawings, Data and Manuals shall be submitted after the bid and for approval and subsequent distribution after the issue of Letter of Intent in quantities and procedures as specified in General condition of contract and/or elsewhere in this specification.

After placement of LOA, six copies of following drawings, manuals and literatures shall be submitted.

To be submitted for Approval and Distribution

(A) : Approval Category; ®: Reference Category

Drawing for Controls:

i) Schematic diagram of transformer cooler control (A)

ii) Schematic diagram and location of WTI and OTI. (A)

iii) General arrangement of ground mounted Marshalling Box for transformer. (R)

iv) Schematic diagram of manual and push button control of on load tap changer. (A)

v) Abbreviation table for OLTC and RTCC (R).

vi) Explanatory note for RTCC (R)

vii) General Arrangement & scheme drawing for RTCC (A)

viii) Explanatory note for transformer cooler (A)

ix) Wiring diagram of ground mounted Marshalling Box for each type of Transformer(A)

x) Wiring diagram of RTCC panel. (A)

xi) Cable Interconnection Diagram and Cable schedule (R).

xii) Drawings other than there mentioned above if required as per provision of Technical Specification for Erection & Maintenance are also to be submitted.

Drawings of Transformer:

(i) Data sheet of Transformer.(A) General outline drawing showing front, side elevation, plan of the transformer and accessories with detailed dimensions and detailed legend. (R)

(ii) Detailed foundation plan. (A)

(iii) Drawing of each type of bushings, lifting dimensions, clearance between Terminals of different voltage level and ground, quantity of insulation oil, name plate, details etc (R).

Flow diagram of the cooling system showing the number of cooling banks, Pumps, fans etc (A).

(iv) Operation and maintenance guide for transformer and ON LOAD TAP CHANGER. (R)

(v) Transport Outline Drawing (R)

(vi) Valve Schedule Plate(A)

(vii) Measured Loss Plate (A)

(viii) Clamp & connectors (R)

(ix) Rating Plate diagram (A)

(x) Oil filling instruction plate (R)

(xi) Roller locking arrangement (R)

(xii) Foundation Plan drawing. (A)

Xiii) Terminal Arrangement both HT and LT side.

xiv) Drawings of major components like bushing, CTs etc (A).

xv) Quality Assurance Plan (A/Approval by owner).

xvi) Test certificates of transformer and auxiliary equipment (A).

xvii) Instruction manuals on transformer and its various fittings (R).

The manual shall clearly indicate method of installation, check-ups and tests to be carried out before commissioning of the equipment.

(xviii) Drawings other than those- mentioned above if required as per provision of Technical Specification for Erection & Maintenance is also to be submitted.

- Four (04) copies of approved drawings and literatures for each transformer along with soft copy shall be submitted for our record and distribution to site.
- Instruction Manuals:

Six (06) copies of operation, maintenance and erection manuals in English language shall be supplied for each transformer against each LOA. The manuals shall be bound volumes and shall contain the drawings and information required for erection, operation and maintenance of the power transformer. The manuals shall include amongst other, the following particulars.

a) Marked erection prints identifying the components parts of the power transformers as dispatched, with assembly drawings.

b) Detailed dimensional drawings, assembly and descriptions of all the components.

- The Bidder may note that the drawings, data and manuals listed are minimum requirement only. The Bidder shall ensure that all other necessary write-ups, curves and information required to fully describe the equipment offered are submitted with his bid.

- The drawings and documents marked with (A) above are of 'Approval' category and are subject to review by Owner. Those marked (R) are for 'reference' category.
- The Owner /Purchaser may review the documents marked (R) if thought necessary. The Contractor shall note that the approval of drawings & documents by the Owner does not relieve him of his contractual obligation.
- All drawings shall be prepared by using AutoCAD and documents shall be generated using Electronic version. The paper copy of the drawings & document shall be submitted for approval & reference. All final drawings and

documents shall be submitted in CD in AutoCAD 2013 and M.S. Office format as applicable for Owner's future reference

To be submitted with the Bid

- Typical general arrangement drawings showing disposition of cooler banks, fittings, terminal arrangement etc.
- Transport/shipping dimensions and weights, space required for handling parts for maintenance.
- Technical leaflets on major components and fittings.
- Write-ups on OLTC if specified, oil preservation and cooling system.
- Type test certificates including short circuit test report of a similar transformer (as per the guidance for identification of a similar transformer as defined in Annexure-A of IEC 60076-5). The type test certificates shall not be more than 5 years old.

ANNEXURE -A

RATINGS AND REQUIREMENTS

AUXILIARY TRANSFORMERS

1.0	Application	:	132/36 kV Power Transformer
2.0	Service	:	Outdoor, step up
2.1	Number of Transformer	:	1 No. 12.5 MVA (3Ph.)
2.2	Environment	:	Hot, Humid, Tropical and heavily polluted atmosphere
3.0	Type	:	Out Door Oil immersed Inter connection Power transformer Running in parallel
3.1	Number of Windings per phase	:	Two winding
4.0	Reference standard	:	IS 2026 & IEC60076

5.0	Rated voltage(line to line)	:	132	33
6.0	Rated power (MVA)	:	12.5	12.5
6.1	Maximum System Voltage (kV)	:	145 kV	36 kV
7.0	Number of phases of each unit	:	3	(1-Ph or 3-PH unit)
8.0	No. of phases	:	3	
9.0	Rated frequency	:	50 Hz	
10.0	Cooling system			
10.1	Type of Cooling & respective power Value % of rated power ONAN/ONAF)	:	ONAN/ONAF 80% / 100%	
10.2	Nos. of cooling units & each capacity	:	2 x 50%	
11.0	Temperature rise			
11.1	Design ambient temperature	:	50 °C	
11.2	Temperature rise above design ambient temperature.			
a)	in oil by thermometer	:	50 °C	
b)	in winding by resistance	:	55 °C	
12.0	Insulation level (LI : Lightning Impulse Voltage, AC : Short duration induced & separate source AC withstand Voltage)			
	HV-(LI/AC)	:	650/275 KV (peak/rms)	
	LV- (LI/AC)	:	250 KVp/ 95KVrms	
	HV Neutral – (LI/AC)	:	75 KVp/ 28KVrms	
12.1	Insulation			

i) H.V. winding	:	Graded insulation
ii) I.V. winding	:	Graded insulation
iii) L.V. winding	:	Full insulation
13.0 Vector group	:	Dyn1
14.0 Short-circuit impedance at 75°C at principal tap	:	10% on 12.5 MVA base
15.0 Parallel operation of transformer	:	Yes continuously with existing
16.0 Type of taps provided	:	On-load, Full capacity suitable for bi-directional flow of rated power.
16.1 Type of Remote Tap Change Controller	:	Microprocessor based numerical type
16.2 Taps provided on	:	H.V. winding
16.3 Range of taps	:	± 10% (±8 x 1.25%)
16.4 Method of Tap charge control-		
a) Manual local	:	Yes
b) Electrical local	:	Yes
c) Electrical Remote	:	Yes
d) Automatic	:	Yes
e) Group and Solo	:	Yes
16.5 Percentage impedance at principal	:	tapping at 75 Deg.C
17.0 a) Transformer Tank to be	:	For Full Vacuum as per

	Designed, Manufactured and Tested		Relevant IEC/IS and CBIP
	b) Bell Type Tank Construction	:	Yes
18.0	Type of Oil preservation system	:	Diaphragm or constant Pressure system with silica gel breather.
18.1	Insulating Oil for Transformer	:	EHV grade as per IS:335 or equivalent
19.0	System earthing -		
	H.V.	:	Unearthed
	L.V.	:	33 kV System is earthed through Grounding Transformer
20.0	Terminal arrangement -		
	H.V.	:	Top cover mounted Bushing suitable for termination of OH ACSR MOOSE conductor / AL Bus
	L.V.	:	36 KV Grade cable
	L.V. Neutral	:	36 kV Grade cable for Transformer grounding.

21.0	Transformer bushing	:	HV	LV	HV-N
21.1	Voltage class KV(r.m.s.)	:	145	36	36
21.2	Material	:	Solid porcelain.		
21.3	Creepage distance bushing mm	:	132 kV 3625	36 kV 1300	
21.4	Type communicating	:	Oil filled condenser / solid /Oil		
21.5	Continuous current rating	:	100	400	

21.6 Minimum clearances (mm)

Clearance			
i) Phase to Phase	:	1550	350
ii) Phase to ground	:	1300	320

22.0 System fault Level

HV Side (132 kV)	:	31.5 KA (r.m.s.) for 3 second
LV Side (33 kV)	:	31.5 KA (r.m.s.) for 3 second

23.0 Max. Flux density in any part of core & Yoke at 110% rated voltage	:	1.9 Tesla
24.0 Max. Noise level in accordance with Conditions specified in NEMA Std. TR-1	:	As per NEMA std. TR-1
25.0 Auxiliary supply	:	415V± 10%, 3 ph. 50 Hz ± 5%
	:	220V +10%, -15% 2 wire DC

ANNEXURE B

FITTINGS AND ACCESSORIES

The transformer shall be equipped with fittings and accessories as listed below :

1. Rating and diagram plate.
2. Rubber back type oil conservator with filler cap, drain plug and prismatic/plain oil level gauge for both main tank and OLTC.
3. Oil preservation system complete with accessories.
4. Air release plugs and valves.
5. Required number of pressure relief device capable of resealing after release of pressure.
6. 150mm dial magnetic oil level gauge with low level alarm contacts for main and OLTC conservator.
7. 150mm dial oil temperature indicator with maximum reading pointer and electrically separate contacts for trip and alarm and embedded temperature detectors (PT-100)with suitable output for remote indication.
8. 150 mm dial winding temperature indicators for each winding with maximum reading pointer and electrically separate sets of contacts for trip, alarm and cooler control and embedded temperature detectors (PT-100) with suitable output for remote indication (data logging).
9. Remote Oil and winding temperature indicator for mounting on RTCC panel with separate measuring system for each winding.
10. Thermometer pockets in tank, OLTC chamber, top and bottom radiator header.
11. Double float Buchholz relay with gas release cock, shut-off valve on either side and separate sets of contacts for trip and alarm.

    Gas collection box and gas check valve at ground level. Copper tube interconnection between gas collection box and relay shall also be provided.
12. Filter valve with threaded adopter (top and bottom).
13. Drain valve with threaded adopter.
14. Sampling valve (Top, Intermediate & Bottom).
15. Necessary valves for detachable cooler units.
16. Jacking pads, handling and lifting lugs.
17. Cover lifting eyes.
18. Bi-directional flanged wheel and skids.
19. Clamping device with bolts & nuts.
20. Handhole of sufficient size for access to interior of the tank.

21. Two-grounding pads on tank and each frame.
22. Ladder with safety device for access to the top of transformer tank. A lockable hinged plate shall be provided to prevent unauthorised climbing upto 1500mm from bottom.
23. Weather-proof marshalling box for housing control equipment and terminal connections.
24. H.V., L.V. and neutral bushing terminal connectors.
25. Steel Rating and terminal marking plates.
26. Cooler units complete with valves, fans, pumps, oil flow indicators, supporting structure with caution plate, fixing and foundation bolts etc as required and Cooler Control panel.
27. Sudden Pressure Relay.
28. Oil surge relay with shut off valves on both sides with trip contacts for tap changer compartment.
29. On-line dissolved hydrogen and water monitor (having communicable ports for both local and remote communication), with sensors.
30. OLTC chamber, Drive mechanism bus coupler with all accessories.
31. Transformer control panel (RTCC) for OLTC & Cooler control for mounting in Electrical control room.
32. Copper busbar, mounting insulators (same kV as neutral bushing) and hardware for Neutral
33. Inspection cover for Bushing, OLTC, Tank
34. Bushing current transformers.
35. CT terminal box.
36. Nitrogen Injection Fire Protection System
37. Thermosyphon filter assembly.
38. Valve position indicating plate.
39. Any other fittings & accessories as may be required for successful installation, operation & maintenance shall be provided.

Note : All indication, alarm, trip contacts provided shall be rated for 5 A at 220 V D.C. and 10 A at 230V A.C.

ANNEXURE- C

Definitions of a similar transformer

[As per IEC 60076-5]

Transformers similar to a reference transformer can be identified by comparison using the following non-exclusive list of critical features:

1. Same type of operation, for example generator step-up unit, distribution, interconnection transformer as the reference unit;

2. Same arrangement of main windings and geometrical sequence as the reference unit:

3. Same type of main windings for example, helical, disc, layer, pancake, as the reference unit.

4. Absorbed power at short-circuit (rated power per unit short-circuit impedance) between 30% and 130 % of that of the reference unit;

5. Axial forces and relative winding stresses (ratio of actual stress to critical stress) at short-circuit not exceeding 110% of those in the reference unit;

6. Same type of winding conductors, for example, aluminum, aluminum alloy, annealed or hardened copper, metal foil, wire, flat conductor, continuously transposed conductors and epoxy bonding, if used, as the reference unit;

7. Same manufacturing processes as the reference unit;

8. Same clamping and supporting arrangement.

9. Same conceptual design, for example dry-type, oil-immersed type, core type with concentric windings, sandwich type, shell type, circular coils, non-circular coils as the reference unit.

ANNEXURE -D

TRANSFORMER LOSSES, EVALUATION OF BID & ACCEPTANCE

Rating of Transformer	Guaranteed Maximum No Load Loss on principal tap at Rated Voltage and frequency, in KW	Guaranteed Maximum Load Losses (Copper + stray loss)at rated current on principal tap at 75 oC in HV-IV ombination for Auto Transformer & HV-LV combination for Two winding Transformer, in KW	Guaranteed Maximum Auxiliary/Cooler Loss in KW
12.5 MVA 132/36 KV	17	130	-

a) The Transformer is to be designed with maximum permissible losses as indicated above.

b) The bidder must clearly specify that the offered losses are "Maximum"(including IS/IEC tolerance) and no further positive tolerance as per IS/IEC shall be applicable on the offered values during evaluation as well as during testing of transformer.

c) Bids offering with losses beyond the maximum limits mentioned above shall be treated as non-responsive and rejected.

d) NIL

e) However once a bidder becomes successful on the basis of loss capitalization with certain declared loss value, they have to strictly achieve the same loss value during the course of testing of transformers, offered for supply. No tolerance as per IS/IEC will be applicable.

f) If they fail to do so, the offered transformer will be rejected and only replaced transformer with declared loss value will be accepted.

g) In this process, the delay so occurred will be on the vendor's account.

h) If the vendor fails to achieve the declared loss during second time, the contract will be terminated at the vendor's risk and cost.

ANNEXURE - E

AUXILIARY EQUIPMENT

AUXILIARY EQUIPMENT

Transformer shall be provided with minimum following quantity of phase and neutral bushing current transformers as specified and indicated below:-

Sl. No.	Description		Qty	Application	Current Ratio	Output Burden (VA)	ISF (Max)	Accuracy class	Min Knee point Voltage (V)	Maximum Excitation Current Ie (mA) at Knee point voltage	Maximum Secondary Resistance Rct (Ohm) at higher ratio
1	**132 KV phase side CT**	BCT2A	3	Metering	150/1 A	40	*	CL.0.2	*	*	*
		BC2B	3	Protection	150/1 A	30	*	CL.5P20/ PS Class	*	*	*
		BC	1 (on Y ph)	For WTI	*	30	*		*	*	*
2	**33 kV LV side CT**	BC3A	3	Metering	1000/1 A	40	*	CL.0.2	*	*	*
		BC3B	3	Protection	1000/1 A	30	*	CL.5P20/ PS Class	*	*	*
		BC3C	3	Protection	1000/1 A	30	*	CL.5P20/ PS Class	*	*	*
3	**Neutral side CT (after neutral formation)**	BC4A	1	Protection	1000/1 A	30	*	CL.5P20/ PS Class	*	*	*
		BC4B	1	Protection	1000/1 A	30	*	CL.5P20/ PS Class	*	*	*

(*) - To be decided by the Bidder, The CT ratio, class and burden are tentative only. Shall be decided during detail engineering.

ANNEXURE - F

ON-LINE DISSOLVED HYDROGEN AND WATER MONITOR

1.0 ON-LINE CONDITION MONITORING

Each phase of generator transformer shall be fitted with online DGA equipment. The terminals shall be wired up to the Common marshalling box to enable remote alarm/trip and status information and possible connection to a LAN system. The On line DGA monitoring equipment shall be able to monitor H2, CO, C2H4 and C2H2.

1.1 TECHNICAL PARAMETERS

The system shall meet the following technical parameters:

a)	**Detection & measurement of gases**	H2, CO, C2H2, C2H4 with 100% sensitivity to H2 & C2H2
b)	**Accuracy (maximum)**	H2: ±10% or ± 5 ppm (whichever is greater) CO: ±10% or ± 10 ppm (whichever is greater) C2H4: ±10% or ± 3 ppm (whichever is greater) C2H2: ±10% or ± 1 ppm (whichever is greater) Moisture: ± 2% RH
c)	**Oil temperature range of sensor**	10°C to 100°C
d)	**Sensor attachment degree of protection**	Minimum IP55
e)	**Minimum detection sensitivity to C2H2**	2 ppm

1.2 GENERAL TECHNICAL REQUIREMENTS OF DGA

The system offered shall be suitable for online monitoring of dissolved gases in oil filled power transformer. It shall at least measure dissolved gases such as H2, CO, C2H4 & C2H2 with 100% sensitivity to H2 & C2H2 and moisture.

A) The system shall be suitably be fitted to transformer in accessible location to be decided by bidder with owner's approval. Bidder shall provide necessary adopter /fittings for this purpose. The attachment shall be provided with an oil sampling port to facilitate oil collection for manual offline DGA by owner. All software/hardware/cables/PC for monitoring from control room shall be in the scope of the bidder. The supplier shall also provide a suitable calibrating arrangement for each online DGA. The software for remote monitoring in owner's control room shall facilitate real time data logging & also historical data/trend display.

B) The system shall have microprocessor, watchdog and clock system complete with LCD display unit and keypad. The function is to show Gas level, hourly/daily trend

C) The equipment shall have MODBUS TCP/IP protocol. For remote indications on Control Room, analogue output of 4-20 mA, serial output RS 232 /RS 485 shall be made available

D) Potential free alarm contacts for high gas concentration (user programmable) of each gas shall be wired up to transformer Marshalling Box. These will be used by owner for alarm in RTCC and in SAS. Also real time data of each gas shall be provided at owner's control room. All required cable, software, hardware & cable laying for the above communication shall be in the scope of bidder.

5.13.7.1 ELECTRICAL CONTROL AND RELAY BOARDS

Electrical Control and Relay Boards as listed below, in accordance with this specification

5.13.7.2.1 SCOPE OF SUPPLY

A: BkTPS:

Control and Relay Board	Type	Quantity in Sets	Location
33 kV Incoming feeder from 10 MW Floating Solar Indoor Switchgear	Simplex vertical	One(1)	New Control room at existing BkTPS Switchyrd.

B: STPS – for Raw Water Pond 2.

Bay Control Unit		Type	Quantity in Sets	Location
A. Control panels				
i)	Transformer (12.5 MVA, 132 kV/ 33 kV) Transformers cooler & OLTC backup control panel.	Simplex vertical	One(1) (Already supplied, bidder has to supply lay, terminate & test all the Power and control cables from the field. Testing and commissioning and customization of this panel is required during detail engineering)	Existing Control room

Bay Control Unit		Type	Quantity in Sets	Location
A. Control panels				
ii)	33 kV Incoming feeder from 5 MW Floating Solar Panel	Simplex vertical	One(1)	New Control room
B. Relay Panel				
i)	33 kV Incoming feeder from 5 MW Floating Solar Panel	Simplex vertical	One(1)	New Control room

N.B.: EXISTING RELAY AND CONTROL PANELS FOR TRANSFORMER WILL BE USED UNDER SAS PERVIEW ONLY. HOWEVER, NEW

- Supply, mounting and wiring of all equipment, devices and accessories.
- Floor channel sills, vibration damping pads and kick plates for control boards complete with holding down bolts and nuts.
- Mandatory spares.

STPS – for Dutta Bandh

Control and Relay Board	Type	Quantity in Sets	Location
33 kV Incoming feeder from 10 MW Floating Solar Indoor Switchgear	Simplex vertical	One(1)	New Control room near WBSEDCL evacuation point / any suitable location shown by STPS authority.
CR Panel	Simplex vertical	As per no. of Breakers	Near Inverter Transformer.

C: SgTPP:

Outdoor VCB & Isolator operation from remote	Simplex vertical	As per no. of Breakers	Near Inverter Transformer.

5.13.7.2.2 SYSTEM CONCEPT

5.13.7.2.3 SPECIFIC REQUIREMENTS

a. **Construction**

- The Control and Relay Boards/panels shall be totally enclosed, floor mounted, free-standing, dead-front assemblies conforming to IP-4X degree of protection.
- Design, material selection, and workmanship shall be such as to present a neat appearance outside and inside with no welds, rivets, screws or bolt heads apparent from the exterior surface of the Boards. The boards shall have a smooth and uniform matt finish, free from scratches, dents, and other imperfections.
- The panels shall be liberally sized so as to provide spacious layout of equipment and devices with sufficient working space in between.
- Each board may consist of a number of panels mounted side-by-side, in which case, these shall be bolted together to form a compact unit. Where two panels meet, the joints shall be smooth, close-fitting and unobtrusive.
- The control boards shall be of folded sheet steel construction, assembled on channel/angle base plates with anti-vibration mountings.
- The boards shall be fabricated of minimum 2 mm thick sheet steel, free from all surface defects. The boards shall have sufficient structural reinforcement to ensure a plane surface, to limit vibration, and to provide rigidity during shipment and installation.
- All doors and removable covers shall be provided with neoprene gaskets all around and latches sufficiently strong to hold them in alignment when closed. The door operating handle shall have locking arrangement.
- All control panels shall have rear door with concealed type hinges and pad-locking arrangement. Doors shall be grounded by flexible copper braid.
- The boards shall be complete with vibration damping pads, stainless steel kick plates, floor channel sills, anchor bolts, and other necessary hardware for mounting.

b. **Equipment Mounting**

- All instruments, relays, switches, etc. mounted on the front face of the panels shall be flush or semi-flush type.
- No equipment shall be mounted on panel door.
- All equipment shall be so mounted that removal and replacement may be accomplished individually without interruption of service to others.
- All equipment inside the panels shall be so located that their terminals and adjustments are readily accessible for inspection or maintenance.
- In case cut-outs are provided on any panel for future mounting of equipment, the same shall be properly blanked off.

c. **Name Plate**

- Nameplates shall be provided on each panel and on each instrument or device mounted in the panel. Each panel shall also have circuit/ feeder designation name plate.
- The material of the nameplates shall be lamicoid or approved equal, 3 mm thick, with white letters on black background.
- The nameplates shall be held by self-tapping screws. The size of nameplate shall be approx. 20 mm x 75 mm for equipment and 40 mm x 150 mm for panels.
- Nameplates for panels shall be provided both on the front and the rear.
- Control and meter selection switches shall have integral nameplates. Nameplates for all other devices shall be located below the respective devices.
- Instrument and devices mounted on the face of the control boards shall also be identified on the rear with the instrument or device number. The number may be painted on or adjacent to the instrument or device case.

d. **Illumination, Space Heating and Receptacles**

- Each panel shall be provided with interior fluorescent tube with door switch, space heater with thermostat and switch, and 5A, 3 pin receptacle with plug. Third pin of the socket shall be effectively grounded through the metallic structure.

- Tube, heater and receptacle circuits shall be suitable for available A.C. supply and furnished with individual ON-OFF switch.
- The tube shall be located at the ceiling and guarded with protective cage. Space heater shall be located near the floor so as not to pose any hazard to service personnel.

e. **AC/DC Power Supply**

- Necessary A.C and D.C supplies to each control board, as required for control and service, shall be arranged provided by WBPDCL. Following feeders shall be shown to successful Bidder during execution stage, however necessary supply of cable and its raceway, cable laying, termination with respective new small ACDB and small DCDB is under bidder scope:

  a) Two A.C. feeders with rating of 63 A each.
  b) Two DC feeders with a rating of 16 A each.

- Bidder shall consider one ACDB and one DCDB panel for distribution of these AC and DC network inside CR Panel room. Panels shall have Two incomers and one bus-coupler with castle key interlocks. Bidder shall provide MCCB / SFU considering short circuit rating for the incomers and bus-couplers of these ACDB and DCDB.

- Alarm relays with reverse flag shall be provided to annunciate failure of main incoming A.C and D.C supplies and annunciation D.C supply in each panel.

- Lamp indications shall be provided individually for main D.C supply-1 fail, main D.C supply-2 fail, and panel annunciation D.C supply fail. A common A.C electric bell shall be provided to give an audible alarm in case of failure of D.C supply-1/D.C supply-2/annunciation D.C. supply in any panel. A common

push-button shall also be provided for cancellation of lamp indication and audible alarm.

- Isolating MCCB / SFU shall be provided for the incoming AC/DC power supplies. Bus wires shall be run for power distribution to different panels. Power supply isolation switches shall be 4-pole, single throw, for A.C. (considering double feeder) and 2-pole, double throw with OFF, for D.C.
- Fuse and link shall be provided for individual circuits for protection & metering including voltage circuits and also for isolation from bus wire without disturbing other circuits. Suitable fuse failure relays shall be provided to give an alarm for voltage circuits of protection/metering. Voltage selection scheme based on relays shall be provided for meters wherever possible.
- The fuse requirements in each panel shall be grouped in easily accessible fuse blocks or distribution panel. The groupings shall be done in a neat and orderly fashion.
- Bus coupler shall be provided in the control bus such that while one bus section of HT/LT is under shut down then control bus section of that particular HT/LT bus section shall remain under dead condition.
- DC should be 100% redundant type. With the fail of one source other must come in place automatically.

f. **Wiring**

- The boards shall be fully wired at the factory to ensure proper functioning of control, protection, and metering schemes. When panels are arranged to be located side-by-side, all inter-panel wiring shall be carried out by longitudinal troughs extending the full length of the board.
- All spare contacts of relays and switches shall be wired upto terminal blocks. All interconnections between the panels of the control board shall be furnished.
- Wiring shall be done with flexible, heat resistant, 1100V grade, PVC insulated, switch board wires with stranded copper

conductor. The minimum size of the wires shall be 4 Sq. mm. for current circuits and 2.5 Sq. mm. for control and voltage circuits.

- Each wire shall be ferruled by plastic tube with indelible ink print at both end having terminal block no. terminal no. as per approved wiring diagram.
- All wire terminations shall be made with insulated sleeve, solder less type tinned copper lugs. Wire shall not be tapped or spliced between terminals.
- Wiring shall be neatly bunched in groups by non-metallic cleats or bands. Each group shall be adequately supported along its run to prevent sagging or strain on the termination.

g. **Terminal Block**

- Terminals shall be box-clamp and clip-on type, suitable for terminating upto two wires of 2.5 sq. mm. cross section and provided with marking strips. Terminals for CT secondary leads shall have built-in disconnecting links with facility for shorting. Terminals for CT leads should have adequate cross section for terminating associated CT leads.
- Not more than two wires shall be connected to one terminal. If necessary, a number of terminals shall be jumpered together to provide wiring points.
- Each terminal shall be identified with designation as per approved schematic. At least 20% of the total number of active terminals shall be furnished as spare in each panel.
- The wiring shall be so arranged that individual wires of an external cable can be connected to consecutive terminals.
- The terminal blocks shall be located to allow easy access and also to suit floor openings for cable entry.
- Terminal blocks shall generally be mounted vertically with adequate spacing (not less than 100 mm) between adjacent rows.
- The bottom of the terminal blocks shall be at least 200 mm above the incoming cable gland plate.

h. **Cable Entry**

- The panels shall have provision of cable entry from the bottom. Bottom plate shall be provided to make entry dust-tight.
- The panels shall have provisions inside for fixing the multi-core (armoured) cable glands. Cable glands shall be made of brass & double compression type. Cable gland support plate shall be 4 mm thick and mounted not less than 200 mm above floor level.

i. **Grounding**

- 50 x 6 mm TINNED COPPER ground bus shall be provided in each panel, extending along the entire length of the assembly.
- The ground bus shall have two-bolt drilling with GI bolts and nuts at each end and shall be suitable for connection to 50 x 6 mm G.S. flat.
- The ground bus shall be bolted to the panel structure and effectively ground the entire assembly. The cases of meters, relays and switching devices shall be grounded through the steel structure.
- Whenever a circuit is grounded, a single wire from the circuit shall be run independently to the ground bus and connected to it.
- Potential and current transformer neutrals shall be grounded only at the terminal blocks where they enter the control boards from the transformers.

j. **Painting**

- The inside of all boards shall be painted white. The outside surface shall be finished with two coats of synthetic enamel paint, the shade of which shall be subject to approval by the Purchaser. Base frames shall be painted black.

k. **Switches**

- Switches shall be dust protected, heavy duty, switchboard type, complete with escutcheon plate. Contacts shall be silver

surfaced and rated minimum 10A at operating voltage. Bidder shall provide soft means for EHV Breaker Control Switch, EHV Isolator, EHV Breaker Maintenance Transfer Switch.

- The switch details and type of handle shall be as given below :

Sl. No.	Application	Switch Type
i)	Breaker	120 deg., 3-position (TRIP/NORMAL/ CLOSE), spring return to normal with lost motion device, non-lockable, sequence device, large pistol grip handle.
ii)	On-Off Switch/ Local-remote	90 Deg., 2-position (ON/OFF OR LOCAL/ REMOTE) stay put type, non-lockable, spade Selector Switch handle.
iii)	Transformer Cooler Control Switch	180 Deg., 3-position (AUTO/OFF/ON), stay-Put type, non-lockable, small pistol grip Handle
iv)	Meter Selector	4-position (OFF/R/Y/B for ammeter selector Switches switch and OFF/RY/YB/RB for voltmeter selector switch), maintained contact, stay put type, knob handle. Ammeter selector switches shall have make- before-break contacts. For in plant power distribution panel miniature version shall be provided.
iv)	Synchronising	120 deg, 4-position (OFF/INCOMER-1/BUS selector switch SECTION/INCOMER-2),stay put type, pistol grip handle

NOTES: The above switches and any other type, if found necessary during detail engineering, shall be subject to approval of the purchaser.

1. **Push Buttons**

- Push buttons shall be oil tight, heavy duty, push to actuate type, with coloured button and inscription plate marked with its function. The colour of ON and OFF push buttons shall be RED And GREEN respectively. All RESET push buttons shall be black.
- Each push button shall have minimum 2 NO + 2 NC contacts, rated 10A at operating voltage.
- Push button shall be shrouded type except for emergency trip button which shall be mushroom type for easy identification.

m. **Lamps**

- LED lamp shall be made in accordance with InP Technology (Aluminium Indium Gallium Phosphide Technology). The body shall be made of Poly Carbonate Unbreakable Lens. LED shall be protected by inbuilt fuse with surge suppressor or leakage voltage glow protection. LED circuit shall be PCB mounted. Intensity shall be greater than 200 mcd.

n. **Operating Range**

Generally, all instruments and relays shall be suitable for operation on 1A or 5A C.T. secondary circuits and/or 110V V.T. secondary circuit.

o. **Meters**

- All indicating instruments shall be switchboard type, back-connected, suitable for flush mounting, with 240 Deg. scale, antiglare glass, and accuracy class of maximum ± 2% of the full scale. The dials shall be made of such material as to ensure freedom from warping, fading, and discolouring during the lifetime of the instruments.
- All indicating instruments shall be enclosed in dust-tight cases suitable for tropical use.
- Meters shall be 96 mm x 96 mm (face dimensions) and shall have provision for zero-adjustment from front of the panel. For inplant power distribution panel miniature meters shall be provided.

- Meters shall be compensated for temperature errors and factory calibrated to read the primary quantities directly without using a multiplying factor.
- DC ammeters, wherever required, shall be provided with external shunt if the current exceeds 5A. The rated voltage drop for the shunts shall be 75 mV.
- The range of frequency meters shall be from 45 to 55 HZ, with 50 HZ. at the centre of the scale.
- The range of power factor meters shall be from 0.5 lag to 0.5 lead, with unity power factor being at the centre of the scale.

p. **Integrating Meters**

- ABT meter shall be provided for each breakers with integration at the Control Room near Raw Water Pond i.e. for SAS/DCS /PLC interfacing.

q. **Recorders**

- Recording meters shall be switchboard type, back connected, suitable for flush mounting, and mounted on a withdrawable or swing-down carriage for easy access. All recorders shall be furnished in dust tight casing suitable for tropical use.
- Provision shall be made for automatic shorting of C.T. leads, wherever applicable, if and when the recorders are drawn out.
- The chart drive shall be supplied from Uninterrupted Power Supply (UPS) feeder.
- Recorders shall be multi-pen/multi-point microprocessor based with chart speed adjustable in a wide range with minimum of 25 mm/hr and chart width shall not be less than 100 mm.
- Recorders shall be provided with indicating scales graduated 0-100% with a printing of actual value of primary quantity every hour (or cyclically after a programmable duration). High & low alarm contacts with programmable set points shall also be furnished.

- Recorders shall be furnished with required transducers, accessories, charts, ink and spares for six (6) months service at 25 mm/hr speed.

r. Relays

- Relays shall be furnished in rectangular /square dust tight, draw out or rugged plug in type, flash /semi flash mounting cases.
- The hardware design for protection and associated equipment shall use latest state–of–the-art technology and shall generally be integrated numerical, modular in nature. Relay shall be designed by n microprocessor with adequate self testing/monitoring/diagnostic facilities and network connectivity.
- The design of the protections shall be based on numerical techniques. All the analogue signals will be converted into digital data, using analogue-to- digital conversion circuit. The data will be processed by a microprocessor, which will perform digital signal processing and executes various protection algorithms. The relay shall be provided with one no. Laptop-PC (latest version) for user interfaces, monitoring, testing facility etc
- The relay shall be designed to perform satisfactorily under highly noisy electrical environment. Sufficient degree of high frequency disturbance immunity and impulse voltage withstand capacity shall be built into electronic designs as stipulated in relevant standards.
- Relay characteristics shall be coordinated for proper functioning in conjunction with associated relays. The Contractor shall co-ordinate the characteristics of all relays to suit the system and equipment parameters. Relays and timers shall have appropriate setting ranges, accuracy, resetting ratio, transient over reach and other characteristics to provide required sensitivity satisfaction to the owner. Some of the relays for generator and generator transformer protection may be back-up for switchyard relays and the settings of these relays shall be properly co-ordinated with the settings of the later.

- In supplied panels numerical protection to be provided which should be IEC61850 compliant.
- The relays shall be suitable for function satisfactorily in non-AC physical environment. The numerical relays shall have continuous self-monitoring and cyclical test facilities. The internal clock of the system shall be synchronized through the GPS Time Synchronizing System.
- All protections shall be furnished compete with necessary auxiliary, supervisory, lock out, timers, interlocking, alarm, logging etc, relays. Suitably separate sets of single phase auxiliary C.T with multiple taps shall be provided with relay whenever required.
- Visual and audible alarm annunciation shall be initiated in the event of operation of protective/supervisory relay.

s. **D.C circuits shall be supervised by relays.**

- Tripping shall be done through separate potential free contacts. High speed lock out relays shall be used. No control relay, which shall trip the circuit breaker when relay is de-energized, shall be employed in the circuits.
- The relay shall have all the features as specified elsewhere in the specification.
- Required protections have been generally been indicated in Annexure for Bidder's reference.
- The numerical relays offered shall have self-diagnostic features to reduce the down time of the relay and to provide useful diagnostic information upon detection of an internal fault so as to speed up the maintenance. The necessary support documentation explaining in detail the self-diagnostic features of the numerical relays shall be furnished for the purchaser's use.

t. **Energy Metering**

- Metering of energy imported and exported from switchyard through individual feeder are to be provided. Accuracy class of

meters and associated core/winding of instrument transformers shall have accuracy class 0.2 or better. Meters shall be ABT meters with provisions for interfacing with Switchyard SAS, Solar Plant DCS/PLC.

u. **Auxiliary Devices**

- The Contractor shall furnish, install, and wire-up all auxiliary devices such as interposing current or voltage transformers, timing/switching/lockout/auxiliary relays , synchro check relay as required for the proper functioning of the schemes offered.

v. **Annunciation System**

- Each control panel shall be provided with an annunciator window board. The annunciator boards shall be back-connected and suitable for semi-flush mounting.
- The annunciation system shall be solid state type with optical isolation for input signals.
- Each annunciator group shall be independent, complete with its own power supply, audible alarms, acknowledge-reset-test buttons and other necessary accessories.
- The annunciator shall be non-integral type with hardware box mounted separately for easy access and maintenance.
- Hooters with distinctly different tones shall be used for trip, non-trip, and ring back annunciations.
- The window size shall be same as existing control panel. The Character height shall be 5 mm.
- The annunciation system shall be suitable for operation from both NO and NC type initiating contacts.
- Minimum 10% annunciation channels and window facia shall be provided as spare on each panel, with a minimum of two (2).
- The annunciations to be provided on each control board shall be as per enclosed annexures and subject to approval of the Purchaser.

w. **Transducers**

- Current/voltage/power/frequency transducers with dual output of 4-20 mA DC shall be provided for input to SAS, Data Acquisition System (DAS), recorders etc.

5.13.7.2.4 TESTS

Each Control Board shall be completely assembled, wired, adjusted, and tested at the factory prior to shipment.

- **Routine Tests**
- The tests shall include wiring continuity tests, insulation tests before and after high voltage test, and functional tests to ensure operation of the control/protection/metering schemes and individual equipment.
- All switches, meters, relays, and other devices shall be tested and calibrated in accordance with relevant IEC/IS standards.
- Type test certificate on any equipment, if so desired by the Purchaser, shall be furnished. Otherwise the equipment shall have to be type tested, free of charge, to prove the design.

5.13.7.2.5 DRAWINGS, DATA & MANUALS

- **To be submitted with the bid**
- General arrangement drawings of all control boards.
- Bill of material.
- Technical leaflets and catalogues on

  a) Control board

  b) Switches , lamps and indications

  c) Meters and relays

  d) Annunciator system

  e) Auxiliary devices.

  System single line diagram and metering & protection three line diagrams.

To be submitted after award of contract

- Dimensional general arrangement drawings of all Control Boards showing equipment disposition and identification.
- Foundation plan and loading diagram, clearly showing panel fixing arrangement, floor opening for cable entry, etc.
- Schedule of material and label inscriptions.
- Detail control schematics incorporating all interlocks from and to external equipment and clearly showing terminal numbering.
- Panel wiring diagrams
- System single line diagrams and metering & protection three line diagrams.
- Back of board wiring diagram showing all equipment and devices in their relative physical positions and all wiring upto the terminal blocks.
- Equipment/Device and terminals shall be identified with designations/numbers as per approved schematic and connection diagrams.

- Data Sheets and Instruction Manual for each piece of equipment.
- Relay setting calculation and recommended settings. Relay catalogues for setting calculations.
- Tenderers may note that the drawings, data and manuals listed are minimum requirements only. They shall ensure that all other necessary write-ups, curves, and information required to fully describe the equipment offered are submitted with their bids.

ANNEXURE-A

A.C./D.C. POWER SUPPLY

1.0 **System Voltages**

All systems shall be designed for satisfactory operation on the following power supply :

A.C. Supply	:	415/240V, 3/1 Phase, 50 Hz, 4/2 Wire, effectively grounded system.

		Fault level 50 KA rms symmetrical.
D.C. Supply	:	220V, 2 Wire, ungrounded. Fault level 25 KA. Indicative only; actual value will be decided by the Bidder and to be substantiated by calculation.

2.0 **Permissible Variation**

Equipment and accessories shall be suitable for operation over the entire range of voltage/frequency variation as listed below :-

A.C. Supply	:	Voltage 230 ± 10%
	:	Frequency 50 ± 5%
	:	Combined Volt + Freq. 10% (absolute sum)
D.C. Supply	:	Voltage 240 ± 10%

ANNEXURE-B

ANNUNCIATOR

TYPE

The annunciation system shall be manually reset type with ring back facility, suitable for operation on 220V DC ungrounded supply.

FUNCTION

The sequence of operation shall be similar to ISA-2A with fast/slow blinking as detailed below:

Field Condition	**Visual Display**	**Audible Alarm**	**Ringback Alarm**
Normal	Off	Silent	Silent
Abnormal	Fast blinking	On	Silent
Acknowledge	Steady On	Silent	Silent
Return to normal	Slow blinking	Silent	On
Reset	Off	Silent	Silent
Normal Before Acknowledge	Slow Blinking	On	On
Acknowledge	Steady On	Silent	On
Reset	Off	Silent	Silent
Test	Fast Blinking	On	On

ANNEXURE-C

LIST OF PROTECTIONS (EXISTING PROTECTION PANELS FOR TRANSFORMER ONLY WILL BE USED UNDER SAS PERVIEW) : only for STPS Raw Water Pond 2.

The following are the minimum specified protection functions as required for Transformer (132/33KV), 33KV feeders. The protections shall be furnished with accessories like master trip relays, timers, auxiliary relays, interposing CTs & VTs, tripping relays etc. as required to fulfill the functional requirement of control, indication, interlock & protection.

i. INTEGRATED TRANSFORMER PROTECTION (Two sets (2 x 100%) of numerical protection)

1.	Transformer Differential protection	:	87AT-1 & 87AT-2
2.	Transformer IDMT Over current protection with high set instantaneous unit	:	50/51AT-1 & 50/51AT-2
3.	Transformer 132KV side Restricted Earth Fault protection	:	64HVREF-1 & 64HVREF-2
4.	Transformer 132KV side Impedance protection	:	21PHV-21PHV-2
5.	Transformer 132 KV side Directional over current protection	:	67PHV-1 & 67PHV-2
6.	Transformer 132KV side Directional Earth fault protection	:	67NHV-1 & 67NHV-2
7.	Transformer Neutral Over current protection	:	51GAT-1 & 51GAT-2
8.	Transformer 33KV side Grounding Transformer Restricted Earth Fault protection	:	64LVREFG-1 & 64LVREFG-2
9.	Transformer 33KV side over voltage protection	:	59NLV-1 & 59NLV-2
10.	Transformer 33KV side over current protection	:	51LV-1 & 51LV-2

11.	Transformer 33KV side Directional over current protection	:	67PLV-1 & 67PLV-2
12.	Transformer 33KV side definite time earth fault protection		50N/2LV-1 & 50N/2LV-2
13.	Transformer over flux protection	:	24AT-24AT-2

Note: The Bidder shall check the existing 132 KV busbar. Any modification is required is in the scope of bidder. The bidder shall connect the new 132 KV CT core for busbar protection to the existing 132 KV busbar protection relays. All transformer mechanical protection devices (like WTI, OTI, PRV, Bucholtz, SPR, etc.) shall be suitably interface to the numerical protection relays to make a comprehensive protection of the new transformer.

ii. PROTECTION OF 33 KV SWITCHYARD (for BkTPS, SgTPP and STPS, however BCU shall be applicable for STPS Raw Water Pond)

- Bidder shall envisage the space at the existing BCU room adjacent to the 132/33 kV Transformer Yard for the installation all the required panels and other accessories. If the space is not sufficient considering the layout requirement as per NIT, Bidder has to install new Concrete room for installation of the new CR panel. This New 33KV switchyard control room for CR Panel and other required panels are under bidder scope. The new CR Panel shall be utilized to perform control, indication, metering and annunciation of all the 33KV switchyard equipment.

- A. **Line Feeder**

1. Over-current protection(IDMT + High set with directional feature): 50/51
2. Earth fault protection : 50N/2

(Will depend on the Vector Group Selection of the Transformer.)

ALL RELAYS ARE TO BE PROVIDED WITH IEC61850 COMMUNICATION PROTOCOL.

STPS:

- New 12.5 MVA Transformer will be controlled from existing SAS. The existing SAS along the BCU **(DUAL PARALLEL REDUNDANT)** panel shall be utilized to perform control, indication, metering and

annunciation of the above equipment including 132 KV and 33KV side bay equipment i.e. all circuit breakers and isolators of the above transformer and 33 kV Bays. For control from existing SAS, bidder have to do necessary modification in control and protection scheme for successful commissioning of the new transformer including Operation, Control, Protection, indication, annunciation etc. through existing Bus-tie breaker is scope of this package vendor.

- The 33KV switchyard is now being controlled from new SAS on IEC61850 protocal.
- Bidder shall install new CR panels for new 33 kV Bay for evacuation of Floating Solar Power.
- For coolers, Pumps & fans and tap changer (OLTC) of new transformer One (1) no. control panel will be provided in the New control room. The control & indication for cooler, OLTC can be done from this panel only.
- Existing BCUs' are GE make model: supplied system should be 1:1 compatible with existing system.
- **CONTROL AND RELAY PANEL FOR TRANSFORMER NOT REQUIRED. EXISTING WILL BE USED. However necessary supply, laying, termination of power and control cable, testing, commissioning of these panel along with all necessary control and protection is under bidder's scope.**

Note: Bidder shall design the system in such a way that flow of power can be done both the way.

ANNEXURE-D

INDICATIVE LIST OF ANNUNCIATIONS TO BE INCLUDED IN SAS (EXISTING PANEL) FOR NEW 132/33 kV TRANSFORMER (for STPS Raw Water Pond only)

I. **LIST OF ANNUNCIATIONS**

Transformer lockout relay (86) - Operated

Transformer lockout relay (86) - Circuit Unhealthy

Transformer H.V Back-up E/F - Operated

Transformer H.V Back-up Over current - Operated

Transformer H.V Restricted E/F - Operated

Transformer Overfluxing (trip unit) - Operated

Transformer Overfluxing (alarm unit) - Operated

Transformer Buccholz relay - Alarm

Transformer Winding Temperature - High

Transformer Oil Temperature - High

Transformer Oil level - Low

Transformer Cooler bank 1/2 oil flow - Low

Transformer Cooler bank 1/2 fan - Fail

Transformer Cooler power/control supply - Fail

Transformer trouble - Trip

Group alarm for Buccholz trip/Winding Temperature trip/Oil temperature trip/Pressure Relief Device - Trip

Transformer EHV circuit breaker - Trip

EHV Bus Tie circuit breaker - Trip

Transformer EHV circuit breaker pole-discrepancy - Operated

EHV Bus Tie circuit breaker as 12.5 MVA Transformer circuit breaker pole - discrepancy -Operated

Transformer EHV circuit breaker bus differential- Operated

EHV Bus Tie circuit breaker as Transformer circuit breaker bus differential- Operated

Transformer EHV circuit breaker LBB lockout relay - Operated

EHV Bus Tie circuit breaker as Transformer circuit breaker - LBB lockout - Operated

Transformer EHV circuit breaker SF6 gas pressure - Low

EHV Bus Tie circuit breaker as Transformer circuit breaker air pressure - Low

Transformer EHV circuit breaker air pressure - Very Low

EHV Bus Tie circuit breaker as Transformer circuit breaker air pressure - Very Low

Transformer EHV circuit breaker trip circuit - Unhealthy

EHV Bus Tie circuit breaker as Transformer circuit breaker trip circuit - Unhealthy

Transformer yard fire protection relay - Operated

ANNEXURE-E

INDICATIVE LIST OF CONTROL EQUIPMENT, LAMP INDICATION, INDICATING INSTRUMENT/METERS TO BE MOUNTED IN TRANSFORMER NEW COOLER & OLTC BACKUP CONTROL PANEL (For STPS Raw Water Pond)

A. **CONTROL EQUIPMENT**

1. Auto/Off/Manual Selector Switches for –
   - Transformer Cooler Fan control
   - Transformer Cooler Pump control
2. Push button for DC Supply
3. Lower/Normal/Raiser selector switch

B. **LAMP INDICATIONS**

1. Main Incoming DC Supply – 1 FAIL
2. Main Incoming DC Supply – 2 FAIL
3. Transformer Cooler Bank 1 – Scheduled fans ON
4. Transformer Cooler Bank 1 – Standby fan ON
5. Transformer Cooler Bank 2 – Scheduled fans ON
6. Transformer Cooler Bank 2 – Standby fan ON
7. Transformer OLTC supply HEALTHY
8. Transformer TAP CHANGE IN PROGRESS
9. OLTC Control Supply ON indicating lamp

C. **INDICATING INSTRUMENT/METERS**

1. Winding Temperature Indicator for Transformers
2. Ammeters for –
   - HV side of Transformer
3. Voltmeters for –
   - HV side of Transformers
4. Tap position Indicator for Transformers

5.13.7.3 TECHNICAL SPECIFICATION FOR 33 KV SWITCHYARD EQUIPMENT & ACCESSORIES

5.13.7.3.1 INTENT OF SPECIFICATION

- This specification is intended to cover complete design, engineering, manufacture, assembly, testing at manufacturer's works, supply and delivery, properly packed for transportation F.O.R. site of all equipment and accessories, Steel Structures including Civil, Structural work, complete and efficient erection, testing, commissioning & putting into successful commercial operation of Extension and retrofitting, replacement, renovation etc. of 33 kV BkTPS, STPS & SgTPP Switchyard.
- The bid for all items of equipment and system covered under this specification shall be complete in all respects and any item of equipment or accessory not specifically mentioned in this specification document but considered essential for efficient and satisfactory operation of individual equipment and system as a whole shall be included in the offer.

5.13.7.3.2 SCOPE OF WORK

The scope of work under this Specification shall essentially comprise of but not limited to the following:

Sl No	Type and description of major equipment	Quantity
	At BkTPS Switchyard BkTPS	
	33 kV 3 Ph VCB Outdoor	1 no.
	1250 A, 33 kV Double Break Isolator (with earth switches on line side)	2 sets
	33 kV LA	1 Set
	33 kV PT with Isolator on Bus side (if applicable)	1 Set
	33 kV CT	1 Set
	STPS: Raw Water Pond 2.	
1	12.5 MVA, 132/ 36 kV Oil filled Transformer complete with all accessories	1 no.
2	132 kV LA	1 Set
3	Control and relay panel for 33 kV Line bay for evacuation of Solar Power from FSP	1 no.
4	33 kV 3 Ph VCB Outdoor	1 no.
5	1250 A, 33 kV Double Break Isolator (with earth switch on line side)	4 sets
6	33 kV LA	3 sets
7	33 kV PT with Isolator on Bus side (if applicable)	1 Set
8	Grounding transformer	1 no.
9	33 kV CT	2 sets

SgTPP : Raw Water Pond 5		
1	33 kV 3 Ph VCB Outdoor	3 no.
2	1250 A, 33 kV Double Break Isolator (with earth switches on line side)	6 sets
3	33 kV LA	3 Sets
4	33 kV PT with Isolator on Bus side (if applicable)	3 Sets
5	33 kV CT	3 Sets
1 set consists of 3 nos.		
These are minimum requirement, however quantity may increase subject to successful completion of the project		

New 12.5 MVA, 132/33 kV transformer shall be installed at the foundation area of existing 7.5 MVA 132/33 kV transformer at Bhojudih Transformer yard inside STPS.
Bidder shall take necessary modification, strengthening of this foundation and other structure, gantry etc. based on their design before installation subject to approval of WBPDCL.
Existing 7.5 MVA, 132/33 kV transformer shall properly be dismantled and shifted to the scrap yard or any location as directed by the STPS authority about 500 mtrs distance from the location of its foundation along with all scrap material.

5.13.7.3.2.1 Switchyard

A. 132 kV switchyard

a) 132 kV switchyard structures and bus work for connecting one (1) transformers and necessary 132 kV equipment such as current transformers, Gantry, Transformer foundation, Tower, Oil pit, and their support structures.

b) Existing 132 kV Bus combination of Main Bus 1, Main Bus 2 and Transfer Bus present at 132/33 kV Transformer. The present 132 kV switchyard have bus configuration with two (2) main bus and one (1) transfer bus.

c) The scope covers following major equipment. However the bidder shall consider all equipment, materials required to make the switchyard complete in all respects.

i) 132 kV Current Transformers (CTs) (if applicable).

ii) 198 kV Lightning Arresters (LAs)

iii) Bus bars, ACSR Moose conductors, insulators, clamps and Connectors, BPI

iv) Cable laying, cable race way, termination, testing and commissioning of existing Relay Panels and Bay Controllers (SAS) with all new equipment and existing upto successful handed over of the system.

v) Interfacing with existing PH-I & PH-II SCADA & SAS with new 12.5 MVA Transformer Bay.

vi) Connection of all existing Main Bus 2 and Transfer Bus with the new equipment. Bidder shall intimate prior 20 days for each Bus shut down for connectivity.

B. 33 kV switchyard

a) 33 kV switchyard cable trench, structures and bus work for connecting transformers, line feeders and provision of necessary 33 kV equipment such as circuit breakers, disconnecting switches, current transformers, potential transformers, lightning arresters etc., and their support structures.

The 33 kV switchyard shall have following bays (Refer SLD):

i) Line bays :

- New Bays with all equipment: for evacuation of Power from BkTPS, STPS Floating Solar Plant.
  BkTPS: 1 no.
  STPS: 1 no for Solar Power;

- New Spare Bay: equivalent open space for Bay to be kept. Bidder shall extend the existing 33 kV switchyard fencing considering this future provisions.

ii) Transformer bay : One (01)
One incoming from 132/33 kV Transformer to 33 kV Bus with new cabling for STPS Raw Water Pond 2.

iii) Shifting of and retrofitting of two existing 33kV feeder bays (Bhojudih-1 & Bhojudih-2) subject to availability of shut down for STPS Raw Water Pond 2.

b) The scope covers following major equipment. However the bidder shall consider all equipment, materials required to make the switchyard complete in all respects.

i) 33 kV VCB Circuit Breakers
ii) 33 kV Disconnecting switch with and without Earth switches
iii) 33 kV Current Transformers (CTs)
iv) 30 kV Lightning Arresters (LAs)
v) Bus bars, ACSR conductors, 36 kV grade cables, insulators, clamps and Connectors.
vi) 36 KV power cables.
vii) Earthing transformers (if applicable).

C: The hardware, materials & miscellaneous items related to 132 kV and 33KV switchyard erection shall include but not limited to the following :

i) Al. Pipe bus, ACSR Conductors (Moose) & shilding wires.
ii) Grounding rods, flats, wires.
iii) Tension Insulator String Assembly Sets.
iv) Suspension Insulator String Assembly Sets.
v) Conductor Spacers, Clamps & connectors, sag compensators.
vi) Post and Disc insulators.
vii) Lightning protection materials.
viii) Bay marshalling boxes.
ix) Junction box for CT and PT.
x) Other item if any.

Any material or accessory, which may not have been specifically mentioned but which is usual and/or necessary, shall be supplied free of cost to the Employer.

D: Miscellaneous common items related to 132 kV and 33KV switchyard shall include but not limited to the following :

a) Earth mat below ground level and earthing of equipment and transformers.
b) Illumination System like Flood Light towers/lighting masts for transformer bays, 33KV switchyard. Complete illumination of control rooms and electrical room.

c) HVAC system, for 33KV switchyard control room and Electrical Room.

d) Fencing, drains, cable trenches with covers.

e) 415 small ACDB, DCDB, MLDB with lighting transformer to cater LTAC power requirement of new switchyard area including the new 33KV switchyard control room and electrical room.

f) Gravels (150 mm thick), in which 100 mm gravel of 40 dia. and 50 mm gravel of 20 dia. shall be laid in 132 & 33 KV Switchyard respectively as required over lean concrete.

g) Fire detection and annunciation system.

h) Fire Hydrant & Fire fighting system.

Nitrogen injection fire protection system shall be considered for transformer.

Water hydrant system shall be provided for -

a) Auxiliary power supply system area

b) Extended control room building

c) Portable extinguishers shall be provided under a shade in the new switchyard area.

i) Power and control cables.

i). Furniture for Control room & Office.

k) Any material or accessory, which may not have been specifically mentioned but which is usual and/or necessary, shall be supplied free of cost to the Employer.

E. **Complete Switchyard Gantry structures**, support, platform and miscellaneous structures, switchyard fencing, trenches and complete civil works required for extension considering the following:

i) Galvanized steel structures for CB, Disconnecting switch, CT, CVT/EMVT, LA under bidder scope.

ii) Intermediate Galvanized steel gantry structures in between 132 KV Switchyard for new Transformer bays. Galvanized steel gantry structures for 33KV switchyard, incoming Gantry for 33KV lines etc.

iii) 33KV switchyard control room building.

iv) Cable trench for Power and control cables

v) Transformer foundation, Transformer Oil pits, fire wall.

vi) Bidder shall shift 33 kV Outgoing Bhojudih feeder as per SLD.

vii) Space to be kept at 33 kV extension switchyard for another two separate 33 KV bays for future use. Bidder shall submit the 33 kV Switchyard Layout showing this future space provision for approval during detail engineering. Chain link fencing, clear space, trench layout, equipment foundation earthing and lightning layout, shield wire protection etc. shall be done considering these future provisions.

Any material or accessory, which may not have been specifically mentioned but which is usual and/or necessary, shall be supplied free of cost to the Owner.

F. All relevant drawings, data and instruction manuals.

G. Mandatory Spare parts.

H. Engineering activities to be performed by contractor shall include but not limited to the following :

i) Sizing of various electrical equipment and confirmation of the rating of the various equipment specified in the project specification.

ii) Switchyard layout drawings including plan, section, direct stork lightning protection drawing, grounding layout, control trench layout, illumination layout, etc. in interconnection with existing switchyard.

iii) Complete civil, structure and electrics for the switchyard

iv) Design calculations for switchyard foundations/structures

v) Walk way layout for operation and maintenance of switchyard equipment

vi) Shop inspection and testing procedure along with Q.A. schedule

vii) Field testing and commissioning procedure

viii) Preparation of as built drawings

5.13.7.3.3 CODES AND STANDARDS

The entire scope of work shall be carried out in accordance with stablished engineering practice and in conformity to this specification and with the relevant specifications and codes of practice of the Indian standards.

All equipment and materials shall be designed, manufactured and tested in accordance with the latest applicable Indian Standards (IS) and IEC except where modified and/or supplemented by this specification. In addition, work shall also conform to the requirements of the following :

IS 10118 – 1982	:	Code of practice for selection installation and maintenance of switchgear and control gear – part-3 (Installation)

Central Board Irrigation & Power (CBIP – New Delhi – India) Technical Manual on layout of substation report No.3

Indian Electricity Act and rules framed there under

Gazette notification No. 502/70/CEA/DP&D, dated 17.03.2006 on the Central Electric Authority (Installation & operation of Meters) Fire insurance regulations

Any other regulations laid down by central / state / local authorities during the execution of this contract.

Major standards, which shall be followed for manufacture and testing of different equipment, are listed below. Other applicable Indian Standards for any component part, even if not covered in the listed standards shall be followed :

i) AC Circuit Breaker

a)	IEC-62271-100	d)	IS-2516
b)	IEC-376	e)	IS-4279
c)	IEC-427	f)	IS-7311
		g)	IS-335
		h)	IS-2099

and Indian Boiler Regulation for SF6 gas cylinders.

ii) Disconnecting switches

a)	IEC-129	b)	IS-1818
		c)	IS-2544

iii) Instrument transformers

a)	IEC-185	d)	IS-2705
b)	IEC-189	e)	IS-3156
c)	IEC-186-A	f)	IS-3347
		g)	IS-3202

iv) Lightning Arrestor

a)	IEC-99 Part I and Part IA	e)	IS-4004
b)	IEC-30-2	f)	IS-3070
c)	IEC-71-2	g)	IS-8263

d) IEC-7C-37-WG-4 Documents

v) Grounding Transformer

a) IEC-289 b) IS-3151

c) IS-335

vi) Insulator

a) IEC-168

b) IEC-273

c) IEC-274

d) IEC-383

e) IEC-437

vii) Disc insulator string

a) IS-3188

viii) Post insulator stack

a) IS-2544

ix) Aluminium conductor steel reinforced (A.C.S.R)

a) IS-398

x) Tension/Suspension clamp assembly

a) IS-2486

xi) Clamps and connectors

a) IS-5561

5.13.7.3.4 DESIGN CRITERIA

- The basic system connection is shown in drawing no ST-FSP-DWG-E-001: Key Single Line Diagram.
- All the equipment, material etc. to be supplied shall be new and of the best quality and shall conform to the specification given here under. All similar materials and removable parts shall be uniform and interchangeable with one another.
- Lightning arresters for Auto transformer shall be mounted on a structure placed near the respective transformer.
- System Parameters

		132KV	33KV
i)	Voltage ..... Nom./Max. ..KV :	132/145	33/36

ii)	Frequency ... Hz ±%	:	..... 50 ± 5%	
iii)	Fault Level .... KA rms	:	31.5	25
iv)	System earthing	:	Effectively earthed.	Earthed through Grounding TR
v)	Short-time current rating (for all Current carrying parts)	:	31.5KA for 1 sec	25KA for 1 sec
vi)	Insulation Level			
	a) Basic insulation level KVP	:	1050	170
	b) Switching impulse KVP			
	Ph-E	:	1050	
	Ph-Ph	:	1575	
vii)	Power frequency withstand voltage KV rms Dry/Wet	:	460	80
viii)	Maximum radio interference voltage level at 1 MHz & 266 KV rms phase to ground voltage for HV winding (Micro volt)	:	1000	1000 --
ix)	Minimum clearances			
	a) Phase to Phase, mm	:	1550	320
	b) Phase to Earth, mm	:	1300	320
x)	Safety Clearances			
	a) Safety working clearances, mm	:	4000	3000
	b) Ground Clearance, mm	:	4500	

xi) Creepage distance mm : .....25 MM/KV.....

xii) Bay width (minimum) m : as per existing 6

xiii) Phase to phase spacing mm: 4000 3000

xiv) Auxiliary Power Supply

a) A.C. System : 415 V ± 10%, 3 Ph, 4W, 50Hz, ± 5%, 50KA, effectively earthed, combined voltage & frequency variation 10%

b) D.C. System : 132V ±10% DC, 2W, 25 KA, unearthed (for control & protection)

- Bus Configuration

132KV : Two Main bus and Transfer bus arrangement
33KV : One Main bus with bus section.

- Conductor

i) Bus Conductor-

132KV : Twin ACSR moose conductor for overhead bay and drop connection.

33KV : Aluminium Tubular Bus-bar.

ii) Shield Wire : 7/9 SWG G.I.

- The type and rating of different equipment shall be as follows :

a) The 33 kV circuit breakers shall be outdoor, VCB, electrically controlled spring / hydraulic operated, remote controlled, trip free design, complete with local control kiosk, operating mechanism with all associated auxiliaries. The circuit breaker and its accessories viz. marshalling box / junction box shall be with IP 55 degree of protection.

The circuit breaker shall have specified current ratings and shall be capable of making and breaking the specified fault current. All current carrying parts of the circuit breaker shall be of adequately

size. Arc control devices shall be capable of rapidly and effectively extinguishing the arc with negligible stresses on the enclosure. The circuit breaker shall satisfactorily interrupt transformer magnetising current, line charging current and short-line faults.

b) All 33KV Disconnecting switches shall be horizontal break. Disconnecting switch shall be provided with A.C. electric motor operated mechanism and manually operated earth switch for earthing one set of switch terminals, where necessary. Earth switches shall be of vertical break type and shall be gang operated.

c) The 132KV and 33KV current transformer shall be suitable for the fault MVA & BIL as mentioned earlier. These shall be hermetically sealed, oil immersed type meant for separate mounting.

d) Gapless type of Lightning Arrestors (ZnO) shall be used for 132KV and 33KV system. The lightning arrestors shall be heavy-duty station class, gapless type.

e) The buses shall be adequately sized for fault and continuous current requirement coordinating with existing system and fault level. The busbar fittings, connectors, etc. will be of suitable aluminium alloy having desired mechanical strength and electrical properties.

f) Extension switchyard structures shall be latticed mild steel structures, hot dip galvanized. Equipment structures shall also be of similar construction. Switchyard structures will be sized to support dead load, short circuit loadings transmitted from high voltage buses, wind load and seismic force, which may be encountered.

- Grounding

A grounding mat has to be provided at a depth of 1000 mm (minimum) within the switchyard to provide low impedance discharge path to earth for lightning surge and fault energy of the system. To ensure safety to personnel, this has to be designed for permissible touch and step potential. All equipment, structures etc. are to be connected to this mat to ensure safety, as per the provisions of I.E. Rules. New Bay ground mat has to be laid and provision for connecting with the future mat shall be kept as per IEEE, IE Rule. This ground mat shall be interconnected to existing switchyard ground mat and power house ground mat separately in mess.

- Mild steel rods will be used as main ground conductor and driven electrodes at intervals. This size has been fixed based on the system ground fault current carrying capability for 1 second and considering loss of size due to corrosion for a period of 30 years. Rate of corrosion at 0.3 mm per year is to be considered in design.
- The minimum ground conductor sizes shall be as follows :

Main ground conductor for underground grounding mat	:	40 mm dia M.S. rod.
Ground Electrode	:	40 mm dia M.S. rod x 3m length.
Risers for equipment connection	:	40 mm dia M.S. rod.
Over-ground grounding grid and	:	a. 75 x 10 mm/50 x 6 mm GI flat. equipment connection b. 8 SWG GI wire

- Testing arrangements shall be provided at suitable locations.
- Shielding

  In addition to providing lightning arrestors, switchyard shall be adequately shielded using shield conductors (Spikes) fixed on different tall switchyard structures and lightning masts meant for the purpose. Where strung shield wires cannot be avoided, such as connection to Auto transformer etc. 7/9 galvanised steel wire (11 Kg/Sq.mm quality) will be strung between Gantry supports , over the phase conductors. The complete shielding net-work will be connected to the main ground mat of the switchyard.
- The angle of protection shall be 45 deg.
- The down conductors shall be 75 x 10 mm G.I. flat minimum.
- Electrodes shall be provided at each connection point of down conductor and underground ground mat.
- Switchyard hardware
- All the ACSR conductors post and string insulators, clamps & connectors, hardwares etc. will be used in switchyard having characteristics as listed in the Annexure-A.
- All equipment, conductors, hardwares, insulators & clamps etc. will be installed outdoor in a hot, humid & tropical atmosphere.

- The maximum temperature in any part of the clamps, connectors, conductors etc. at specified rating shall not exceed the permissible limits as stipulated in the relevant standards.
- All equipment, conductors, clamps, connectors, insulators etc. shall be capable of withstanding the dynamic & thermal stresses of maximum short circuit current without any damage or deterioration.
- In order to avoid concentration of stresses, all sharp edges of clamps, connectors etc. shall be rounded off.
- Bi-metallic connectors shall be used for any connection between dissimilar materials.
- Expansion joints shall be provided in the Aluminium tube bus system, whenever necessary, to eliminate undue stresses on the equipment terminals and post insulator stacks.
- In order to maintain the specified inter-group spacing between the sub conductors of bundle under all normal working condition, spacers shall be fitted in the bundle.

5.13.7.3.5 SPECIFIC REQUIREMENTS OF 33 KV SWITCHYARD EQUIPMENT AND ACCESSORIES

A. 33KV Circuit breaker-

The circuit breakers of 36 KV Class shall be outdoor type vacuum circuit breaker.

The equipment covered by this specification shall be complete in all respects. Any material or accessory which may not have been specifically mentioned but which is usual or necessary for satisfactory and trouble-free operation shall be within the scope of supply without any extra charge to the WBPDCL.

Two nos. trip coils shall be provided for circuit breaker for 36 KV (each pole operated individually). The support structure of Circuit Breaker as well as control cabinet shall be hot dip galvanized. All other parts shall be painted as per Specification.

The quantity of each type circuit breaker to supplied and installed are as follows:-

i) 1250A, 33KV VCB Circuit Breakers for incoming feeders at 33KV switchyard from Solar Plants.

- The equipment will be used in 33KV system of the substation having characteristics as listed in the Annexure-A.
- The equipment will be installed outdoor in a hot, humid and tropical atmosphere.
- All equipment, accessories and wiring shall have tropical protection, involving special treatment of metal and insulation against fungus, insects and corrosion.
- The maximum temperature in any part of the equipment at specified rating shall not exceed the permissible limits as stipulated in the relevant standards.
- There shall be no radio interference when the equipment is operated at maximum service voltage.
- The safety clearances of all live parts of the equipment shall be as per relevant standards.
- Corona shall be reduced to the minimum as per relevant standard by using suitable devices.
- **Type and Duty**

a) The circuit breaker shall be three-pole, VCB, outdoor type, having internal isolation without any sequential interlock.

b) The circuit breaker shall be restrike free as per IEC under all duty conditions and shall be capable of performing their duties without opening resistors.

c) The duty of the circuit breaker shall involve satisfactory interruption of short circuit currents as listed in the annexure.

d) The breaker shall be suitable for operation even under condition of "phase opposition" arising out of faulty synchronization.

e) The breaker shall be capable of clearing the "Kilometric" fault of same magnitude as rated short-circuit current.

f) The breaker shall be capable of interruption of low reactive currents (lagging/leading) without undue over voltage as per IEC.

g) Breakers with multi-break interruptions shall be so designed that the voltage developed across a pole is uniformly distributed over the power breaks.

h) The circuit breaker shall be capable of :

i) Interrupting line/cable charging current as per IEC without any restrike and without use of opening resistors.

ii) Clearing short line fault (kilometer faults) with source impedance behind the bus equivalent to symmetrical fault current specified.

iii) Breaking 25% of the rated fault current at twice rated voltage under phase opposition condition.

i) The breaker shall satisfactorily withstand the high stresses imposed on them during fault clearing, load rejection and re-energization of lines with trapped charges. The breaker shall withstand successfully all transient and sustained voltages under various operating condition.

This specification covers design, manufacture, assembly, testing at manufacturer's works of Vacuum Circuit Breaker of 36 KV class (Outdoor) as detailed in the enclosed Schedule, complete with accessories required for efficient and trouble free operations.

The circuit breakers offered shall be as per specific technical parameters and suitable for outdoor installation.

The circuit breakers are required complete with structures, operating mechanism, all associated accessories and auxiliaries.

- **STANDARDS**

The equipment to be furnished under this specification, shall unless and otherwise stated, be designed constructed and tested in accordance with the latest revisions of Indian Standards as follows :

IS-13118 - General requirements for circuit breakers for voltages above 1000 V

IS-9135 - Guide for testing of Circuit Breaker

IS-2099 - Bushings

IEC - 62271-100

IEC - 60694

IEC - 56

- **GENERAL INFORMATION**

The circuit breakers of 36 KV Class shall be outdoor type vacuum circuit breaker

The equipment covered by this specification shall be complete in all respects. Any material or accessory which may not have been specifically mentioned but which is usual or necessary for satisfactory and trouble-free operation shall be within the scope of supply without any extra charge to the WBPDCL.

Two nos. trip coils shall be provided for circuit breaker for 36 KV (each pole operated individually). The support structure of Circuit Breaker as well as control cabinet shall be hot dip galvanized. All other parts shall be painted as per Specification.

- **DESIGN CRITERIA**

a) The Circuit Breakers shall be used in neutral solidly ground system with symmetrical fault level of 25 KA for 3 sec at system voltage of 33KV. Earthing of 33KV system for 220/33KV transformer is under bidder scope of design as per system requirement.

b) All controls shall be suitable for 85% to 110% for closing and 70% to 110% for tripping of 220 Volts (±10%) D.C supply voltage for 33 KV & above. The A.C. supply shall be available at 400 V (±10%), 50 c/s, 3 phase 4 wire system or 230 V (±10%), 50 c/s, 1-ph 2-wire system.

c) Radio interference voltage shall not exceed 1000 micro volt when the equipment will be operated at maximum service voltage for circuit breakers rated 132KV and above.

d) The maximum temperature attained by any part of the equipment at specified rating should not exceed the permissible limits as stipulated in relevant standards. Equipment shall be designed taking 50°C as maximum ambient temperature.

e) The minimum safe clearance of all live parts of the equipment shall be as per relevant standards and electricity rules. Clearance of Phase to Phase low level pipe bus are as follows :

f) 33 KV : Phase to Phase (mm) 1500

g) In case of gang operated breaker of 36 KV class, the minimum clearance between poles shall not be less than 430 mm respectively and shall withstand the impulse/power frequency level as specified in our technical parameters.

h) Provision of electrical interlocks for safe and satisfactory operation of the Breaker shall be furnished. The interlocking device shall be of proven quality.

i) The breaker shall be able to function even under conditions of phase opposition that may arise due to faulty synchronization or otherwise as per relevant IS standard or IEC Standard.

j) Breaker shall be capable of interrupting line/cable charging current as per IEC without any restriking and without use of opening resistors.

k) The breaker shall be capable of interrupting rated breaking current with recovery voltage equal to maximum line service voltage and at all indicative power factor of the circuit equal to or exceeding 0.15.

l) Breaker shall be capable of clearing short line fault without excessive rise of restriking voltage.

m) The breaker shall be suitable for interrupting low inductive currents (0.5A to 10A) as well as capacitance, without undue over voltage.

n) The Bidder may indicate in his offer the methods adopted for limiting over voltages.

o) The circuit breaker of 36KV rating shall be capable to withstand power frequency over voltage as per value specified in IEC 62271-100 or relevant IS.

p) Operating duty of all circuit breakers from voltage range 36 KV shall be as follows :

O-0.3 sec-CO-3.0 min-CO

q) The Circuit Breaker shall be re-strike free as per IEC under all duty conditions and shall be capable of performing their duties without opening resistors.

r) The Circuit Breaker shall meet the duty requirement of any type of fault or fault location also for switching when used on 33KV ungrounded system as well as non-effectively grounded but with NGR (if applicable) for 220/33KV substation and perform make and break operation as per duty cycles specified in above clause.

s) The breaker shall be capable of interrupting steady state and transient magnetizing current corresponding of power transformers.

t) If specifically mentioned in BOQ, Circuit breaker shall be provided with Control Switching device as per relevant standard.

- **CONSTRUCTIONS**

Each 36KV VCB shall comprise of three identical poles linked together electro-mechanically for simultaneous operation of pole units.

Operation counter should be provided to monitor the no. of operations.

MAIN CONTACTS AND ARC QUENCHING CHAMBER:

The tips of the main contacts shall be of suitable design and adequately silver plated to withstand arcing.

- **OPERATING MECHANISM:**

i. The operating mechanism shall be electrically controlled spring / spring operated for 36 KV class breakers. The mechanism shall have anti-pumping and trip free circuitry. The anti-pumping arrangement shall be initiated through Normally open (NO) type auxiliary contact of circuit breaker and shall be of 'self-hold' type. Type of such mechanism shall be mentioned. Local arrangement for operating the breakers both electrically and mechanically shall be provided in addition to remote electrical operation.

ii. There shall be mechanical ON/OFF indicator and number of operation counter for each pole of breaker in case of single pole operation and one mechanical ON/OFF indicator and provision for operation counter for 3 pole gang operated breaker.

iii. All three poles of circuit breaker shall operate simultaneously. Pole discrepancy feature shall be provided to trip the breaker if all the poles do not close/open simultaneously in case of single pole operation. For mechanically gang operated breaker pole discrepancy feature need not be provided.

iv. The operating mechanism box shall be fixed at a suitable man working height from ground level. View glass shall be provided on hinged door at the front. Hinged door shall be properly earthed with main body through copper flexible braided conductor. In case operating mechanism box shall not be placed at a suitable man working height, platform is to be arranged /supplied for each such breaker by the contractor. Suitable arrangement at site has to be made near each breaker to climb on the platform and work comfortably.

v. Suitable arrangement shall have to be made for easy accessibility to the operating mechanism box. All necessary arrangements are within the scope of bidder.

vi. Indication for spring charged condition shall be provided for breaker with spring charging mechanism. The spring charging mechanism shall be motor operated. After failure of power supply to the motor, one CO operation shall be possible with the energy stored in the operating mechanism.

- **SPRING OPERATED MECHANISM:**

ii. Spring operating mechanism shall be complete with motor. Opening spring and closing springs with limit switch for automatic charging and other necessary accessories to make the mechanism a complete operating unit shall also to be provided.

iii. As long as power is available to the motor, a continuous sequence of closing and opening operations shall be possible. The motor shall have adequate thermal rating for this duty.

iv. Breaker operation shall be independent of the motor, which shall be used solely for compressing the closing spring. Facility for manual charging of the closing spring shall also be provided.

v. Closing action of circuit breaker shall compress the opening spring ready for tripping.

vi. When closing springs are discharged after closing a breaker, closing spring, shall be automatically charged for the next operation and an indication of this shall be provided in the local and remote control cabinet.

vii. Provisions shall be kept to prevent a closing operation of the breaker when spring is in partially charged condition. Mechanical interlocks shall be provided in the operating mechanism to prevent discharging of closing springs when the breaker is already in closed position.

viii. The spring operating mechanism shall have adequate energy stored in the operating spring to close and latch the circuit breaker against the rated making current and also to provide the required energy for the tripping mechanism in case of tripping energy is derived from the operating mechanism.

- **COMMON CONTROL CUBICLE / MARSHALLING BOX**:

  - A free standing outdoor type weather proof common marshalling box/cubicle shall be provided to house different accessories except those which must be located in the pole unit operating box. Rubberized gaskets of durable quality shall be provided to make it water proof, dust and vermin proof. Degree of protection shall be IP-55 as per IS:13947
  - This outdoor cubicle shall be of 3.00 mm thick steel sheet and shall have hinged doors at front and rear for access to the mechanism. Doors should be of proper design & adequate MS sheet thickness and providing adequate stiffener, for smooth opening and closing. There shall be arrangement for padlocking, individual door panel should be connected with the main panel body by flexible braided copper conductor for earthing purpose at two points.
  - A removable gland-plate, 3.00 mm thick shall be provided at the bottom of the cubicle for cable entry. Gland sizes shall be suitable for entry of adequate number of multicore cables separately for AC & DC as per approved scheme.
  - Terminal blocks for AC & DC shall be kept isolated. Terminals shall be suitable for at least three nos. 2.5 mm sq. copper leads. All control wiring shall be of 1100 Volt grade 2.5 mm sq. copper PVC insulated cables.
  - Thermostat controlled heaters shall be provided to prevent condensation within the cubicle /switchgear. Cubicle illumination lamps with switch shall be provided.
  - A 230 Volt combined 5A/15A three pin socket with neutral earthing and a control switch shall be provided inside the box.
  - Suitable arrangement i.e. platform shall be provided with support structure for easy access to the operating mechanism box for personnel of average height. View glass shall be provided on hinged door for reading pressure gauge, ON-OFF indication mounted inside the cubicle.
  - Spring charged mechanism shall be placed within the operating mechanism box / marshalling box and contacts shall be provided for spring charged indication.
  - All controls, alarms, indications and interlocking devices furnished with breaker shall be wired up to the terminal block in common operating box /

marshalling box. Not more than two wires shall be connected to one terminal. All spare contacts available in the pressure switches etc shall be wired upto terminal block.

- All wires shall be identified at both ends with ferrule marking in accordance with approved wiring diagram.

The terminal blocks shall be of 1100 V grade and have continuous rating to carry the maximum expected currents on the terminals. Insulating barriers shall be provided between the terminals. The terminal block shall have locking arrangement to prevent its escape from the rails. The terminal blocks to be provided shall be fully enclosed with removable covers and made of moulded, non-inflammable plastic material. All terminals shall be clearly marked with identification numbers or letters to facilitate connection to external wiring. At least 20% spare terminals shall be provided.

- **INSULATORS:**

- The porcelain to be used in bushing shall be homogeneous, free from laminations, cavities and other flaws which may impair its mechanical and/or dielectric strength and shall be glossy, tough and impervious to moisture.
- The bushings shall have adequate mechanical strength and rigidity for conditions under which they will be used.
- Bushing insulation shall be coordinated with that of Circuit Breaker. The puncture strength of the bushings shall be greater than the dry flashover value.
- When operating at rated voltage and under operation in heavily polluted area, there shall not be any electrical discharge between bushing terminal and earth. No radio disturbance shall be caused by the bushings when operating up to the maximum system voltage. It shall also be free from corona.
- All iron parts shall be hot dip galvanised.
- All bushings of identical rating shall be interchangeable. Each bushing shall be provided with :
- Terminal connector suitable for connection to either 'ACSR' Conductor / Aluminium pipe shall be provided as per requirement. Particulars of 'ACSR' Conductor / Aluminium pipe to be connected with terminal of different voltage classes are specified under Specific Technical Parameters.

- All terminal connectors required for circuit breaker shall be guided by technical specification for Clamps and Connectors. Relevant drawings are to be submitted for approval before supply.

- **AUXILIARY CONTACTS**:
  - The breaker shall be provided with 6 NO + 6 NC for 36KV CBs as spare auxiliary / multiplied contacts in addition to the auxiliary contacts required for breaker's own operational requirements.
  - The auxiliary / multiplied contacts shall have continuous current rating of at least 10 A. The breaking capacity shall be adequate for the circuits controlled, and at least 2 A at 220 V DC for inductive circuit with time constant of minimum 20 ms.
  - All auxiliary / multiplied contacts shall be wired up to terminal block in the control cubicle.
  - Auxiliary/multiplied contacts shall be suitably protected against arcing. Insulating materials of the base of the contacts shall be moulded plastic or other non-breaking, non-inflammable insulating material.

- **GROUNDING**

  Circuit Breaker shall be provided with two grounding terminals suitable for connecting G.S. Flat of 50×10mm (min) for all voltage classes per pole each with tapped holes. Necessary stainless steel bolts and washers, spring washers are to be supplied for connection to grounding strip, size of which shall be as per requirement.

- **PAINTING**

All steel surfaces shall be cleaned by sand blasting or chemical process as required to produce a smooth surface, free of scale, grease and rust. Steel surface in contact with insulating oil shall be painted with heat resistant oil insoluble insulating varnish. External surfaces shall be given a coat of high quality red or yellow chromate primer and finished with gray colour (IS:631) with two coats of synthetic enamel paints. Paints shall be carefully selected to withstand tropical heat, rain etc. The paint shall not scale off or crinkle or be removed by abrasion due to normal handling. Sufficient quantity of touch up paint shall be furnished by application at site.

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- **EQUIPMENT FOUNDATION AND SUPPORT STRUCTURE**

The equipment shall be supplied with all support structures, which are integral part of the breaker. All support structure shall be hot dip galvanised after full chemical treatment as per IS: 4759 or equivalent.

- **36 KV VACUUM CIRCUIT BREAKER:**

  Each vacuum Circuit breaker shall comprise of three identical poles linked together electrically and mechanically for synchronous operation.

- **VACUUM INTERRUPTER AND CONSTRUCTIONAL FEATURE**

  - The vacuum interrupter, consisting of fixed contact and moving contact, shall be interchangeable among the same type interrupter. Short circuit capacity of vacuum bottle should be 25 KA and design life should be 100 nos. operation at rated short circuit level.
  - Constructional features of the vacuum chamber along with its functional arrangements are to be shown in a drawing submitted along with tender documents.
  - The gap between contacts of the Circuit Breaker inside interrupter should be capable of withstanding 1.5 time voltage to neutral at one atmospheric pressure at normal ambient condition within Breaker in the event of vacuum pressure drop due to leakage.
  - The circuit breakers and their components shall be capable of withstanding the mechanical forces and thermal stresses of the short circuit current of the system without any damage or deterioration of material.
  - The circuit breakers shall have motor wound spring charged trip free mechanism with anti-pumping feature, and shunt trip. In addition, facility for manual charging of spring, shall be provided.
  - Each breaker shall be provided with manual close & open facility, mechanical ON-OFF indication, an operation counter and mechanism charge/discharge indicator.
  - For motor wound mechanism, spring charging shall take place automatically after each breaker closing operation. One open-close-open operation of the circuit breaker shall be possible after failure of power supply to the motor. A visual mechanical indicating device will also be provided to show the position of the spring.

- 36KV VCB, with duty cycle O- .3sec CO-3min CO, Class- C2-M2 as per relevant IEC, 1250A, 25KA for 3 sec, 70kvrms/170kvp, 3-Phase, Outdoor VCB with 2TC & 1CC, 220V DC.
- The offered VCB shall be well proven in NTPC/WBSEDCL/WBSETCL. Offered bottle shall be identical with Type tested one. Brochures/leaflet on technical data sheet for vacuum bottle shall also to be submitted.
- The VCB shall be complete with structure, operating mechanism in a common Control cubicle with degree of protection IPW-55, situated at accessible man height, along with all associated accessories and auxiliaries and terminal connector as per specification and approved drawing during detailed engineering. The supply shall include 2 Set of complete bottle. (1 set comprises of one complete VCB i.e. inclusive of 3 poles).
- The bidder shall submit detailed as well as complete Type test reports as stipulated in relevant IS and IEC with complete identification, date and serial no. of circuit breakers of identical design with identical bottle from CPRI, NABL accredited/a Government recognized test house or laboratory during detailed engineering.
- Make & Type of VCB & Vacuum Interrupter with detailed literature shall be furnished along with bid.

- **TEST**

A. Routine Test

During manufacture and on completion, all equipment, clamps, connectors and accessories shall be subjected to the Routine Tests as laid down in latest revision of IEC/IS.

In addition to above tests specified by IEC/IS, the following tests also have to be carried out for specific equipment :

The speed curves for 220 KV circuit breaker shall with the help of a suitable operation analyser to determine the breaker contact movement during opening, closing, auto-reclosing and trip-free operation under normal as well as limiting operating conditions (Control Voltage etc.)

B. Type Test

Type tests on circuit breaker, disconnecting switch, CT & LA shall carried out as stipulated in relevant IEC/Indian Standards.

Following additional type tests are to be conducted for 220 KV circuit breaker:

i) Out of phase closing test as per IEC-267 & IEC-62271-100.

ii) Line charging breaking current test. The breaker shall be able to interrupt the line charging current with a test voltage of 1.4p.u. instead of 1.2 p.u. as per IEC-62271-10.

- **AVAILABILITY OF SPARE**

  The successful bidder shall submit manufacturer's undertaking during submission of drawings of Circuit Breaker that the spares for the supplied breaker (for all voltage classes and all makers) shall be available for at least ten years from the date of placement of LOA. All the participating bidders shall have to confirm in writing submission that the above mentioned undertaking from the manufacturer shall be submitted in case they receive order.

- **FURNISHING DETAIL GTP FOR 36 KV VACUUM CIRCUIT BREAKERS) during approval**

Sl. No.	Description	Particulars
1.	Conforming Standard	:
2.	Service (Outdoor/Indoor)	:
3.	Frequency	:
4.	Rated operating duty	:
5.	Rated (TRV) for terminal fault	:
6.	Short time Fault breaking capacity MVA	:
7.	Line charging current breaking capacity	:
	a) line charging current AMP	:
	b) Corresponding Over voltage (KV)	:
	c) Whether Switching Resistor is provided	:
	i) Value of Resistor	:
	ii) Time of insertion	:
	iii) Thermal Rating of Resistor	:
8.	Maximum shunt capacitor bank switching/breaking capacity in MVA and the over voltage factor.	:
9.	Maximum over voltage in Kilovolts on switching OFF Transformer on low load.	:

Sl. No.	Description	Particulars
10.	i) Breaks per pole (No)	:
	ii) Length of each break per pole (mm)	
	iii) Length of moving contact travel mm	
	iv) Rate of contact travel (m/sec)	
11.	Make time (ms)	:
12.	Minimum reclosing time at rated interrupting Capacity from the instant of the trip coil energisation (ms)	:
13.	Minimum dead time for 1 phase & 3 phase reclosing With corresponding limits of adjustment of dead time, If any.	:
14.	Maximum radio interference voltage between 0.5 MHz to 2 MHz with Voltage of 110% of rated rms voltage between phase & ground (Micro-Volt)	:
15.	Details of manually/motor operated spring charging mechanism.	:
16.	i)Voltage and Power requirement for a) closing coil b) Tripping coil ii) No of Tripping Coil	:
17	Vacuum Bottle	
17 a)	Make, Country, Type & Designation of Vacuum Bottle used in VCB.	:
17 b)	Number of operation at full short ckt level,	:
17 c)	no. of operation at rated current and other details	:
17 d)	Whether Literature & Catalogue of offered Vacuum Bottle containing the specific particulars enclosed?	:
18.	Weight of Vacuum Circuit Breaker	:
19.	No. of auxiliary contacts (Spring Charging LS) number of NO and NC shall be mentioned. No. of auxiliary spare contacts	:
20.	Power frequency withstand capability of breaker in open condition at :	:
	i) Atmospheric Pressure of Air/Zero Vacuum	:

Sl. No.	Description	Particulars
	Pressure	
21.	Actual opening time (from Trip Coil energisation to contact separation) (ms)	:
22.	Allowable time limit between breaker per pole (for multibreak type) and between poles (ms)	:
23.	Actual closing time (from Closing Coil energisation to contact touching (ms)	:
24.	Whether type tests report submitted in line with specification for similar breaker with offered vacuum Interrupter?	:
25.	Whether a) Dimensional GA Drawing Cross Sectional b)Drawing of interrupting Chamber and c)scheme diagram are furnished.	: a) b) c)
26.	Whether brochure/ leaflet on Technical data for Vacuum bottle enclosed?	

B. 33KV Disconnecting switch

Type, rating, connections etc. Of the equipment shall be as detailed in the annexures. The equipment shall be offered in strict compliance with the same. The details of each type of Disconnecting switch are as follows:-

i) 1250A, 33KV Horizontal double break type Disconnecting switch at switchyard.

Each disconnecting switch shall be furnished with fittings and accessories as listed in the Annexure-B.

Disconnecting switches shall be suitable for connection to Al.-tube bus of required no. & size.

The equipment will be used in 33KV system of switchyard, having characteristics as listed in the Annexure-A.

The equipment will be installed outdoor in a hot, humid and tropical atmosphere.

All equipment, accessories and wiring shall have tropical protection, involving special treatment of metal and insulation against fungus, insects and corrosion.

- The maximum temperature in any part of the equipment at specified rating shall not exceed the permissible limits as stipulated in the relevant standards.

- The equipment shall be capable of withstanding the dynamic and thermal stresses of listed short circuit current without any damage or deterioration.

- There shall be no radio interference when the equipment is operated at maximum service voltage.
- The safety clearances of all live parts of the equipment shall be as per relevant standards.
- Corona/grading ring as required shall be provided.

- **Constructional Features**

a) The 33 KV disconnecting switches shall be triple pole mechanically ganged horizontal double break type (contact blades moving through horizontal plane) with earth switches(wherever required).

b) The 3-pole disconnect switch shall be gang operated type unless specifically called for individual pole operated disconnect switch. The construction shall be such that all the poles make and break simultaneously.

c) The disconnect switch and its earthing switches including operating mechanism shall be so constructed that they can not come out of their open or closed position by gravity, wind pressure, vibration, shocks or accidental touching of connecting rods of the operating mechanism.

d) The mechanical linkages shall be such that then deflection is negligible. Facility of adjustment of the interpole operating rods and locking arrangement shall be provided.

e) The disconnect switch shall be designed for upright disposition unless specifically stated. The steel base frame shall be suitable for mounting on steel structure/concrete column as per the requirement of the switchyard layout.

f) The disconnect switch shall have padlocking arrangement in both `Open' and 'Closed' positions.

g) All current carrying parts shall be of non-ferrous metal or alloy. All live parts shall be designed to avoid sharp points and edges.

h) All metals parts shall be of such material and treated in such a way as to avoid rust, corrosion and deterioration due to atmospheric condition. Ferrous parts shall be hot-dip galvanised.

i) Bolts, nuts, pins, etc. shall be provided with appropriate locking arrangement such as locknuts, spring washers, key etc.

j) Bearing housing shall be weatherproof with provision for lubrication. The design, however, shall be such as not to require frequent lubrication. The requirement of lubrication shall be after 1000 operations or after 5 years whichever is earlier.

k) All bearings in the current path shall be shorted by flexible copper conductor of adequate size.

l) All isolator/earth switches shall be provided with manual operating handles enabling one man to operate the switch with ease in one single movement. The operating handle shall be provided with padlocking facility and located at around one (1) meter above the ground level.

- **Main Contacts**

i) The main contacts shall be of silver-plated copper alloy and controlled by powerful springs designed for floating and pressure point contact. The thickness of the silver plate shall not be more than 25 micron.

ii) The contacts shall have sufficient area and pressure to prevent excessive heating liable to bring about pitting or welding.

iii) Contacts shall be adjustable to allow for wear, shall be easily replaceable and shall have minimum movable parts and adjustments.

iv) The blade shall be made of electrolytic copper tube of liberal section. Rotating feature of the blade at the end of travel for contact wiping shall be provided. The high-pressure type contacts of horizontal break isolators shall wipe the contact surfaces while opening and closing. The contacts shall be so designed that wiping action shall not cause scouring or abrasion on the contact surfaces.

v) Arcing horns shall be provided to divert the arc from main contacts to the separating horns after the main contacts have opened. Arcing horns shall be renewable type.

vi) Arcing contacts shall close first and open last so that no damage due to arcing whatsoever shall be caused to the main contacts.

- **Auxiliary Contacts**

i) Each disconnecting switch shall be provided with minimum ten (10) normally closed and ten (10) normally open electrically separated spare contacts, in addition to the auxiliary contacts required for its operation and indication.

ii) The contacts shall be convertible type so that normally open contact may be converted to normally closed contact and vice-versa at site.

iii) The auxiliary contacts shall be rated 10A at 230V A.C. and 2A at 132V D.C.

iv) The auxiliary contacts shall be adjustable type to suit the following requirement:

a) Signalling of 'Closed Position' shall not take place unless the main power contacts have reached a position so that rated normal and short time current can be carried safely.

b) Signalling of 'Open Position' shall not take place unless the main power contacts are at a safe isolating distance.

- **Interlocks**

i) All disconnecting switch and earth switches shall be suitable for electrical interlocks. In addition to the provision of electrical interlocks, earthing switches shall be mechanically interlocked with main isolator.

ii) The disconnecting switch shall be suitable for sequential interlocking with associated equipment, for closing and opening.

iii) Interlocks are required to be provided :

a) To prevent isolators open on load.

b) To prevent closing of earthing switch when isolator is closed.

c) To prevent closing of the line isolator when earthing switch is closed.

iv) Operating of earth blade shall not take place when corresponding main isolator is in operation stroke and vice-versa.

- **Insulators**

i) Insulators shall be solid core porcelain type and composed of stacked units including for operating rods. Insulators of identical rating shall be interchangeable.

ii) Insulator shall be of wet-process porcelain, brown glazed and free from all blemishes. Metal parts and hardwares shall be hot-dip galvanised.

iii) When operated at maximum system voltage there shall be no electrical discharge. Shielding rings, if necessary, shall be provided.

iv) Insulation shall be co-ordinated with basic impulse level of the system.

v) The insulators shall have the minimum cantilever strength of 6000 KNm.

vi) The insulators shall be so arranged that leakage current will pass to earth and not between terminals of the same pole or between phases.

vii) Each rotating insulator shall be supported on double-roller or ball bearings.

- **Blades**

i) All metal parts shall be of non-rusting and non-corroding metal. All castings except current carrying parts shall be made of malleable cast iron or cast steel.

ii) The live parts shall be designed to eliminate sharp joints. The isolators shall be so designed that the switchblade will not move to closed position if the operating shaft gets disconnected.

- **Operating Mechanism**

i) The mechanism shall be motor type with electrical control from remote as well as local position.

ii) The mechanism shall also have provision for manual operation with detachable handle. The arrangement shall be such that the operator may be able to operate without undue effort.

iii) Interlock shall be provided such that electrical power to the motor is cut off on insertion of normal operating handle.

iv) The mechanism of 3 pole disconnecting switch shall be so designed that all three blades are in positive continuous control throughout the cycle of operation.

v) Visible indication of switch position and means to prevent false indication if the mechanism fails to complete the operation shall be provided.

vi) Starters, relays, limit switches shall be provided as required for operation, indication and interlocks. Adjustable mechanical stop and/or electromagnetic brakes shall be provided to limit over travel.

vii) The motor operated mechanism shall be suitable for operation from 415 V, 3 phase, 50 Hz supply. The drive mechanism shall be such that during manual operation the motor drive shall be automatically de-coupled. Suitable reduction gearing shall be provided between the motor and the drive shaft of the disconnecting switch. A quick electro-mechanical break shall be fitted on the higher speed shaft.

viii) Hydraulically operated mechanism shall be complete with operating unit with power cylinder, control valves, motor etc. The oil pressure controlling the oil pump and pressure in the reservoir shall be continuously monitored.

- **Mechanism Box**

i) The mechanism box shall house the operating mechanism, electrical, controls, monitoring devices and all other accessories.

ii) The box shall be IP-55W, of gasketted weatherproof construction, fabricated from sheet steel minimum 2 mm thick. They shall be dust, water and vermin proof.

iii) The box shall have front access door with lock and key, and removable gland plate at bottom for cable entry.

iv) The box shall be suitable for mounting on disconnecting switch support structure. The mounting height shall be such as to permit easy manual/electrical operation standing at grade level.

v) Thermostat controlled space heater, internal illumination lamp and 3 pin 5A socket with individual ON/OFF switches shall be provided in the box.

vi) For local operation following shall be provided :

a) Local-remote selector switch.

b) Open/Close/Stop Push Button.

vii) Cable entries shall be from the bottom, suitable removable cable gland plate shall be provided on the cabinet for the purpose.

- **Wiring**

i) Wiring shall be complete in all respects to ensure proper functioning of the control, protection, monitoring and interlocking schemes.

ii) Wiring shall be done with flexible 1100V grade, PVC insulated switchboard wires with stranded copper conductor of 2.5 mm^2 for voltage circuit & 2.5 mm2 for current circuit. The operating coils and small wirings shall be tested as assembled for a power frequency voltage of 2 KV for one minute.

iii) Each wire shall be identified at both ends with permanent markers bearing wire numbers as per contractor's wiring diagram.

iv) Wire terminations shall be done with crimping type connectors with insulating sleeves. Wires shall not be spliced between terminals.

v) All spare contacts of push buttons, auxiliary switches etc. shall be wired up to the terminal blocks in the mechanism box.

- **Terminal Blocks**

i) Terminal blocks shall be 1100 V grade, box-clamp type, minimum 10 mm^2 or approved equal.

ii) Not more than two wires shall be connected to any terminal. Spare terminals equal in number of 20% active terminals shall be furnished.

iii) Terminal blocks shall be located to allow easy access. Wiring shall be so arranged that individual wires of an external cable can be connected to consecutive terminals.

- **Earthing Switch**

i) Earthing switch shall be triple-pole, gang operated type, with provision for padlocking in both open and close positions.

ii) The manual operating mechanism shall be such that it can be easily operated from standing height at grade level. The earthing mechanism shall only be locally operated.

iii) The earth switches shall be power operated but shall be constructional interlocked. Mechanical and electrical safety interlocks shall be provided to prevent closing of earthing switch when the main disconnecting switch is closed and vice-versa.

iv) Earthing switch shall be provided with minimum 4 NO + 4 NC contacts for indication and interlocking. All auxiliary switches & interlocking coils shall be wired up to terminal blocks in mechanism box through G.I. Conduits.

v) The earthing blades shall be required to carry peak current and rated short time current as the main blades of the isolator and shall withstand dynamic stresses.

vi) Each earth switch shall be provided with flexible copper braids for connection to the ground mat. These braids shall have same short time current carrying capacity as the earth blades.

- **Assembly**

i) The disconnecting switch along with its base frame and operating mechanism shall be completely assembled and checked for correct alignment and operation at manufacturer's works prior to despatch.

ii) All parts and accessories shall have appropriate benchmarks and part numbers for identifications at site.

- **Grounding**

i) Each equipment shall be provided with two ground pads for connection to station ground.

ii) The ground pad shall comprise buffed metal surface with two tapped holes, M10 G.I. bolts and spring washers for connection to G.S. flat of approved size.

iii) Each disconnecting/earth switch-operating rod shall be separately grounded at a point above the mechanism box. This is done by flexible copper braid of adequate section but in no case less than 70 mm^2.

- **Painting**

i) Base frame, operating rod and all hardwares shall be hot-dip galvanised.

ii) Mechanism box will be finished with two coats of aluminium paints after surface treatment, involving chemical cleaning, phosphating and application of under coats.

iii) Sufficient quantity of touch-up paints shall be furnished for application at site.

C. 33KV Current transformer

Type, rating, connections etc. Of the equipment shall be as detailed in the annexure. The equipment shall be offered in strict compliance with the same. The details of each type of Current transformers are as follows:-

i) 33KV CT at switchyard

- The equipment will be used in 33KV switchyard, having characteristics as listed in the Annexure-A. The equipment shall be furnished with fittings & accessories as listed in the Annexure-B.
- The equipment will be installed outdoor in a hot, humid and tropical atmosphere with heavy chemical pollution.
- All equipment, accessories and wiring shall have tropical protection, involving special treatment of metal and insulation against fungus, insects and corrosion.
- The maximum temperature in any part of the equipment at specified rating shall not exceed the permissible limits as stipulated in the relevant standards.
- The equipment shall be capable of withstanding the dynamic and thermal stresses of listed short circuit current without any damage or deterioration.
- There shall be no radio interference when the equipment is operated at maximum service voltage.
- The safety clearances of all live parts of the equipment shall be as per relevant standards.

- The Current Transformers shall be oil immersed self-cooled and hermetically sealed type.
- Current Transformers shall be furnished with number of independent cores with ratios and other ratings as specified above.

- **Constructional Features**

i) The current transformer shall be single pole unit, oil filled, self-cooled, designed for upright mounting on steel structure and furnished complete with fixing hardware.

ii) Insulator shall be of wet process porcelain, brown glazed and free from imperfections. All metal parts and hardwares shall be hot dip galvanised.

iii) The creepage distance shall correspond to heavily polluted atmosphere. Grading ring, if required, shall be furnished to maintain voltage gradient within permissible limit.

iv) The current transformer shall be filled up under vacuum with the insulating oil and be hermetically sealed. Current transformer shall be provided with oil level gauge, drain plug and pressure relief device. An inert gas cushion shall be provided on top of the oil.

v) Core lamination shall be of cold rolled grain-oriented silicon steel or better as dictated by design consideration. The cores used for protection shall be of low reluctance type and shall produce undistorted secondary current at transient condition at all ratios. Instrument saturation factor for the metering core shall be low enough to prevent damage to the instruments connected to it under maximum short circuit current specified.

vi) Current transformer characteristic shall provide satisfactory performance for burdens ranging from 25% to 100% of rated burden over a range of 10% to 100% rated current in case of metering core and up to knee point voltage in case of protection core.

- **Terminals**

i) Primary terminals shall be made of non-ferrous corrosion resistant material and provided with bimetallic terminal connectors.

ii) Secondary terminals shall be brought out to a terminal box and suitable for connection to 1100 V grade, steel wire armoured, PVC sheathed 5 x 4 mm^2 stranded copper conductors. The terminal box shall be provided with a removable cable gland plate at the bottom for mounting five cable glands suitable for aforementioned cables.

iii) All primary and secondary terminals shall be clearly and indelibly identified as per relevant standard.

iv) The terminal box shall be of 3 mm thick sheet steel, IP-55, weather proof and dust-tight, complete with gasketted front access cover and removable gland plate at bottom for cable entry.

- **Grounding**

i) Each current transformers shall be provided with two ground pads on the opposite sides of the tank, for connection to station ground mat. The grounding conductor shall be MS flat of size 75 mm x 10 mm.

ii) The ground pad shall comprise buffed metal surface with two holes, M10 G.I. bolts and spring washers to receive G.I. flat of approved size.

D. 198KV and 30KV Lightning arrestors

Type, rating, connections etc. Of the equipment shall be as detailed in the annexures. The equipment shall be offered in strict compliance with the same.

The details of each type of Lightning arrestors are as follows:-

i) 198KV Lightning arrestors

ii) 30KV Lightning arrestors

The equipment will be used in 33KV switchyard having characteristics as listed in the Annexure-A. The equipment shall be furnished with fittings & accessories as listed in the Annexure-B.

- The equipment shall be capable of withstanding the dynamic and thermal stresses of listed short circuit current without any damage or deterioration.
- There shall be no radio interference when the equipment is operated at maximum service voltage.
- The safety clearances of all live parts of the equipment shall be as per relevant standards.
- Arresters shall be designed with sufficient cantilever strength to meet with stress due to wind pressure and short circuit forces arising from rated short time current.

- The lightning arrester shall be installed as close to the equipment as possible and also on the line entrance.
- Lightning arrester shall be station class, heavy duty, metal oxide gapless type with ratings as detailed in the Annexure-A.
- The arrester shall have adequate thermal discharge capacity for severe switching surges, long duration surges and multiple strokes.

- **Constructional Features**

  i) The arrester shall be single pole, hermetically sealed, of robust construction with excellent electrical, thermal and mechanical characteristics even after repeated operation.

  ii) Insulator shall be wet process porcelain, brown glazed and free from imperfections. All metal parts and hardware shall be hot dip galvanised.

  iii) Creepage distance shall correspond to heavily polluted atmosphere. Grading ring, if required, shall be provided to maintain voltage gradient within permissible limit.

  iv) The arrester shall be provided with pressure relief device to prevent shattering of porcelain in case excessive gas pressure builds up.

- **Accessories**

  i) Lightning arrester shall be furnished complete with insulating base, arrester disconnector, surge counter leakage current monitor and anchoring hardware for mounting on steel structure.

  ii) The surge counter shall be suitably enclosed for outdoor duty and be mounted at a convenient height for reading. Counter terminals shall be such as to permit connections with minimum possible bends. No auxiliary power supply or battery shall be required for operation of counter.

  iii) A leakage current detector shall be furnished with the counter as an integral part. This is for monitoring the leakage to indicate any possible breakdown. Readings of milliammeter and counter shall be visible through inspection glass panel.

  iv) A suitably sized by-pass shunt along with necessary terminals shall be furnished for bypassing the discharge counter if required.

  v) Grading ring/corona ring as applicable for the particular voltage class of arrester shall be provided.

- Terminals

i) All connection terminals shall be of corrosion resistant material and complete connection hardware.

ii) All ground terminals shall have provision of connection to G.I. flat of approved size.

E. Grounding Transformer

This specification is intended to cover the design, engineering, manufacture, testing at manufacturer's works of 3 ph, Copper wound, oil immersed 33KV Earthing transformers for efficient and trouble free operation as specified herein. The neutral of the earthing transformer shall be solidly earthed to provide earthed neutral in the 33 KV systems. The Earthing Transformer shall have impedance to restrict earth fault current.

The earthing transformer covered by this specification shall be complete in all respect. Any material or accessories which may not specifically mentioned here but which is usual and necessary for satisfactory and trouble free operation and maintenance of the transformer shall be supplied without any extra charge.

- Type, rating, connections etc. of the equipment shall be as detailed in the annexures..

The scope of work under this Specification shall essentially comprise of but not limited to the following:

i) Oil filled ONAN, gronding transformer (for STPS Raw Water Pond 2).

- Transformer shall be furnished completed with:
- Fittings and accessories
- Cooling & Auxiliary equipment
- First filling of oil including 10% extra
- Protection & metering devices
- All relevant drawings, data and instruction manuals.
- Commissioning spares and recommended spare part list for three (3) years operation.

Brief description of the Transformer : As per design calculation.

General Design Criteria :

(a) The transformer will be installed at outdoor. All equipment accessories and wiring shall be provided with tropical finish to prevent fungus growth.

(b) If not specifically mentioned in BOQ, the transformer shall be capable of withstanding a fault current of 300 Amps at rated voltage and frequency through the neutral for a time duration of 30 seconds without using neutral grounding resistor and without exceeding the temperature of 250° C for copper. Ultimate temperature rise during fault should be restricted to 200°C. To achieve this required current density for 30 seconds is to be maintained.

(c) The earthing transformer shall be capable of withstanding the mechanical and thermal stresses caused by the rated short time current flowing in the windings under fault conditions. This shall be determined by tests as per relevant IS and the results furnished along with the bid.

(d) The maximum flux density in any part of the core and yokes, at normal voltage and frequency of each transformer shall be consistent with the material used. The maximum flux density shall be 1.7 Tesla.

(e) The thermal ability to withstand short circuit shall be proved by calculation and shall be furnished along with the drawings.

(f) The transformer shall be free from annoying hum or vibration. The design shall be such as not to cause undesirable interference with radio or communication circuit.

- Type & Rating :

d) The Earthing Transformer shall be of 33 KV, 3-phase, 50 c/s Copper wound, oil-immersed, ONAN type. The earthing tra

e) nsformer shall have impedance to allow rated earth fault current at rated system voltage in the event of occurrence of a solid single phase to ground fault. The fault KA rating of the earthing transformer shall be 25KA for duration of 30 seconds.

b) The rating and other guaranteed particulars of the earthing transformer shall be as per specific technical parameters of this specification, submitted G.T.P. and relevant IS.

- Terminal Bushing :

The terminals shall be brought out through outdoor type bushings on HV side conforming to IS: 2099 and provided with suitable Bi-metallic terminal connectors for phases and suitable size copper flat for neutral.

The bushing shall have high factors of safety against leakage to ground and shall be so located as to provide adequate electrical clearances between bushings and grounded parts. Bushings of identical voltage rating shall be interchangeable. All bushings shall be equipped with suitable terminals of approved type and size. The insulation class of the high voltage neutral bushing shall be properly coordinated with the insulation class of the neutral of the high voltage winding.

Each bushing shall be so coordinated with the transformer insulation that all flash-over will occur outside the tank.

All porcelain used in bushings shall be homogeneous and free from cavities or other flaws. The glazing shall be uniform in colour and free from blisters, burns and other defects.

All bushings shall be porcelain shed type. The neutral bushings shall be insulated for 33 KV. Bushings shall conform to IS: 3347, IS: 2099 and IEC: 137. Main terminals shall be solder less. The spacing between the bushings must be adequate to prevent flashover between phases under all conditions of operation.

All bushings shall be suitable for heavily polluted atmosphere.

- Core :

a) The material circuit of the earthing transformer shall be constructed from high quality, low loss and high permeability cold rolled grain oriented silicon steel laminations especially suitable for transformer core.

b) Inter-laminar insulation shall be coated over laminations during manufacturing process.

c) The legs and yokes of cores shall have similar section to minimise heating and noise. Necessary cooling ducts shall be provided for heat dissipation.

d) The whole core shall be electrically connected by copper strip of not less than 6.25 sq.mm cross section to the tank inside for being earthed to drain off any electrostatic potential that may build up.

e) Each core bolt and part of the core clamping frame work shall be insulated from the core lamination. The core shall be tested to withstand a voltage of 2500 volts AC for a duration of one minute.

- Winding :

a)Earthing Transformer with single inter-star connected windings shall consist of two distinct sections, each representing one half of each inter-star winding and shall be rated for one-third of the line voltage.

b)The winding shall be made of paper insulated continuous and smooth electrolytic copper conductor and shall be so designed that all the coil assemblies of identical voltage rating shall be interchangeable and field repairs to the winding can be made without special equipment. The insulation of the coils and assembly of windings shall be insoluble, non-catalytic, chemically inactive in the hot transformer oil & shall not be adversely affected under the operating conditions.

c)The insulation of the windings shall withstand the impulse and power frequency test voltages as specified in technical parameters.

d)Windings shall be designed to withstand the Electromechanical stresses exerted during the short circuit conditions as per IS:2026.

e)Liberal ducts shall be provided for oil circulation and prevention of any hot spot temperature in the winding that may affect the life of the transformers. All leads and connections shall be mechanically strong, heavily insulated and rigidly clamped, so as to withstand stresses due to terminal short circuit.

- Tank :

a)Tank shall be of welded construction and fabricated from good quality sheet steel of adequate thickness. The thickness of top, bottom and side plates shall be stated by the bidder. The tank shall be so shaped as to reduce welding to a minimum. All seams shall be double welded for absolute oil tightness.

b)Bushing turret covers, access-holes covers, pockets of thermometer shall be so designed to prevent any ingress of water. The conservator shall be liberally dimensioned so that oil level remains above the bushing top at the lowest ambient temperature and no-load, and the oil shall not spill into the breather pipe, or the exterior as waste. The conservator shall be provided with a window type oil gauge. The tank shall withstand specified pressure and vacuum tests without any deformation in excess of the permissible deflections.

- Insulating Oil :

The transformer oil shall be duly filled in with required quantity for first filling and to supply 10% extra . The oil shall conform to IS:335. The transformer should be filled in with oil having dielectric strength 60 KV

(rms) minimum after filtration .The oil in the transformer being supplied shall be provided with test result conforming to IS:335.

- Cooling Equipment :

  Transformer shall be suitable for 100% continuous maximum current rating with ONAN Cooling within the specified maximum temperature rise of 50°C by oil & 55°C rise by winding . The transformer if required, shall be fitted with radiators of tubular construction. Thickness of radiator tubes should not be less than 2.5 mm and material should be mild steel.

- Current Transformer for E/F protection:

  Outdoor type current transformer conforming to IS-2705 as per annexure shall be provided by the manufacturer for 33 KV neutral bushing.

- Fittings & Accessories :

  The Earthing Transformer shall be complete with necessary fittings and accessories, but not limited to the following:

  a) Conservator with filling hole, cap and drain valve having flanged terminal.
  b) Conservator and supporting bracket for mounting on transformer tank.
  c) Isolation valve for the conservator.
  d) Magnetic oil level gauge with low oil level alarm contacts.
  e) Silica gel breather with oil seal and connecting pipe for non-inert gas sealed transformer .
  f) Pressure relief pipe, double diaphragm type, complete with port-hole type oil gauge for indication of the puncture of lower diaphragm and necessary air equalizer connection between the conservator and the pressure relief pipe.
  g) Access holes/Inspection holes with bolted covers for access to inner ends of bushing.
  h) Lifting eyes for cover, core and winding and lifting lugs for the complete transformer.
  i) Air release plugs on top of cover and bushing turrets.
  j) Upper & Bottom filter valve and Drain valve flanged with oil sampling device.
  k) Jacking pads with hauling holes.
  l) Flat roller wheels.
  m) Two nos. tank earthing terminal.
  n) Buchholz (gas) relay, double float type with one set of alarm contacts and one set of trip contacts and a testing cock. The contacts shall be wired up to terminal cabinet with insulted cables.

o) Dial type thermometer for oil temperature indication complete with two sets of alarm and trip contact.

p) Pocket for inserting alcohol thermometer for oil temperature with necessary thermometer.

q) Rating plate and Diagram plate.

r) Rigid type terminal connectors on the HV bushing.

s) Insulating oil required for first filling.

t) Other attachment/accessories required to complete the equipment for satisfactory operation.

- Painting :

All steel surfaces shall be cleaned by sand blasting or chemical process as required to produce a smooth surface, free of scale, grease and rust. Steel surface in contact with insulating oil shall be painted with heat resistant oil insoluble insulating varnish. External surfaces shall be given a coat of high quality red or yellow chromate primer and finished with gray colour (IS:631) with two coats of synthetic enamel paints. Paints shall be carefully selected to withstand tropical heat, rain etc. The paint shall not scale off or crinkle or be removed by abrasion due to normal handling. Sufficient quantity of touch up paint shall be furnished by application at site.

- Equipment foundation and steel structure :

a) The earthing transformers shall be furnished complete with base frame, anchor/ foundation bolts and hardwares

b) The equipment shall be designed for mounting on concrete base.

- Tests

Only type tested Earthing transformer are to be offered conforming to technical specification, and relevant IS and IEC.

During manufacture and on completion, all transformers shall be subjected to the routine tests in accordance with latest IEC 60076 and its different parts.

In addition, the following tests shall be performed on each transformer:

a) Measurement of Zero-sequence impedance

b) Measurement of no-load loss and no load current.

c) Measurement of winding resistance.

d) Measurement of insulation resistance.

e) Induced voltage withstand test.

f) Separate source voltage withstand test.

- Test Witness

  Tests shall be performed in presence of Owner/Purchaser's representative if so desired by the Owner/Purchaser. The Contractor shall give at least seven (7) days' advance notice of the date when the tests are to be carried out.

- Test Certificates

  a)Certified reports of all the tests carried out at the works shall be furnished in six (6) copies for approval of the Owner/Purchaser.

  b)The equipment shall be dispatched from works only after receipt of Owner/Purchaser's written approval of the test reports.

  c)Type test certificates on any equipment, if so desired by the Owner/ Purchaser, shall be furnished. Otherwise the equipment shall have to be type tested, free of charge, to prove the design.

  d)Porcelain bushing, Bushing current transformers, winding temperature indicating device, Dial Thermometers, Double float type Buchholz relays, Insulating oil and other accessories to be supplied by the manufacturer shall be tested by the manufacturer in accordance with the relevant I.S. Publication. Six (6) copies of test reports of each of the component shall be furnished along with the test certificate of the main equipment.

- Following drawings, leaflets and test reports shall be submitted for approval-

  (a) Dimensional general arrangement drawing transformer showing constructional features and dispositions of various fittings and accessories.

  (b) Technical leaflets on transformer and accessories explaining the functions and special features.

  (c) Type test certificates on similar transformers.

  (d) Transport/shipping dimensions with weights.

  (e) Dimensional general arrangement and sectional view with plan and elevation of bushing with technical parameters.

  (f) Foundation and anchor details including dead-load and impact load with direction.

  (g) Assembly drawing for erection at site with part numbers and schedule of materials.

(h) Electrical schematic and wiring diagram.

(i) Any other relevant drawings and data necessary for erection, operation and maintenance.

(j) Instruction manuals and data sheets for each piece of equipment. The manuals shall clearly indicate the installation methods, checkups and tests to be carried out for covering the equipment and maintenance procedure.

(k) Rating and diagram plate of the transformer.

F. ACSR Conductor

- The Aluminium Stranded Conductor and steel reinforced shall have the technical parameters matching with the requirements given in Annexure-A. For all constructions, each alternate layer shall be stranded in opposite direction. The final layer of wires shall be right hand lay. These conductors will be utilised for stringing various buses & equipment connections both in switchyard area and transformer yard area. ACSR conductors shall conform to the latest revision of IS-398.
- The Aluminium strands of the Steel-Aluminium conductor shall be hard drawn from 99.5% pure electrolytic aluminium rods of E.C. Grade. The steel wire strands shall be drawn from high carbon steel rods procured by acid or the basic open-hearth process, the electric furnace process or the basic oxygen process. The Zinc used for galvanising shall be electrolytic high-grade zinc of 99.95% purity.
- All aluminium and strands shall be smooth and free from all imperfections such as spill & splits, die marks, scratches etc. The steel strands shall be hot-dip galvanized and shall have a zinc coating of minimum 260 gms/sq.m. The zinc coating shall be smooth and uniform thickness.

  No joints shall be permitted in the individual wires in the outermost layer of the finished conductor. However joints in the 12 wire and 18 wire layers of the conductor shall be allowed, but the joints shall be made by cold pressure butt welding method and shall be such that no two joints are within 15 m of each other in the complete stranded conductor.

K. Clamps and Connectors

- All clamps, connectors and hardwares shall be designed, manufactured and tested as per relevant standards. All connectors shall be IS-5561 or equivalent IEC and shall of the type most

suitable for the purpose they are intended to be. The materials with which they are made shall be :

i) Aluminium alloy to Grade AG of IS 617-1959

ii) Brass to grade 3 of IS 292-1961

iii) Aluminium bronze to Grade 2 of IS 305-1961

iv) Copper laminations for flexible connector Grade FRTP-2 of IS 191-1967

- All clamps & connectors for connection with equipment or ACSR conductors shall have high tensile aluminium alloy body. U-bolt and nut for the clamp shall be made of non-magnetic material e.g. chromium steel. The connectors shall be free from cavities blowholes and such other defects. All sharp edges and corners shall be blurred and rounded off. All connectors shall be designed corona free.
- Bolt, nut, washer, shackle, etc. required for other purpose shall be of forged steel with adequate strength and the surface shall be so protected as to offer maximum resistance to corrosion. Malleable iron wherever used for any part shall be of best quality and shall correspond to latest amendments of relevant IS. Bolts shall be so located that pressure is uniformly distributed from bolts over the contact surface.
- Various fittings & accessories of the clamps & connectors shall be so designed as to eliminate sharp edges & maintain bright smooth surface. All bolts, nuts, rivets etc. shall have round profiles. For bimetallic clamps, copper alloy linear or minimum thickness of 4 mm shall be cast integral with the aluminium body.

L. Disc Insulator

- All disc insulators shall be dimensioned appropriately so as to have the required Electro - Mechanical strength for EHV outdoor duties.
- Suspension & Tension string assembles shall have adequate number of insulator discs in order to ensure high creepage distance for heavily polluted atmosphere and rain. The same shall be of anti-fog type.

- Suspension and Tension string assembles shall be supplied as per details given in Annexure-A. All Insulators and fittings shall generally be supplied as per relevant IS amended up-to-date.

M. Post Insulator Stack

- Post insulator stack shall be used to support either the ACSR conductor or tubular Aluminium bus of Outdoor EHV switchyard. Insulators shall be solid core polycone type and composed of stacked units. Insulators of identical rating shall be interchangeable.
- Insulator having sufficient cantilever strength shall be of wet process porcelain, brown glazed and free from all blemishes. Metal parts and hardwires shall be hot-dip galvanised.
- Insulator shall have adequate mechanical strength and rigidity to withstand the duty involved.
- When operated at maximum system voltage, there shall be no electrical discharge. Corona/grading ring if necessary, shall be provided with the post insulator.
- Each post insulator will be mounted on steel structure and shall be complete with necessary fixing clamp at top for clamping of ACSR conductor or tubular Aluminium bus. The insulators shall be provided with necessary nuts, bolts & washers.
- Post insulator shall conform to the latest amended IS requirements and technical particulars of the stack are given in the enclosed Annexure-A.

N. Tubular Aluminium Bus

- The material of tubular aluminium bus shall be E - 91E grade or equivalent having best possible combination of Electrical and Mechanical properties.
- Rigid type tubular Al bus bar arrangement supported on post insulators at intervals is used in outdoor EHV substation. Technical parameters of tubular bus-bar are given in the enclosed Annexure-A.
- Tube buses are provided with fixed clamp at one end & sliding/flexible type clamp on the other end for taking care of thermal expansion. Long run of tubular buses shall be complete with suitable internally mounted vibration dampers at intervals in order to achieve quick damping of vibrations arising out of Electro-mechanical forces.

O. Bundle Spacers

- The spacers shall be provided at a suitable longitudinal spacing in each phase of the line as recommended by the manufacturer of giving most satisfactory performance.
- Bundle spacers shall have enough strength so as to restore normal spacing of conductors after displacement by winds, short circuits etc. without damage or permanent deformation. The spacers shall have long life without fatigue or wear and shall have gentle but firm grip on conductor. They shall be able to withstand all the electromagnetic and electrostatic forces under different operating conditions including dead short circuit.
- They shall be of one piece construction and shall not have separate small components.
- The materials used in spacers shall be corrosion resistant and made of aluminium alloy of an approved type.
- The spacers shall be flexible enough so as to avoid distortion or damage to the conductor or themselves. Rigid spacers are not acceptable.
- The spacers shall be capable of being installed or removed from the energised line by means of hot line tools without completely separating the components.
- The spacers shall not have any projection cuts, abrasions etc. which may cause corona radio interference. They shall have enough strength to resist any deformation, which may cause their RI performance to change. The units shall be corrosion resistant. Ferrous parts, if used, shall have magnetic losses not more than 5 watt for 600 Amp 50 Hz AC. Elastomers if used shall be resistant to ozone, sunshine and ageing.

P. Junction Box for CT connection

- A suitable weather proof and dust proof kiosk of suitable thickness (not less than 3 mm) shall have to be installed at each bay near the position of CT installation at the switchyard for termination of all the CT secondary connections. This kiosk shall be provided with terminal block for such CT connections. Arrangement is to be provided at the CT terminal block for shorting of the secondary terminals while the CT is in energized condition for testing and other purposes, if necessary.
- Star/Delta connection of the CT secondary terminal from Red, yellow and Blue are to be made here and necessary shorting links are to be provided in the said terminal block for each connection. Connections made from respective marshalling Kiosk after those terminal are connected either in Star/Delta.
- 10 mm wide plastic plates bearing identification mark shall be fixed under each connection at the marshalling kiosk to indicate the CT secondary circuit

used for different protections. The CT secondaries used for metering shall also be marked similarly.

- The marshalling kiosk shall be placed at such a height that it becomes convenient for any person to work on the CT secondary terminal block. Sufficient space shall be provided so that all terminals become easily accessible. All incoming and outgoing connections in the marshalling kiosk shall be properly marked with ferrules. 20% terminals are to kept as spare. It shall be provided with hinged door at the front of the terminal block for easy inspection.
- The terminal block to be used shall be of best quality, rust proof and suitable for climatic conditions at site as mentioned in the general condition of site. The outside of the kiosk shall be coloured with same colour as that of control panel. The size of the kiosk shall be determined as per requirement.
- The enclosure of marshalling box shall provide with a degree of protection of not less than IP-55 as per IS-2147 and one marshalling box shall be type tested for the same.

Q. Marshalling Kiosk for AC Auxiliary Power Distribution in the Switchyard:

- Each bay shall be provided with a suitable weather and dust proof kiosk of thickness not less than 3 mm to be required for supply of auxiliary AC supply to isolators, breakers, switchyard lighting etc. This kiosk is to be provided with terminal block and also fuse and link to be used for different circuits. Normally there will be two end feeding of the incoming supply to each kiosk by interconnection. This incoming supply shall be brought to the terminal at the kiosk through links. So that in case of emergency one faulty incoming supply can be isolated. The outgoing circuits from the terminals of the Kiosk shall be through fuse and link.
- This kiosk shall be placed at a convenient position in each bay.
- 10 mm wide plastic plates bearing identification mark shall be fixed suitably under each circuit. Each control cable shall be properly marked with ferrules. 20% of the terminal block including fuse and link unit shall be kept as spare.
- The rating of the fuse shall be such as it can maintain a coordination between itself and the fuse unit provided in the AC control board for local fault. The size of the kiosk shall be determined as per requirement.
- The enclosure of marshalling box shall provide with a degree of protection of not less than IP-55 as per IS-2147 and one marshalling box shall be type tested for the same.

- Suitable space heaters with thermostat shall be provided to prevent condensation and maintain a cubicle temperature approximately 10°C. above ambient.
- Illumination lamp with door switch shall be provided. A 230 V, AC, 5A/15A combined socket and switch shall also be provided.

R. Grounding

- GI Flats shall be provided at intervals for serving as ground mat riser to which earth connections for different equipment will be made, as per I.E. Rules.
- Grounding mat for different systems shall be interconnected between themselves.
- Switchyard ground grid will be connected to the main plant grid with multiple connections.
- Earth mat within the new bay of switchyard has to be extended by 1 metre beyond the fence, so as to ensure that the area in the vicinity of the substation fence is safe.
- New bay of switchyard shall be surfaced with gravel, 150 mm deep, over concrete which will be extended 1 metre beyond the switchyard fence. Existing concrete road also to be extended to cover the additional bay.
- The underground mat will be made of mild steel rods laid underground in length and breadth of the area at a depth of 500mm below grade level. All crossings and straight run shall be arc welded for good electrical continuity. Ground conductors, when crossing underground trenches, directly laid underground pipe and equipment foundation, if any, shall be at least 300 mm below the bottom elevation of such trenches/pipes.
- Ground electrodes will be 3 metres long M.S. rod of adequate size. These are to be fabricated and driven into the ground by the side of mat conductors. All connections to the conductors shall be done by arc welding process.
- Risers are required for connecting the equipment and structures with the ground mat. These will be of M.S. rod, laid from ground mat to above ground level properly clamped or supported along the outer edge of the concrete foundation. Connection to the ground mat shall be done by arc welding and the other end is to be kept free, at least 300 mm above ground level.
- All non-current carrying steel/metal parts in the switchyard shall be connected to the grounding grid at two points including equipment except LAs which shall be earthed directly through earth electrodes. These electrodes shall in turn be connected to the ground grid. All steel structures are required to be grounded from ground mat. Laying, supporting along with foundation connecting at ground mat are within the scope of this specification.

- For rust protection the welds shall be treated with Barium Chromate, welded surfaces shall be painted with red lead and bitumen. All exposed steel conductor shall be protected with bituminous paint.

S. Shielding

The lightning protection system shall be comprising of shield wire, shielding mast, down conductor, riser and other accessories required for complete protection of the switchyard.

The lightning conductor shall be as straight as possible. Sharp bends shall be avoided.

The connections between the conductors shall be electrically continuous.

T. Tropical Protection

All equipment, accessories and wiring shall have fungus protection, involving special treatment of insulation and metal against fungus, insects & corrosion.

Screens of corrosion resistant material shall be furnished on all ventilating louvers to prevent entry of insects.

U. Painting

The panels/switchgear shall be finished in light grey (IS Shade # 631) with two coats of synthetic enamel paint.

5.13.7.3.6 TESTS

a. Routine Test

During manufacture and on completion, all equipment, clamps, connectors and accessories shall be subjected to the Routine Tests as laid down in latest revision of IEC/IS.

In addition to above tests specified by IEC/IS, the following tests also have to be carried out for specific equipment :

i) The speed curves for 33 KV circuit breaker shall with the help of a suitable operation analyser to determine the breaker contact movement during opening, closing, auto-reclosing and trip-free operation under normal as well as limiting operating conditions (Control Voltage, pneumatic pressure etc.)

ii) Mechanical operation test (routine test) on 33 KV disconnecting witches (Main switch and earth switch).

b. Type Test

All equipment to be supplied shall be of type tested design. During detailed engineering, the bidder shall submit Type test reports all equipment viz. circuit breaker, disconnecting switch, CT & LA shall carried out as stipulated in relevant IEC/Indian Standards. (not more than ten year old from the date of bid opening) to prove the capability and suitability of these equipment. of his Type tests on Test certificates for type tests, as stipulated in Indian Standards carried out on similar equipment clamps, connectors etc. shall be furnished. If type test certificate is not available or it is found during engineering stage that the submitted test reports are not meeting the NIT requirement, the equipment shall have to be type tested, free of charge, to prove the design.

- Apart from the above requirement, following additional type tests are to be conducted for 33 KV circuit breaker:
  - i) Out of phase closing test as per IEC-267 & IEC-62271-100.
  - ii) Line charging breaking current test. The breaker shall be able to interrupt the line charging current with a test voltage of 1.4p.u. instead of 1.2 p.u. as per IEC-62271-100.

c. Special Tests

Special tests listed under shall be carried out in presence of purchasers representative if valid certificate of CPRI /NABL is not available of last 7 years from the date of Techno commercial Bid of this project.

i) 33 KV disconnecting switch
   - a) Test on insulators [as per IS:2554; IEC:168].
   - b) Test on terminal connectors [as per IS:5561].
   - c) Test on galvanised components [as per IS:2633].
   - d) Stalled torque test on motor operating mechanism [at 110% of supply voltage].

ii) 33 KV Lightning arrestor
   - a) Special thermal stability tests to be conducted on lightning arresters according to IEC, as an acceptance test.
   - b) Temperature cycle test on the porcelain housing of the arrester to be conducted as per IS/IEC.
   - c) The artificial pollution test shall be carried out as per applicable standards.
   - d) The galvanisation test on metal parts shall be carried out as acceptance test.

e) The functional (operational) acceptance tests shall be carried out on the surge counter.

d. Tests Witness

Tests shall be performed in presence of Employer's representative if so desired by the Employer. The Contractor shall give at least fifteen (15) days' advance notice of the date when the tests are to be carried out.

- To be furnished after award of contract
  - Calculations
    - i) Parameter for 132 KV CT and PT
    - ii) Direct stroke lightning protection
    - iii) Stresses in rigid conductor and forces on support & equipment and check for deflection
    - iv) Sag tension
    - v) Short circuit force on strung bus and spacer span
    - vi) Temperature rise of bus bar (Rigid and strung)
    - vii) Tubular bus bar ampacity
    - viii) Corona / voltage gradient & SC Thermal withstand capability of 132 KV bus system
    - ix) ACSR conductor ampacity
    - x) Grounding including step potential & touch potential.
    - xi) Cable schedule & interconnection chart
    - xii) DC & AC system sizing calculation
    - xiii) Power cable sizing calculation
    - xiv) Relay co-ordination chart & setting
  - Drawings
    - i) SLD for switchyard, AC & DC Aux. System
    - ii) Switchyard layout plan & section
    - iii) Electrical clearance diagram
    - iv) Direct stroke lightning protection layout of switchyard and lightning protection of control room
    - v) Earthing layout for switchyard & control room
    - vi) Cable trench layout for switchyard & control room
    - vii) Illumination layout for switchyard & control room
    - viii) Metering & protection diagram of different bays
    - ix) Notes & details for cabling, illumination, earthing & lightning protection

x) Control & interlock logic diagram

- Circuit breaker
  - i) Dimensional general arrangement drawing showing disposition of various fittings.
  - ii) Foundation plan and loading.
  - iii) Control schematic and wiring diagram.
  - iv) Instruction manual on circuit breaker and its accessories. The manual shall clearly indicate method of installation, check ups and tests to be carried out before commissioning of the equipment.
- Disconnecting switch
  - i) Dimensioned general arrangement drawing showing disposition of various fittings.
  - ii) Transport/shipping dimensions with weights.
  - iii) Foundation plan and loading.
  - iv) Assembly drawing for erection at site with part numbers and schedule of materials.
  - v) Control schematics and wiring diagram.
  - vi) Instruction manuals on disconnecting switch.
- Current transformer
  - i) Dimensional general arrangement drawing of C.T. showing disposition of various fittings.
  - ii) Dimensional general arrangement drawing of Terminal Connectors and Master Terminal Box.
  - iii) Foundation plan and loading.
  - iv) Wiring diagram of C.T.s showing all the windings, cores and earthing along with terminal details.
  - v) Magnetisation Curves.
  - vi) Instruction manuals on the equipment and its various accessories.
- Lightning arrestor
  - i) Dimensioned general arrangement drawing showing disposition of various accessories and safety clearances.
  - ii) Foundation plan and loading.
  - iii) Characteristic curves for insulation coordination.
  - iv) Instruction manuals on the equipment and its various accessories. The manual shall clearly indicate method of installation, check-ups and tests to be carried out before commissioning f the equipment.

- Potential Transformer
  - i) Dimensioned general arrangement drawing showing disposition of various fittings.
  - ii) Dimensioned drawing of terminal box and terminal connectors.
  - iii) Foundation plan and loading.
  - iv) Assembly drawing for erection at side with part numbers and schedule of materials.
  - v) Wiring diagram showing all the windings and earthing with terminal details.
  - vi) Another relevant drawing or data necessary for satisfactory installation, operation and maintenance.

- Switchyard Hardwares
  - i) Consolidated Bill of Materials.
  - ii) Transport/Shipping dimensions with weights.
  - iii) Foundation Plan and Loadings.
  - iv) Assembly drawing for erection at site with part numbers.
  - v) Data Sheet and technical leaflets on each piece of equipment, clamps, connectors, hardwares, insulators, conductors etc.

ANNEXURE-A

RATINGS AND REQUIREMENTS

1.0 **CIRCUIT BREAKER**

Sl. No.	Description	33KV
A.	Type	VCB
B.	Service	Outdoor
C.	Pole	3
D.	Rated frequency (Hz)	50Hz ± 5%
E.	i) Nominal system voltage (KV r.m.s)	33
	ii) Rated voltage (KV r.m.s)	36
F.	System Neutral Earthing	NEE through Earthing Transformer
G.	Standard to be followed	IS:13118/IEC-56
H.	Insulating level (KVp) 1.2/50 micro- Sec impulse	±170

	withstand volt. a) between line terminals and ground (KVP)	
I.	1 min power frequency withstand voltage (KV rms)(dry & wet) a) between line terminals and ground	70
J.	Corona extinction voltage (KV rms) with CB open or close.	As per IS/IEC
K.	Max. radio interference voltage (micro volts) between 0.5 MHZ and 2 MHZ in all position of equipment	As per IS/IEC
L.	**Rated Normal Current** i) Continuous at 50°C	1250
M.	**Rated Breaking Capacity**	
	i) Short-circuit breaking current (Symmetrical)	25KA
	ii) Percentage D.C. component	As per IEC
	iii) Rated short-circuit making current (KA peak)	100
	iv) Rated peak withstand current (KA peak)	100
	v) Rated short time with- stand current	25 KA for 3 seconds
	vi) Out of phase breaking Current (KA r.m.s)	As per IEC
N.	Rated line charging interrupting current at 90° leading power factor- The breaker shall be able to interrupt the rated line charging current with a test voltage immediately before opening equal to U/ _3 x 1.5 as per IEC.	As per IEC
O.	Rated line charging breaking	As per IEC

	current (Amps)	
P.	Rated cable charging breaking current (Amps)	50
Q.	Rated small inductive current switching capability with over-voltage less than 2.3pu.	0.5A to 10A
R.	Rated operating sequence (O – Operating, C – closing)	O-0.3 sec- CO – 3.0 min-CO
S.	First pole to clear factor	1.3
T.	Operating mechanism	Spring/Spring
U.	Mode of operation	Individual Pole /Gang Operated
V.	No. of trip coils	2 common for 3 pole
W.	Minimum Creepage distance	900mm
X.	Total break time (ms)	Not exceeding 60 millisec
Y.	Closing time	Not exceeding 120 millisec
Z.	Phase to phase clearance between bus	1500mm
AA.	Minimum clearance of live parts in air and ground (mm)	3700mm
BB.	Auxiliary Voltage	
	i) Closing	220 VDC(85% to 110%)
	ii) Tripping	222 VDC (70% to 110%)
	iii) Spring Charge Motor	220V DC(85% to 110%) / 240 V±10%, 1-Phase, 50 Hz
	iv) Heater/Lamp/Socket	240 V±10%, 1-Phase, 50 Hz
CC.	Auxiliary contacts	
	i) Rating of auxiliary contacts	10A 132V DC
	ii) Breaking capacity of auxiliary contacts	2A DC with circuit time constant not less than 20 ms.
DD.	Mounting	On Galvanized steel structure

EE.	Seismic Accleration	0.3g horizontal

2.0 **DISCONNECTING SWITCH**

Sl. No.	Description	33KV
A.	Type	Motor operated, double end break, center post rotating type
B.	Service	Outdoor
C.	Pole	3
D.	Rated frequency (Hz)	50Hz ± 5%
E.	i) Nominal system voltage (KV r.m.s)	33
	ii) Rated voltage (KV r.m.s)	36
F.	System Neutral Earthing	NEE through Earthing Transformer
G.	Standard to be followed	IS:13118/IEC-56
H.	Insulating level (KVp) 1.2/50 micro- Sec impulse withstand volt.	
	a) between line terminals and ground (KVp)	±170
	b) between line terminals with isolator open(KVp)	±195
I.	1 min power frequency withstand voltage (KV rms)(dry & wet) a) between line terminals and ground	
	a) between line terminals and ground	70
	b) between line terminals with isolator open(KVp)	80
J.	**Rated Normal Current** i) Continuous at 50°C	1250
K.	Short time withstand current	25kA for 3 sec
L.	Peak withstand current KA (P)	100
M.	Short circuit making	100

	current for Earth Switch. KA (P)	
N.	Creepage distance (mm)	900
O.	Operating Mechanism	
	i) Main blade	A.C. motor and manual
	ii) Earth Switch	Manual
	iii) Mode of operation	Gang Operated
P.	Auxiliary Voltage	
	i) Motor	415V ±10%, 3 Ph, 50Hz ± 5%
	ii) Control & Interlock	220V DC(80% to 110%)
	iv) Heater/Lamp/Socket	240 V±10%, 1-Phase, 50 Hz
Q.	Mounting	Galvanized Steel structure.
R.	Phase to phase spacing (mm)	1500
S.	Operating Time of isolator and Earth switch.	Less than 12 seconds
T.	Seismic acceleration	0.3g horizontal

3.0 CURRENT TRANSFORMER

Sl. No.	Description	33KV
A.	Type	Oil filled, self-cooled hermetically sealed, Pedestal type
B.	Service	Outdoor, heavily polluted atmosphere with dust
C.	Nos. of phases	3
D.	Rated frequency (Hz)	50Hz ± 5%
E.	i) Nominal system voltage (KV r.m.s)	33
	ii) Rated voltage (KV r.m.s)	36
F.	System Neutral Earthing	NEE through Earthing Transformer
G.	Standard to be followed	IS/IEC
H.	Insulating level (KVp) 1.2/50 micro- Sec impulse withstand volt.	±170
I.	1 min power frequency	IS/IEC

	withstand voltage (KV rms)	
	a) between HV terminal & earth	70
	b) between LV terminal & earth	4
	c) between secondary wiring & earth	2
J.	**Rated Normal Current** i) Continuous at 50°C	1250
K.	Rated continuous thermal current (A)	120%
L.	Short time withstand current	25kA for 3 sec
M.	Rated dynamic current	100 KA peak
N.	Creepage distance (mm)	900
O.	Mounting	Galvanised Steel structure.
P.	Phase to phase spacing (mm)	1500
Q.	Insulation medium	Oil
R.	Type of Tank	Dead Tank
S.	Insulator	Oil filled condenser type porcelain bushing/Insulator
T.	Instrument security factor	Less than 5 for metering core
U.	Partial discharge level (PC)	Not exceeding 10 PC

CT RATINGS

Sl. No.	Description	No of Core	Core No.	Application	Current Ratio	Output Burden (VA) at Lower Ratio	ISF (Max)	Accuracy class	Min Knee point Voltage (V)	Maximum Excitation Current Ie (mA) at Knee point voltage at higher ratio	Maximum Secondary Resistance Rct (Ohm) at higher ratio
1	**132**	5	1	Protectio	1200-600-	*	*	PS	1200/	20/40/	6/3/

	KV CT			n	300/ 1A			Class	600/ 300V	80 mA	1.5 Ohms @ 75°C
			2	Protection	1200-600-300/ 1A	*	*	PS Class	1200/ 600/ 300V	20/40/ 80 mA	6/3/ 1.5 Ohms @ 75°C
			3	Metering	1200-600-300/ 1A	40VA	<5	0.2	*	*	*
			4	Protection	1200-600-300/ 1A	*	*	PS Class	1200/ 600/ 300V	20/40/ 80 mA	6/3/ 1.5 Ohms @ 75°C
			5	Protection	1200-600-300/ 1A	*	*	PS Class	1200/ 600/ 300V	20/40/ 80 mA	6/3/ 1.5 Ohms @ 75°C
2	**33 KV CT**	4	1	Metering	1200-800-400/ 1A	30	<5	0.2	*	*	*
			2	Protection	1200-800-400/ 1A	*	*	PS Class	*	*	*
			3	Protection	1200-800-400/ 1A	*	*	PS Class	*	*	*
			4	Protection	1200-800-400/ 1A	*	*	PS Class	*	*	*

3	**GR. TRAN F. NEUT RAL SIDE CT**		1	Protectio n	500/ 1	*	*	PS Class / 5P20	*	*	*
			2	Protectio n	500/ 1	*	*	PS Class / 5P20	*	*	*

(*) - To be decided by the Bidder

The CT ratio, class and burden are tentative only. Shall be decided during detail engineering.

4.0 **LIGHTNING ARRESTER**

Sl. No.	Description	33KV
A.	Type	Station class, Heavy duty, Gapless
B.	Service	Outdoor, heavily polluted atmosphere with dust
C.	Nos. of phases	3
D.	Rated frequency (Hz)	50Hz ± 5%
E.	Highest system voltage	36 KV
F.	System Neutral Earthing	NEE through Earthing Transforme
G.	Standard to be followed	IS/IEC
H.	L.A. rating	
	Rated Arrester Voltage	30KV
	Nominal discharge current	10 KA (heavy duty)
	Long duration discharge class	3
	Pressure relief class	A
I.	Insulating level (KVp) 1.2/50 micro- Sec impulse withstand volt.	170
J.	1 min. p.f. withstand (KVrms) voltage (dry & wet) for arrestor housing	70
K.	Maximum residual voltage at 10 kA discharge current with 8X20 microsecond wave (KV peak)	84
L.	(Minimum) High Current	100

	Impulse withstand (4/10 micro second wave) KA (peak)	
M.	Creepage distance (mm)	900
N.	Mounting	Galvanised Steel structure.
O.	Phase to phase spacing (mm)	1500
P.	Pressure relief Current	25kA
Q.	Partial discharge level (PC)	Not exceeding 10 PC
R.	Ground terminal	Suitable for 75 x 12 mm G.I. flat
S.	Surge monitor	Yes

5.0 GROUNDING/EARTHING TRANSFORMER

Sl. No.	Description	
A.	Type	250KVA, 33KV/0.415KV, 50Hz., Oil filled, Copper wound natural air cooled (ONAN),ZNyn11, 3ph, Earthing transformer, Class-A insulation for winding.
B.	Service	Outdoor, heavily polluted atmosphere with dust
C.	Zero sequence Impedance (Ohm) per phase. (tolerance +20%, - 0%)	As per design
D.	Maximum permissible neutral current for single phase to ground fault (amps) for 30 secs.	300
E.	Basic Insulation level (a) Winding (b) Bushing	 170 KVp 170 KVp
F.	Power frequency withstand voltage Dry one minute (i) HV Winding (ii) HV Bushing	 70 KV (rms.) 70 KV (rms.)
G.	Temperature rise over ambient (50°C) for continuous rating (a) Winding, by resistance (b) Oil by thermometer (c) Core	 55°C 50°C As permitted by adjacent winding
H.	Flux density	1.7 tesla. In the event of over

		voltage to the extent of 12.5%, the core shall not get saturated
I.	Whether uniformly insulated or graded	Uniformly Insulated

6.0 **DISC. INSULATOR STRING**

Sl. No.	Description	132KV	33KV
A.	Nom./Highest System Voltage..KVrms	132/245	33/36
B.	1.2 x 50 µs Impulse Withstand voltage .KVp	1050	170
C.	Wet 1 min. 50 Hz withstand voltage .KVrms	460	70
D.	Corona Extinction voltage, KV (r.m.s) min	266	
E.	Total no.of discs for string (nos.)	16	4
F.	Electro-Mechanical Strength (KN)	120	70
G.	Reference standard	IS : 3188	

7.0 **POST INSULATOR STRING**

Sl. No.	Description	132KV	33KV
A.	Nom./Highest System Voltage..KVrms	132/245	33/36
B.	1.2 x 50 µs Impulse Withstand voltage .KVp	1050	170
C.	1 min. 50 Hz withstand voltage .KVrms		
	i) Dry	460	70
	ii) Wet	460	70
D.	Corona Extinction voltage, KV (r.m.s) min	266	
E.	Creepage Distance (mm)	6125	900
F.	Insulator Mounting	Steel Structure	
G.	Cantilever Strength (Per Stack)..KN	8	

H.	Reference standard	IS : 2544

8.0 **ALUMINIUM CONDUCTOR STEEL REINFORCED (A.C.S.R)**

Sl. No.	Description	132KV	33KV
A.	Code Name	ACSR Moose	
B.	Copper Equivalent Area (Sq.mm)	322.6	
C.	Aluminium Net Area (Sq.mm)	528.5	
D.	Overall Diameter.(mm)	31.77	
E.	Stranding no.& Wire Diameter(mm)	Al=54/3.53 Steel=7/3.53	
F.	Approx. Weight of Conductor (Kg/m)	2.004	
G.	Ultimate Strength. (Kg)	16270	
H.	Reference standard	IS: 398	

9.0 **ALUMINIUM TUBULAR BUS-BAR**

Sl. No.	Description	132KV	33KV
A.	Reference standard	Al. alloy as per IS:5082	
B.	Normal size	2.5”	1.5”
C.	Aluminium Area (Sq.mm)	1454.19	699.03
D.	Overall Diameter (mm)	73.03	48.26
E.	Approx. Weight (Kg/m)	3.94	1.87
F.	Grade	EHIPS , E-91E, Sch.80	

10.0 **TENSION/SUSPENSION CLAMP ASSEMBLY**

Sl. No.	Description	
A.	Material	Aluminium Alloy
B.	Ball Socket Dimension	To be co-coordinated with Ball-socket Dimension of Insulator
C.	Short time current carrying capacity	According to voltage and system fault current & duration
D.	Reference standard	IS : 2486

11.0 **CONNECTORS/P.G. CLAMP ASSEMBLY**

Sl. No.	Description	
A.	Material	Aluminium Alloy
B.	Ball Socket Dimension	To be co-coordinated with Ball-socket Dimension of Insulator
C.	Short time current carrying capacity	According to voltage and system fault current & duration
D.	Rated current	Depend upon point of application (shall be same as connected equipment rated current)
E.	Max. Temp. rise above ambient temp. 50°C	35°C at rated current
F.	Current density (A/sq.mm.)	0.75(for Al. alloy)/ 1.75 for copper
G.	Minimum thickness of bi-metal in bimet-allic connections	2 mm
H.	Reference standard	IS : 5561

ANNEXURE-B

FITTINGS & ACCESSORIES

J. **Circuit Breaker**

A.I Each Circuit Breaker shall be furnished complete with fittings and accessories as listed below :

1. Operating mechanism complete with all accessories, fittings and double tripping coils and closing coil, pole discrepancy feature and low pressure blocking device etc. As required.
2. Type : Outdoor 33 kV VCB.
3. Pedestal for O&M activity at VCB Control cubical.
4. Two ground pads per pole suitable for termination of 75 x 10 mm GS flats.
5. Base frame and anchor bolts and nuts.
6. Set of valves, pressure gauges and pressure switches as required.
7. Auxiliary contacts and relays.
8. LOCAL/REMOTE Selector switch, TRIP/CLOSE Push Buttons.
9. Manual tripping devices with protective flap.
10. Mechanical ON-OFF indicator.
11. Operation counters.
12. Weatherproof outdoor type control cubicle and pole boxes having IPW55 enclosure.
13. Set of MCB and switch fuse units for A.C. and D.C. supply.
14. Space heater with thermostat and ON-OFF switch.
15. Cubicle illumination lamp with ON-OFF switch.

16. 3 Pin 5A Socket with ON-OFF Switch.
17. Terminal blocks and internal wiring - lot as required.
18. Set of pre-fabricated copper pipe with fittings, clamps, and hardware for connection between control cubicle and pole boxes as required.
19. Interconnecting wires, G.I. conduits and accessories for connection between control cubicle and pole boxes.
20. Other standard accessories which are not specifically mentioned but supplied with breakers of similar type and rating for efficient and trouble-free operation.
21. Bimetallic terminal connectors. (Suitable for Al tube / ACSR / AAC – Horizontal / vertical).
22. Supporting galvanized steel structure.

B. **Disconnecting switch**

Each disconnecting switch shall be furnished complete with fittings and accessories as listed below :

1. Clamp-type bimetallic terminal connector for conductor.
2. Ground pads for 75x10 mm flat.
3. Base frame with anchor bolts, nuts and washers.
4. Operating mechanism with all accessories including operating rod of required length, for disconnect switch and for earth switch
5. Starters, relays and auxiliary switches.
6. Local / Remote selector switch.
7. Open / Stop / Close push buttons.
8. Spare auxiliary switches 6 NO + 6 NC.
9. Mechanical ON-OFF indicator
10. Weather-proof mechanism box with lock and key for disconnect switch and for earth switch.
11. Set of MCB and switch fuse units for A.C. and D.C. supply.
12. Space heater with thermostat and ON-OFF switch.
13. Internal illumination lamp with ON-OFF switch.
14. 3 pin 5A socket outlet with ON-OFF switch.
15. Terminal blocks and wiring - lot.
16. Earthing switch, if specified, complete with safety interlocks and 4 NO + 4 NC spare auxiliary switches.
17. Flexible copper braid for grounding of operating rod.
18. Other standard accessories, which are not specifically mentioned but are usually provided with Disconnecting Switch of such type and rating for efficient and trouble free operation.

C. **Current transformer**

Each Current Transformer shall be furnished complete with the accessories as listed below :

1. Base frame with anchoring bolts, nuts etc. for fixing the equipment on to structure.
2. Two grounding pads with bolts and spring washers.
3. Lifting Lugs.
4. Clamp type bimetallic terminal connectors.
5. Weather-proof secondary terminal box with set of terminals.
6. Grading ring, if necessary.
7. Oil level gauge and pressure relief device.
8. Oil sampling valve.
9. Spark gap arrangement.
10. Nitrogen sealing hole cover where inert gas cushion provided.
11. Other standard accessories, which are not specifically mentioned but are usually provided with current transformers of such type and rating for efficient and trouble free operation.

D. **Lightning arrestor**

Each Lightning Arrester shall be furnished complete with the accessories as listed below :

1. Insulating Base with anchoring bolts, nuts etc. for fixing the equipment on to structure.
2. Surge counter with integral leakage current monitor.
3. By-pass shunt with connection provision.
4. Clamp type bimetallic terminal connectors.
5. Ground terminals.
6. Grading ring, if necessary.
7. Other standard accessories which are not specifically mentioned but are usually provided with Lightning Arrester of such type and rating for efficient and trouble-free operation.

5.13.8.1 OTHER REQUIREMENTS:

i. All switchyard structure should be lattice mild steel structure hot dip galvanized.

ii. All the buses should be adequately sized for fault and continuous current requirement.

iii. For 33kv bus, suitably supported single "Moose" conductor will be used in each phase.

iv. The bus bar fittings, connectors etc will be of suitable aluminium alloy having desired mechanical strength and electrical properties.

v. The contractor shall be fully responsible for carrying out all co ordination and liaison work with electrical inspectors and other statutory bodies for implementation of the work, as and when required.

vi. The relay for the switchgear units shall have all the features as specified under **Cl. no. 5.13.11** of, Sec-V of the Technical Specification.

vii. The scopes which are mentioned above are only for indicative purpose only. The contractor to supply all equipment which are also required for successful completion of the work.

5.13.8.2 Approval

Before starting manufacturing any equipment, the contractor shall have to take approval of relevant drawings and data from the purchaser.

5.13.8.3 OTHER REQUIREMENTS:

- All switchyard structure should be lattice mild steel structure hot dip galvanized.
- All the buses should be adequately sized for fault and continuous current requirement.
- For 33kv bus, suitably supported single "Moose" conductor will be used in each phase.
- The bus bar fittings, connectors etc will be of suitable aluminium alloy having desired mechanical strength and electrical properties.
- The contractor shall be fully responsible for carrying out all co ordination and liaison work with electrical inspectors and other statutory bodies for implementation of the work, as and when required.

- The relay for the switchgear units shall have all the features as specified under Cl. no. 5.13.11 of, Sec-V of the Technical Specification shall also be considered.

- The scopes which are mentioned above are only for indicative purpose only. The contractor to supply all equipment which are also required for successful completion of the work.

- 33 kV Switchyard shall be provided with fencing as per IE rule. Fencing shall be properly earthed according grounding stipulation mentioned elsewhere in this specification. Necessary doors shall be provided in the fencing with road connectivity for entry and exist of equipment.

- Bidder has to do all the necessary retrofitting jobs of existing 33 kV Switchyard while integrating new 132 /33 kV transformer (STPS Raw Water Pond) and 33 kV (BkTPS, STPS & SgTPP) New feeder coming from Solar Plat as per detail engineering.

5.13.8.4 Approval

Before starting manufacturing any equipment, the contractor shall have to take approval of relevant drawings and data from the purchaser.

5.15.8 STATION AUXILIARY TRANSFORMER

5.13.8.1 SCOPE

This section covers the activities related to design, manufacturing, testing at works, supply, insurance, transportation and delivery at Project site, storage, erection, testing, commissioning of 33 / 0.415 kV Oil type one number station auxiliary transformers and associated equipment as detailed hereunder.

Capacity of Station Transformer shall not be less than following rating:

a) BkTPS: 250 kVA : 2 nos.

b) STPS: i) Raw Water Pond 2: 400 KVA : 1 no.

ii) Dutta Bandh: 80 KVA : 1 no.

c) SgTPP: 100 KVA SAT to be installed inside Transformer Yard at Raw Water Pond 3.

The scope of supply shall also include necessary spares required for normal operation & maintenance of transformers for a period of 5 (five) years & special tools

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

The transformers and associated equipment shall be suitable for interfacing with SCADA system and all necessary transducers shall be included in the scope of supply.

5.13.8.2 STANDARDS

The equipment and materials covered by this specification shall conform to the latest edition of following Indian Standards or equivalent IEC standards except where specified otherwise in this specification:

Sl. No.	Standards	Description
1	IS: 2026 (Part I to IV) /IEC 76	Power Transformer
2	IS: 2099/IEC 137	Transformers bushings
3	IS: 2705/IEC 185	Current transformers
4	IS: 1180	Three phase distribution transformer
5	IS: 6088	Dimensions for porcelain transformer bushings
6	IS: 3347	Loading guide for oil-immersed transformers
7	IS: 335	Transformer oil
8	CBIP No. 295	CBIP Manual on Transformers Publication

Equipment meeting with other authoritative standards which ensure an equal or better quality is also acceptable. Where the equipment conforms to any other authoritative standard, the salient points of difference between the standard adopted and IS/IEC shall be clearly brought out in the tender. Complete set of documents and standards in English shall be supplied by the bidder without any extra charge. It shall, however, be ensured that equipment offered comply with one consistent set of standards except in so far as they are modified by the requirement of this specification.

5.13.8.3 TECHNICAL REQUIREMENTS

- Bidder shall provide Baffle walls to meet the Statutory and TAC requirement.

- HT side of the transformer shall be connected to the 33 kV Bus through an indoor VCB and LT side shall be terminated to the Station Service Board (SSB)/ 415 V LT Switchgear.
- SAT shall be installed at the Transformer Yard adjacent to the Inverter Duty Transformer as per TAC guideline.
- The transformer shall be able to perform satisfactorily under voltage variation limit of +/- 10 % and frequency variation limit of +/- 5 %.
- Vector group of the transformer shall be Dyn11
- Off Circuit Tap changer (-10% to +10% @1.25% steps) shall be provided with the transformer. Owner will take final decision regarding this based on the proposal submitted by the contractor.
- % Impedance, type of bushing, class of insulation, temperature rise etc. shall be as per relevant Indian Standard.
- The transformers shall be suitable for co-ordination and integration with SCADA System and necessary contacts and/or ports for the purpose shall be provided.
- Earthing arrangement of the transformers shall be provided as per the relevant Indian Standard.
- Necessary protection arrangement like should be provided in the transformer.
- Construction of different parts of the transformer shall conform to the latest edition of relevant Indian Standard.
- Fittings and accessories shall be provided as per relevant Indian Standard code.
- Transformer oil shall conform to latest edition of IS 335.
- 415V side of the transformer shall be terminated through cable with the new extended section of the LT Switchgear.

5.13.8.4 APPROVAL

The Detailed Design Report Submitted by the contractor to WBPDCL must contain but not limited to the following details of the transformers:

- Detailed specification
- Fittings and Accessories
- Necessary Drawings shall contain but not limited to the following:
  - Outline dimension drawings of transformers and fittings/accessories

- Assembly drawings and weight of main components.
- Transport drawings, showing main dimensions and weight of each package.
- Foundation details
- Tap-changing equipment
- Name-plate diagrams
- Schematic control and wiring diagrams for all aux. equipment etc.

- Tools and spare parts etc.
- Type Test Reports and certificates etc.

A joint inspection and testing will be done by owner and the authorized representatives of the contractor at the manufacturer's workshop, if desired so by the owner. Testing will be done as per relevant IS Code.

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

- Guarantees
- Instructions for installation and operation, manual
- Test Reports for routine and acceptance tests etc.

The contractor can deliver the product to the site only after receiving such approval against their prayer in writing from WBPDCL.

5.13.8.5 SIZING CRITERIA FOR TRANSFORMER

Sizing of LT Transformer shall take into consideration of following aspects:

a) Maximum continuous running load of operation i.e. according to the maximum demand at most stringent condition.

b) Lighting, Ventilation & other on line equipment in service.

c) Loads like receptacles not to be considered.

d) 20% design margin over maximum consumed power shall be considered.

f) Transformers shall be provided with Two 160 kW Motor Feeder where one running and standby.

5.13.8.6 TEST

- **Type test:**
  During detailed engineering, the contractor shall submit all the type test reports including temperature rise test and surge withstand test carried out within last ten years from the date of LOA of this project for Owner's approval.
- **Routine test:**
  All routine tests shall be carried out in accordance with IEC 60076 (part 1 to 3).

5.15.9 LT SWITCHGEAR

5.13.9.1 SCOPE

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.) transmission line (all Al conductor) for the entire area from the LT switchgear at both site 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 equipment for a period of 5 (five) years & special tools & plants required for erection & maintenance.

Corresponding parts of all the equipment & 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.

Table for new 415 kV LT Switchgear

BkTPS:

Sl. No.	Description	Quantity
1.	Incoming feeder (ACB)	2 Nos. (630 A Capacity).
2.	Bus-coupler	1 No. (630 A Capacity).
3.	Outgoing feeders	As per load list + Additional 150 A two separate MCCB feeders.
4.	Draw out type Line PT and Bus PT	One no. each for each bus section.
5.	Spare feeder	10% of each type & rating (Minimum 1 no.)

6.	Outgoing feeders of 100 A capacity at both the Bus-section for future use.	2 Nos.

STPS:

Raw Water Pond:

Sl. No.	Description	Quantity
1.	Incoming feeder (ACB)	Nos. (630 A Capacity).
2.	Outgoing feeders	As per load list + + Additional 150 A four separate MCCB feeders.
3.	Draw out type Line PT and Bus PT	One no. each.
4.	Spare feeder	10% each type & rating (Minimum 1 no.)
5.	Outgoing feeders of 100 A capacity for future use.	1 No.

Dutta Bandh:

Sl. No.	Description	Quantity
1.	Incoming feeder (MCCB)	1 Nos. (150 A Capacity).
2.	Outgoing feeders	As per load list+ Additional 150 A two separate MCCB feeders.
3.	Draw out type Line PT and Bus PT	One no. each.
4.	Spare feeder	10% each type & rating (Minimum 1 no.)
5.	Outgoing feeders of 32 A capacity at both the Bus-section for future use.	2 Nos.

SgTPP:

LT Switchgear:

Sl. No.	**Description**	**Quantity**
1.	Incoming feeder (Air Circuit Breaker)	1 Nos. 630 A
2.	Outgoing feeders	i) 3 nos. 16 A at Bus section 1 & 3 nos. 16 A at Bus Section 2; ii) 3 Nos. 32 A at Bus section 1 & 3 nos. 32 A at Bus Section 2; iii) 3 Nos. 63 A at Bus section 1 & 3 nos. 63 A at Bus Section 2. iv) 3 Nos. 100 A at Bus section 1 & 3 nos. 100 A at

		Bus Section 2.

Note: It should be connected as extension panel of the existing LT Panel of Main Switchgear Room near Raw water Pond #3.

Sub ACDB at Inverter room near Raw Water Pond #4: 1 no.

Sl. No.	Description	Quantity
1.	Incoming feeder (MCCB)	2 Nos. (100 A Capacity).
2.	Bus-coupler	1 no. (100 A Capacity)
3.	Outgoing feeders (MCCB)	i) 3 nos. 16 A at Bus section 1 & 3 nos. 16 A at Bus Section 2; ii) 3 Nos. 32 A at Bus section 1 & 3 nos. 32 A at Bus Section 2; iii) 1 No. 63 A at Bus section 1 & 1 no. 63 A at Bus Section 2.
4.	Spare feeder	10% each type & rating (Minimum 1 no.)

5.13.9.2 STANDARDS

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

Sl. No.	Standards	Description
1	IS: 13947 (Part 1 to 5)	Specification for Low-Voltage Switchgear and Control gear.
2	IS: 10118 (Part 1 to 4)	Code of practice for selection, installation and maintenance of switchgear & control gear.
3	IS: 1248	Specifications for Electrical Indicating Instruments
4	IS: 2633	Hot dip Galvanizing
5	IS: 2705	Current Transformers
6	IS: 3156	Voltage Transformers
7	IS: 3231	Electrical Relays for Power System Protection
8	IS: 5082	Wrought Aluminium and Aluminium Alloy bars, tubes and sections for electrical purposes.
9	IS: 8623	General requirement for factory built assemblies up to 1000V.
10	IS: 8828	Circuit breakers for over current protection for household and similar installations
11	IS: 13703	Low Voltage fuses for voltages not exceeding 1000V AC
12	IS: 11353	Guide for uniform system of marking and identification of conductors and apparatus terminals.

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

acceptable. Where the equipment conforms to any other standards than those mentioned above, salient points of difference between the standards adopted and standards mentioned above shall be brought out in the tender.

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

5.13.9.3 TECHNICAL REQUIREMENTS

- Main Incoming A.C. circuits on Station service Board shall be controlled through microprocessor based numerical relay with draw out type Air Circuit Breaker. Type and capacity of the breakers shall be proposed by the bidders in their bid considering the total auxiliary load of the plant.
- The LT switchgears shall be suitable for indoor installation in the control room.
- LT switchgears shall be placed in each site control room and shall be connected to each other by means of 415 V (3 phase, neutral) transmission line along the whole area. LT switchgear at main control room shall be connected with Station Auxiliary Transformer 1 (as mentioned in the chapter "Station Auxiliary Transformer") and LT switchgear of a local control room placed at a suitable distance away from the Main Control Room shall be connected with Station Auxiliary Transformer 1 (as mentioned in the chapter "Station Auxiliary Transformer").
- The Station Service Board shall be sectionalized in two parts through sectionalizing breakers of equivalent capacity and protection of incomers on the bus to ensure continuity of supply to the auxiliaries in case of failure/fault on one section. This Switchboard shall be considered as two Incomers and one Bus-coupler method with a castle key interlock.
- For interconnection with various boards and all outgoing feeder circuits, 50 kA, 3 pole draw-out type MCCBs with adjustable current setting shall be provided.
- The Air Circuit Breakers, Boards etc. shall have at least the following ratings:
  - No. of phases : Three
  - Rated voltage : 1.1 kV
  - Service voltage : 415 V ± 10%
  - Frequency : 50 Hz. ± 5%
  - Rated short time current rating : 50 kA for 1 sec. for bus & switchgear
  - Normal control voltage : 220V DC
  - Degree of Protection : IP 42 or higher

- The following equipment at LT switchgear shall be monitored from SCADA /DCS.

  1) All Air Circuit breaker – On & Off status, test, service, spring charged, TCS healthy, 86 operated, DC fail etc.

  2) All ACB - On and Off command from DCS /SCADA

  3) Energy meters

  4) Voltmeters-from transducer

  5) Ammeters-from transducer

  6) Numerical Relays should also be integrated with SCADA.

- The 415V switchboards shall be metal-enclosed draw out type, free standing, self-supporting, floor mounted, indoor type, totally enclosed and compartmentalized to house the switchgear. Circuit breakers and other switchgear components shall be arranged in compartments, vertically in a multi-tier formation. All metering and protection equipment associated with a particular circuit shall be housed in separate and independent compartment earmarked for particular circuit and in the fixed portion of the vertical panel in case of breaker panels.

- Construction of all the switchboards and equipment shall conform to the latest edition of relevant IS codes.

- All cable glands and aluminum crimping type cable lugs for all power and control cables shall be in the bidder's scope of supply. Panels shall be suitable for bottom entry of cable unless otherwise specified.

- The bidder shall indicate clearly the de-rating factors, if any, employed for each component and furnish the basis for arriving at these de-rating factors duly considering the specified current ratings, ambient temperature etc.

- The equipment shall comply with all safety requirements during erection and operation as per relevant standards.

- The neutral of the incoming transformer secondary shall be connected to the neutral bus of the auxiliary boards. The neutral shall be connected to the common earthing system of the switchyard/control room.

- All auxiliary devices for control, indication, measurement and protection such as push buttons, control and selector switches, indicating lamps, Power monitors, kWh meters and protective relays shall be mounted on the front side of the respective compartment. The design shall be such that unless

required for maintenance / inspection purposes, all power ON/OFF or START / STOP and relay reset operations shall be performed without opening the panel door.

- The switchboard panels shall be provided with thermostatically controlled space heaters to prevent moisture condensation.
- Tube light / CFL lamp fittings along with necessary isolating switches shall be provided for illumination inside the panels. Each panel shall be provided with an industrial grade power socket as well.
- The 415V bus shall be of suitable cross-section so as to be able to carry the required continuous and short circuit currents within the limits of temperature rise for the site conditions.
- Control and selector switches shall be rotary type with escutcheon plates clearly marked to show the function and positions. The switches shall be of sturdy construction suitable for mounting on panel front.
- AC Distribution Board is to be provided in the main switchgear room and in the particular local control room having auxiliary transformer as per requirements.
- Instrument transformers shall be provided and shall conform to the relevant standard.
- The relay for the switchgear units shall have all the features as specified under Cl. no. 5.13.11 of, Sec-V of the Technical Specification.
- All relays shown in the drawing and others required for operation of the system as per the specification shall be included in the scope of supply. The relays shall be of electromagnetic/ static/numerical type/ microprocessor based conforming to the requirements of IS: 8686 or IEC: 255.
- All instruments and meters shall be suitable for operation under the climatic conditions prevailing at site. The instrument cases shall be dust-proof, water tight, vermin proof, specially constructed to adequately protect the instruments against damage or deterioration due to high ambient temperature and humidity.
- The VA burden of instrument coils/elements shall be as low as possible, consistent with the best modern design.
- Watt hour meter shall be suitable for 3-Phase, 4-wire unbalanced system and shall comply generally with the requirements of relevant IS code and shall be

of first grade for the purpose of accuracy classification. Watt hour meters shall be provided in each LT switchgears as well as each 33 kV switchgears.

- Panels shall be supplied completely wired internally to equipment and terminal blocks for connection to external cables entering the panel from the bottom. Terminal blocks shall be complete and provided with necessary terminal accessories for cable ends.
- Engraved PVC labels shall be provided on incoming and all outgoing breaker compartments, the exact details of legend to be engraved shall be furnished later to the contractor.
- All vertical cubicles shall be connected to earth bus bar running throughout the length of the switchboard. All doors and movable parts shall be connected to the earth-bus with flexible copper connections. Provision shall be made to connect the earthing bus bar to the main earthing grid at two ends. All non-current carrying metallic parts of the mounted equipment shall be earthed. Earthing bolts shall be provided to ground cable armours.
- Finishing work like painting etc. for switchgears should be as per relevant IS.

5.13.9.4 APPROVAL

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

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

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

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

The contractor can deliver the product to the site only after receiving such approval against their prayer in writing from WBPDCL.

5.15.10 DC BATTERY, BATTERY CHARGING EQUIPMENT & DCDB

5.13.10.1 SCOPE

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

The equipment shall be offered in strict compliance with the same.

BKTPS:

a) 220V DC station battery for Plant Water System of Plante Type: Two (02) sets.

b) 220V Dual Float cum boost battery charger (2 x 100% Float Cum Boost Charger) : Two (02) sets.

following equipment/item shall also be provided:

i. One DCDB with two Incomers and one bus-coupler.

ii. DC fuse board at output of each battery with Fuse monitoring relay, indication facility.

iii) Tools and tackles.

STPS:

Raw Water Pond 2:

a) 220V DC station battery for Plant Water System of Plante Type: One (02) set.

b) 220V Dual Float cum boost battery charger (2 x 100% Float Cum Boost Charger) : One (02) set.

following equipment/item shall also be provided:

i. One DCDB with One Incomer and one bus-coupler.

ii. DC fuse board at output of each battery with Fuse monitoring relay, indication facility.

iii) Tools and tackles.

Dutta Bandh:

a) 220V DC station battery for Plant Water System of Plante Type: One (01) set.

b) 220V Dual Float cum boost battery charger (2 x 100% Float Cum Boost Charger) : One (01) set.

following equipment/item shall also be provided:

i. One DCDB with One Incomer and one bus-coupler.

ii. Out-going feeders from DCDB with DC fuse / DC MCB as per specification.

iii. DC fuse board at output of each battery with Fuse monitoring relay, indication facility.

iv. Tools and tackles.

SgTPP:

i. One Sub-DCDB with Two Incomers and one bus-coupler.

ii. Out-going feeders from Sub-DCDB with DC fuse / DC MCB for RMU operation, DC emergency lighting etc.

iii) Tools and tackles.

[**Note**: *Bidder shall provide two sets of cable from DCDB of Main Switchgear cum control room near Raw Water Pond 3 to this Sub-DCDB at SgTPP. Necessary supply, laying, termination of DC cable is under Bidder's scope.*]

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

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

Corresponding parts of all the equipment & 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.

5.13.10.2 STANDARDS

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

Sl. No.	Standards	Description
1	IS: 1651	Stationary cells & batteries, lead acid type (with tubular positive plates)
2	IS: 266	Battery grade Sulphuric Acid. (Battery electrolyte)
3	IS: 1069	Water for storage batteries
4	IS: 1146	Rubber & Plastic containers for lead Acid storage batteries
5	IS: 1248	Electrical Indicating Instruments

6	IS: 13947	Low voltage switchgear and control gear
7	IS: 3895	Mono-crystalline semi-conductor rectifier cells & stacks
8	IS: 8320	General requirement and methods of tests for lead acid storage batteries
9	IS : 6071	Synthetic separators for lead acid batteries
10	IS : 8623	Factory built assemblies of switchyard and control gear for voltage up to including 1000 V AC and 1200 V DC (Part 1 to 3)
11	IS : 4540	Non-crystalline semi-conductor rectifier assemblies & equipment

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

5.13.10.3 GENERAL REQUIREMENTS

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

- Lead acid tubular type battery of required rating shall be provided at Main Control Room and each Local Control room. Battery Bank at Main Control Room shall be 220 V and Battery Bank at Local Control Rooms shall be selected based on the Control Voltage required for closing and tripping of 33 kV Indoor type VCBs. 10 hours continuous discharge shall be considered for sizing the battery.
- One float charger and one float cum boost chargers shall be provided to maintain constant voltage at D.C. bus bars while supplying the continuous load in addition to keeping the battery on float charge.
- In case of sudden D.C. requirements due to failure of A.C. supply or charger itself, the battery shall be capable of meeting the system load demand. In case of failure of float charger supplying the continuous DC load, the affected battery charger shall get disconnected automatically from the DCDB and the complete D.C. load requirements shall be met by the float charger of float cum boost charger unit.

- The charger shall be protected against overloads by having suitable characteristics so that all loads in excess of the capacity of the charger would be transferred to the battery.
- In the event of failure of A.C. supply, the battery shall meet the complete D.C. requirements. After the discharge of battery to a considerable extent, the boost charger on restoration of A.C. supply shall recharge the battery in a short period. During the period of boost charging, the D.C. load requirements of power station shall also continue to be met.
- The distribution board with necessary switch and interlock, if any, shall be provided for distributing the D.C. power for the control & protection circuits, emergency D.C. supply for essential lighting etc.
- The bidder may give his recommendation on the scheme of operation of battery, battery chargers as described in the specifications. However, the decision of the owner in this regard shall be final and bound to the bidder/contractor.

  The battery shall be capable of delivering the rated output at the minimum temperature of -3°C and maximum temperature of +40°C.
- The battery shall be mounted on the two tier wooden racks supplied along with the battery. Each cell as well as its locations shall be numbered for proper record of maintenance operations. Battery should be placed on the porcelain base kept on the wooden rack.
- The battery shall be connected to D.C. distribution board by single core cables laid above ground. Suitable terminal arrangement with glands shall be provided for this purpose.
- Battery room shall be painted with acid proof paint. Exhaust fans should be provided in the battery room. Contractor shall submit the details of the same to the owner.
- Battery room shall be corrosion proof type lamp and fixtures.
- The ripple content in the D.C. current shall be less than 1%.
- The float charger unit shall be capable of supplying continuous D.C. load and trickle charge the battery.
- Necessary alarm and indication shall be provided with the DC System and also in the annunciation window of the Battery Charger.
- Necessary terminals with lugs for earthing the charger panels with two distinct separate earthing for each panel shall be provided. In addition, separate terminals for earthing of equipment shall be provided. The charger panels shall have space heaters.

- Compression type cable glands of suitable rating for PVC unarmoured cable, suitably mounted in the panel for cable entry from the bottom for A.C. & D.C. supplies shall be provided.
- Type of cell, cell terminal, containers and installation of battery, chargers, inverter, DC Distribution Board, cables etc. should conform to the latest edition of relevant Indian Standard.
- During installation of battery, charging & discharging and charging is to be done proper installation procedure.

5.13.10.4 TECHNICAL REQUIREMENTS

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

- The battery shall be made of lead-acid cells with tubular type plates conforming to latest issue of IS 1651. The battery cells shall be high discharge performance (HDP) type.
- The capacity of 220 V D.C. batteries based on 10 hours discharge rate shall be selected to fulfill the plant‟s requirement. The contractor shall propose the same to the owner and decision of the owner will be final and bound to the contractor.
- The battery shall normally remain under floating condition with the charger supplying the normal continuous load. However, the battery shall be capable of

  supplying the load without fall of terminal voltage per cell below 1.85V (92.5% of rated voltage).
- The number of cells of the 220 volt battery bank at Main Control Room and required voltage at Local Control Room shall be chosen to suit the following conditions.
- Nominal floating voltage per cell shall be between 2.15 and 2.21 V.
- The voltage of each cell under floating conditions shall be of optimum value for its performance and maintenance in a healthy condition.
- The voltage of the battery after meeting the D.C. load cycle shall not be less than 90% of the rated voltage. The manufacturer shall ensure safe operation of the battery after the aforementioned end voltage.
- The voltage across the load shall not exceed 110% of rated value under charging conditions of the battery. To achieve this condition under quick charging, a blocking diode may be incorporated by the supplier in the charging equipment.

- The bidder shall clearly justify the choice of number of cells in the tender on the above lines and furnish any clarifications required by the owner.
- All cell terminals shall have adequate current carrying capacity and shall be of lead-alloy or lead-alloy reinforced with copper core inserts. Cell terminal posts shall be equipped with acid resisting connector bolts and nuts.
- The electrolyte shall be of battery grade sulphuric acid. The battery shall be transported dry.
- The charging equipment shall preferably employ solid state full wave rectifier in a 3 phase full wave bridge circuit with suitable filter circuit of AC ripples, suitable for operation in conjunction with static voltage regulator. A.C. and D.C. Circuit breakers with thermal overload and instantaneous short circuit releases shall be provided on input and output sides of chargers respectively.
- Capacity of the float charger and the boost charger in the float cum boost charger shall be sufficient to meet the system requirement. Contractor shall submit the details to the owner.
- The charger shall be capable of providing the floating voltage between 2.15 V to 2.21 V per cell with the variation of not more than +1% irrespective of input supply voltage fluctuations within +/-10%, frequency fluctuation within +/-5 % throughout its ampere rating with ambient air temperature range of -30C to 400C.
- The DC Distribution Board (DCDB) shall be free standing, self-supporting and floor mounting type. It shall be totally enclosed and compartmentalized. DCDB shall be made as per relevant Indian Standard.
- One equivalent capacity of Incomer provision shall be there to connect with existing DC system with a castle key interlock
- The Emergency Lighting Board supplying the emergency lighting requirement of the power house at A.C shall have an arrangement so that automatic changeover to emergency lighting in case of A.C. failure, is achieved through an inverter of suitable capacity. Normally, the inverter shall run on AC. supply. In the event of failure of AC, the inverter shall automatically switch-over to DC supply and feed the selected emergency loads (lighting loads) at 230 V AC. On restoration of AC supply, the inverters load will automatically return to AC.

The DC system shall have necessary control & protection arrangement which include but not limited to the following.

- Auto/Manual selector switch
- Digital D.C. voltmeter, ammeter

- A.C. failure alarm
- Ground fault relay and its annunciation
- Double pole D.C. contactor of suitable capacity for annunciation
- Triple pole A.C. contactor of suitable capacity for ON/OFF operation
- MCCB and DC contactor of suitable capacity in output circuit of each charger to suit the operation requirements.
- Indicating lamps, as required
- Triple pole, A.C. circuit breaker of sufficient capacity to meet system requirements & capacity with overload and short circuit release for incoming A.C. supply to charger panel
- MCB/MCCBs for A.C. supply to individual chargers
- A.C. under voltage relay
- A.C. voltmeter, ammeter etc.
- Nearest local control room from the main control room should be connected with 220 V DC from Battery Bank DCDB.
- 220 V AC/DC converter is to be provided in each isolated switchgear for operation of circuit breaker/isolator as and where required. Power required in ACDB/DCDB for illumination, control system etc. for each control room should be collected from 415 V (3phase+N) transmission line with necessary cables and protection.

5.13.10.5 APPROVAL

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

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

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

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

The contractor can deliver the product to the site only after receiving such approval against their prayer in writing from WBPDCL.

5.13.10.6 SIZING CRITERIA FOR BATTERY

The successful bidder shall determine Battery Duty Cycle curve. The procedure for estimating battery capacities shall be as per guide-lines stipulated in latest revision of IEEE Std. 485 for Lead acid battery and IEEE std. 1106/IS 10918 for lead acid battery. Dererating factor for prolonged float charging shall be duly taken into account, as applicable, in estimating battery capacity. While estimating battery capacities, aging margin as per relevant standard, temperature correction factor as per manufacture's standards and a design margin 25% shall be considered. Important loads to be considered while deciding duty cycle of station batteries are to be tabulated below but not limited to following

1. 33KV Switchgear & RMU: all indication, control, operation, protection etc.
2. Switchyard VCB, Isolator, Control and relay panel: all indication, control, operation, protection etc.
3. 415V Switchgear : all indication, control, operation, protection etc.
4. Misc Instrumentation
5. Annunciation system & intercommunication system
6. DC emergency Lighting
7. Any other load (to be decided by successful bidder)

Continuous momentary (0-1), continuous emergency (1-59 min) and impulse (59-60 min) loads shall be calculated and duly considered in battery duty cycle curve. Emergency DC lighting as stated shall be considered for 0-60 minute period for sizing the battery and battery charger of ash handling system.

FITTINGS & ACCESSORIES

BATTERY

Each set of battery shall be equipped with fittings and accessories as listed below	
1.	One battery log book
2.	Two copies of printed instruction sheet.
3.	One no. cell testing voltmeter (3-0-3 volts) complete with leads
4.	One no. rubber syringe type hydrometer suitable for specific gravity reading
5.	Three nos. pocket thermometer.(Digital type)
6.	One no. thermometer (0 to 100deg C) with specific gravity correction scale
7.	One set cell bridging connector

8.	Two nos. each Electrolyte resistant plastic funnels and plastic jugs
9.	Battery racks suitable for accommodating the cells coated with paint
10.	Insulator (with 5% extra), rubber pad etc. for rack
11.	Two nos. plastic filling bottle for filling up
12.	One pair of spanners.
13.	Requisite quantity of electrolyte with 10% extra in non-returnable containers
14.	Two pairs of rubber hand gloves.
15.	Two nos. cell lifting straps.
16.	One set of inter cell, inter tie and inter bank connectors as required for complete installation.
17.	Self adhesive PVC stickers for cell numberings
18.	Goggles.
NOTE:	Any other accessories if required for satisfactory operation of the complete battery system shall also be included in Bidder's offer and to be supplied accordingly.

5.15.11 RELAYS (For HT and LT Switchgear)

I. General- A

a) All relays & timers in the protection circuit shall be flush mounted with connection from inside. They shall have transparent, dust tight covers, removable from the front. They shall have built-in testing facilities. Except small auxiliary relays and timers all relays shall be draw out type.

b) Relays shall be rated for operation on 1A / 5A secondary current and 110V secondary voltage to be decided by the bidder. Number and rating of relay contacts shall suit the job requirements.

c) The Bidder shall furnish, install & co-ordinate all relays to suit the requirements of protection, interlock. Application check shall be made on all protection relay. The result of such check shall be furnished for approval.

d) It shall be the responsibility of the Bidder to fully co-ordinate the overload and short circuit tripping of the circuit breakers with the upstream and downstream circuit breakers to provide satisfactory discrimination.

e) All setting devices shall be accessible after removing the front cover. No relay shall be mounted on the rear side of Switchgear panel.

f) All relay coils and their auxiliary contacts (including un-enabled relays in Composite Numerical Relays, if any), including spare contacts will be wired up to the terminal blocks of respective panels for wiring to remote panel / PLC and for future use.

g) Parameterization and loading and downloading of data shall be possible from local HMI as well as from remote panel / PLC/DCS.

h) All numerical relays shall have front communication port for parameterization, loading and downloading of data through Laptop.

i) All numerical relays and multi-functional meters shall be hooked up and connected with HMI through Fiber Optic cable.

II. General- B

a) All protective relays shall be of numerical microprocessor based multifunctional type having communication facility.

b) All relays shall conform to the requirements of IS: 3231 / IEC: 60255 standards. The Numerical relays shall have communication, Metering and monitoring facility.

c) Bidder shall ensure availability of spare parts and maintenance support for the equipment for at least 15 years from the date of supply.

d) Separate Master trip Lockout Relay shall be provided for all VCB, SF6, ACB operated HT and LT system.

e) Any foreign relay manufacturer through his Indian partner or subsidiary company in India shall provide application, testing, commissioning and other necessary support for minimum 15 years. They shall also maintain adequate inventory of each type of relay or spares to meet the requirement arising during project execution and plant operation.

III. Technical Requirement

a) **Auxiliary Power Supply**

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

b) **Basic Requirement and Constructional Requirement**

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

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

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

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

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

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

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

c) Display & Indication

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

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

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

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

d) **Software Security**

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

e) **Disturbance, Event Recording & Data Storage**

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

f) **Trip Circuit Supervision & Lock out function**

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

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

g) **Input / Output Interface, Filters and Galvanic Isolation**

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

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

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

i) **Serial Communication**

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

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

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

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

v. One (1) set of Laptop, loaded with common support software and which will allow easy settings of relays in addition to uploading of event, fault, disturbance records and measurement from relay front communication port. The Switchgear supplier shall furnish CD's for the above relay parameterization as well as download of disturbance recorder for all relays of his supplied switchgear.

Accessories like table/chair/desk/power socket etc. as required for all PC/Laptop should be supplied.

5.15.12 PROTECTION SYSTEM (HT and LT Switchgear)

5.13.12.1 SCOPE

The scheme shall consist of design, engineering, quality surveillance, manufacture, tests at manufacturer's works before dispatch, transport, transit insurance, supply, delivery to site, storage at site, erection, testing, trial run and commissioning, handing over to the purchaser of protection system for

- PV Array yard
- Solar Inverter
- Two/Three winding Step up Transformer
- Incomer feeder for 33 kV Switchyard
- Outgoing feeder for 33kV Switchyard
- Station Auxiliary Transformer

The protection system shall include protection relays, trip relays, relay contacts, trip & alarm circuits, Annunciation system, diagnostic system, other necessary equipment with all accessories, wiring and cubicles for making the protection system complete for 22.5 MW Floating Solar PV Power Plant in, BkTPS, STPS & SgTPP in West Bengal.

5.13.12.2 STANDARDS

All materials and equipment shall conform to latest edition of relevant Indian/IEC Standards unless otherwise specified. Equipment conforming to any other authoritative standard ensuring equal or better quality than the standards indicated below will also be acceptable. However, in such eventuality, the salient points of difference between the standards adopted and the standards mentioned below shall be brought out by the bidder. The list of reference standards is given below:

Sl. No.	Standards	Description
1	IS: 2705	Current Transformers
2	IS: 3156	Voltage Transformers
3	IEC: 60255 (Part 1 to 23)	Electric Relays
4	IEC: 60337	Control switches and low voltage switching devices for control and auxiliary circuits
5	IS: 1885	Electro-technical vocabulary on Electrical relays, Electric Power System Protection and Switchgear & Control

6	IS:13947	Degree of protection provided by enclosures for low voltage switchgear and control gear
7	IS: 3231	Electric relays for Power System protection
8	IS: 5834	Electric Timer relays
9	IS: 8686	Static Protective relays

5.13.12.3 TECHNICAL REQUIREMENTS

The technical requirements of the protection system shall be but not limited to the following.

- Protection shall be designed to ensure reliability, sensitivity and stability under through fault conditions of the system.
- The protection system shall be fully integrated with SCADA system.
- The protection scheme shall be coordinated with control & protection of solar modules, solar inverters and generator transformers etc. All protection, though not specified but which are recommended for this capacity of the machine as per relevant IEC / other Standards shall be provided.
- The protective relays shall be of the numerical, fully tropicalised, plug in type, arranged in protection cubicles including all ancillary devices, such as interposing transformers, tripping matrix and relays, test facilities, power supply units, etc. with all circuits complying to latest editions of IEC 60255-4 recommendation or British Standard 142 and 5992, parts 1, 2 and 3 or relevant Indian Standard. However necessary SAS integration provision shall be there.
- The relays/protection system shall be of state of the art of technology and only latest proven versions of the relay series shall be offered. If the protection system mentioned in the awarded Contract become obsolete at the time of supply, the Supplier shall offer the latest model with the approval of Employer, without any extra cost.
- Protection system shall be provided to prevent operation of protective equipment due to, magnetizing current inrush during switching-in of the transformer from the high voltage side.
- Precaution shall also be taken so that the unavoidable inductive and capacitive couplings from the power circuits do not cause disturbances.
- Protection relay shall have features but not limited to the following:
    - Man machine communication interface with alarm and trip value setting, displaying of alarm/trip set values, alarmed/tripped values, fault current and disturbance values etc.
    - Self-supervision and indication of any failure.

- Continuous monitoring of external and internal auxiliary voltages
- Easiness of replacing a set in case of failure.
- Communication interfaces or ports.
- Indication of alarm and trip condition.
- Test facilities etc.

- All devices shall remain inoperative during external faults and transient phenomenon. They shall be insensitive to mechanical shocks, vibration and external magnetic fields.
- The protection relays, shall be located in conventional panels and shall be flush mounted in dust and moisture proof cases with protection class IP 54 and of the draw out type with rear connections. The protection class of the cover for all relays or protection systems, in which the modules are mounted, shall not be inferior to IP 54.
- The protection systems shall be fed by the battery banks installed in the main control room and local control rooms. Relay shall be suitable for operation on DC systems without the use of voltage dropping resistors.
- The supplier has to supply the equipment for protection of best quality. The supplier has to maintain control and quality assurance during the manufacture, installation, testing and commissioning of equipment as per approved quality assurance plan.
- Minimum protection functions to be provided for different type of circuits are listed below -

For 33kv Incomer feeder-

a) 3 Nos. IDMTL over current (51) for phase fault
b) 1-Definite time O/C relay (50 N/2) for earth fault.
c) Under voltage with time delay (27)
d) VT fuse failure

For Outgoing feeder-

a) 3 Nos. IDMTL over current (51) for phase fault feeder
b) 1-Definite time O/C relay (50 N/2) for earth fault.
c) Under voltage with time delay (27)

For Transformer-

a) 3 Nos. IDMTL over current (50/51) with high set instantaneous units for phase faults
b) 1 No. Definite time O/C (50G) for earth fault (through CBCT)

c) 1-Definite time O/C relay (50 N/2) for earth fault
d) Differential protection (for transformers rated 5MVA and above)
e) Restricted Earth fault (64) for Transformer LV side from transformer neutral including LV side Bus duct / cable.
f) Low vacuum alarm and trip.
g) Winding temperature alarm and trip.
h) Oil temperature alarm and trip.
i) Pressure relief device operated alarm.
j) Conservator oil level low alarm.
k) Double float type Buchholz protection.

LT Incomer:

- 3 Nos. IDMTL over current (51) for phase fault
- 1-Definite time O/C relay (51N) for earth fault.
- Under voltage with time delay (27)

LT ACB operated Motor Feeder (if applicable) :

- Thermal model with negative sequence current.
- - Voltage compensated acceleration.
- - Under voltage, over voltage protection.
- - Overload protection.
- - Short circuit & SC back-up.
- - Current unbalance.
- - Ground fault (through CBCT)
- - Temperate monitoring (stator, bearing etc.).
- - Phase reversal.

Apart from above suitable provision for metering and monitoring such as voltage,

5.13.12.4 APPROVAL

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

- Detailed specification of all the items.
- All required drawing etc.

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

- Guarantees
- Instructions for installation
- Instruction O&M manual Testing & commissioning manuals

- Detailed BOQ covering protection relays, CTs /PTs, DC Sources and all other devices.

The contractor can deliver the product to the site only after receiving such approval against their prayer in writing from WBPDCL.

5.15.13 EARTHING AND LIGHTNING PROTECTION SYSTEM

5.13.13.1 SCOPE

The scope of work under this specification covers the design, supply, transportation, delivery at project site, transit insurance, storage at site, erection, testing & commissioning of electrical grounding and lightning protection system along with necessary materials. All the equipment and building shall be protected from lightning through Lightning Protection System.

5.13.13.2 STANDARDS

The grounding system shall conform to the requirement of following standards.

Sl. No.	Standards	Description
1	ANSI/IEEE: 80 –2000	Guide for safety in AC Substation Grounding
2	CBIP Publication: 223	Design of Earthing Mat for High Voltage substation
3	IS: 3043	Code of Practice for Earthing Indian Electricity Rules

5.13.13.3 OBJECTIVE

The grounding system shall be designed with the following objectives:

- To provide low impedance path to fault currents, during ground faults, to ensure prompt and consistent operation of protective devices to effect isolation
- To keep the maximum voltage gradient during ground faults along the surface inside and around the switchyard, PV array yard, control rooms etc. within safe limits
- To protect the life and property from electrical shocks due to over voltage
- To stabilize circuit potentials with respect to ground and limit the overall potential rise

5.13.13.4 TECHNICAL REQUIREMENTS

Minimum technical requirement of the earthing system is mentioned below.

- The earth resistance should be less than 1 Ω.
- Suitable number of earthing pit shall be provided at the array field.

- Design and installation of the earth mat and other associated system shall confirm IS: 3043 and shall be followed by modern practice.
- The earthing for solar field and power distribution system shall be made with GI pipe of suitable size including accessories, and providing masonry enclosure with cast iron cover plate having locking arrangement, watering pipe using charcoal or coke and salt as required as per provisions of IS: 3043. The Mounting structure shall be grounded properly using GI strips and maintenance free earthing kit.
- Size of ground earth mat shall be 1000mm below FGL and 40 mm dia MS rod
- Necessary provision shall be made for bolted isolating joints of each earthing pit for periodic checking of earth resistance.
- The earth conduction shall run through GI pipe partly buried and partly on the surface of the control room building.
- The complete earthing system shall be mechanically & electrically connected to provide independent return to earth.
- All three phase equipment shall have two distinct earth connections.
- Along the cable trays suitable size of GI Flat shall be provided inside the control room.
- For each earth pit, necessary Test Point shall have to be provided.
- The earthing system shall be connected to the following.
    - Solar modules with suitable number of earthing pit at the solar array field
    - The neutral point of each system/equipment
    - Equipment framework and other non-current carrying parts
    - Frames of panels & cubicles
    - Metallic structures of switchgear, cable racks, casing of cable boxes
    - Equipment supporting Steel structures
    - All extraneous metallic frame work not associated with equipment
    - The earth point of lightning arrestors; voltage transformers and lightning conductors through their permanent independent earth electrodes.
    - Fence
- For equipment connection to mat/riser, 50 mm x 6 mm or higher size GS flat shall be used.
- Each neutral point of transformer shall be provided with two separate treated earth pit through 80 mm dia GS perforated pipe having 3 mtr depth. Necessary charcoal, salt etc. to be provided for earth pit as per relevant

standard. Each earth pit shall be connected with Main earth grid through a bolted type test point.

- Separate grounding grid to be provided for electronic earthing for PLC system.
- The conductor shall be of adequate cross-section to safely withstand the system fault current for time duration of fault clearance by the remotest/back up protective system.
- Sufficient allowance needs to be provided for corrosion of the embedded conductor on account of chemical properties of soil and also due to galvanic action with other embedded systems.
- For determination of the size of the conductor, the value of fault current may be taken as 40 kA; duration of fault current may be considered as 1 second. The extra allowance of 20% to take care of corrosion shall be added to arrive at final conductor size.
- For designing of the earth mat for 33kV switchyard, the material of ground mat conductor shall be 40 mm MS rod and that of risers emanating from ground mat shall be GS flats. Soil resistance of the site is available in the soil report.

Lightning Protection System:

Lightning protection work shall be carried out in compliance to the following standards/codes. All standards, specifications and codes of practice (COP) referred to herein shall be the latest editions including all amendments and revisions as on the date of opening of bid. In case of conflict between the specification and those standards/codes referred to herein, the former shall prevail:

- Indian Electricity rules
- National Electrical Code
- COP for the protection of building and allied structures against lightning : IS 2309
- Recommended practice for hot-dip galvanizing of iron and steel: IS 2629
- Method of testing uniformity of coating on zinc coated articles : IS 2633
- Methods for determination of mass of zinc coating on zinc coated iron and steel articles : IS 6745
- IEEE guide for instrumentation and control equipment grounding in generating stations : IEEE 1050;
- Lightning protection will also be provided for building/ structures where the overall rise factor exceeds 10^{-6} as per IS: 2309

5.13.13.5 APPROVAL

The successful bidder shall carry out the earth resistance measurement at the site and they need to submit the measurement report to WBPDCL.

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

- Detailed specification of all the items.
- Soil resistivity measurement data
- Necessary calculations and drawings etc.

The successful bidder required to produce schematic diagram of the earthing system and the proposed locations for earth mat as per relevant standard with the Detailed Design Report.

All drawings and calculations submitted by the contractor will be subjected to approval of the WBPDCL.

5.15.14 CONTROL, MONITORING AND DATA ACUSITION

5.13.14.1 SCOPE

The scope of work under this specification covers the design, engineering, manufacture, testing at manufacturer's works, transportation, transit insurance, delivery at project site, storage at site, erection, testing at site and commissioning of Control, monitoring & Data Acquisition system comprising of computers, VDU, key board/mouse, SCADA System, PLC's, input and output relays, meters, fields sensors, panels/cubicles for housing above equipment/devices, power supplies, transducers, converters, wiring etc. to make the system complete.

5.13.14.2 REQUIREMENT

1.0 SCADA

1.1 Contractor shall provide complete SCADA system with all accessories, auxiliaries and associated equipment and cables for the safe, efficient and reliable operation of entire solar plant and its auxiliary systems.

1.2 Bidder shall supply all the Hardware, Software, Panels, Power Supply, HMI, Laser Printer, Gateway, Networking equipment and associated Cable etc. needed

for the completeness even if the same are not specifically appearing in this specifications.

1.3 SCADA System shall have the provision to perform the following functions:

i) Remote control of all the HT Breakers either in hard or soft signal.

ii) Remote control of Inverter active and reactive power as per requirement mentioned in respective chapter.

iii) SCADA shall also be able to acquire, display and store real time data, status and alarm signal from following equipment included but not limited to as required or offered under the scope of this specification:

a) All the HT Switchgear/RMU equipment
b) Incomer and bus coupler breaker of LT Panel.
c) Power conditioning unit (PCU)
d) UPS and Battery charger as per requirement mentioned in respective chapter
e) Weather Monitoring Equipment
f) TEM, ABT, MFM meter, numerical relay, fire alarm panel, GPS time synchronization unit and transformer.
g) SCADA Hardware, Accessories and Communication link
h) Any other equipment required as per specification

iv) Display of status of major equipment in Single Line/Mimic Diagram. Mimic Diagram colour shall comply to IS 11954: Guide for colour coding of electrical mimic diagrams.

v) Display and storage of derived/calculated/integrated values

vi) Generate, store and retrieve user configurable periodic reports. All data shall be recorded chronologically date wise. SCADA shall have facility to generate report in MS Excel file type and should have the facility of easy downloads.

vii) Remote monitoring of essential parameters of plant on the web using popular web browser without requirement of additional software.

Same shall be authorised with user id and password using standard modem. User ID and password for remote view can only be changed by SCADA Administrator. Internet connection for transferring data to web shall be taken by Contractor for O & M period.

Licenses for Remote Monitoring of SCADA: Minimum 2 Nos with provision of Concurrent viewing for all users.

viii) Performing self-monitoring and diagnostic functions.

1.4 The contractor shall provide at least one GPS clock, which shall be synchronized with the SCADA system. All devices having real-time clock (RTC) with time synchronization facility and are communicating with plant SCADA shall be synchronized with GPS Clock through SCADA or directly with GPS Clock. The technical details of GPS have been specified elsewhere in the specification.

Time synchronization equipment as mentioned above has to be provided in each control room.

1.5 Type of signal from equipment (Hard wired or Soft) shall be as per specification of the equipment mentioned in the respective chapter and approved during detail engineering.

1.6 SCADA shall provide real time performance monitoring according to IEC 61724 standard. In case of conflict between this specification and those (IS codes, standards, etc.) referred to herein, the former shall prevail.

1.7 The control system shall provide safe operation under all plant disturbances and on component failure so that under no condition the safety of plant, personnel or equipment is affected. Control system shall be designed to prevent abnormal swings due to loss of Control System power supply, failure of any Control System component, open circuit/short circuit. On any of these failures the controlled equipment/parameter shall either remain in last position before failure or shall come to fully open/close or on/off state as required for the safety of plant/personnel/equipment and as finalized during detailed engineering. System shall be designed such that there will be no upset when power is restored. These operations shall be demonstrated by vendor during Factory Accepted Test (FAT) in the presence of WBPDCL Representative.

1.8 Scope of supply of SCADA Work Station at Control Room is as mentioned below:

Sl. No.	Items	New Switchgear cum Control room			New solar control room
		BkTPP (near Raw water Pond #1&2 area)	STPS (near Raw water Pond #2 area)	STPS (near Dutta bandh area)	SgTPP (adjacent to existing main solar control room near raw water pond#3)
1	Engineering cum Operators' Work Station (EOWS) (with monitor, keyboard, mouse and other accessories)	1 no.	1 no.	1 no.	1 no.
2	Operators' Work Station (EOWS) (with monitor, keyboard, mouse and other accessories)	1 no.	1 no.	1 no.	1 no.
3	Historian (with monitor, keyboard, mouse and other accessories)	1 no.	1 no.	1 no.	1 no.
4	Printer	1 no.	1 no.	1 no.	1 no.
5	Control Desk	1 set	1 set	1 set	1 no.
6	Chairs	3 nos. (min.)	3 nos. (min.)	3 nos. (min.)	3 nos. (min.)

Technical details of workstations, printer, control desk etc. shall be as per specification given under detail technical specification.

1.9 The SCADA at control room shall be of PLC based and shall comply technical requirement as given under detail technical specification.

1.10 Dedicated PLC based SCADA system shall be provided in Switchgear cum control room for BkTPP (near Raw water Pond #1&2 area), STPS (near Dutta bandh area) and new solar control room of SgTPP (adjacent to existing main solar control room). It shall be used for control, operation and monitoring of respective solar plant.

Note:

1. However, only outgoing breaker for SgTPP project shall be hardwired to BHEL DCS using the available spare IOs in the existing DCS panel. Termination

of the cable in DCS panel, modification of HMI pages and implementation of the protection logic in the existing DCS shall be under bidder's scope of work. Additional 1 no. DI, 1 no. of DO, 1no. AI module of the existing DCS panel to be supplied as main supply.

2. For STPS raw water pond 2 area, separate control room and PLC system is not envisaged under this project.

Bidder shall terminate all the IOs in the PLC system of 5 MW floating solar plant on raw water pond 1 at STPS. Bidder shall use the spare IOs in the above-mentioned PLC system for this hardwire interfacing.

Also, all the soft interfacing, as required for WMS, data logger, numerical relay, energy meter, inverter, SMBs etc., shall be done in the PLC system of 5 MW floating solar plant on raw water pond 1 at STPS. This is also under Bidder's scope.

Any implementation/modification of logic and HMI graphic page in the above-mentioned PLC system shall be done by the bidder.

Bidder must keep in mind that the PLC based SCADA system of 5 MW floating solar plant on raw water pond 1 shall be used for control, operation and monitoring of entire 10 MW floating solar plant at STPS (5MW floating solar at raw water pond 1 + 5 MW floating solar plant on raw water pond 2 at STPS).

1.11 Bidder has to provide suitable hardware DMZ network firewall to restrict unauthorized access to HMI/ SCADA system. Details specification of hardware firewall is provided elsewhere in the specification.

1.12 SCADA system shall have the following features as minimum:

i) SCADA system shall have data logging and display system for continuous monitoring of data.

ii) In addition to the real time trend, SCADA shall also have provision for offline viewing and retrieving of historical data of all parameters. All the trend and cumulative graphs shall be able to view and store. Also all the events including outages and faults shall be logged and stored with time and date stamped. SCADA should also have provision for offline viewing of daily, monthly and annual average of all the parameters.

iii) The SCADA work station and push button control panel shall be interlocked by means of hardwired and software (Logic) to ensure smooth and safe operation of the plant.

iv) All pre-synchronisation checks shall be made to ensure normal and safe operation of the machine. Detailed philosophy shall be submitted by the contractor.

v) System shall acquire on continuous basis the parameters of PV array, parameters of Solar Inverters, parameters of Transformers etc. as mentioned elsewhere in the specification.

vi) The Monitoring system shall perform String level monitoring for trouble free operation and maintenance of the plant. System shall indicate these on SCADA alongside relevant device.

vii) System shall monitor status of all electrical devices including all switchgear and indicate on SCADA.

viii) System shall provide mimics of main single line diagram, Auxiliary SLD and DC SLD in colour. The parameters as above shall be displayed by the side of respective device in proper units of measurement.

ix) The Plant based monitoring system should have the provision of graphical representation of the data shall include but not limited to the following:

SI. No.	Operating Parameter	Desired specification
1	Input data	PV Power PV Energy
2	Meteorological data	Insolation (inclined on the plane of module as well as horizontal) Module Temperature Ambient Temperature Wind Velocity
3	Output data	Inverter Export Power Inverter Export energy

x) In case the data cable to be laid in the array field, SPD (surge protection device) suitable for communication network, as much number at suitable location are required must be provided with the system.

2.0 Power Supply System:

- Bidder shall supply 2X100% parallel redundant Uninterruptible Power Supply (UPS) system (along with 2x100% Ni-Cd battery bank) at each control room. [i.e. Switchgear cum control room for BkTPP (near Raw water Pond #1&2 area), STPS (near Dutta bandh area) and new solar control room of SgTPP (adjacent to existing main solar control room)]

  Supply of UPS system for STPS raw water pond 2 area is not envisaged under this project. Bidder shall use the UPS system of 5 MW floating solar plant on raw water pond 1 at STPS for this project's requirement. However, Power supply distribution to all the consuming points shall be in the scope of Bidder.
- Each of the Battery banks (Nickel Cadmium type) shall have at least 1-hour back-up.
- Power supply distribution to all the consuming points shall be in the scope of Bidder. The exact power supply scheme shall be submitted by Bidder during detailed engineering stage for Owner's approval.
- SCADA and PLC system as well as all system peripherals such as engineering & operators' work stations, servers, printers etc., CCTV system, Fire alarm panels, weather monitoring stations, data logger etc. shall be powered from UPS system. Any other system that requires UPS power, as per OEM requirement, shall be powered from UPS system.
- Technical details of UPS system shall be as per specification given under clause no. 5.13.14.3(k), detail technical specification of UPS System **(Annexure-I)** and tender drawing of UPS system.

3.0 Air conditioned system in control room:

Each control room shall have humidity controlled Air Conditioned environment. SCADA system along with PLC panels, HMI peripherals, UPS system along with UPS Battery, CCTV server along with workstation, LED display, Fire alarm panel etc. shall be installed inside AC environment in each of the control room.

4.0 CCTV system:

- Bidder shall supply IP based Close Circuit Television (CCTV) System for the total plant area and control room building surveillance.
  PTZ (Pan-Tilt-Zoom)/CCTV outdoor/indoor cameras covering the whole plant area (nos. of cameras requirement shall be as per design for well coverage of the plant) and total Switchgear cum Control Room building.

- Bidder shall supply dedicated CCTV system (with all the items and requisite quantity as mentioned in the relevant technical specification) for below mentioned area:

  - 10 MW Floating Solar on Raw Water Pond 1 & 2 at BkTPP
  - 5 MW Floating Solar on Raw Water Pond 2 at STPS
  - 2.5 MW Floating Solar on Dutta Bandh at STPS
  - 5 MW Floating Solar on Raw Water Pond 5 at SgTPP

- CCTV system shall be centrally monitored from the respective control rooms i.e.
  i) Switchgear cum control room for BkTPP (near Raw water Pond #1&2 area),
  ii) Switchgear cum control room for STPS (near Raw water Pond #2 area),
  iii) Switchgear cum control room for STPS (near Dutta bandh area) and
  iv) new solar control room of SgTPP (adjacent to existing main solar control room)

- CCTV system shall be powered from UPS ACDB.

- Bidder's scope of supply shall be CCTV system comprising CCTV cameras, CCTV Viewing Station, Management Server, Recording Server, Network Storage Device, L2 Ethernet Switch, OFC, Cat 6 cable, power cables, cable protections, cable conduits & sub-trays, supports, junction boxes, distribution frames, enclosures etc. and grounding connections as required for safe and trouble free operation of IP Based CCTV SYSTEM

- CCTV system network shall be separate from SCADA network.

- Control desk has to be supplied for CCTV monitoring stations, servers, storage device etc. in each control room. Also minimum 2 nos. of chairs to be provided for CCTV system control desk in each control room.

- Control desk along with chairs, HMI peripherals, storage device etc. for CCTV system of 5MW floating solar at raw water pond 2 shall be installed in control room of 5 MW floating solar plant on raw water pond 1.

5.0 Bidder shall supply proven latest version of hardware and software available at the time of system designing. All software (supplied for the project by the bidder) user licenses shall be valid for entire life of power plant. User should not have to pay any recurring license fee during the usage period of the system. In case of future up-gradation of software, Bidder shall remain committed to upgrade the supplied system at per with the new version within the warranty period and ensure successful integration of the system without any additional cost to owner. Beyond the warranty period and during the remaining life of the plant, any up-gradation in hardware and software shall be brought to the notice of Owner indicating whether it shall be possible to upgrade the system by partially replacing, modifying and/or patching of hardware /software.

Also user license for all the software shall not be machine specific. That is, if any hardware / machine is upgraded or changed, the same license shall hold good and shall not be necessary for owner to seek a new license/renew license due to upgradation/change of hardware/machine in system at site.

Password security shall be provided in order to ensure security level to the plant operation.

6.0 Screened instrumentation cable, Cat6 cable and fibre optic cable and other hardware as required for interconnection and complete commissioning of SCADA system and complete commissioning of solar PV power plant shall be supplied by the bidder.

7.0 Electronic Earth pit along with connection to the equipment where electronic earthing is required has to be done by the bidder.

5.13.14.3 DETAIL TECHNICAL SPECIFICATION

5.13.14.3.(A) PROGRAMMABLE LOGIC CONTROLLER (PLC)

1) Programmable Logic Controller (PLC) shall meet the following general requirement:

   i) Each PLC shall have redundant Central Processing units (CPUs) of word length of 32 bits minimum.

   ii) Each CPU rack shall have redundant Power supply units, CPU, IO communication processor (between IO Rack & CPU), Communication processor (between CPU & HMI via ethernet switch), memory module (if applicable) etc.

   iii) Each IO rack shall have redundant Power supply units, IO communication processor (between CPU & IO rack) and IO modules.

   iv) The redundant CPU rack and IO rack shall be connected through redundant data highway.

   v) The CPU rack shall be connected to the operator station through redundant 10/100 Mbps data network.

   vi) IO racks shall be backplane type. i.e, the IO cards mounted on the rack shall be on the back plane

   Two CPUs shall operate on fault tolerant mode with continuous self and cross-monitoring facility. Failure of the active CPU shall not affect the operation of the plant.

   In the event of failure of active CPU, tasks shall be transferred to the standby CPU bumplessly within fastest possible transfer time without causing any output to drop during the transfer period. The bumpless change over shall be accomplished within one Scan-cycle.Transfer speed shall not be less than 1 Gbit/sec. CPU Redundancy shall be achieved through dedicated hardwared Synchronised Link between active and standby CPU.

   In the event of both the CPU failure, the system shall revert to the fail-safe mode. CPUs shall not be loaded over 60% of the individual capacity even under worst data loading conditions. It shall be possible to make a manual transfer from the active to the back-up CPU from engineering station and as well as from the front panel of CPU module. Module shall have adequate status and diagnostic indication on the front panel and as well as on the engineering station.

2) The system shall be of modular construction and expandable by adding hardware modules and incorporating them in the address register.

   Bidder shall provide at least 20% or minimum one number, whichever is higher, spare channel as hot-on-rail spares in each configured cards/modules.

   In addition to this 10% or minimum one number, whichever is higher, extra assigned complete spare modules mounted on rails in racks for each type of I/O modules shall also be provided.

The spare channel and cards shall be fully wired and terminated.

Each IO rack shall have 10% spare rack space for IO module installation in future.

10% spare relays of each type and rating shall be mounted and wired in cabinets TB. All contacts of relays shall be terminated in terminal blocks of cabinets.

The spare capacity as specified above shall be uniformly distributed throughout all cubicles. The system design shall ensure that above mentioned additions shall not require any additional controller/processor/ peripheral drivers in the system delivered at site. Further, these additions shall not deteriorate the system response time / duty cycle, etc. from those stipulated under this specification.

3) The memory unit of the CPU shall be field expandable. The memory capacity shall be sufficient for complete system operation and shall have the capability for future expansion at least to the tune of 25%. The application program/sequence logic etc. shall be stored in nonvolatile memory (EEPROM). However, all the dynamic memories shall be provided with battery back up at least for 360 hours. The batteries shall be lithium or Ni-Cd type.

4) The number of input / output points per card shall not exceed 32 (Thirty Two) for digital and 16 (Sixteen) for analog/ thermocouple/ RTD. Individual input channels shall have galvanic/optical isolation. Output points shall also have optical/galvanic isolation. Merely fusing of individual or a group of channels is not acceptable.

5) The data communication system of the PLC shall not be limited to the following:

a) Internal Bus and External data network loading shall in no case be more than 60% of its capacity.

b) Redundant communication controller shall be provided for the purpose of communication between the I/O modules (including remote I/Os if any) and the PLC as well as in between PLC and the operators work stations.

c) The communication system design shall ensure that any single point failure on the system bus/media shall not disrupt more than single message and disrupted message shall be automatically retransmitted.

d) Failure or physical removal of any station/modules connected on the system bus shall not lead to any loss of communication.

e) Diagnostics message shall be issued on fault detection.

f) Bus change over from active bus to stand by bus, during failure of active bus shall be performed automatically and bumpless. Such event shall be suitably logged or alarmed.

g) Noise immunized and reliable high speed dual fault tolerant optical fibre communication cable between CPUs and remotely located remote I/O modules with standard communication protocol shall be provided.

h) Main data network shall be noise immune high-speed communication link with bit rate in the range of 10 / 100 MB/sec and shall comply with the International Standard IEEE-802.3 (Ethernet) for data exchange and communication.

6) The PLC system shall be open protocol at both layers (OPC compliant) i.e. Supervisory layer (between PLC & HMI) and Control Layer (between PLC & I/O). Supervisory level Ethernet must be unmodified with non-proprietary application layer.

All PLC based controls shall have provision for interface with main plant DCS and other Solar plant PLC (if any) for future. Communication for selected data transfer with DCS shall be through OPC soft link.

7) Quantity of workstations and printers shall be as mentioned under clause no. 5.13.14.2.

8) HMI function of PC based operator's station shall not be limited to the following:

a) Selection of auto/Manual, open/close operation, sequence auto, start/stop operation etc.
b) Dynamic Mimic display depicting the entire process for control and monitoring purpose.
c) Alarm monitoring, report generation, logs, calculations and printing of logs, reports, trends etc.
d) On-line / historical trending, historical storage and retrieval of data.

9) Annunciation System

a) For PLC controlled area / plant, window based annunciation wherever required shall be an integral part of the PLC system. Sequence for annunciation shall be configured in PLC and shall conform to ISA sequence. Window lamps will be driven by PLC. For the systems where only monitor & keyboard based operator workstation has been envisaged, alarm/ annunciation will be displayed in the operator workstation.

b) The window lamps for the system shall be driven through output modules of the PLC. Each window shall have removable lamp box.

The window shall have black lettering inscription on white background.

However, for trip application red background shall be provided. Each of the annunciation windows shall be backlighted with minimum two groups of clustered LED lamps with minimum readable distance of 3 Meter. The

window design shall be such that the lamp replacement can be done easily from the front.

c) Immaterial of whether the annunciation is window based or HMI based, one no. Electronic hooter with adjustable sound level and intensity controls to be provided as audible device for the annunciation system.

10) Software

a) All the necessary software for fulfilling the complete implementation of the control logics, operational displays & logs, data storage, retrieval and other functional requirements as indicated in this specification, shall be provided.

b) Offered PLC system must use Tag based addressing structure. Tags must be inherent in the controller not in the HMI. The HMI shall support directly by referring the Tags resident in the controller.

c) Licensed version of required software including operating system, configuration and HMI software shall be provided.

d) Programming language shall be user friendly. Detail documentation on the all programming softwares shall be furnished by Bidder and this shall be a part of the O&M Manual.

e) Contractor shall provide software locks and passwords to Owner's engineers at site for all operating and application software so that Owner's engineers can take back up of these software and are able to do modifications at site.

11) Control & Power Supply Scheme

Bidder shall provide two nos. redundant 240V AC ± 1% UPS (Uninterruptible Power Supply) Power feeders for the PLC system from the unit UPS systems.

All required hardware/ equipment etc. for conversion and/or stabilization of the power source to all other levels which may be necessary for meeting individual requirements of equipment/ systems shall be furnished by the bidder.

Separately mounted I/O racks, shall be provided with separate power supplies. Power supply module shall be of ample capacity to feed all the modules. In addition 20% spare capacity for future shall be provided.

All the drives shall be switched ON/OFF through 24 V DC interposing relays to be located in HT/LT SWGR panels.

Power supply distribution to all the consuming points shall be in the scope of Bidder. The exact power supply scheme shall be submitted by Bidder during detailed engineering stage for Owner's approval.

12) Bulk power supply units for interrogation, relay and solenoid voltage shall be separate from system power supply units and shall be redundant in all cases.

13) The system shall have high MTBF and shall be hot maintainable. The system hardware shall be designed to be `fault avoidant' by selecting high-grade components of proven quality and properly thermally de-rated design. The network shall have extensive fault monitoring, self-surveillance & on-line self diagnostic capability so that failure up to module/card level is immediately detected. Each of the modules shall have its self-diagnostic system. The operator workstation located at the local area control room shall be used for fault data presentation and monitoring purpose.

14) It is preferred that Termination & Relay cabinet shall be separate from the system and RIO cabinets.

15) Data exchange in a bus shall be fully monitored and checked for validity.

16) Response time consisting of IO scan time, Data communication time, Processing time etc. shall be equal to or less than the following:
    a) OLCS & sequence control inputs : 100 ms.
    b) CLCS inputs : 250 ms.
    c) Monitoring analog parameters : 500 ms.
    d) Monitoring digital parameters : 100 ms.

17) Following operations will be performed on I/Os, as required:
    a) Square root extraction
    b) Pressure & temperature compensation
    c) Reasonability check of all inputs (analog specially), validate and quality tagging like good, bad, suspect etc.
    d) Channel wise engineering unit conversion
    e) Contact bounce filtering with adjustable time constant.

18) All controllers shall be freely configurable with respect to requisite control algorithms. An extensive library of macros shall be included for the purpose.

    Adequate software capability shall be provided to implement closed loop control functions as follows:
    a) PID control and their variations.
    b) On-off control
    c) Cascade control
    d) Ratio and bias control

19) Features for Open Loop Control shall not be limited to following:

    a) Logic functions like AND/OR/NOT gates, timers (on-delay, off-delay), shift registers, counters, latches, flip-flops, mono-shots etc.

    b) The automatic sequence control to ensure sequential start up and shutdown of auxiliaries/equipment. Sequence control shall be performed in groups initiated by command from operator's console. A sequence shall be

made of steps executed in predetermined order according to logic criteria. For each step there shall be a provision for `waiting time' and `monitoring time', and it shall output an action on the process. System shall have the capability to bypass a step if desired by the operating personnel from the operator workstation. Such action however shall be registered as an exception or alarm.

c) Increase the reliability and availability of the plant as a whole, for example, by timely and correctly switchover to standby drives etc.

d) Priority of the following commands shall be as follows:

i) Manual intervention shall be possible at any stage of operation.
Protection commands shall have priority over manual commands and manual commands shall prevail over auto commands.

ii) A forcing facility shall be provided for changing the states of inputs and outputs, timers and flags to facilitate fault finding and other testing requirements. It shall be possible to display the signal flow during operation of the program.".

20) Interface of the system with MCC/Switchgears shall be in the form of potential free contacts via interposing relay modules mounted in the respective MCC/Switchgear unit. All other interposing relays (like solenoid valve etc.) shall be mounted in a cabinet seperate from the system cabinet.. 10% wired additional interposing relay modules shall be provided as installed spare.

Freewheeling diodes shall be provided across the coil of DC solenoid and contactors/relays. For AC solenoids and contactors directly driven from output cards, arc suppressors shall be provided across the coil.

Each RIO rack shall have 10% spare rack space for future up gradation.

21) The operator's station shall be responsible for handling all commands as well as in generating desired displays and print outs.

22) Programming shall be with an easily understandable high-level language. Programming shall also be permissible by drawing Ladder or Boolean Diagram. Single programming instruction/command shall be sufficient to delete a program rung from memory. Similarly, any rung can be inserted into the program. The active and the stand-by CPU programs shall equalize automatically, once the new program is permitted to 'RUN'.

23) Updating time and reaction time under worst case loading condition (system's response to an operator's command) for operator stations shall be as follows:
a) Calling up a mimic : 2 sec or better
b) Updating status signal in mimic : 1 sec or better
c) Updating variables in a mimic : 1 sec. or better
d) Issuance of command to output : 1 sec. or better (without considering process lag)

24) Programmable Controller shall be responsible for real time process parameter monitoring, storage & display.
Basic requirements are
i) Operator Interface,
ii) Basic Calculation,
iii) Alarm Monitoring with display & audio & Reporting,
iv) Display generation,
v) Logs,
vi) Trend Recording &
vii) Historical Storage & Retrieval.

25) The displays at the operator console shall be classified into overview display, group display, point display and trend display.

a) Overview display - This display is to enable the operator to set an overview of the entire plant section.

b) Group display - The group display page shall display several subsections & present status information.

c) Point display - Along with the specified parameter value, this page should indicate historical trend of the parameter.

d) Trend display - This display include real time/historical trend display facility including Dynamic Graphic Display & Bar Graph Display.

e) Alarm Message Display - It shall be possible to display process as well as system alarms for operator's attention and action. Alarm shall appear immediately on the operator workstation as and when they occur on priority basis. In addition to alarms appearing on different displays, the system shall also be able to display alarm summary and alarm history listing the date and time of occurrence, tag number, point description, type of alarm (absolute value or deviation), serial number of alarm in the sequence of occurrence etc. Alarm shall disappear from display only when they are acknowledged and cleared.

Abnormal condition in the system shall be displayed as system alarm message on the operator workstation irrespective of display selected.
In all cases occurrence of an alarm shall be logged.

26) Logs shall not be limited to the followings. The printing of these logs shall be initiated automatically at prescribed time intervals, or initiated on demand by the occurrence of predefined events.

a) Shift/Daily Log
A shift/daily log shall be provided to furnish data for routine analysis of plant performance. This log shall be automatically printed at specified time each day and on demand at any time.

b) Summary Log (On Demand)
The system shall permit the operator to specify minimum of 5 summary logs each with minimum of 25 points to be printed on demand.

27) The salient hardware/ software features of the PLC system for I/O handling shall be as follows.

a) Input filters to attenuate noise.
b) SWC of 500V DC common mode and 500V AC peak to peak
c) Common Mode Noise rejection for analog inputs of 120 db at 50 Hz.
d) Normal Mode noise rejection for analog inputs of 60 db at 50 Hz.
e) LED indicators on each card to show status of individual signal.
f) All the outputs shall be with individual fuse.
g) K type thermocouple mV input where applicable.
h) Pt-100 three / four wire resistance thermometer input where applicable.
i) Non change over/change over type of contacts
j) 24 V DC power supply to field mounted two wires transmitters.
k) 4-20 mA Input
l) 4-20 mA output
m) 24/48 V DC output signals for energizing interfacing relays

28) The salient hardware/ software features of the CPUs as follows:

a)	CPU Type	:	Single slot CPU module
b)	Max. scan time for I/O	:	I/O scan time must be less than 50% of the processor scan time.
c)	Maximum Scan Rate	:	0.25 ms (Per K Word) or better
d)	Memory capacity	:	25% spare capacity after full utilization. Expandable in multiples of 16 K.
e)	Communication processor	:	Integral / Separate
f)	Battery back up for RAM	:	Ni-Cd / lithium type, at least for 360 hrs continuous operations during power failure.
g)	Watch dog timer	:	Periodical reset. Alarm and interruption, if not reset within stipulated time.
h)	Diagnostic feature	:	Periodic, automatic self-diagnostic. Result available at the operator workstation.
i)	Communications	:	LAN-supporting multidrop.

29) The salient features of the Input / Output modules are as follows.

a) All modules

1. Ambient temp.	:	0-50 degC
2. Surge withstand capability	:	IEC-255.4

b) Digital General

1. No. of channels / module	:	32
2. Interrogation voltage	:	24V DC or 48 V DC
3. Status indicator	:	LED type.

	4. Isolation	:	Optical
c)	Digital Input Module		
	1. Contact bounce filtering	:	Adjustable time constant of 15 m. sec.
	2. Diagnostic	:	Module fault
d)	Digital Output Module		
	1. Output protection	:	Short ckt. Proof & Individual fuse
	2. Diagnostic	:	Module fault
	3. Rating	:	To switch ON/OFF interposing relays of approx. 3 VA at 24 VDC.
e)	Analog General		
	1. No. of channels / module	:	16
	2. Isolation	:	Galvanic/Optical
f)	High level Analog Input Module		
	1. Type of input	:	4-20 mA DC / 1-5V DC
	2. A/D Converter	:	11 bits + Sign (or better)
	3. Accuracy	:	0.1% or better
	4. Diagnostic	:	Module fault
	5. Powering of transmitter	:	24 V DC 2 Wire type
g)	Low Level Analog Input Module		
	1. Type of input	:	Pt-100; T/C(As required)
	2. C-J-C	:	On Module
	3. Accuracy	:	0.1% or better
	4. A/D converter	:	15 bits + Sign (or better)
	5. Diagnostic	:	Module fault
h)	Analog Output Module		
	1. Type of output	:	4-20 mA DC
	2. Accuracy	:	+ 0.1% or better
	4. A/D Converter	:	11 bits + Sign (or better)
	5. Load	:	500 Ohm
	6. Diagnostic	:	Module fault

Note : Electrical isolation of 1.5 KV with optical couplers between the plant input/output and controller shall be provided on the I/O cards.

5.13.14.3.(B) HISTORICAL STORAGE AND RETRIEVAL SYSTEM (HSRS)

i) The HSRS shall collect, store and process system data from HMI & Peripheral Interface System data base. The data shall be saved online on hard disk and automatically transferred to non-erasable long term storage media once in every 30 Days periodically for long term storage. Provision shall be made to notify the operator when hard disk is certain percentage full.

ii) The data to be stored in the above system shall include alarm and event list, periodic plant data, selected logs/reports.

iii) The system shall provide user-friendly operator functions to retrieve the data from historical storage. It shall be possible to retrieve the selected data on OWS in form of trend/report by specifying date, time & period. Further, suitable index files/directories shall also be provided to facilitate the same.

iv) In addition to above, the system shall also have facility to store & retrieve important plant data for a very long duration on portable external long term storage media. **Bidder shall provide two numbers of portable external hard drive of 2TB each.**

v) For long term plant performance analysis, the following plant data as a minimum with time stamping and interval as indicated in below table but not limited to shall be stored daily on historian.

vi) **For specification of Historical Storage Unit please refer clause no. 5.13.14.3(C).**

vii) Some Important plant data for a very long duration (plant life) Storage on Historian

Sl. No.	Parameter	Time Interval
1.	Weather Monitoring Stations data: Global Horizontal Irradiance, Global Inclined Irradiance and Diffuse Horizontal Irradiance, Ambient Temp, Wind Speed, Wind Direction, Rain Fall and Relative Humidity.	1 (One) Minute
2.	Calculated Daily Global Horizontal Insolation, Global Inclined Insolation and Diffuse Horizontal Insolation.	24 (Twenty Four) Hours
3.	Power Conditioning Unit (PCUs):- DC Voltage, DC Power, DC Current, SMB/SMU Current (PCU end), AC Active & Reactive Power, Power factor, AC Current & Voltage, Energy, Inverter room temp, Inverter Cabinet temp and Modules Temp	1 (One) Minute
4.	MFM, Energy meter and Numerical Relay data:- Active & Reactive Power, Energy (day), Current and Voltage	1 (One) Minute
5.	Export feeder/s Energy Meter Data:- Active & Reactive Power, Energy import and export, Current and Voltage and Grid Frequency.	1 (One) Minute
6.	Daily energy export from each Inverter	24 (Twenty Four) Hours
7.	Total sum of daily energy export from all Inverter	24 (Twenty Four) Hours

viii) **Minimum Hardware Requirements for the HSU Servers**

01. Processor	:	Intel Xeon or higher version prevalent during engineering or procurement stage
02. Clock Speed	:	2.66 GHz
03. NIC	:	4 No.1000Base-T
04. RAM	:	10 GB DDR
05. Graphic Card	:	256 MB 3D
06. Hard Disc	:	3x600 GB SATA (RAID 5) hot pluggable/swappable
07. Mounting Arrangement	:	Rack mounted to be mounted in a common Server Rack (rack to be supplied by bidder)
08. Mouse	:	Optical scroll
09. Keyboard	:	English
10. DVD drive	:	52 X DVD +/- RW SATA
11. Operating Voltage Range	:	90 V to 260 V, 50 Hz
12. Display Resolution	:	1920 X 1080 or greater
13. Serial Interface	:	9 Pin
14. Parallel Interface	:	25 Pin Hz
15. USB Interface	:	Yes
16. Monitor Interface	:	Yes
17. LAN Interface	:	RJ45, 10/100/1000 MB/s
18. Operating System	:	Windows 2008 standard R2 server 64 bit edition or higher version prevalent during engineering or procurement stage
19. Other Accessories	:	Mouse, Keyboard

(Historical Storage Unit hard disk shall have the capability for back up data for at least 02 years or as mentioned above, whichever is higher).

Monitor for the Server

01. Type	:	LED colour monitor
02. Screen diagonal	:	23”
03. Display	:	Full HD or better
04. Resolution	:	1920 X 1080 or better
05. Degree of protection	:	IP-30
06. External Controls Vertical amplification & shift	:	Brightness, contrast, Horizontal /
07. Power supply	:	240 V, 50 Hz, 1 phase
08. Ambient temperature	:	0-50 deg C
09. Humidity	:	95% non-condensing.
10. Version	:	To suit industrial application (latest version as per availability at the time of detailed Engineering/procurement).

5.13.14.3.(C) HUMAN MACHINE INTERFACE (HMI) AND PERIPHERALS

Engineering cum Operator’s Station/ Historical Storage Unit

Engineering cum Operator’s Work Station and Operator’s Work Station shall be of Industrial Grade.

1.	Processor	:	Engineering Cum Operators’ Workstations : 64 bit Server Grade (Xeon or Equivalent), Octacore minimum For Operators’ Workstation: 64 bit (i7 or Equivalent)
2.	Configuration	:	Tower
3.	Internal clock	:	3.2 GHz (min.)
4.	Architecture	:	64 bit
5.	Video Card	:	PCI

6.	RAM	:	Engineering Cum Operators' Workstations: 16 GB RAM upgradable to 24 GB minimum For operators' Workstation: 8 GB RAM upgradable to 16 GB
7.	Hard drive	:	Engineering Cum Operators' Workstations: 1 TB RAID1 For Operators' Workstation: 500 GB SATA (7200 rpm)
8.	Cache	:	512 KB Level 2
10.	Audio controller	:	16-bit
05.	Network	:	Interface Card
07.	Gigabit Ethernet	:	NIC (10/100/1000 Base T)
09.	Graphics card	:	Latest with minimum of 2 GB
10.	CD/DVD Drive Read & Write	:	16x or higher
11.	Operating system	:	Windows 10 Pro Downgrade win 7 pro 64 bit or latest All software shall be licensed version and license fee certificate shall be produced before product approval
13.	Communication ports	:	(a) RJ-45 NIC- 02 Nos. (b) USB ports – 04 nos (min.) (c) USB 3.0 - 02 nos (d) VGA port-1 no. (e) HDMI port – 1 no.
10.	Accessories	:	USB Keyboard, USB mouse
11.	Software	:	MS. Windows latest, MS Office Editor (EXCEL,WORD, POWER POINT), Adobe Acrobat, Anti Virus, Network Security, Etc. (All Softwares shall be of licensed version)

Monitor

01.	Type	:	LED

02.	Screen diagonal	:	23”
03.	Display	:	Full HD
04.	Resolution	:	1920 X 1080 or better
05.	Degree of protection	:	IP-30
06.	External Controls	:	Brightness, contrast, Horizontal / Vertical amplification & shift
07.	Power supply	:	240 V, 50 Hz, 1 phase
08.	Ambient temperature	:	0-50 degC
09.	Humidity	:	95% non-condensing.
10.	Version	:	To suit industrial application(latest version as per availability at the time of detailed Engineering/procurement).

Key Board

01.	Type	:	Flat spill proof membrane type or Positive depression type.
02.	Interface	:	USB
03.	Different keys	:	a) Soft and user defined function keys for software/ programming including text correction, scan rate alteration, zooming/ flashing color selection etc. b) Panel select keys for alarm summary, control loop display, overview, trend, graphic, operator guide message etc. c) Standard Alphanumeric keys d) Alarm acknowledge keys e) Cursor keys f) Mode/loop status switching keys g) Setting change keys h) Print-out command keys

			i) Other keys as required to operate the system
04.	Key lock	:	Lockable type push button mounted on keyboard
05.	Life Expectancy	:	50 million cycles per key
06.	Version	:	To suit industrial application

Color Laser Printer

01.	Type	:	Electro-photographic laser, tabletop
02.	Printer Memory	:	512 MB (min.)
03.	Speed	:	Monochrome 24 ppm - A4 Color 6 ppm - A4
04.	Resolution	:	1200 x 1200 DPI in color
05.	No. of color (Basic)	:	4 (four) minimum
06.	Duty cycle	:	Monochrome 75000 pages / month
07.	Power supply	:	240V AC, 50 Hz, 1 phase UPS
08.	Ambient temperature	:	0-50deg C
09.	Humidity	:	95% non-condensing.
10.	Interface	:	USB and Ethernet (RJ45)
11.	Size of paper	:	Letter, A4, Legal, Ledger, A3
12.	Print media	:	Plain paper, transparencies, thick stock, glossy stock, envelopes
13.	Special Features	:	1) Automatic Two-sided printing. 2) Built in Networking with Fast Ethernet 10/100 Base-T network port. 3) Minimum 2 Nos. Multi-purpose sheet tray
14.	Accessories	:	i) Printer table ii) Connector & Cable

5.13.14.3.(D) TIME SYNCHRONISATION EQUIPMENT

Time Synchronization equipment shall be provided at

- Switchgear cum control room at BkTPP (near Raw water Pond #1&2 area),
- Switchgear cum control room at STPS (near Raw water Pond #2 area),
- Switchgear cum control room at STPS (near Dutta bandh area) and
- New solar control room of SgTPP (adjacent to existing main solar control room).

Time Synchronization equipment shall be provided and shall be located in Control Room. It shall receive Coordinated Universal Time (UTC) transmitted through Geo Positioning Satellite (GPS) for time synchronization of all components of the SCADA.

i) It shall be complete in all respects including antenna, all cables, processing equipment, etc.

ii) All auxiliary systems and special cables required for synchronization of the equipment shall be supplied and commissioned by the Contractor.

iii) It shall work from DC supplies only and the Contractor to clarify if any built-in battery backup is provided, in which case, same shall be of long life lithium batteries.

iv) It shall be immune to hostile electrical environment. Suitable protections are to be provided against lightning surges and over-voltages in power supply systems and antenna feeders.

v) The system shall be fully tested to the relevant international standards such as IEC: 801 and IEC: 255.

vi) All components of the PLC based SCADA, Workstations and all numeric protection relays as per requirement under this scope of technical specification or offered by bidder shall be synchronized with an accuracy of 1ms.

vii) The GPS shall be synchronized with the SCADA system to be supplied under this contract. Necessary software and Hardware (including laying of communication cable) required for time synchronization with SCADA and all other devises shall be in scope of contractor.

viii) The system should be able to track more than 1 satellite at a time to ensure no interruptions of synchronization signals.

ix) The system shall have provisions for combination of any of the following output signals:

- NTP (network time protocol) 100Mbits Ethernet port
- IRIG-B00x (TTL, pulse width modulated signal)
- 2 x Pulse per half-hour/ Pulse per minute/ Pulse per second
- outputs via potential free contacts
- Any other output port as may be required for the offered system.

- Alarm status contact indicating healthy status of system

x) These output ports shall be compatible with the requirement of the equipment to be synchronized as per scope of the specification. The master clock in control room shall also be synchronized with the time synchronization system. The actual port requirements (no./type) in line with the system offered shall be finalized during detailed engineering.

xi) The equipment should have a periodic time correction facility of one-sec. periodicity.

5.13.14.3.(E) TECHNICAL SPECIFICATION FOR NETWORK FIREWALL

Offered firewall shall include but not limited to the following features-

A	**General**	
A1	Common Criteria Certification.	The offered product series or its operating system series must have achieved EAL (Evaluation Assurance Level) Certification of EAL4 or higher in the Common Criteria for Information Technology Security Evaluation (ISO/IEC 15408) for computer security certification.
A2	Architecture	The firewall should be a purpose built hardware appliance based next generation firewall (NGFW) solution having application awareness & Intrusion prevention function.
A3	End of sale	OEM End-of-sale declaration shall not have been released for the offered model at the time of the bid submission.
B	**Hardware Specifications & Performance Parameters**	
B1	Firewall Interfaces	Minimum Four or AS REQUIRED Nos of gigabit 10/100 base T Ethernet ports to be provided.
		Provision of addition of at least Two Nos of gigabit Fiber SFP ports shall be available.
		Each Port must be configurable flexibly in any security zone as per the requirement without any fixed zone assignments.
		All the above specified interfaces shall be firewall interfaces. Internal Switch interfaces shall not be considered.
		The Firewall shall NOT have any wireless interfaces.
B2	Security Zones	At least four Security zones must be supported.
C	**Firewall Inspection**	
C1	Application Support for Inspection	Should support standard protocols Internet based applications like Telnet, FTP, SMTP, http, DNS, ICMP etc. should be supported for filtering
		Internet web 2.0 applications & widgets.
C2	NAT & PAT	Dynamic NAT as well as one to one NAT
		Port / IP Address Forwarding
		PAT
C3	Resistance to Evasion	The firewall shall be able to detect and block evasion techniques including SYN flood, Address spoofing and TCP split handshake etc.

D	**Application awareness**	
D1	Application intelligence and control	Firewall should support detection of application regardless of port, protocol etc.
		firewall must identify and control applications sharing the same session
		The firewall should allow creation of securities policies to identify, allow, block or limit an application regardless of port, protocol etc.
E	**Intrusion Prevention System (Integrated with firewall)**	
E1	General	The IPS must provide intrusion prevention functionality out of the box.
		The IPS should be capable of accurately detecting intrusion attempts and discern between the various types and risk levels, including unauthorized access attempts, pre-attack probes, suspicious activity, vulnerability exploitation etc
		The IPS should provide protection from Advanced Botnets, inbound and outbound.
		The IPS should use stateful detection and prevention techniques and provide zero-day protection against worms, Trojans, spyware, keyloggers, and other malware from penetrating the network.
E2	Detection Methods	The offered solution should use the following methods for detection of malicious traffic:
		(a) Signature based detection
		(b) Statistical Anomaly based detection
E3	Threat Intelligence and signature Updates	The IPS OEM should have a 24x7 security service update and should support real time signature update of the system as soon as updates are released.
E4	Exception List	The IPS should support the creation of Access Control Lists to bypass the inspection of any specific flow.
E5	DoS/ DDoS protections	The offered solution should be capable of preventing Denial of Service and Distributed denial of service attacks.
E6	Threat control features	The offered solution should provide the following Security features:
		a) Detection and blocking malicious web traffic on any port.
		c) Capability of detecting attacks within protocols independent of port used
		d) IPS Sensor should allow the admin to create IPS policies on the basis of IP addresses and range.
E7	Signature Tuning	The offered solution should allow enabling/disabling of each individual signature. Each signature should allow granular tuning to suit user requirement.

5.13.14.3.(F) CONTROL DESK

i) Bidder shall provide control desk & chairs at each control room for engineering and operator's workstations and associated equipment of ergonomic design from reputed manufacturer especially designed for computer peripherals.

Also control desks & chairs shall be provided for CCTV server and associated equipment at each control room.

ii) All devices mounted on the control desks shall be flush type. Devices shall be so mounted that the removal and replacement can be accomplished individually without interruption of services to others.

iii) Aesthetic, argronomy and room illumination shall be considered while positioning of the desk and panels in control room.

iv) Control desk shall be free standing floor mounting type table top design for placing computer monitor and other hardwares. Desk shall be of latest technology aesthetic design and constructed from aluminium with high density fiber. All operators' workstations with LED monitors & keyboards, printers etc. shall be mounted on the desk. Desk shall be arranged in arc like shape. Exact profile & shape shall be finalized during detailed engineering.

v) Crating of the desks shall be suitable for protection against shock, vibration, inappropriate handling and inclement weather conditions during transportation and warehousing and all panel mounted equipment shall have adequate protection against damage during handling, transit and storage. Suitable desiccant shall be used inside the packing case.

vi) Workstations and other application terminals mounted on the control desk shall be powered from UPS feeders and each feeder shall be provided with MCB at the upstream of the permanent Power receptacles.
All the above furniture shall have permanent Modular type power receptacles of ISI standard having five Plug points (15Amps rated) with individual isolation switches.

vii) Technical Specification of Unit Control Desk

a) The frame / structure should be minimum 2mm thick Powder Coated Extruded Aluminum profile.

b) The Table Top / Work Surface shall be 36mm thick, Medium Density Fiber (MDF) board with high pressure laminate or Acrylic Plastic Solid Surface (APSS). Top surface shall be finished with anti-scratch material.

c) The curvilinear angles shall be 4 - 10 degree..

d) Foot extension shall be of Cast Aluminum & painted.

e) Foot Leveler shall be injection molded glass filled nylon foot with steel insert.

f) END Caps & Extruded PVC Caps shall be provided where required.

g) Front edge shall be extruded PVC or rounded post-formed laminate

h) Concealed cable tray shall be powder coated steel.

i) Design shall include Earthing bolts on left side end and right side end of the Workstation Desk / Rack.

j) Rectractable keyboard tray in the control desk shall be provided.

k) Rectractable tray with telescopic slide for CPU/PC block shall be provided.

l) Front and Rear door shall be considered.

viii) Chairs – Industry standard revolving chairs with wheels and with provision for adjustment of height (hydraulically/gas lift) shall be provided for the operators and other personnel in control room area. These shall be designed for sitting for long duration such that these are comfortable for the back. Arm-rests in one piece shall be of poly-urethane and twin wheel castor of glass filled nylon.

ix) One Printer Table made of Laminated Wood or Heavy Duty MDF shall be provided for printer.

x) All the furniture shall be of reputed make (Godrej or Equivalent).

5.13.14.3.(G) SCADA PANEL/CABINETS

i) The SCADA cabinets shall be IP-22 protection class.

ii) The Contractor shall ensure that the packaging density of equipment in these cabinets is not excessive and abnormal temperature rise, above the cabinet temperature during normal operation or air-conditioning failure, is prevented by careful design. The Contractor shall ensure that the temperature rise is limited to 10 deg. C above ambient and is well within the safe limits for system components even under the worst condition and specification requirements for remote I/O cabinets.
Ventilation blowers shall be furnished as required by the equipment design and shall be sound proof to the maximum feasible extent. If blowers are required for satisfactory system operation, dual blowers with blower failure alarm shall be provided in each cabinet with proper. Suitable louvers with wire mesh shall be provided on the cabinet.

iii) The cabinets shall be designed for front access to system modules and rear access to wiring and shall be designed for bottom entry of the cables.

iv) The cabinets shall be totally enclosed, free standing type.

v) The cabinets shall be equipped with full height front and rear doors. If width of a cabinet is more than 800 mm, double doors shall be provided.

vi) Panel / Desk shall have gland plate at cable entry to panel.

vii) Panels / enclosure shall be provided with 20% spare terminals. In addition, the spare hot on rail mounted input output channels /modules shall be in fully wired & terminated condition for system cabinets.

viii) Contractor shall provide the two UPS power supply feeders and one raw supply feeder of suitable rating to cater all the load requirements of SCADA panel/cabinet/control desk. System remain in service in case of single power supply failure/power supply module failure.

Suitable alarm shall be generated in case of any power supply failure.

ix) The cabling / wiring between OWS & CPU'S, power supply cables etc. shall be aesthetically routed and concealed from view.

x) Panel shall conform to the requirement as mentioned below:

01.	Material of construction	:	Cold rolled steel sheet
02.	Thickness of Sheet	:	a) 3.0 mm for faces supporting instruments / terminals. Mounting plate shall also be 3.0 mm. b) 2.0 mm for other sides inclusive of top.
03.	Construction	:	Welded throughout as per (metallic parts) approved National Standards.
04.	Panel height	:	2300 mm maximum
05.	i) Corners	:	7 mm inner radius
	ii) Dimensional Tolerances	:	a) In height & length - 3 mm b) In height between adjacent sections - 2 mm. c) Total for a group - 6 mm
06.	Doors	:	Double, recessed, turned back edges. Doors shall have 4 point IP Lock
	i) Thickness of Sheet	:	2 mm
	ii) Hinges	:	It shall be of Stainless steel. Hinges shall be of concealed type.

	iii) Door latches	:	Three point type.
	iv) Door gaskets	:	Neoprene rubber on fixed frame to result dust proof/weatherproof enclosure.
	v) Opening of the doors	:	Outward. Door swing shall be Min. 110-120 Degree
	vi) Louvers	:	With removable wire mesh to ensure dust and vermin proof.
07.	Color of interior	:	Brilliant white (Approval shall be accorded by owner during detail engineering)
08.	Colour external	:	RAL 7032 (Approval shall be accorded by Owner during engineering)
09.	Painting	:	Epoxy powder coated or better. Minimum Paint thickness shall be 80-100 microns
10.	Gland plates	:	Removable 4 mm thick (bottom)
11.	Cable entry	:	Bottom
12.	Hardware	:	a) Anti vibration pad- 15 mm b) Predrilled base channel ISMC – 100 or equivalent for all sides. c) Lifting hook / Eye bolt d) Drawing pocket e) Door switch, lamps, thermostat, heaters and fans

5.13.14.3.(H) INSTRUMENTATION CABLE

a) General Requirements

i) Bidder shall supply, erect, terminate and test all instrumentation cables for control and instrumentation equipment/devices/systems included under his scope.

ii) Any other application where it is felt that instrumentation cables are required due to system/operating condition requirements, are also to be provided by Bidder.

iii) Bidder shall supply all cable erection and laying hardware like cable trays, supports, flexible conduits, cable glands, lugs, pull boxes etc. on as required basis for all the systems covered under this specification.

iv) The Cables shall be supplied in non-returnable standard seasoned drums. The drum length shall be 1000m (± 5%) up to & including 8 pairs and 500 m (± 5%) above 8 pairs. Drum shall be anti rodent, anti termite and smooth finish. Both ends of cable shall be capped by means of non hygroscopic sealing material.

v) Durible marking shall be provided on the outer sheath of the cable at intervals not exceeding 5 metres. Marking shall include Manufacturer's name, Year of manufacture, Voltage grade, Type of cables (Conductor size & no. of pairs / type of compensating /extension cable, Analog or Binary), Insulation material, FRLS etc.
Sequential length marking shall also be provided at every metre interval on outer sheath of cable.

vi) For all Digital Output (DO) signal from PLC, minimum 1.5 Sq mm cable shall be used. Moreover, bidder shall submit the calculations for selecting the cable size.

vii) Multipair individual pair shielded & overall shielded twisted pair instrumentation cable (2/4/8/12pair) shall be used for analog signals with stranded copper conductor.
Multipair overall shielded & twisted pair instrumentation cable (2/4/8/12pair) shall be used for binary signals with stranded copper conductor.

viii) All cables shall be FRLSH type (inner and outer sheath) and armored. Short run cables may be unarmored. Unarmored cables shall run through conduits.

ix) Fibre Optic cables in the field shall be laid through HDPE conduits for buried section and through dedicated encased perforated GI trays for over-ground section.

x) DI & DO signal cannot be routed through the same cable.
AI & AO signal cannot be routed through the same cable.

xi) Each instrumentation cables shall have 20% or minimum one pair, whichever is higher, as spare.

xii) Cable laying of C&I cable on perforated cable trays shall not exceed three (3) vertical layers.

xiii) The screen shall be grounded at the electronic equipment room /control room end only. Adequate separation shall be maintained from electrical cables carrying 240 V AC or higher voltage levels to avoid electrical interference.

xiv) Two pair or Two triad signal cables as well as multi-pair or multi-triad signal cables shall not have individual conductor cross section less than 0.5 mm2.
For interposing relay drive connection, individual conductor cross section shall be 1.5 mm2.

b) Detail Specification of Multi-paired Instrumentation cables

01.	Conductor type	:	Multi-stranded annealed tinned high conductivity copper
02.	Conductor size	:	0.5 / 1.0 / 1.5 Sq.mm (as required)
03.	Conductor resistance	:	39 Ω/Km/ 18 Ω/Km/ 12 Ω/Km
04.	Conductor Insulation	:	Extruded PVC meeting the requirements of VDE 0207 Part 4 compound Y I3. Insulation thickness for individual core shall be between 0.28 and 0.35 mm for 0.5 mm2 cables, 0.5 to 0.6 mm for 1.0 mm2 cables and 0.8 to 0.9 for 1.5 mm2 cable.
05.	Voltage Grade	:	225 V (peak value)
06.	Twisting	:	Twin twisted with lay of 50 mm (max)
07.	Twisting Direction	:	All pairs in the same direction. Lapped to form bunch with mylar tape.
08.	Screen (Pair & Overall)	:	Aluminium mylar tape with a thickness of 28 µm (min.) for individual pair screen and 60 µm (min.) for overall screen with 100% coverage and 25% overlapped edges. Over the individual pair screening tape two laps of 0.05 mm thick (min.) polyster tape shall be applied with minimum overlap of 25%. Metallic side of the screen shall be in contact with drain wire. Analog signals - Individual pair & overall shield. Binary signals - overall shield.
09.	Drain wire	:	Annealed tinned copper wire, stranded. Size 0.5 Sq. mm. (No. of strands / size:- 7 / 0.3mm). Separate drain wire for individual pair shield (wherever applicable) as well as overall shield.
10.	Inner Sheath	:	Extruded PVC (compound YM1) as per VDE 0207 Part 5 (anti rodent, anti termite & moisture resistant properties) and shall be of flame retardant low smoke low halogen (FRLSH) type
11.	Fillers	:	Non metallic flame & moisture retardant

12. Armouring : GI wire / strip

13. Outer Sheath : Extruded PVC (compound YM1) as per VDE 0207 Part 5 and shall be of flame retardant low smoke low halogen (FRLSH) type

14. Temperature Range : 70 degC (continuous) except for high temperature resistant Teflon insulated cables which shall be suitable for continuous operation at 205 degC

15. Sheath colour : Inner- Black and Outer- Sky Blue

16. Tests on outer sheath :
    a) Oxygen Index: Min.29% at room temp. (ASTMD-2863)
    b) Acid Gas Gen.: Max.20% by weight as per IEC 754 Part-I
    c) Temp Index : Min 250O C (ASTMD-2863)
    d) Smoke Density Rating : Max.60% (ASTMD-2843).
    e) Complete cable assembly shall pass Swedish Chimney Test- as per SEN-4241475 AND Flammability Test as per IEEE-383.

17. High voltage test :
    a) Core to core - 1.5 KV for 1 min.
    b) Core to screen - 1.0 KV for 1 min.
    c) Screen to Armour - 1.0 KV for 1 min.

18. Rodent & Termite repulsion test: Presence of lead shall be confirmed

19. Colour of core insulation for Instrumentation Cable

Pair	Core	Color
1st	1st	Blue
1st	2nd	Red
2nd	1st	Gray
2nd	2nd	Yellow
3rd	1st	Green
3rd	2nd	Brown
4th	1st	White
4th	2nd	Black

Above 4 Pairs, 4 Pairs making a unit shall have indelible printed colour coded bands like Pink for 1st unit, Orange for 2nd unit and Violet for 3rd unit and so on. In addition band marking, for example single band for 1st unit, double band for 2nd unit and so on, shall be provided on each conductor for identification of

unit. Band marking on individual core shall be provided at regular intervals not exceeding 50 mm.

c) Cable Parameters

Cable parameters such as mutual capacitance between conductors, conductor resistance, insulation resistance, characteristic impedance, cross talk and attenuation figures at 20 deg. C (± 2 deg. C) for various types of cables as applicable shall be as specified in TABLE-1.

TABLE-1

SL. NO.	PARAMETER / TYPE	TYPE – F	TYPE – G	REMARKS
01.	Mutual Capacitance at 0.8 kHz (max.)	120 nF/Km.	100 nF/Km.	
02.	Conductor Resistance (max.)	73.4 Ohm/km (Loop)	73.4 ohm/km (loop)	
02.	Insulation Resistance (minimum)	100 M ohm/km	100 M ohm/km	
04.	Cross-talk figure at 0.8 kHz (minimum)	60 dB	60 dB	
05.	Characteristic Impedance (maximum) at 1 kHz	320 ohm	340 ohm	
06.	Attenuation at 1 kHz (maximum)	1.2 dB/Km	1.2 dB/Km	

d) Identification of the cores & pairs shall be done with suitable colour coding & band marking as well as by numbering of cores/pairs as per VDE: 0815. The details of colour coding etc. shall be as approved by Owner during detailed stage.

Also refer TABLE - 2 for description of various type of cables.

TABLE- 2

Description of various types of cables

Sl. No.	Type	Conductor size in sq.mm	R E M A R K S
01.	F	0.5	2 pair or Multipair individual pair & overall shielded twisted pair instrumentation cable (2/4/8/12 pair) for analog signals with stranded copper conductor.
02.	G	0.5	2 pair or Multipair overall shielded & twisted pair instrumentation cable (2/4/8/12 pair) for binary signals with stranded copper conductor.

5.13.14.3.(I) OPTICAL FIBER CABLE

i) This specification defines the minimum general requirements for the Design, manufacture, supply, inspection, installation, testing & commissioning of optical fiber cables and accessories, such as fiber distribution (patch) panels, adapters, connectors, joint boxes, pigtails and other components, as required to complete the system. Bidder shall consider all related activities, such as cable stripping, cable entry in boxes and panels, cable fiber splicing/fusion, cable performance testing and other services, to achieve a properly documented and operational cable network. all Fibre Optic cables shall be Single Mode type.

ii) Fiber Optic Cables shall be installed on cable tray, duct bank, cable trench installation as necessary. For outdoor applications the cable shall be armoured with Poly Ethylene sheathing. In all cases cable shall be routed through suitable grade HDPE permanently lubricated protection pipe as per IS 4984, IS 12235 & TEC.G/CDS-08 /01of suitable size @ 53% fill factor. Permanent route marking in FRP (Fibre Reinforced Plastic) material shall be provided at intervals not exceeding 5 meters for all FO cables layed outdoor buried under the ground.

iii) The Optical Fiber core shall be of ultra-pure fused silica glass coated with UV cured acrylate suitable to withstand temperature of about 80 degC (continuous).

iv) Fiber optic cable shall be of loose tube design. Typically, fibers shall be housed in-groups of 6 (minimum) within gel-filled buffer tubes to protect against ingress of moisture and vibration. The tubes shall be manufactured with industry standard material like Poly-Butylenes Terathylate (PBT). They shall be colored for easy identification. Buffer tubes shall be approachable with industry standard tools and practices. The buffer tubes shall be stranded around the Central Strength Member utilizing Reverse Oscillating Lay (ROL). Blank fillers shall be used as necessary to maintain circular cable structure. The fiber optic cable shall withstand water penetration when tested with a one meter static head or equivalent continuous pressure applied at one end of a one meter length of filled cable for one hour. No water shall leak through the open cable end.

v) The central strength member of the cable shall be Fiberglass Reinforced Plastic (FRP) or other material with equivalent mechanical strength to provide both tensile and anti buckling strength to the cable.

vi) In addition to central strength member, additional strengthening substance like aramid yarns shall be helically applied over the cable core to provide additional tensile strength to the cable.

vii) The cable shall be of dual jacket & armoured. Inner sheath consists of a medium density polyethylene (MDPE) jacket extruded over the cable core.

viii) Two highly visible ripcords are placed under the jacket to aid in sheath removal. A co-polymer coated steel tape is corrugated and wrapped around the inner jacket to provide additional cable compression strength and rodent protection. The armor is covered with an outer black FRLS MDPE jacket. A ripcord is also placed underneath the armor for easy outer jacket removal.

ix) Minimum bending radius shall be equal or more to 15 D (D= Diameter). A continuous strength member shall be provided for the entire length of the cables. Every tube and fiber shall be colour coded to provide easy identification. The outer sheath shall be marked to show fiber type and cable classification at suitable intervals.

x) The entire length of each cable shall be marked with the following items:

- Manufacturer's Name
- Month and year of manufacturing
- Coded description of the cable based on Telcordia's (Bellcore) SR-2014 Suggested Optical Cable Code (SOCC).
- Sheath Identification Number
- Sequential Length Marking in meter
- A Telephone Handset symbol to distinguish communication from power cable as per NESC section –35 G.

xi) Fiber optic cable shall provide a long life expectancy of minimum 25 years and shall meet the industrial standard of operation at temperature of 55 deg C and humidity to 100% without degradation to optical or mechanical performance.

xii) Minimum 100% cores shall be kept as spare in all types of optical fibre cables.

xiii) All testing of the optic fibre cable being supplied shall be as per the relevant IEC, EIA and other international standards.

xiv) The outer sheath shall have Flame Retardant, UV resistant properties.

xv) Optical fiber used in the plant shall generally conform to the following specification.

i. Specification for G.652 monomode fiber

ATTRIBUTES		VALUE
1.	Cladding Diameter	: 125µm ± 1.0µm
2.	Cladding non-circularity	: ≤ 1.0%
3.	Attenuation Coefficient at	
	(a) 1290 nm to 1340 nm	: < 0.36 dB/km
	(b) 1525 nm to 1575 nm	: < 0.25 dB/km
4.	Chromatic Dispersion Coefficient at	
	(a) 310 nm	: < 3.5 ps/nm.km
	(b) 1550 nm	: < 18 ps/nm
5.	Polarization Mode Dispersion (PMD)	: ≤ 0.5 ps/√km
6.	Mode Field Diameter at	
	(a) 1310 nm	: 9.2 ± 0.4 µm

	(b) 1550 nm	:	10.50 ± 1.0 µm
7.	Mode Field Concentricity Error	:	≤ 0.5 µm
8.	Proof Test	:	≥ 1%
9.	Fiber Curl (ROC)	:	≥ 4.0 m
10.	Macro-bend Test on Fiber at 1550 nm	:	≤ 0.1 dB

ii. Cable assembly

Optical Fiber Environmental Splice Enclosure

Optical fiber environmental splice joint enclosures shall be re-enterable and rack / wall mountable. The interior splice case shall be equipped to mechanically accommodate single-mode optical fibers connected by the fusion method. Splice case shall be equipped to organize the splice trays and the required service loops of buffered incoming optical fibers and outgoing 'pigtails' in such a way that allows each completed splice and associated optical fiber to be maintained in an unstrained configuration. Splice enclosure shall be dust and weather proof.

iii. Fiber Optic Distribution Patch Panel

Fiber optic distribution panels shall be provided as required. The fiber optic distribution panels shall be of a standard wall mounted sheet metal enclosure type. Fiber optic distribution panels shall be equipped to secure optical fiber patch cables and pigtails to prevent damage during all operation and maintenance functions. In general splice enclosure are envisaged. However,
If no optical fiber splice enclosures are implemented, than the fiber optic distribution panels shall be equipped with splice trays for storage and protection of fusion splice connections of single-mode fiber optic cable and pigtails. Each fiber optic distribution panel shall be fully equipped with 'SC' type bulk head connector sleeves or equivalent. Unused sleeve ports shall be equipped with reusable caps to prevent the intrusion of dust.

iv. Pigtail and Patch Cord

All pigtails shall be factory SC-connectorized, and satisfy specified performance for optical links. All unused pigtails (including spares) shall be terminated with the connector to a bulkhead connector sleeve, protected by a reusable cap on the opposite sleeve port, to prevent the intrusion of foreign material or dust. All necessary connectorized pigtails shall be provided in the lengths required.

v. Tests

Following minimum test as per any approved standards shall be carried out on the cables

a. Attenuation and Dispersion Characteristics Tests
b. Proof Tests
c. Macro-Bend Resistance Test
d. Mechanical Tests
e. Low And High Temperature Cable Bend Test
f. Impact Resistance Test
g. Compressive Strength Test
h. Tensile Strength Test
i. Cable Twist Test
j. Cable Cyclic Flexing Test
k. Environmental Characteristics Test
l. Temperature Cycling Test
m. Color Permanence Test Cable Aging Test
n. Water Penetration Test
o. Lightning Test
p. Routine Test / Sample Test
Site Test (Like Continuity & Attenuation)

5.13.14.3.(J) COMMUNICATION CABLE (MODBUS)

i) Data (Modbus) Cable to be used shall be shielded type with stranded copper conductor based on VDE 0881. Cable shall have minimum 2 pair each with conductor size of 0.5 SQMM and core identification shall comply with DIN 47100.

ii) Cable shall be flame retardant according to IEC 60332-1- 2. Equivalent Standard Surge protection device to be provided shall be approved from UL/CSA or any national/international approved lab.

5.13.14.3.(K) UNINTERRUPTED POWER SUPPLY (UPS) SYSTEM

A. <u>UPS (>=3 KVA)</u>

Please refer **<u>Annexure-I</u>** for detail technical specification of UPS (>=3KVA) System.

B. <u>UPS (<3 KVA)</u>

01.	Type	:	Packaged Unit, Solid-state SCR/ power Transistor & Microprocessor controlled.
02.	Duty	:	Continuous

03.	Enclosure	:	Sheet steel, IP-42
04.	Transformer	:	Ferro-resonant
05.	Inverter	:	Solid state pulse width modulated
06.	Inverter Capacity	:	To be decided by the bidder on load calculation. 25% extra capacity margin to be considered.
07.	Control	:	Microprocessor based.
08.	Battery	:	220 Volt, Ni-Cd vented type, pocket plate high discharge battery of adequate capacity to meet the requirement of UPS, generally confirming to IS-10918
09.	Total harmonic distortion	:	< 2%
10.	Harmonic attenuation	:	400%
11.	Line regulation	:	Better than ± 5%
12.	Load regulation	:	Better than ± 3%
13.	Spike attenuation	:	3000 : 1
14.	Power factor	:	Self correcting > 0.95
15.	Metering display	:	Frequency, Battery, input, output voltage & % load
16.	Status display	:	ON, on battery, low battery, self diagnostic malfunction alarm with SPDT potential free contacts rated at 230 VAC, 5A for each alarm.
17.	Output		
	a) Voltage	:	240 V A.C, 50 Hz,1-phase +/- 1.0%
	b) Frequency	:	50 Hz(+/- 0.5%)
	c) Load Power factor	:	0.8%
	d) Wave form	:	Sinewave
18.	Input		
	a) Voltage	:	180 V to 270 V A.C
	b) Frequency	:	45 to 60 Hz
	c) Power Factor	:	0.92
19.	Battery back-up		

	capacity	:	60 Minutes at full load
20.	Charger	:	Built-in
21.	Static switch	:	Built-in
22.	Quantity	:	As required
23	Rating / Capacity	:	125% of System powering capacity

5.13.14.3.(L) CCTV SURVEILLANCE SYSTEM

Please refer **Annexure-II** for detail technical specification of CCTV System.

5.15.15 CABLES & CONDUCTOR:

5.13.15.1 SCOPE

The scope of work under these specification covers the Design, Manufacture, Assembly, Shop Testing, Delivery at site, transit insurance, Storage, Erection, Testing & Commissioning of power, control and instrumentation cables (complete with cable terminals and all accessories for making the systems complete and for warranting a trouble free and safe operation).

The scope shall also include supply of all material, fabrication and erection of cable supporting structure, cable trance, cable racks & trays as well as laying of cables on cable racks.

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

5.13.15.2 STANDARDS

The equipment 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 60529/IEC60502	All cables that are submerged or in contact with water should be with IP 68 rating.
2.	IS: 7098 – Part 1	Cross linked polyethylene insulated PVC sheathed cables for working voltage up to and including 1.1kV
3.	IS: 7098 – Part 2	Cross linked polyethylene insulated PVC sheathed cables for working voltage from 3.3kV up to and including 33kV
4.	IS 10418	Drums for cables
5.	IS 8130	Conductors for insulated electric cables and flexible cords

Sl. No.	Standards	Description
6.	IS 8308	Compression type tubular inline connectors for aluminium conductors
7.	IS 8309	Compression type tubular terminals for aluminium conductors
8.	IS 8438	Moulds of cast resin based straight joints of cable up to including 1.1kV
9.	IS 11967	Specifications for co-axial cables
10.	IS : 2062	Structural Steel (Standard Quality)
11.	IS : 513	Cold rolled low carbon steel sheets & strips
12.	IS : 277	Galvanized sheet steel
13.	IS : 808	Rolled Steel Beam, Channels and Angle section
14.	IS : 2629	Recommended practice for hot dip galvanizing of iron and steel.
15.	IS : 2633	Method of testing uniformity of coating on zinc coated articles.
16.	IS : 800	Specification for use of structural steel in general building construction.

Cables and other accessories complying with other internationally accepted standards such as IEC, IEEE, BS, etc. will also be accepted if they ensure performance and constructional features equivalent or superior to standards listed above. In such a case the Contractor shall clearly indicate the standard/standards adopted and furnish a copy of English version of the latest revision of the standard(s) along with the Bid and the salient features of comparison shall be brought out.

5.13.15.3 GENERAL REQUIREMENTS

Minimum requirements are mentioned hereunder.

- The cables shall be of type and design with proven record of similar power station installations.
- The colours of the cables (both AC & DC) should be so selected that there should not be any problem for identification of cables used for various circuits during inspection & testing.
- To facilitate easy identification of cores, multi-core control and instrumentation cables shall be colour coded by using PVC insulation of red, black, yellow, blue and grey colours in accordance with IS 1554 (Part I).
- Cable lengths shall be considered in such a way that straight through cable joint is avoided. However no cable joint is allowed in DC cable from module to SMB and from SMB to PCU / Inverters.

- Cable terminations shall be made with suitable cable lugs & sockets etc, crimped properly and passed through brass compression type cable glands at the entry & exit point of the cubicles.
- Cables shall be shipped in non-returnable drums, adequately braced, and with cable ends adequately sealed to prevent ingress of moisture.
- The contractor shall ensure that no bimetallic action takes place between the Aluminium conductor of the cable and the cable connecting lugs by filling the lugs with suitable compound.
- For the main cable ways, a system of cable racks and trays as well as cable ducts and trenches shall be provided. The power and the control cables will run on separate trays. The cables for emergency lighting, fire alarm systems, etc., shall run on separate trays. The power cables shall be laid on the uppermost rack to prevent spread of fire.
- In indoor installations, the cables must be laid through PVC conduit or GI pipe. In case of using metallic pipe as conduit proper grounding of the conduit must be done.
- Different voltage grade cables will be laid in separate trays when trays are run in tier formation. Power cables will normally be on top trays and control/instrumentation cable on bottom trays.
- Exposed cables, wherever, used, shall preferable have UV resistant jacket besides being water resistant.
- Cables for each equipment must be tagged with permanent metal tag of impregnated cable number as per drawings at MCC/switchgear end and equipment terminal end as well as in the mid portion of the cables at certain distances as instructed by the owner or his authorized representative.
- The loop length shall be provided for various cables as per the relevant Indian Standard.
- All types of control as well as instrumentation cables shall have at least 10% spare cores.
- Cables shall be properly clamped at regular intervals with the help of non magnetic/molded fiber glass strip clamps/PVC sleeved clamps, of suitable size.
- When power cables are laid in the proximity of communication cables, the minimum horizontal and vertical separation between them may be 300 mm.

- Proper sealing arrangements at the points of cables entering the enclosures should be incorporated. Although not mandatory, manufacturers are however encouraged that the cables entering into the enclosures be sealed with modular EPDM based cable sealing and protection system based on multi-diameter technology.
- Cable selection criteria: In cable sizing the following are to be taken into consideration.
    - Short circuit current and duration
    - Continuous current.
    - Installation conditions.
    - Voltage drop under normal running and starting condition.
- Cable identification: Cable identification shall be provided by embossing on every meter

5.13.15.4 TECHNICAL REQUIREMENTS FOR CABLES AND CONDUCTOR

Minimum Technical requirements are mentioned below:

- All cables and connectors for use for installation of solar field must be of solar grade which can withstand harsh environment conditions including High temperatures, UV radiation, rain, water, humidity, dirt, burial and attack by moss and microbes for 25 years and voltages as per latest IEC standards.
- The cables used in module/ array wiring shall be TUV 2Pfg 1169/08.2007 or VDE EPV 01:2008-02 or UL4703/ EN 50618certified.
- Temp. Range 0°C to +90°C. Cable must be able to withstand this ambient temp range while carrying max current. Maximum and minimum withstand temperature of cable must be mentioned in engineering drawing for approval of purchaser with documentary proof.
- Fulfils IEC 60332-1 requirements. Accredited lab test report/Manufacturer's test report shall be attached.
- Conductor class IEC 60228 class 5. Accredited lab test report/Manufacturer's test report shall be attached. Only Copper conductor is to be used.
- All cables shall be Fire Retardant Low Smoke (FRLS) type. The cables shall be sized based on the following considerations:
    - Rated current of the equipment
    - The voltage drop in the cable, during motor starting condition, shall be limited to 10% and during running condition, shall be limited to 3% of the rated Voltage

- Overload protection is to be provided. Design Overload capacity for 10 sec of 125% of continuous rating. The principle aim in this protection is to reduce the over voltage to a tolerable value before it reaches the PV or other subsystem components. The source of over voltage can be lightning or any other atmospheric disturbance.
- Short circuit withstand capability De-rating factor for various conditions of installations shall be considered while selecting the cable size
- Variation in ambient temperature for cables laid in air
- Grouping of cable
- Variation in ground temperature and soil resistivity for buried cables

- HT cable shall be designed based on the short circuit conditions and LT cable shall be sized based on the voltage drop.
- For breaker protected circuits minimum size will be determined by short circuit rating.
- Size of aluminium power cable shall in no case be less than 16 mm^2 and copper power cable shall not be less than 4 mm^2. Where there is requirement of cables less than the above mentioned values, copper cable of appropriate size but not less than 4 mm^2 may be used.
- Minimum size of the control cable for CT circuit shall be 2.5 mm^2 and that for potential circuit shall be 2.5 mm^2.
- The cables shall be capable of satisfactory operation under a power supply system voltage variation of ± 10% and frequency variation of ± 5% and a combined frequency voltage variation of 10% (absolute sum). The cables shall have heat and moisture resistant properties.
- DC and LT Power cable Voltage drop criteria: From Module to Inverter end before connection individual voltage drop shall be limited to maximum 1.5 % of rated voltage. From Inverter to Inverter transformer shall be limited to 0.5% of the rated voltage. For HT cable (from Inverter transformer to evacuation point) maximum voltage drop shall be limited to 0.5% of the rated voltage.
- For all other LT cable, maximum voltage drop shall be limited to 2.5 % at rated voltage.
- All XLPE cables shall be rated at 90 deg C conductor temperature for AC voltage drop calculation and 80 deg C for DC Voltage calculation.
- The short circuit withstand temperature shall be 250^0C and 160^OC for XLPE and PVC cables respectively.

- All cables shall be suitably derated as per the laying condition for carrying the required load current and fault current. For derating the ambient temperature for directly buried cables or laid in air shall be taken as 50 deg C.
- All Power cables shall be XLPE, FRLSH.
- The Jointing Boxes shall comply in all aspects with the provision of the latest issue of relevant standards.
- The control cables shall be multi-core, colour coded, annealed, stranded high conductivity copper, single conductor, insulated with HR-PVC insulation, PVC sheathed, unarmored FRLS type conforming to IS 1554 (part I & II)/relevant IEC. The outer sheath is of specially formulated PVC compound.
- The instrumentation cables in addition to meeting the requirements of control cables shall be provided with electrostatic shielding by aluminium tape and screening by annealed tinned copper wire.
- Multipair, individual pair & overall screened, twisted pair instrumentation cable shall be provided for analog signals with stranded copper conductor.
- Multipair, overall screened & twisted pair instrumentation cable shall be provided for binary signals with stranded copper conductor.
- For connecting solar modules with solar inverter via array junction box, three winding transformer output with 33 kV Indoor Switchgear (33 kV) and 33 kV Indoor Switchgear (33 kV) with the 33 kV Switchyard (33 kV), cables of suitable size shall be provided.
- Cabling from Control Room to adjacent 33 kV Switchyard to be made through Cable Trench of suitable size as per relevant standard.
- Cable to be routed in standard manner through cable trays & cable marker to be placed for future identification.
- Cable route along the Oil pipe or crossing the Oil pipe line inside plant premises shall be as per statutory safety rules and NIT drawing.
- For physical protection of unarmoured cables (wherever used) suitable conduit to be provided wherever necessary. Armoured cable is to be used wherever required.
- The communication confined within the control/equipment room shall be through Shielded twisted Pair cable (STP) CAT 6.
- Single mode FO cable will be provided, wherever FO cable is required.

- Dual redundant Optical Fiber Communication (OFC) cable shall be considered, wherever possible. Necessary ports/converters/hardware/software shall be provided.
- Separate system will have dedicated FO cable (as applicable).

RATINGS & REQUIREMENT OF POWER & CONTROL CABLE

HV POWER CABLES 33/36 kV GRADE

1.0 33000/33000 V grade 90 Deg.C rating heavy duty XLPE power cable suitable for use in 33000V non-effectively earthed system conforming to following requirement and in line with IS-7098, IS:8130 & IS:5831, IS:3975.

1.1	Conductor	:	Stranded and compacted aluminium conductor of grade H2 and class 2 for all sizes, generally conforming to IS:8130.
1.2	Conductor Screen	:	Extruded semi-conducting compound.
1.3	Insulation	:	Extruded cross linked polyethylene (XLPE) conforming to IS:7098
1.4	Insulation Screen	:	Extruded semi-conducting compound with a layer of non-magnetic metallic tape. For single core armoured cables, the armouring shall constitute the metallic part of screening. The semi-conducting tape shall be easily strippable.
1.5	Core Identification	:	By coloured strips applied on (For three core cables) cores or by numerals.
1.6	Inner Sheath	:	Extruded PVC compound conforming to type ST2 of IS:5831 for three core cables. Single core cables shall have no inner sheath. Filler material shall also be of type ST2 PVC.
1.7	Armour	:	Galvanised single round steel wire armour for twin and multicore cables. Non-magnetic hard drawn aluminium

		single round wire conforming to H4 grade of IS:8130 for single core cables.
1.8 Overall Sheath	:	Extruded FRLS PVC compound conforming to type ST2 of IS:5831.

- **L.V. POWER CABLES 1100 V GRADE**

1.0 1100 V grade, 90^0 C rating, heavy duty, XLPE power cable conforming to following requirement and in line with IS-1554, IS-5831, IS-8130 & IS-3975, 7098

1.1 Conductor	:	Stranded and compacted plain aluminium of grade H2 and class 2/stranded, high conductivity annealed plain copper as per Annexure, generally conforming to IS:8130.
1.2 Insulation	:	Extruded Cross Linked polyethylene (XLPE) conforming to IS:7098(Part-3).
1.3 Inner Sheath	:	Extruded PVC compound conforming to type ST2 of IS:5831 for multicore cable. Single core cables shall have no inner sheath.
1.4 Armour	:	Galvanised single round steel wire armour for twin and multicore cables. Non-magnetic hard drawn aluminium single round wire conforming to H4 grade for single core cables.
1.5 Overall Sheath	:	Extruded FRLSH PVC compound conforming to type ST2 of IS:5831.
1.6 Core Identification	:	By color coding
1.7 Overall Sheath	:	Extruded FRLS PVC compound conforming to type ST2 of IS:5831. having improved fire performance category and type as stated below. Category Type C2 FRLSH (Fire Retardant Low smoke and halogen evolution)
1.8 Drum	:	Conforming to IS-10418(Wooden Drum)
FRLSH	:	Fire Retardant Low smoke and halogen Evolution

CONTROL CABLES 1100 V GRADE

1.0 1100 V grade, 700 C rating, heavy duty, PVC Control cable conforming to following requirement and in line with IS-1554, IS-8130, IS-5831 & IS-3975.

1.1	Conductor	:	Stranded, non-compacted & circular, high conductivity annealed plain copper, generally conforming to IS:8130.
1.2	Insulation	:	Extruded PVC compound conforming to type A of IS:5831.
1.3	Inner sheath	:	Extruded PVC compound conforming to type ST1 of IS:5831 for multicore cables. Single core cables shall have no inner sheath.
1.4	Armour	:	Galvanised single round steel wire for twin and multicore cables.
1.5	Overall sheath	:	Extruded FRLSH PVC compound conforming to type ST1 of IS:5831.
1.6	Core Identification	:	By color coding and numbering at interval of 100mm or less
1.7	Overall Sheath	:	Extruded FRLS PVC compound conforming to type ST2 of IS:5831. having improved fire performance category and type as stated below.

Category	Type
C2	FRLSH (Fire Retardant Low smoke and halogen evolution)

1.8	Drum	:	Conforming to IS-10418(Wooden Drum)
1.9	FRLSH	:	Fire Retardant Low smoke and halogen evolution

5.13.15.5 TECHNICAL REQUIREMENTS OF CABLE RACKS AND TRAYS

Minimum technical requirements for cable racks and trays are mentioned below:

- The contractor shall fabricate and supply the mounting arrangement for the support and installation of all the cable trays on hot dip galvanized steel structure including channels, angles, rods etc at requisite spacing in the suspended cable trays, cable trenches. Supporting structures wherever necessary, shall be provided by the contractor.
- The contractor shall provide embedment/anchor fasteners for fixing the supporting structures.

- These supporting structures shall be fabricated from structural steel members (channels, angles and rods) of the required size.
- The vertical member of the support will be of ISRO12 threaded rod or ISMC100 channel. The horizontal member of the support will be of angle ISA 50X50X6. For the threaded rod support configuration the horizontal member shall be fixed by bolting whereas for channel configuration the horizontal member shall be fixed by welding to the channel.
- Trays shall be of ladder type. The trays shall be fabricated from Hot Rolled Carbon Mild Steel (conforming to IS 1079, Grade "O", of chemical composition (C, Si, Mn, S, Ph) sheet of proper thickness as per IS.
- Cable trays shall be fixed with support by hold-down clamps. The clamps shall be fabricated from MS sheet of appropriate thickness and Hot Dip Galvanized.
- The contractor shall supply various tray fittings and accessories like coupler plate with fasteners, horizontal tees, vertical and horizontal elbows, vertical and horizontal adjustable connectors required for the mentioned trays. All accessories, fittings, elbows and tees shall be Hot Dip Galvanized. The nuts, bolts and washers shall be cadmium plated or electrolytically galvanized.
- Proper earthing of the trays and continuity between tray components must be ensured by the contractor.
- The contractor shall install the cable trays in accordance with relevant standards.
- The cable trays shall conform to bending & galvanization tests as per the relevant standards.

5.13.15.6 TECHNICAL REQUIREMENTS OF BURIED CABLE

Cable from the Inverter to SMB placed at Floaters:

i) From Control room to pond Embankment: DC cable to be laid on pedestal with cable tray.

ii) Cable shall be laid as concrete cable duct over the embankment. **DC Cable shall be laid with a minimum 500 mm depth from finished level of the embankment. Cable duct shall be filled with sand. For detail please refer NIT Drawing.**

ii) From embankment to SMB: **Over the floaters dressed and laid with proper tags. Bidder shall provide dedicated floaters for cable laying. During detail engineering necessary extra loop of cable to be kept so that cable should not be tear or break due to water level change.**

Note: *All HT and LT cable inside Transformer yard shall be laid through concrete cable trench with cable tray arrangement.*

- **33kV cable laying:**

  BkTPS, STPS & SgTPP: a) From Inverter Transformers to Switchgear Cum Control room: cable shall be laid through Buried cable.

  b) From Main Control Room to 33 kV Existing Switchyard : cable shall be laid through buried as per NIT drawing.

- **Buried cable route shall be finalized after details engineering in line with the NIT drawing.**

5.13.15.7 APPROVAL

The Detailed Design Report Submitted by the contractor to WBPDCL must contain but not limited to the following details of the Cables and conductor and the accessories for their installation:

- Detailed design and specification of all the items.
- All necessary drawings
- Calculations for choosing cable size
- Type test reports and necessary certificates etc.

Before dispatch, sample pieces of the cable shall be subjected to type, routine, acceptance and FRLS tests at the manufacturer's works as stipulated in IS 1554 (Part I)/IEC in the presence of owner or his representative. Routine tests and acceptance tests as per relevant standards shall be carried out on each type of cable in presence of the owner or his representative.

Before commissioning of complete system all cabling system shall be checked as per cable schedule and complete report shall be prepared by Contractor and shall be submitted.

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

- Guarantees
- Cable routing and layout drawings
- Detailed procedure adopted for the earthing of the trays
- Type test certificates for cable trays etc.

The contractor can deliver the product to the site only after receipt of such approval against their prayer in writing from WBPDCL.

5.15.16 DATA LOGGER:

a) Web enable data logging system may be an integral part of the inverter or a separate unit.

b) The data logger should have required transducer to monitor and record the required system parameters.

c) The data Logger, where the weather monitoring station shall be connected, shall keep record of **Global Solar Radiation, PV module temperature and ambient temperature and associated electrical parameters** at different stages to study performance of system as well as to study status of the system at a particular instant.

d) The Data logger shall continuously send data to the Web server.

e) If the Power Plants shall installed in distributed manner and at more than two buildings then necessary arrangement shall have to be provided so that compiled data shall be uploaded to the Website against each site.

f) The data logger shall have reliable data storage capacity (of minimum four months) to record all sorts of data simultaneously round the clock.

g) **SPD (surge protection device) Type II suitable for communication network, as much number at suitable locations are required must be provided with the system**

5.15.17 WEATHER MONITORING STATION

Weather Monitoring Station with all the instruments and accessories (with requisite quantity as mentioned below) has to be provided separately for –

i) 10 MW Floating Solar on Raw Water Pond 1 & 2 at BkTPP
ii) 5 MW Floating Solar on Raw Water Pond 2 at STPS
iii) 2.5 MW Floating Solar on Dutta Bandh at STPS
iv) 5 MW Floating Solar on Raw Water Pond 5 at SgTPP

- As a part of weather monitoring station, Bidder shall provide following measuring instruments with all necessary software & 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.
- 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.
- All the measuring instruments to be supplied shall have valid and traceable calibration certificate.

Each Pyranometer shall be recalibrated at an interval not more than one year and all other instruments shall be recalibrated at an interval not more than four years. During O&M period under bidder, calibration of all the instruments shall be done by the bidder. If calibration of Pyranometer is done at some other places outside the plant, a similar instrument to be provided as temporary replacement until the calibration process is complete.

- Sensors shall be installed at suitable height for which Mast/Structure for the sensor shall be provided by the bidder. Proper fencing shall be provided around meteorological station where the Pyranometer, Wind, Ambient Temp. Sensor, Data logger etc. are installed.
- 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.

5.13.17.1 Solar Radiation Sensors

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.

Pyranometer:

Bidder shall provide minimum 03 (Three) numbers of Secondary Standard Pyranometers as per ISO 9060 for measuring incident solar radiation as for following:

- Global Horizontal Irradiance (GHI)- 1 Nos.
- Global Inclined Irradiance (GII)-1 Nos.
- Diffuse Horizontal Irradiance (DHI)- 1 Nos.

Technical Requirement of Pyranometer:

Pyranometer shall be Class II or better.

Sl. No.	Description	Requirement
01	Principle	Thermopile

02	Spectral Response	310 to 2800 nm
03	Time response (95%)	Max 15 s
04	Sensitivity	Min 7 micro-volt/w/m2
05	Non linearity	±0.5%
06	Temperature Response	±2%
07	Tilt error:	< ±0.5%.
08	Operating temperature range	0 deg to +80 deg. C
09	Zero offset thermal radiation	±7 w/m2
10	Zero offset temperature change	±2 w/m2
11	Uncertainty (95% confidence Level):	Hourly- Max-3%, Daily- Max-2%
12	Response Time(95% of final value)	<5 sec
13	Non stability	Max ±0.8%

Shadow ring/ball for measuring DHI shall require no regular adjustment for of tracker and shadow ring/ball. Pyranometer shall be shaded throughout the day and shall be exposed to diffuse solar radiation only to provide DHI value without any calculation.

All the Pyranometer have to be mounted at single location at shadow free area. The GII Pyranometer has to be at the same inclination as the angular tilt of module mounting structure.

Bidder shall provide 1 (One) no. Battery powered portable handheld data logger supplied by the OEM of the offered Pyranometer.

5.13.17.2 Temperature Sensors

i) Ambient Air Temperature Sensor (Qty -1 no.)

Sl. No.	Description	Requirement
01	Principle	RTD (Platinum) Resistance proportional to temperature
02	Range	0-50 deg C
03	Accuracy	± 0.2 deg C
04	Operating Temperature	0 to 50 deg C
05	Radiation Shield	Non-aspirated Radiation Shield

ii) Indoor Air Temperature Sensor (Qty – 1 no. at each Inverter room)

Sl. No.	Description	Requirement
01	Principle	RTD (Platinum) Resistance

		proportional to temperature
02	Range	0-70 deg C
03	Accuracy	± 0.2 deg C
04	Operating Temperature	0 to 70 deg C

iii) Module Temperature Sensor (Qty – 1 no. per 05 MW)

Sl. No.	Description	Requirement
01	Principle	RTD (Platinum) Resistance proportional to temperature
02	Range	0-100 deg C
03	Accuracy	± 0.2 deg C
04	Operating Temperature	0 to 100 deg C

Module temperature sensor shall be fixed on the back of module surface with adhesive or tape without using any mechanical fastener.

5.13.17.3 Wind Sensor

i) Wind Speed Sensor (Qty- 1 no)

Sl. No.	Description	Requirement
01	Principle	Frequency proportional to wind speed/Ultrasonic Sensor
02	Velocity range	0-60 m/ sec
03	Threshold	0.3 m/s
04	Operating Temperature	0 to 50 deg C
05	Accuracy	3% (upto 35 m/s), 5% (Above 35 m/s) RMS

ii) Wind Direction Sensor (Qty- 1no)

Sl. No.	Description	Requirement
01	Principle	Potentiometric type sensor (Resistance proportional to Wind direction) /Ultrasonic Sensor
02	Range	0-360 deg
03	Accuracy	± 5 deg
04	Operating Temperature	0 to 50 deg C

5.13.17.4 Relative Humidity (%) (Qty- 1no)

Sl. No.	Description	Requirement
01	Range	0-100 %

02	Accuracy	± 3 %
03	Resolution	1 %
04	Operating Temperature	0 to 50 deg C

5.13.17.5 Additional Measurement

As per latest regulatory requirement, following measurement for the Solar PV is also included in the scope of bidder.

i. Direct Normal Irradiance (DNI)
ii. Sunrise and Sunset time
iii. Rainfall (mm)
iv. Cloud Cover – (Okta)

Instrument and accuracy for the above-mentioned measurement shall comply with applicable regulation ("Implementation of the framework on forecasting, scheduling and imbalance handling for Renewable Energy (RE) generating stations including Power Parks on Wind and Solar at Inter-State Level").

5.13.17.6 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:

Processor	:	32 bits
Time synchronization	:	With Built in GPS Clock or with Solar SCADA GPS Clock
Data storage	:	Min. 2 MB internal Flash Memory and Min. 8 GB SD card (expandable) 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 screen which should be easily accessible to be provided. It should display relevant details like all sensor values, battery strength, network strength etc.

		Display shall be 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
Port	:	Provision for RS232 and RS485 serial outputs

- Connectivity and Data transmission:
  - Built-in GSM/ GPRS modem for wireless data transmission to SCADA/cloud server (procurement of GPRS enabled SIM Card and connection subscription to be the responsibility of Contractor). It should be possible to remotely communicate with the device for configuration settings.
  - Data logger shall be interfaced with Solar SCADA on modbus preferably on TCP-IP for data collection and storage on SCADA
  - Web interface with provision for user login to enable viewing and downloading of weather data in XLS/ CSV format
  - Communication protocol should support fast data transmission rates, enable operation in different Frequency bands and have an encryption based data security layer for secure data transmission

- Data Logger shall have provision for analog, digital and counter type inputs for interfacing with various type of sensors.
  It shall have facility for arithmetic processing (Time Integration, Simple Average, and Moving Average etc.) of incoming raw data.

- The data logger shall have reliable battery backup and data storage capacity to record all sorts of data simultaneously round the clock.

- 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.

- 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. Any configuration changes shall be possible only with authorized User ID and password.

- Vendor shall submit Factory Acceptance Test (FAT) report and procedure before dispatch of material to site.

5.15.18 WEB BASED ON LINE REMOTE MONITORING SYSTEM:

a) Web based Remote Monitoring system must be compatible with data logger (s).

b) The system(s) shall be provided with suitable modem and required SIM card for wireless communication or connection from internet service provider (Wire system)

c) The Modem shall be interconnected with all the locations of installation of PV power Plants at different buildings of the site through wires / wireless system/ or any other technology so that Beneficiary wise composite and for individual power plant data shall be observed and downloaded from the remote server through web.

d) The contractor shall provide the website address and password to the purchaser for asses the data from the remote server.

e) If there is communication signal at the site is weak, necessary antenna or any other suitable instrument as may be required must be provided with the communication system.

f) The Data logger shall continuously send data to the Web server.

g) The other required accessories, hardware and compatible software shall have to be provided as an integrated part of the system to monitor the real time data (maximum 20 minutes delay) through web server.

h) The system can be monitored from anywhere through internet without installing any special application software. The server shall be arranged by the contractor.

i) The rental and other costs of the SIM cards, IP address, Server charge (storage, access charge and other charges if any), Rental charge of data communication for remote monitoring system for a period of five (05) years shall be within the contract value.

j) If more than one data logger and web based monitoring system shall with different PV Power Plant installed at different location within a same campus, consolidated data and graphical representation of the parameters including the weather monitoring report shall be obtained through web.

k) The Web based monitoring system should have the provision of graphical representation of the data shall include but not limited to the following:

Sl. No.	Operating Parameter	Desired specification

1.0	Input data	PV Power PV Energy
2.0	Meteorological data	Global solar Radiation Module Temperature Ambient Temperature Wind Speed
3.0	Output data	
3.1	Inverter	Export Power Export energy

l) All data shall be recorded chronologically date wise. The data file should be

m) MS Excel/XML/or any readable form compatible and should have the facility of easy downloads from the website and onsite.

5.15.19 EXPORT IMPORT ENERGY METER:

3 phase whole current Export Import Energy Meter. All the ABT Meter to be supplied must be tested. This ABT meter shall be installed to measure the total energy to be imported and exported from the PV power Plant. Please note this ABT metering should be connected and configured at WBPDCL existing system for connectivity with ERLDC, SLDC or as directed by the respective WBPDCL site authority. Bidder has to supply necessary accessories along with ABT meters which need to be compatible with the BkTPS, STPS & SgTPP existing ABT system. The export Import Energy meter (Class 2S) shall be installed at the following Panels

:

BkTPS:

- New Outgoing feeder of Indoor 33 kV Switchgear/CR panel : 1 no.
- New Control cum Relay Panel for 33 kV Power Evacuation at Switchyard: 1 no.

STPS:

- Raw Water Pond 2: Outgoing feeder of Indoor 33 kV Switchgear: 1 no.
- New Control cum Relay Panel for 33 kV Power Evacuation at Switchyard: 1 no.
- Dutta Bandh: Outgoing feeders of Indoor 33 kV Switchgear: As per requirement.

SgTPP:

- New 33kV Extension panel at Main Control Room: 1 no.

Note : All the power evacuation data shall be captured in respective SCADA for / PLC for PG test and NMGG calculation.

Note: All the power evacuation data shall be captured in existing/new SCADA for PG test and NMGG calculation.

WBPDCL Existing ABT Compliant Energy Meter Details:

Meter Model: Part Code: ION8650
SCHNEIDER MAKE Meter- Model code-
M8650C4C0J5E1A0A-AA607 (8650-FT21-BOP-HVAUX-50- ETH 8650 POWER)

Capturing data also to be transmit through FO cable from Raw Water Ponds to the existing Grid control room (GCR) and integration with existing ABT system. Necessary License for Software of ABT Compliant Energy Meter and Ethernet switch (48 Port, Layer-2 Managed Switch), UTM / Firewall, STP / UTP cable for establishment of network shall be supplied as required. Necessary cable raceway work for this integration is also under the bidder scope.

5.15.20 ILLUMINATION SYSTEM

5.13.20.1 SCOPE

The scope of work under this specification covers design, manufacture, assembly, shop testing, delivery, site erection, testing & commissioning of Illumination system comprising of main Illumination switchboards, distribution boards, sub distribution boards, switchboards, lighting fixtures, convenience and power outlets, conduits & fittings, cabling, outdoor lighting including mounting structures & poles, lighting for control rooms, security cabin, watch tower, access road.

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

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

5.13.20.2 STANDARDS

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

Sl. No.	Standards	Description
1	IS: 3646	Code of practice for interior Illumination (Part I, II, III)
2	IS: 6665	Code of Practice for Industrial Lighting
3	IS: 732	Code of Practice for Electrical wiring installations
4	IS: 9537	Conduits for Electric installations
5	IS: 2418	Tubular fluorescent lamps for general lighting service
6	EN 61347-2-13	Particular requirements for D.C. or A.C. supplied

		electronic control gear for LED modules
7	EN 62384	D.C. or A.C. supplied electronic control gear for LED modules
8	EN 61000-3-2	Electromagnetic compatibility (EMC). Limits for harmonic current emissions (Equipment input current < 16 A per phase)
9	EN 61000-3-3	Limitation of voltage fluctuation and flicker in low voltage supply systems for equipment with rated current < = 16 A

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

5.13.20.3 REQUIREMENT

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

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

5.13.20.4 LIGHTING LEVELS

The complete switchyard shall be lightened with an average illumination level of 100 lux.

Lighting in other areas such as control room, office rooms and battery room & other areas (i.e. street light) shall be such that the average LUX level to be maintained shall be as under:

Sl No.	Area	LUX
1	Control Room and conference rooms	400
2	33 kV Switchyard	100
3	Battery & other rooms	150
4	Outdoor areas including embankment	20
5	H – pole and metering point	20
6	Equipment room	250
7	Transformer yard	100

5.13.20.5 EMERGENCY LIGHT POINTS

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

- All emergency light shall be from 220 V DC Battery.

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

5.13.20.6 APPROVAL

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

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

Drawings and scheme submitted by the contractor will be subjected to approval of the owner.

The contractor can deliver the product to the site only after receipt of such approval against their prayer in writing from WBPDCL.

E. MISCELLANEOUS WORKS:

5.15.21 FIRE PROTECTION SYSTEM

5.13.21.1 SCOPE

The scope of work under this specification covers design, engineering, quality assurance, manufacture, shop testing, transport, transit insurance, delivery to site, storage at site, site erection, testing & commissioning of fire protection system (fire extinguisher (type shall be selected as per requirement), fire buckets, fire alarms at all control rooms etc.) complete with all accessories.

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

5.13.21.2 STANDARDS

All equipment covered under this section will conform to the latest edition of following Indian Standards:

Sl. No.	Standards	Description
1	IS: 3034	Code of Practice for Fire Safety of Industrial buildings: Electrical generating and distributing stations.
2	IS: 3844	Code of Practice for installation of internal fire hydrants in multi-storied buildings
3	IS: 1646	Code of Practice for fire safety of buildings (General) Electrical Installations
4	IS: 2878	Specification for fire Extinguishers – Carbon dioxide type
5	IS: 2171	Specification for fire Extinguishers – Dry Powder type
6	IS: 933	Specification for fire Extinguishers – Foam type
7	IS: 2175	Specification for heat sensitive fire detectors for use in automatic electrical fire alarm system
8	IS: 2189	Code of Practice for installation of automatic fire alarm system using heat sensitive type fire detectors

5.13.21.3 APPROVAL

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

- Detailed scheme and technical specification
- Placing and type of fire extinguisher with justification
- Necessary drawings related to the system etc.

Drawings and scheme submitted by the contractor will be subjected to approval of the owner.

The contractor can deliver the product to the site only after receiving such approval against their prayer in writing from WBPDCL.

5.15.22 VENTILATION SYSTEM

5.13.22.1 SCOPE

The scope of work under this specification covers design, manufacture, shop testing, supply, transportation, delivery, storage at site, erection, testing and commissioning of ventilation system complete with all accessories at each Inverter cum control rooms, store room etc.

The Scope shall include supply of all blower fans, GS ducting, air plenum, exhaust fans air dampers etc as required to make the ventilation system complete in all respects for satisfactory operation.

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

Corresponding parts of all the equipment & 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.

5.13.22.2 DESIGN:

To prevent the maximum permissible temperature in the inverter room from being exceeded because of internal heat emission of inverters and other auxiliaries in the inverter room, the inverter room in the PV plant shall be adequately ventilated. The Ventilation plant capacity and air quality of inverter room shall be as per inverter and other auxiliary's system manufacturer's recommendations. Filters at the air inlet of the inverter room shall be provided to prevent dust ingress. Bidder shall furnish peak power consumption of cooling system of the PCU along with the data sheet.

Ventilation shall be designed in such a way that the temperature rise of the inverter rooms doesn't exceed the maximum designed temperature of Inverters and other auxiliary equipment's placed inside the inverter room. Accordingly the air velocity through the filter shall be suitably chosen to remove the heat from the inverter room. All exhaust and fresh air fans shall be provided with thermostat control.

5.13.22.3 STANDARDS

The ventilating equipment shall comply with the requirement of the latest edition of relevant Indian standards or equivalent British Standards. Some of the relevant standards are given below:

Sl. No.	Standards	Description
1	IS : 3103	Code of Practice for industrial ventilation
2	IS : 2312	Specifications for propeller type A.C. Ventilating fans.
3	IS: 4894	Centrifugal fans

5.13.22.3 APPROVAL

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

- Detailed scheme and technical specification
- Calculations showing air requirements at various locations

- Necessary drawings etc.

The successful bidder required to produce all necessary test certificates and approvals of the product as per relevant standard with the Detailed Design Report.

Drawings and scheme submitted by the contractor will be subjected to approval of the owner. The contractor can deliver the product to the site only after receiving such approval against their prayer in writing from WBPDCL.

- Additional requirement:
  - 100% redundant corrosion proof exhausts fans to be provided at Battery room.
  - Equipment rooms shall be having forced air ventilation.
  - All fans shall be of industrial type.

5.15.23 AIR CONDITIONING SYSTEM

5.13.23.1 SCOPE

The scope of work under this specification covers design, manufacture, testing, supply, transportation, transit insurance, delivery, storage at site, erection, testing and commissioning of Air conditioning system with control and accessories at the operator's work station, SCADA room and UPS room with 100% redundancy at main control building. Bidder shall submit heat load calculation before finalization of AC system for control room and conference room considering all parameters.

5.13.23.2 STANDARDS

Equipment shall conform to the latest Indian standards or equivalent British Standards.

Sl. No.	Standards	Description
1	IS: 659	Safety code for Air conditioning
2	IS: 660	Safety code for Mechanical Refrigeration
3	IS: 655	Metal Air ducts

5.13.23.3 APPROVAL

The successful bidder required to produce all necessary test certificates and approvals of the product as per relevant standard with the Detailed Design Report.

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

- Detailed scheme and technical specification
- Necessary drawings etc.

Drawings and scheme submitted by the contractor will be subjected to approval of the owner. The contractor can deliver the product to the site only after receipt of such approval against their prayer in writing from WBPDCL.

5.15.24 DRINKING WATER

5.13.24.1 SCOPE

The scope of supply under this section shall cover the design, manufacture, shop testing, supply, transportation, delivery, storage at site, erection, testing and commissioning of drinking water system with water purifier unit and other related plumbing arrangement and accessories etc. for drinking water supply for the personnel at the Control Building. A drinking water point will be provided (within 500m from control building) and the contractor to draw pipelines to the requisite location.

5.13.24.2 STANDARDS

The whole system shall conform to the latest edition of relevant Indian Standard.

5.13.24.3 APPROVAL

The Detailed Design Report submitted by the contractor to WBPDCL must contain but not limited to the following details of the water purification unit:

- Detailed Technical specification
- Necessary drawings etc.

Specification submitted by the contractor will be subjected to approval of the owner. The contractor can deliver the product to the site only after receiving such approval against their prayer in writing from WBPDCL.

5.15.25 SIGNAGE:

5.13.25.1 Project information Signage:

The Signage will be made up of metallic base of minimum size 3'x 2'. The Signage provide with detail of the project as approved by WBPDCL. The font size on the signage has to be big enough so that everyone can read it easily. The Signage will be fixed **up two (02)** prominent place of the project area.

5.13.25.2 SCHEMATIC DIAGRAM SIGNAGE:

Schematic Diagram of Installation must be provided on a display board of minimum size 3'x 2' made up of metallic base. The schematic diagram must be fixed up at any prominent place of installation.

5.13.25.3 SAFETY SIGNAGE:

Safety Signage must be provided indicating the level and type of voltage and symbols as per IE Rule at different position as may be required. In the safety signage Voltage level and type of voltage must be mentioned

Each set of Safety Signage contain minimum 06 (six) nos. safety signage:

Location	Quantity
PV Array Field	Minimum 2 nos.
On PV Array JB each	01 No. (Sticker)
Near each Inverters	01 No
On Inverter Interfacing HT Panel	01 no. (Sticker)
On Switchyard	01 No (Sticker)

5.15.26 FIRE BUCKETS AND HOLDING STANDS

Each set of Fire Buckets and Fire Bucket Holding Stand shall have four (04) Fire Buckets and one (01) Double Tier Fire Bucket Holding Stand with an arrangement of holding of minimum four (04) Fire Buckets. The Fire Bucket Stand shall be installed at the suitable location.

The minimum technical specification is a follows:

BIS Specification	IS 2546 (with latest amendments)
Fire Bucket Capacity	10 liters
Fire Bucket Body Material	Mild Steel Sheet

FIRE EXTINGUISHERS

Minimum three (3) nos DCP type dry power portable fire extinguishers of minimum capacity 5 kg shall be provided. Standard of Fire Extinguisher BIS 2171 (with latest amendments).

5.15.27 KIOSK

Some small outdoor Panels (if required) shall be installed in suitable locations in Metallic Kiosks. The kiosks of must be of a suitable design, painted for avoiding rust, covered with a door and locking arrangement with good air circulation. The Kiosks must have security arrangement against theft, manhandling etc. Minimum clearance of the lower edge of the equipment from floor should be 1.0 m. There must be a suitable clearance from the front door of the Kiosk with any of the equipment / panel within the Kiosk.

Necessary civil work as required to construct / fixing the Kiosks (s) shall be done by the contractor. If any civil construction is required for installing the whole

arrangement, as and where required, it will be within the cost of contract value.

5.15.28 TOOLS, TACKLES AND SPARES

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

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

5.15.29 OTHER CONDITIONS

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

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

5.15.30 APPROVED VENDOR LIST FOR BOIs:

Equipment	List of Vendor for various BOIs
SOLAR PANELS	Any Solar PV Manufacturer in India (domestic manufacturer only for module) having MNRE

Equipment	List of Vendor for various BOIs
	Certification (as per ALMM and its all terms and conditions)
INVERTERS	ABB/ HITACHI/SMA/ DELTA
132 / 33 kV TRANSFORMER	BHEL / GE /ABB/ BHARAJ BIJLEE/INDOTECH TRANSFORMER LTD./CROPMPTON GREAVES LTD.
INVERTER AND AUX, TRANSFORMER	SUDHIR/VOLTAMP/BHEL/AREVA
POWER CABLES	KEI/ FINOLEX /POLYCAB /APAR
CONTROL CABLES	KEI / DELTON/ FINOLEX /POLYCAB /APAR
LT SWITCHGEAR	L&T / SIEMENS / SCHNEIDER/ABB
STEEL MEMBERS	TATA / VIZA STEEL/SAIL (GI coating done) or any equivalent ISI Mark
EARTHING/ LIGHTNING	CG Power/ELPRO INT. LTD/OBLUM
WEATHER MONITORING STATION	KIPP & ZONNEN / EPPLEY / EKO INSTRUMENTS /SOLAR L /GREEN POWER Monitoring
LT POWER PANEL	L&T / SIEMENS / SCHNEIDER/GE POWER
JUNCTION BOX	L&T / PYROTECH / SCHNEIDER
ENERGY METER	SECURE METERS//RISHABH(L&T)
PLC & SCADA System	BHEL, ABB, SCHNEIDER, GE, ROCKWELL AUTOMATION (ALLENBRADLEY), SIEMENS
33 kV INDOOR SWITCHGEAR	BHEL / SCHNEIDER / SIEMENS
UPS	EMERSON / HITACHI-HIREL / MERLINEGERINE / AEG (SAFT)
220 V DC Battery	EXIDE
220 V DC Battery Charger	CHLORIDE POWER SYSTEMS AND SOLUTIONS LTD. / STATCON POWER LTD./ CHHABI / HBL POWER
UPS BATTERY (Ni-Cd)	HBL POWER SYSTEM
INDUSTRIAL PC ALONGWITH CRT (EWS/ OWS/ SERVER/ HISTORIAN)	DELL / HP (Pavilion)
PRINTER	HP
ETHERNET SWITCH	CISCO / MOXA

Equipment	List of Vendor for various BOIs
CONTROL DESK/ LOCAL PANEL	PYROTECH / RITTAL / SCHEINDER / CONTROL & SWITCHGEAR / CONTROL DEVICE / SWITCHING CIRCUIT
OPTICAL FIBRE CABLE	TYCO / MOLEX / BIRLA ERICSSION / HFCL
CCTV camera	BOSCH/PELCO/HONEYWELL
36 KV OUTDOOR VCB	SIEMENS LTD. / ABB INDIA LTD. / SCHNEIDER ELECTRIC / TOSHIBA T&D SYSTEMS (INDIA) / CG POWER & INDUSTRIAL SOLUTION LTD. (FORMERLY KNOWN AS CROMPTON GREAVES LTD.)
ISOLATOR	SIEMENS / ELPRO
PLC BASED PANEL	PYROTECH / RITTAL
INSTRUMENTATION CABLE	UNIVERSAL CABLES/ DELTON/ RELIANCE/ NICCO/ POLYCAB/ KEI INDUSTRIES/ CORDS
COUPLING RELAY	ELESTA, OEN, OMRON, MAGNETRUFF, ROCKWELL
TERMINAL BLOCK	WAGO/ WIED MULER/ PHOENIX

5.15.31 LIST OF MANDATORY SPARES

Sl. No.	Equipment/Package Name	Quantity (Each type, rating and each Project)
1.00.00	Inverter Transformer (33/---- kV)	
1.01.00	Bushing	
(i)	HV Bushing with metal parts, connectors and gaskets	1No.
(ii)	LV bushing with metal parts, connectors and gaskets	1No.
(iii)	Neutral bushing with metal parts, connectors and gaskets	1No.
(iv)	CT at Transformer each type and rating	1No.
1.02.00	33 kV Surge Arrestor complete with insulating base and surge monitor	1Set.
1.03.00	33KVSwitchyard	
1.03.01	33KV Breaker	
(i)	Closing Coil with resistor	6Nos.
(ii)	Tripping Coil with resistor	12Nos.
(iii)	Breaker Auxiliary Contact	2Sets
(iv)	Set of O-ring	3Sets
(v)	Set of Seals	3Sets
1.03.02	33 kV Isolator	

(i)	Complete set of motor operating mechanism box with all accessories including motor.	1Set
(ii)	Limit Switch	3 sets
(iii)	Copper contact fingers for female & male contacts	3Sets
(iv)	Drive Motor with gear	1No
1.03.03	33 kV CT	1No. for each application
1.03.04	33 KV Switch yard Protection and Substation Automation System	
(i)	Numerical Relays	1 No of each make
1.04.00	33 kV SWITCHGEAR	
1.04.01	Pole of breaker of each type & rating	1 set (1set is complete for 3 phases)
1.04.02	Spring charging motor complete	2 nos
1.04.03	Trip coil	10 nos
1.04.04	Closing Coil	05 nos
1.04.05	Current transformer	1 nos of each ratio
1.04.06	Fuse for Potential transformer of each type & ratio	3 no.
1.04.07	Relays	2 no.
1.04.08	Limit switches of each type	5 nos.
1.04.09	Operating mechanism rod for each rating	2 nos.
1.04.10	Ammeter of each type & range	1 no
1.04.11	Voltmeter of each type & range	1 no
1.04.12	Indicating lamps	5 nos.
1.05.00	Inverter	
1.05.01	Control Unit	2 nos. make.
1.05.02	Protection Switch	2 nos. make.
1.05.03	Control Panel	2 nos. make.
1.05.04	AC Fuse	5 nos. make.
1.05.05	Fuse link	2 nos. make.
1.05.06	I/O module	2 nos. make.
1.05.07	AC Breaker	1 no. make.
1.05.08	AC and DC Contactor	2 nos. make.
1.05.09	ARRESTER	2 nos. make.
1.05.10	FAN	2 nos. make.
1.05.11	SPD	2 nos. make.
1.06.00	PV Module	
1.06.01	PV Module	200 nos

1.07.00	Floater	
1.07.01	Complete set of floaters with all accessories	50 Nos. of each size

2.00.00	**CONTROL & INSTRUMENTATION ITEMS**			
2.01.00	**Control System**	**For BkTPP**	**For SgTPP**	**For STPS**
2.01.01	Multifunction Processor Unit	10% of total nos. used in the system or minimum 1(one) no. whichever is more.	10% of total nos. used in the system or minimum 1(one) no. whichever is more.	10% of total nos. used in the system or minimum 1(one) no. whichever is more.
2.01.02	Binary Input Module	10% of total nos. used in the system or minimum 2(two) nos. whichever is more.	10% of total nos. used in the system or minimum 2(two) nos. whichever is more.	10% of total nos. used in the system or minimum 2(two) nos. whichever is more.
2.01.03	Pulse Input Module	10% of total nos. used in the system or minimum 1(one) no. whichever is more.	10% of total nos. used in the system or minimum 1(one) no. whichever is more.	10% of total nos. used in the system or minimum 1(one) no. whichever is more.
2.01.04	Analog Input Module (4 to 20mA input type)	10% of total nos. used in the system or minimum 2(two) nos. whichever is more.	10% of total nos. used in the system or minimum 2(two) nos. whichever is more.	10% of total nos. used in the system or minimum 2(two) nos.. whichever is more.
2.01.05	Analog Input Module (Thermocouple input type)	10% of total nos. used in the system or minimum 1(one) no. whichever is more.	10% of total nos. used in the system or minimum 1(one) no. whichever is more.	10% of total nos. used in the system or minimum 1(one) no. whichever is more.
2.01.06	Analog Input Module (3-wire RTD input type)	10% of total nos. used in the system or minimum 1(one) no. whichever is more.	10% of total nos. used in the system or minimum 1(one) no. whichever is more.	10% of total nos. used in the system or minimum 1(one) no. whichever is more.
2.01.07	Analog Output Module (4 to 20mA output type)	10% of total nos. used in the system or minimum 1(one) no. whichever is more.	10% of total nos. used in the system or minimum 1(one) no. whichever is more.	10% of total nos. used in the system or minimum 1(one) no. whichever is more.
2.01.08	Pulse Output Module	10% of total nos. used in the system or minimum 1(one) no. whichever is more.	10% of total nos. used in the system or minimum 1(one) no. whichever is more.	10% of total nos. used in the system or minimum 1(one) no. whichever is more.
2.01.09	Binary Output (contact) Module	10% of total nos. used in the system or minimum 2(two) nos. whichever is	10% of total nos. used in the system or minimum 2(two) nos. whichever is	10% of total nos. used in the system or minimum 2(two) nos. whichever is

		more.	more.	more.
2.01.10	Binary Output (Voltage) Module	10% of total nos. used in the system or minimum 2(two) nos. whichever is more.	10% of total nos. used in the system or minimum 2(two) nos. whichever is more.	10% of total nos. used in the system or minimum 2(two) nos. whichever is more.
2.01.11	Interposing Relays	10% of total nos. used in the system or minimum 5(five) nos. whichever is more.	10% of total nos. used in the system or minimum 5(five) nos. whichever is more.	10% of total nos. used in the system or minimum 5(five) nos. whichever is more.
2.01.12	Output Relay modules/ Relay Board & Auxiliary Relay	10% of total nos. used in the system or minimum 2(Two) nos. whichever is more.	10% of total nos. used in the system or minimum 2(Two) nos. whichever is more.	10% of total nos. used in the system or minimum 2(Two) nos. whichever is more.
2.01.13	Rack Mounted Power Supply Unit (SMPS or otherwise)	10% of total nos. used in the system or minimum 1(one) no. whichever is more.	10% of total nos. used in the system or minimum 1(one) no. whichever is more.	10% of total nos. used in the system or minimum 1(one) no. whichever is more.
2.01.14	MCB (Moulded case circuit breaker)	10% of total nos. used in the system or minimum 5(five) nos. whichever is more for each type and rating.	10% of total nos. used in the system or minimum 5(five) nos. whichever is more for each type and rating.	10% of total nos. used in the system or minimum 5(five) nos. whichever is more for each type and rating.
2.01.15	Racks for housing I/O & Processor Modules	1(One) no. each type used in the system	1(One) no. each type used in the system	1(One) no. each type used in the system
2.01.16	Bus extension Module	10% of total nos. used in the system or minimum 1(one) no. whichever is more.	10% of total nos. used in the system or minimum 1(one) no. whichever is more.	10% of total nos. used in the system or minimum 1(one) no. whichever is more.
2.01.17	Bus end module	10% of total nos. used in the system or minimum 1(one) no. whichever is more.	10% of total nos. used in the system or minimum 1(one) no. whichever is more.	10% of total nos. used in the system or minimum 1(one) no. whichever is more.
2.01.18	Bus extension cable with end connectors.	1(one) no. each type used in the system	1(one) no. each type used in the system	1(one) no. each type used in the system
2.01.19	Termination Unit/Card	1(one) no. each type used in the system	1(one) no. each type used in the system	1(one) no. each type used in the system
2.01.20	Backup cable for Redundant Processor Modules with end connectors	1(one) no. each type used in the system	1(one) no. each type used in the system	1(one) no. each type used in the system
2.01.21	Network communication cable with end connectors (from the Processor module)	10% of total nos. used in the system or minimum 2(two)	10% of total nos. used in the system or minimum 2(two)	10% of total nos. used in the system or minimum 2(two)

		nos. whichever is more for each type.	nos. whichever is more for each type.	nos. whichever is more for each type.
2.01.22	I/O Connector with prefab cable	10% of total nos. used in the system or minimum 2(two) nos. whichever is more for each type.	10% of total nos. used in the system or minimum 2(two) nos. whichever is more for each type.	10% of total nos. used in the system or minimum 2(two) nos. whichever is more for each type.
2.01.23	Communication Processor / Card	10% of total nos. used in the system or minimum 1(one) no. whichever is more for each type.	10% of total nos. used in the system or minimum 1(one) no. whichever is more for each type.	10% of total nos. used in the system or minimum 1(one) no. whichever is more for each type.
2.01.24	Network Interfacing card	10% of total nos. used in the system or minimum 1(one) no. whichever is more.	10% of total nos. used in the system or minimum 1(one) no. whichever is more.	10% of total nos. used in the system or minimum 1(one) no. whichever is more.
2.01.25	Signal Isolator Module/Card	10% of total nos. used in the system or minimum 1(one) no. whichever is more.	10% of total nos. used in the system or minimum 1(one) no. whichever is more.	10% of total nos. used in the system or minimum 1(one) no. whichever is more.
2.01.26	Any other system specific Module/Cards used in the system but not mentioned in this list	10% of total nos. used in the system or minimum 1(one) no. whichever is more for each type and rating.	10% of total nos. used in the system or minimum 1(one) no. whichever is more for each type and rating.	10% of total nos. used in the system or minimum 1(one) no. whichever is more for each type and rating.
2.01.27	Network Items for Control System			
i)	Managed Switch	10% of total nos. used for each type and model in the system or minimum 1(one) no. whichever is more.	10% of total nos. used for each type and model in the system or minimum 1(one) no. whichever is more.	10% of total nos. used for each type and model in the system or minimum 1(one) no. whichever is more.
ii)	Un-managed Switch	10% of total nos. used for each type and model in the system or minimum 1(one) no. whichever is more.	10% of total nos. used for each type and model in the system or minimum 1(one) no. whichever is more.	10% of total nos. used for each type and model in the system or minimum 1(one) no. whichever is more.
iii)	Transceiver (Optical to UTP converter)	10% of total nos. used for each type and model in the system or minimum 1(one) no. whichever is more.	10% of total nos. used for each type and model in the system or minimum 1(one) no. whichever is more.	10% of total nos. used for each type and model in the system or minimum 1(one) no. whichever is more.

iv)	Fibre-optic Patch Cords	10% of total nos. used for each type and model in the system or minimum 1(one) no. whichever is more.	10% of total nos. used for each type and model in the system or minimum 1(one) no. whichever is more.	10% of total nos. used for each type and model in the system or minimum 1(one) no. whichever is more.
v)	Fibre-optic Patch Box/Patch Panel	10% of total nos. used for each type and model in the system or minimum 1(one) no. whichever is more.	10% of total nos. used for each type and model in the system or minimum 1(one) no. whichever is more.	10% of total nos. used for each type and model in the system or minimum 1(one) no. whichever is more.
vi)	Other associated Hardware	10% of total nos. used for each type and model in the system or minimum 1(one) no. whichever is more.	10% of total nos. used for each type and model in the system or minimum 1(one) no. whichever is more.	10% of total nos. used for each type and model in the system or minimum 1(one) no. whichever is more.
vii)	RS232 to RS485/RS422 Converter or any other media Converter (if applicable)	10% of total nos. used for each type and model in the system or minimum 1(one) no. whichever is more.	10% of total nos. used for each type and model in the system or minimum 1(one) no. whichever is more.	10% of total nos. used for each type and model in the system or minimum 1(one) no. whichever is more.

Bidder shall arrange and supply all the items during execution of the project to their site store and under Bidder's custody. Finally, all the above items shall be handed over to WBPDCL store after completions of defect liability period i.e. end of the O&M contract.

TENDER DRAWING

LIST OF DRAWING

Sl No.	Description	Drawing
1.	ELECTRICAL SINGLE LINE DIAGRAM INCLUDING 220/33 KV SWITCHYARD FOR BKTPS	WB-FSP-DWG-E-001, (2 sheets)
2.	ELECTRICAL SINGLE LINE DIAGRAM FOR STPS INCLUDING 132/33 KV SWITCHYARD	WB-FSP-DWG-E-002A , WB-FSP-DWG-E-002B, (2 sheets)
3.	ELECTRICAL SINGLE LINE DIAGRAM FOR SGTPP	WB-FSP-DWG-E-003A, WB-FSP-DWG-E-003B, (2 sheets)
4.	UPS SCHEME	WB-FSP -DWG-E-004
5.	PLOT PLAN BKTPS	WB-FSP -DWG-E-005
6.	PLOT PLAN STPS	WB-FSP-DWG-E-006, (2 sheets)
7.	PLOT PLAN SgTPP	WB-FSP -DWG-E-007
8.	PEB INVERTER ROOM	WB-FSP -DWG-E-008
9.	CABLING NOTES AND DETAILS	WB-FSP -DWG-E-009, (4 sheets)
10.	EARTHING NOTES AND DETAILS	WB-FSP -DWG-E-010
11.	TYPICAL CONTROL ROOM LAYOUT	WB-FSP -DWG-E-011A, WB-FSP -DWG-E-011B, (2 sheets)

SECTION – VI
FORMS

Sl No	Form Name	Form No
01.	Check List	Form-1
02.	Forwarding Letter for submission of Bid Security and Tender Fee	Form -2
03.	Bid Form	Form-3
04.	Bid security (Bank Guarantee format)	Form- 4
05.	Summary Statement Of Yearly Turnover And Net Worth	Form-5
06.	Capability status	Form-6
07.	Statement of similar type of order orders executed as on date of issuance of the NIT	Form-7
08.	Curriculum Vitae Of Key Personnel	Form-8
09.	Format For Submission Of Pre-Bid Queries	Form- 9
10	Proposed modifications	Form-10
11	Joint Venture/Consortium Agreement	Form-11
12	Power of Attorney	Form-12
13	Declaration for Net Minimum Guaranteed Generation	Form-13

FORM-1: CHECK LIST: FORM

Sl. No.	Scanned Copy of Documents to be uploaded	Name of folder	To be submitted in cover	Submitted (Y/N)	If Y the File name or serial no.
1.	Tender Fee **(Scanned copy)**	Drafts	Statutory Cover (Technical proposal)		
2.	Bid Security **(Scanned copy)**	Drafts	Statutory Cover (Technical proposal)		
3.	Check List **(Form – 1)**	Forms	Statutory Cover (Technical proposal)		
4.	Forwarding Letter for submission of Bid Security and Tender Fee **(Form – 2)** (**Scanned copy)**	Forms	Statutory Cover (Technical proposal)		
5.	Bid Form/Undertaking including time schedule **(Form – 3)**	Forms	Statutory Cover (Technical proposal)		
6.	Summary statement of yearly turnover and net worth **(Form 5)**	Forms	Statutory Cover (Technical proposal)		
7.	Capability Status **(Form 6)**	Forms	Statutory Cover (Technical proposal)		
8.	Statement of similar type of order orders executed as on date of issuance of the NIT **(Form 7)**	Forms	Statutory cover (Technical proposal)		
9.	Curriculum Vitae of Key Personnel **(Form 8)**	Forms	Statutory Cover (Technical proposal)		
10.	Net Minimum Generation Guarantee **(Form 13)**	Forms	Statutory Cover (Technical proposal)		
11.	Copy of the CST / VAT / TIN Certificate	Certificates	Non-Statutory cover (Technical proposal)		
12.	Copy of the Service Tax Registration Certificate	Certificates	Non-Statutory cover (Technical		
13.	Copy of the PAN certificate/ PAN Card	Certificates	Non-Statutory cover (Technical proposal)		

Sl. No.	Scanned Copy of Documents to be uploaded	Name of folder	To be submitted in cover	Submitted (Y/N)	If Y the File name or serial no.
14.	Declaration of PF Registration Number **or** Proof of PF Registration	Certificates	Non-Statutory cover (Technical proposal)		
15.	MNRE Chanel partner certificate under *"Grid Connected Ground Mounted and Small Solar Power Plants Programme"* / Website Download copy from MNRE Website as a proof of enlistment	Certificates	Non-Statutory cover (Technical proposal)		
16.	Copy of the Registration Certificate under Company Act (Company Incorporation Certificate) o**r** copy of the Registered Deed for Partnership Firm	Company Details	Non-Statutory cover (Technical proposal)		
17.	Copy of the Order(s)/ Contract Agreement(s) with the Purchaser / any other Proof of Purchase, as primary agency **AND** Corresponding Copy of the Completion Certificate(s) /Commissioning report signed by the Purchaser / Ordering Authority to substantiate the proof of completion of the Solar PV Power Plant(s). **(As per declaration in Form-6)**	Credential (Technical)	Non-Statutory cover (Technical proposal)		
18.	Copy of the Audited Balance Sheet and Statement of Profit and Loss Account / Tax Audit report as per NIT	(Financial)	Non-Statutory cover (Technical proposal)		
19.	Copy Income Tax return Acknowledgement for assessment years as per NIT	(Financial)	Non-Statutory cover (Technical proposal)		
	Finance Proposal				

Sl. No.	Scanned Copy of Documents to be uploaded	Name of folder	To be submitted in cover	Submitted (Y/N)	If Y the File name or serial no.
20.	BOQ (Financial proposal)	Bill of Quantities (BOQ)	Financial Proposal		
21.	Mode Of Transaction Statement Of Materials and Equipment	Mode of Transaction	Financial Proposal		

Date : (Printed Name).....

Place : (Designation).....

Signed and Upload

FORM-2: FORWARDING LETTER FOR BID SECURITY AND TENDER FEE

Date:
Bidder's Name and address

To
The Deputy General Manager-IC(M&C)
The West Bengal Power development Corporation Limited
Bidyut Unnauan Bhaban,
Plot No. 3/C LA-Block,
Sector-III, Bidhannagar,
Kolkata-700 106

Subject : E-tender cum reverse auction for Design & Engineering, Manufacture / Procurement, Supply, Erection, Testing and Commissioning of 22.5 MW Grid Connected Floating Solar Photovoltaic Power Plants on different Water Ponds at BkTPS, STPS & SgTPP of WBPDCL, West Bengal including warrantee obligation with 05 (Five) years comprehensive Operation and Maintenance on turnkey basis at various locations of West Bengal.

Reference : NIT No:

Dear Sir,
We are enclosing the following:

1. Account payee Demand draft / Bankers Cheque (No. ……[insert No.]…… dated …… [insert date]……. drawn on ……[insert name of the bank on which drawn]…… for …….. [insert amount in Rs. and words]……., drawn in favor of"**The West Bengal Power Development Corporation Ltd (WBPDCL)**." payable at Kolkata **towards Tender Fee.**

2. Account payee Demand draft / Bankers Cheque (No. ……[insert No.]…… dated …… [insert date]……. drawn on ……[insert name of the bank on which drawn]…… for …..[insert amount in Rs. and words]……., drawn in favor of"WBPDCL" payable at Kolkata **towards Earnest Money (Bid Security) Deposit.**

Or

Bank Guarantee in the prescribed proforma from a scheduled commercial bank in India in favour of WBPDCL for Rs. ……[Insert value]……/-valid for a period of one hundred and eighty days (180) days from the bid opening date with a further claim period of thirty (30) days.

[*Strike out whichever is not applicable*].

Enclosures:

1. …… (Tender fee : DD / BC in original)
2. …… (Bid security : DD / BC / BG in original)
3. ……

Thanking You,

……

(Signature of authorized signatory)

Name: ……

Designation: ……

Date: ……

Place: ……

FORM-3: BID FORM/UNDERTAKING

(To be executed on non-Judicial stamp paper of requisite value)

(For genuineness of the information furnished on-line and authenticity of the documents produced before Tender Committee for verification in support of his eligibility)

Reference : NIT No:

I, the undersigned, being the authorized signatory of ……(Name of the Bidder), having read and examined in detail the NIT including minimum eligibility criteria in particular, instruction to Bidders, general terms & conditions, special terms & conditions and specification, do hereby submitting our offer to execute the contract as per terms & conditions as said forth in your Tender document.

1. We are submitting Tender for the Work _____against Tender NIT. No. _____

2. We confirm having submitted the eligible criteria as required by you in your Tender Document along with this proposal. In case you require any further information or clarification in this regard, we agree to furnish the same in time.

~~3. We have submitted the requisite amount of "Tender Fee" of **Rs.XXXXX (Rupees XXXX)** only in form of (DD/BC) on ……(Bank name) DD/BC no: …… Dtd:…… Payable at Kolkata~~

4. We have submitted the requisite amount of Earnest Money (Bid Security) of **…….(Bid Security Amount)…….. (Rupees. In Word……)** only in form of …… (DD/BC/BG). Detailed as follows :

Mode of Financial Instrument (DD/DC/BG)	Details (No., Name of the Bank etc.)

5. We hereby furnish the following:

1.	Company / Partnership/LLP regeneration i)Registration No: ii) Place of registration:	
2.	i) Central Sales Tax Regn. No: ii)VAT Regn. No:	
3.	Excise Regn. No	
4.	Service Tax Regn. No	
5.	PAN No	
6.	PF A/C No	
7.	Channel partner Certificate No of MNRE Government of India under **"Grid Connected Ground Mounted and Small Solar Power Plants Programme".**	

6. Our contact details related to this tender are as follows:

Information	**Local office (In West Bengal)**	**Head office**
Name of the Contact Person		
Designation		
Telephone No		
Fax No		
Mobile No		
Email Address		

7. We confirm that our bid in response to the NIT is consistent with all the requirements of submission as stated in the Tender Document and subsequent communications from WBPDCL.
8. We confirm none of the Partners of our firm is relative of employee of West Bengal State Electricity Distribution Company Limited (WBPDCL).
9. All information furnished by us in respect of fulfillment of eligibility criteria and qualification information of this Tender is complete, correct and true.
10. All documents/ credentials submitted along with this Tender are genuine, authentic, true and valid.
11. If any information and document submitted is found to be false/ incorrect any time, department may cancel my Tender and action as deemed fit may be taken against us, including termination of the contract, forfeiture of all dues including Earnest Money and banning / delisting of our firm and all partners of the firm etc.
12. Should this Bid be accepted, I/We* also agree to abide by and fulfill all the terms and conditions of provisions of the above mentioned Bidding Documents.
13. We have neither made any statement nor provided any information in this Bid, which to the best of our knowledge is materially inaccurate or misleading. Further, all the confirmations, declarations and representations made in our Bid are true and accurate.
14. We declare that the submitted our offer is without any deviations and are strictly in conformity with the documents issued by WBPDCL.
15. We declare that content of the Tender Document including NIT, ITB, BDS ,GCC, SCC, Technical Specification and subsequent corrigendum, addendum, if any, are acceptable to us and we have not taken any deviation in this regard. This is to expressly certify that our offer contains **no deviation** either in direct or indirect form.
16. We also declare that in case any deviations are noticed which might have crept inadvertently, that such deviations without reservation of any kind are automatically deemed to have been withdrawn by us.
17. If you accept our offer, we agree to complete the entire work in accordance with work completion time given in the Tender document. We fully understand that the work completion time stipulated in is the essence of the contract, if awarded.
18. We offer to execute the work in accordance with the conditions of the NIT document as available in the website.
19. This Bid and your subsequent Letter of Acceptance / Work Order /agreement shall constitute a binding contract between us.

20. We hereby confirm our acceptance of all terms and conditions of the NIT document unconditionally.

21. We also declare that, we have never been blacklisted and / or there were no debarring actions against us as on date due to any reason what-so-ever, by any Government or Government Agencies. In the event of any such information pertaining to the aforesaid matter found at any point of time either during the course of the contract or at the bidding stage, our bid/contract will be liable for truncation / cancellation / termination without any notice at the sole discretion of WBPDCL.

Date : (Printed Name).....

Place : (Designation).....

Signed and Upload

FORM-4: BID SECURITY

FORM FOR BID SECURITY

BANK GUARANTEE FORMAT FOR EMD/ BID SECURITY

(To be stamped in accordance with Stamp Act, if any, of the Country of the issuing Bank)
Bank Guarantee No.: _____
Date: _____

To,
The GM(M&C)
The West Bengal Power Development Corporation Limited
Bidyut Unnayan Bhaban, Block– LA, Plot No. 3/C, Sector–III,
Salt Lake City, Kolkata– 700106, West Bengal, India.

Dear Sir,
In accordance with your NIT No. _____M/s XXX (Name of Participating Contractor) having its Registered Head Office at _____ (hereinafter called the Bidder) wish to participate in the said RFP/NIT for _____ (Name of Job).

As an irrevocable Bank Guarantee against Bid Security for an amount of ____ is required to be submitted by the Bidder as a condition precedent for participation in the said Tender, which amount is liable to be forfeited on the happening of any contingencies mentioned in the Tender Document, we, the _____ Bank at _____ having our Head Office / Registered Office at _____ (Address of Bank) guarantee and undertake to pay immediately on demand by the West Bengal Power Development Corporation Limited the amount of _____ (in words and figures) without any reservation, protest, demur and recourse. Any such demand made by said Procuring Entity shall be conclusive and binding on us irrespective of any dispute of difference raised by the Bidder.

This Guarantee shall be irrevocable and shall remain valid up to *Date*_____ (six months from the Closing date of submission of bid) with a claim period of another 3(three) months. If any further extension of this guarantee is required, the same shall be extended to

such required period on receiving instructions from M/s XXX (Participating Bidder) on whose behalf this Guarantee is issued.

All rights of the West Bengal Power Development Corporation Limited under this Guarantee shall be forfeited and the Bank shall be relieved and discharged from all liabilities there under unless the WBPDCL brings any suit or action to enforce a claim under this Guarantee against the Bank within ninety (90) calendar days from the above mentioned expiry date of validity or, from that of the extended date.
In witness whereof the Bank, through its authorised Officer, has set its hand and stamp on this _____ day of _____ Year ..... at _____.
WITNESS:
_____
(Signature and Name) (Signature and Name)
_____ _____
(Engineer / Officer address) (Designation with Bank Stamp)
Attorney as per Power of Attorney No. _____
Date:

FORM-5: SUMMARY STATEMENT OF YEARLY TURNOVER AND NET WORTH

NIT No:

Bidder's Name & Address:

This is to certify that the following statement is the summary of the Audited /Tax audited Accounts of our Company/firm (The Bidder) arrived for the three consecutive years or for such period since inception of the Firm, if it was set in less than such three year's period as follows:

Sl. No.	Financial		Remarks
	Year	Turnover rounded up to in lakh (two digit after decimal)	
1.	20.. - 20..		
2.	20... - 20.....		
3.	20... - 20.....		
5.	Net Worth as at last financial Year		

Note:

1. Average turnover is to be expressed in rupees in lakh, rounded up to two digits after decimal.
2. The statement must be the individual bidder's turnover and not the consolidation as

the result of accounts of group and associates.

3. Average turnover for 3 years is to be obtained by dividing the total turnover by 3.0. If the bidder was set up in less than 3 year's period, consider the turnover for the period from inception to the Year-1. It may be either 1.0 or 2.0. Average turnover is to be obtained by dividing the total turnover by 1.0 or 2.0, as the case may be.
4. In case, the bidder was set up in less than 3 year's period, mention the year of inception in the 'Remarks' column.

Signed and Upload

FORM-6: CAPABILITY STATUS

NIT No:

Bidder's Name & Address:

To
The GM(M&C)
The West Bengal Power Development Corporation Limited
Bidyut Unnayan Bhaban, Block– LA, Plot No. 3/C, Sector–III,
Salt Lake City, Kolkata– 700106, West Bengal, India.

Subject : E-tender cum reverse auction for Design & Engineering, Manufacture / Procurement, Supply, Erection, Testing and Commissioning of 22.5 MW Grid Connected Floating Solar Photovoltaic Power Plants on different Water Ponds at BkTPS, STPS & SgTPP of WBPDCL, West Bengal including warrantee obligation with 05 (Five) years comprehensive Operation and Maintenance on turnkey basis at various locations of West Bengal.

We provide the following details to conform that we have sufficient capacity to execute the supply of Goods covered in the NIT:

A	Manufacturing Capacity (applicable in case of original manufacturers only)	
B	Orders in Hand	
i	Total value of Orders	
ii	Value of work completed out of above value upto 31.01.2018.	

Details of orders in hand are as follows:

Sl. No	Purchaser / Client	Scope of works	Order Value	Schedule Time of Completion	Value of Outstanding work	Estimated Completion date

Note:

- Continuation sheets of like size and format may be used and annexed to this format if required.

Date : (Printed Name).....

Place : (Designation).....

Signed and Upload

FORM-7: SIMILAR TYPE OF ORDERS

STATEMENT OF SIMILAR TYPE OF ORDERS EXECUTED AS ON DATE OF ISSUANCE OF THE NIT

[Applicability up to the extent of meeting Technical QR].

NIT No:

Bidder's Name & Address:

To
The Deputy General Manager-IC(M&C)
The West Bengal Power development Corporation Limited
Bidyut Unnauan Bhaban,
Plot No. 3/C LA-Block,
Sector-III, Bidhannagar,
Kolkata-700 106

Subject : E-tender cum reverse auction for Design & Engineering, Manufacture / Procurement, Supply, Erection, Testing and Commissioning of 22.5 MW Grid Connected Floating Solar Photovoltaic Power Plants on different Water Ponds at BkTPS, STPS & SgTPP of WBPDCL, West Bengal including warrantee obligation with 05 (Five) years comprehensive Operation and Maintenance on turnkey basis at various locations of West Bengal.

Sl No	Name of the Installed Plants/	Financial year	Order No. and date	Name of Purchaser / order	Cumulative capacity of the order (Considering	Ordered Value/Time (extended time, if any)	Cumulative capacity installed (	Completion report of installed systems	Remarks

	Project			issuing authority	similar type of work) (scanned copy of certificate to be Submitted in non-statutory cover) (kWp)	of Completion	Considering similar type of work) (kWp)	(scanned copy of certificate to be Submitted in non-statutory cover)	

- Continuation sheets of like size and format may be used and annexed to this format if required.

Similar type of work means Solar PV power plant each of minimum capacity as per QR of the tender

Date : (Printed Name).....

Place : (Designation).....

Signed and Upload

FORM-8:CURRICULUM VITAE OF KEY PERSONNEL

NIT No:

Bidder's Name & Address:

To
The General Manager(M&C)
The West Bengal Power development Corporation Limited
Bidyut Unnauan Bhaban,
Plot No. 3/C LA-Block,
Sector-III, Bidhannagar,
Kolkata-700 106

Subject : E-tender cum reverse auction for Design & Engineering, Manufacture / Procurement, Supply, Erection, Testing and Commissioning of 22.5 MW Grid Connected Floating Solar Photovoltaic Power Plants on different Water Ponds at BkTPS, STPS & SgTPP of WBPDCL, West Bengal including warrantee obligation with 05 (Five) years comprehensive Operation and Maintenance on turnkey basis at various locations of West Bengal.

S.No	Proposed Position	Name	Position Held since	Professional Qualification	Experience in relevant Field	Any other Information

Date : (Printed Name).....

Place : (Designation).....

Signed and Upload

Note:

- Continuation sheets of like size and format may be used and annexed to this Form if required.

FORM-9: FORMAT FOR SUBMISSION OF PRE-BID QUERIES

FORMAT FOR SUBMISSION OF PRE-BID QUERIES			
NIT No.			DTD.
Subject : E-tender cum reverse auction for Design & Engineering, Manufacture / Procurement, Supply, Erection, Testing and Commissioning of 22.5 MW Grid Connected Floating Solar Photovoltaic Power Plants on different Water Ponds at BkTPS, STPS & SgTPP of WBPDCL, West Bengal including warrantee obligation with 05 (Five) years comprehensive Operation and Maintenance on turnkey basis at various locations of West Bengal			
NAME OF THE BIDDER:	<To be filled in by the bidder>		Work name : <To be filled in by the bidder>
PART A - TECHNICAL QUERIES			
Sl no	GCC Clause reference (if any)	BIDDER'S QUERY	WBPDCL's REPLY
1			
2			
3			
PART B: COMMERCIAL/GCC RELATED/CONTRACTUAL QUERIES			
Sl no	GCC Clause reference (if any)	BIDDER'S QUERY	WBPDCL's REPLY
1			
2			
3			
4			
5			
• Continuation sheets of like size and format may be used as per Bidders requirements and shall be annexed to this Form.			

Note:

i. To be submitted before Pre- bid meeting.

ii. This sheet must not the part of the offer submitted by the bidder and not to be upload

iii. This sheet to be mailed in Excel Format at email address : s.dass@wbpdcl.co.in

Date :	(Signature).....
Place :	(Authorized Representative of bidder)..
	(Designation).....
	Name of the bidder: .....

FORM-10: PROPOSED MODIFICATIONS

(To be submitted before Pre-bid meeting)

Ref:

Bidder's Name & Address:

To
The General Manager (M&C)
The West Bengal Power development Corporation Limited
Bidyut Unnauan Bhaban,
Plot No. 3/C LA-Block,
Sector-III, Bidhannagar,
Kolkata-700 106

Subject : E-tender cum reverse auction for Design & Engineering, Manufacture / Procurement, Supply, Erection, Testing and Commissioning of 22.5 MW Grid Connected Floating Solar Photovoltaic Power Plants on different Water Ponds at BkTPS, STPS & SgTPP of WBPDCL, West Bengal including warrantee obligation with 05 (Five) years comprehensive Operation and Maintenance on turnkey basis at various locations of West Bengal

Reference : NIT No: _____

We have carefully gone through the Technical Specifications and the General Conditions of Contract and we have satisfied ourselves and hereby propose certain modifications as mentioned below:

S.No.	Sec./Clause & Page No.	Existing Clause	Modified clause (proposed by Bidder)	Reasons for modification

Note:

i. To be submitted before Pre- bid meeting.

ii. This sheet must not the part of the offer submitted by the bidder and not to be upload

iii. This sheet to be mailed in Excel Format at email address : s.dass@wbpdcl.co.in

Date : **(Signature)**.....

(Authorised Representative of bidder)

Place :

(Designation).....

Name of the bidder: .....

FORM-11: PROFORMA FOR JOINT VENTURE/CONSORTIUM AGREEMENT

(ON NON-JUDICIAL STAMP PAPER OF APPROPRIATE VALUE)

This Joint Venture/Consortium Agreement made and entered into on _____ day of..... (year)

BY AND BETWEEN _____ (Name of the Lead Member), a Company/Firm registered under the laws of _____ (Name of the Country) with its Head/Registered Office at _____ (Address of the Head/Registered Office) and a place of business in _____ (Address of place of business) (hereinafter referred to as "The Lead Member") and represented by Mr/Mrs/Ms. _____ (Name of Authorized Signatory).

AND

_____ (Name of the other Member), a Company/Firm registered under the laws of _____ (Name of the Country) with its Head/Registered Office at _____ (Address of the Head/Registered Office) and a place of business in _____ (Address of place of business) (hereinafter referred to as "The Member") and represented by Mr/Mrs/Ms. _____ (Name of Authorized Signatory).

WITNESSETH

WHEREAS WEST BENGAL POWER DEVELOPMENT CORPORATION LIMITED (hereinafter referred to as "The Procuring Entity") has issued RFP/ Notice Inviting Tender No. _____ Dated _____ for (.....Name of the Job.....). The Procuring Entity intends to select the suitable Bidder through competitive bidding process for the aforesaid Project/Works / Services.

WHEREAS the Parties are interested in jointly preparing and submitting an Application to Bid for the Project/ Works / Services mentioned above as a Joint Venture/Consortium.

1.0 PURPOSE OF THIS AGREEMENT

1.1. The purpose of this Agreement is to define the principles of collaboration among the Parties to:

1.1.1 Submit an Application jointly to Bid for the (.....Name of the Job.....) as a Joint Venture /Consortium.

1.1.2 Negotiate and sign Contract in case of award.

1.1.3 Provide and perform the supplies / works / services / EPC etc. which would be ordered by the Procuring Entity pursuant to the Contract.

1.2. For the purpose of participating in the Bid, the name of the Joint Venture /Consortium shall be "_____".

2.0 LEGAL RELATIONSHIP OF THE MEMBERS

2.1. This Agreement shall not be construed as establishing or giving effect to any legal entity such as, but not limited to, a company, a partnership, etc. It shall relate solely towards the Procuring Entity for (.....Name Of the Job.....) and related execution works to be performed pursuant to the Contract and shall not extend to any other activities.

2.2. The Parties shall be jointly and severally responsible and bound towards the Procuring Entity for the performance of the Job in accordance with the terms & conditions of the Tender Document and Contract.

3.0 LEAD MEMBER

_____ (Name of Member) shall act as Lead Member of the Joint Venture /Consortium. As such, it shall act as the coordinator of the Members' combined activities and shall carry out the following functions:

3.1. To ensure the technical, commercial and administrative co-ordination of the Project/Works / Services.

3.2. To lead the contract negotiations of the Project/ Works / Services with the Procuring Entity.

3.3. The Lead Member is authorized to submit bills, receive payments and instructions and incur liabilities for and on behalf of Joint Venture /Consortium Members.

3.4. In case of an award, act as a channel of communication between the Procuring Entity and the Joint Venture /Consortium to execute the Contract.

4.0 SCOPE OF WORK AND SERVICES OF EACH MEMBER

4.1 Scope of Work and Services: The Scope of Work and Services for each Member shall be defined as follows:

4.1.1. _____ (Name of Member) shall be responsible for the following (Define the Scope of Work):

a)

b)

4.1.2. _____ (Name of Member) shall be responsible for the following (Define the Scope of Work):

a)

b)

4.1.3. _____ (Name of Member) shall be responsible for the following (Define the Scope of Work):

a)

b)

4.2 Participation Share of each Member:

Lead Member_____ %

Other Member_____ %

Other Member_____ %

4.3 Financial Commitment of each Member in terms of Contract Value:

Lead Member_____ %

Other Member_____ %

Other Member_____ %

5.0 SECURITIES

Securities, in the form of Bank Guarantees or any other mode as required under the Tender Document and/or Contract shall be provided in the following manner.

Lead Member_____ Rs.

Other Member_____ Rs.

Other Member_____ Rs.

6.0 LIABILITY

Liability of the Parties with respect to Claims of the Procuring Entity: All the joint venture/consortium members are jointly and severally liable to the Procuring Entity for the Performance in terms of Scope of Work under the Contract in its entirety.

7.0 DURATION OF THE AGREEMENT

The present Agreement is valid until successful completion of the Contract including defect liability period, if any, and full and final settlement of all accounts and disputes, if any, between the Parties and the Procuring Entity, except if the Procuring Entity has decided not to award the Contract to the Parties, in such case the Parties are free from any obligation under this Agreement.

IN WITNESS WHEREOF, this agreement executed on the _____ day of _____ (month)..... (Year) by the duly Authorized Representatives of the Parties hereto.

For and on behalf of M/s. _____

(Lead Member)

Name:

Company Seal:

For and on behalf of M/s. _____

(Other Member)

Name:

Company Seal:

For and on behalf of M/s. _____

(Other Member)

Name:

Company Seal:

Notary Seal:

FORM-12: POWER OF ATTORNEY

Format for Power of Attorney to be provided by each of the other members of the Consortium in favour of the Lead Member

(To be on non-judicial stamp paper of appropriate value as per Stamp Act relevant to place of execution)

Whereas the West Bengal Power Development Corporation Ltd. (WBPDCL) (the "Procuring Entity") has invited Bids from bidders for " E-tender cum reverse auction for Design & Engineering, Manufacture / Procurement, Supply, Erection, Testing and Commissioning of 22.5 MW Grid Connected Floating Solar Photovoltaic Power Plants on different Water Ponds at BkTPS, STPS & SgTPP of WBPDCL, West Bengal including warrantee obligation with 05 (Five) years comprehensive Operation and Maintenance on turnkey basis at various locations of West Bengal"

Whereas, M/s....., and M/s..... (collectively the "**Joint Venture/ Consortium**") being Members of the Joint Venture/ Consortium are interested in bidding for the Project in accordance with the terms and conditions of the tender document and other Bid documents including agreement in respect of the Project/works/services,

AND

Whereas, it is necessary for the Members of the Joint Venture/ Consortium to designate one of them as the Lead Member with all necessary power to do for and on behalf of the Joint Venture/ Consortium, all acts, deeds and things as may be necessary in connection with the Joint Venture's/ Consortium's Bid for the Project/Works/Services and its execution.

NOW THEREFORE KNOW ALL MEN BY THESE PRESENTS

We, M/s..... having our registered office at ....., and M/s..... having our registered office at ....., (hereinafter collectively referred to as the "**Principals**") do hereby irrevocably designate, nominate, appoint and authorize M/s ..... having its registered office at ....., being one of the Members of the Joint Venture/ Consortium, as the Lead Member and true and lawful attorney of the Joint Venture/ Consortium (hereinafter referred to as the "**Attorney**"). We hereby irrevocably authorize the Attorney (with power to sub-delegate) to conduct all business for and on behalf of the Joint Venture/ Consortium and any one of us during the Bidding process and, in this regard, to do on our behalf and on behalf of the Joint Venture/ Consortium, all or any of such

acts, deeds or things as are necessary or required or incidental to the Bid, including but not limited to signing and submission of all applications, Bids and other documents and writings, participate in meetings, respond to queries, submit information/ documents, sign and generally to represent the Joint Venture/ Consortium in all its dealings with the Procuring Entity, in all matters in connection with or relating to or arising out of the Joint Venture's/ Consortium's Application.

AND hereby agree to ratify and confirm and do hereby ratify and confirm all acts, deeds and things done or caused to be done by our said Attorney pursuant to and in exercise of the powers conferred by this Power of Attorney and that all acts, deeds and things done by our said Attorney in exercise of the powers hereby conferred shall and shall always be deemed to have been done by us(Joint Venture/ Consortium).

IN WITNESS WHEREOF WE THE PRINCIPALS ABOVE NAMED HAVE EXECUTED THIS POWER OF ATTORNEY ON THIS ……. DAY OF ……. 20…

For …….

(Signature)

…….

(Name & Title)

For …….

(Signature)

…….

(Name & Title)

For …….

(Signature)

…….

(Name & Title)

(Executants)

(To be executed by all the Members of the Joint Venture/ Consortium)

Witnesses:

1.

2.

Notes:

1. The mode of execution of the Power of Attorney should be in accordance with the procedure, if any, laid down by the applicable law and the charter documents of the executants (s) and when it is so required, the same should be under common seal affixed in accordance with the required procedure.

2. Also, wherever required, the Bidder should submit for verification the extract of the charter documents and documents such as a board or shareholders' resolution/ power of

attorney in favour of the person executing this Power of Attorney for the delegation of power hereunder on behalf of the Bidder.

FORM-13: DECLARATION FOR NET MINIMUM GUARANTEED GENERATION

DECLARATION SHEET – FOR NET MINIMUM GUARANTEED GENERATION
(To be submitted on official letter head by the bidder)

We ..... declare that the (project description)offered by us within the scope of this tender, will generate following NMGG measured in the Net Meter installed at the outgoing feeder. The Net Minimum Guaranteed Generation shall be calculated after deducting the Auxiliary Consumption for the plant.

Project Location	**NMGG target for 1st year**
BkTPS	16.39 MU from 10 MW (AC)
STPS	12.52 MU from 7.5 MW (AC)
SgTPP	8.29 MU from 5 MW (AC)

The Net Minimum Guaranteed Generation shall be reduced @ 1% per year.

In case we fail to produce the Net Minimum Guaranteed Generation as stated above, the provisions of penalty according to Clause No. 4.3.5 of the Special Conditions of Contract of this tender shall be applicable.

I hereby certify that I am duly authorized representative of the Bidder whose name appears above my signature.

Bidder's Name: .....

Authorised Representative's Signature.....

SECTION – VII

ANNEXURES

Sl No	Annexure Name	Annexure No
01.	Proforma Of Contract Agreement	Annexure-1
02.	Proforma Of Bank Guarantee For Contract Performance	Annexure-2
03.	Proforma Of Bank Guarantee For Mobilisation Advance	Annexure-3
04.	Proforma For Extension Of Bank Guarantee	Annexure-4
05.	Proforma Of Indemnity Bond	Annexure -5
06	Completion Certificate	Annexure-6
07	Application for Payments	Annexure-7
08	Taking-Over Certificate	Annexure-8
09	No-Claim Certificate	Annexure-9
10	Indemnity bond to be executed by the contractor for the equipment handed over by the Purchaser for performance of its contract (Entire Equipment Consignment in one lot)	Annexure-10A
11	Application for Material Gate Pass	Annexure-10B
12	Authorization letter	Annexure-11
13	Material Receipt Certificate	Annexure-12
14	RECORD BOOK FOR GRID OUTAGE	Annexure-13
15	Declaration	Annexure-14
16	Bidder information sheet	Annexure-15

ANNEXURE-1: CONTRACT AGREEMENT

PROFORMA OF CONTRACT AGREEMENT

(To be executed on Non-Judicial Stamp Paper of Rs. 100/-)

THIS AGREEMENT made at this _____ day of _____, _____, between **The West Bengal Power Development Corporation Limited of Plot No. 3/C LA-Block, Sector-III, Bidhannagar, Kolkata-700 106** (hereinafter called "the Procuring Entity"), of the one part, and _____of _____ (hereinafter "the Contractor"), of the other part:

WHEREAS the Procuring Entity invited bids "<Tender Description> in WBPDCL" and has accepted the Bid offered by the Bidder/Contractor for the same in the sum of _____ (hereinafter "the Contract Price"). After due consideration, the procuring entity has decided to entrust to the contractor with the job/ work/ supply of **"E-tender cum reverse auction for Design & Engineering, Manufacture / Procurement, Supply, Erection, Testing and Commissioning of 22.5 MW Grid Connected Floating Solar Photovoltaic Power Plants on different Water Ponds at BkTPS, STPS & SgTPP of WBPDCL, West Bengal including warrantee obligation with 05 (Five) years comprehensive Operation and Maintenance on turnkey basis at various locations of West Bengal"**

FOR THE CONSIDERATION payable under this agreement, the contractor hereby agrees to complete the execution of job/ work/ supply in a satisfactory manner following scope of Work within the specified period.

NOW THIS AGREEMENT WITNESSETH AS FOLLOWS:

1. In this Agreement words and expressions shall have the same meanings as are respectively assigned to them in the Contract referred to.
2. The following documents shall be deemed to form and be read and construed as part of this Agreement, viz.:
   a) the Procuring Entity's Notification (LoA) to the Contractor of Award of Contract;
   b) the Bid Forms(including Price Bid) submitted by the Contractor;
   c) the Special Conditions of Contract;
   d) the General Conditions of Contract;
   e) _____
   f) _____

This Contract shall prevail over all other Contract documents which are not covered under Clause 2 above. In the event of any discrepancy or inconsistency within the Contract documents referred under Clause 2, then the contract shall be governed by the documents in the order listed above.

3. In consideration of the payments to be made by the Procuring Entity to the Contractor as indicated in this Agreement, the Contractor hereby covenants with the Procuring Entity to provide the goods and services / to execute works and to remedy defects therein in conformity with the provisions of the Contract in all respects.
4. The Procuring Entity hereby covenants to pay the Contractor in consideration of the provision of the goods and services / execution of works and the remedying of defects therein, the Contract Price or such other sum as may become payable under the provisions of the Contract at the times and in the manner prescribed by the Contract.

IN WITNESS WHEREOF, the parties through their duly authorized representatives have executed these presents (execution whereof has been approved by the competent authorities of both the parties) on the day, month and year first above mentioned at Kolkata.

Signed by for and on behalf of the Procuring Entity
……
[Signature]

……
[Title]

In the presence of
…… (Signature, Name and Title)

Signed by for and on behalf of the Contractor/ Lead Member
……
[Signature]

……
[Title]

In the presence of
…… (Signature, Name and Title)

ANNEXURE-2: BG (CONTRACT PERFORMANCE)

PROFORMA OF BANK GUARANTEE FOR CONTRACT PERFORMANCE

(To be executed in non-judicial stamp paper of Rs. 100/-)

(To be stamped in accordance with Stamp Act, if any, of the Country of the issuing Bank)

Bank Guarantee No.: _____

Date: _____

To,

The West Bengal Power Development Corporation Limited
Plot No. 3/C LA-Block, Sector-III, Bidhannagar, Kolkata-700 106

Dear Sir,

In consideration of the West Bengal Power Development Corporation Limited (Hereinafter referred to as the 'Procuring Entity' which expression shall unless repugnant to the context or meaning thereof, include its successors, administrators and assigns) having awarded to M/s..... *[Contractor's Name]*..... With its Registered/Head Office at..... (Hereinafter referred to as the 'Contractor', which expression shall unless repugnant to the context or meaning thereof, include its successors administrators, executors and assigns), a Contract by issue of *Procuring Entity's* Letter of Acceptance No. ..... dated ..... and the same having been acknowledged by the Contractor, for ..... [Contract sum in figures and words] for ..... *[Name of the work]* and the Contractor having agreed to provide a Contract Performance Guarantee for the faithful performance of the entire Contract equivalent to ..... (*)..... of the said value of the aforesaid work under the Contract to the Procuring Entity.

We..... *[Name & Address of the Bank]*..... having its Head Office at..... (hereinafter referred to as the 'Bank', which expression shall, unless repugnant to the context of meaning thereof, include its successors, administrators, executors and assigns) do hereby guarantee and undertake to pay the *Procuring Entity* on demand any and all monies payable by the Contractor to the extent of ..... (*) ..... as aforesaid at any time upto..... (@) ..... *[days/month/year]* without any demur, reservation, contest, recourse or protest and/or without any reference to the Contractor. Any such demand made by the *Procuring Entity* on the Bank shall be conclusive and binding notwithstanding any difference between the *Procuring Entity* and the Contractor or any

dispute pending before any Court, Tribunal, Arbitrator or any other authority. The Bank undertakes not to revoke this guarantee during its currency without previous consent of the *Procuring Entity* and further agrees that the guarantees herein contained shall continue to be enforceable till the *Procuring Entity* discharges this guarantee or till ……*[days/month/year]* whichever is earlier.

The *Procuring Entity* shall have the fullest liberty, without affecting in any way the liability of the Bank under this guarantee, from time to time to extend the time for performance of the Contract by the Contractor. The *Procuring Entity* shall have the fullest liberty, without affecting this guarantee, to postpone from time to time the exercise of any powers vested in them or of any right which they might have against the Contractor, and to exercise the same at any time in any manner, and either to enforce or to forbear to enforce any covenants, contained or implied, in the Contract between the Procuring Entity and the Contractor or any other course or remedy or security available to the Procuring Entity. The Bank shall not be released of its obligations under these presents by any exercise by the Procuring Entity of its liberty with reference to the matters aforesaid or any of them or by reason of any other act or forbearance or other acts of omission or commission on the part of the *Procuring Entity* or any other indulgence shown by the *Procuring Entity* or by any other matter or thing whatsoever which under law would, but for this provision have the effect of relieving the Bank.

The Bank also agrees that the Procuring Entity 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 Contractor and notwithstanding any security or other guarantee the Procuring Entity may have in relation to the Contractor's liabilities.

Our liability under this Bank Guarantee shall not exceed ……

This Bank Guarantee shall be valid up to and including ……

We are liable to pay the guaranteed amount or any part thereof under this Bank Guarantee only and only if Procuring Entity serve upon Bank a written claim or demand on or before ……@…… Dated this…… Day of ……(Month)…… (Year)…… at……

WITNESS

……	……
(Signature)	(Signature)
……	. ……

(Name) (Name)

....

(Engineer / Officer Address) (Designation with Bank Stamp)

.....

Attorney as per Power of Attorney No.....

Dated.....

Notes:

1. (*) This sum shall be 3% (three percent) of the Contract Price.

2. (@) This date will be Ninety (90) calendar days beyond the defects liability period as specified in the Contract.

3. The stamp papers of appropriate value shall be purchased in the name of guarantee issuing Bank.

ANNEXURE-3: BG (MOBILISATION ADVANCE)

PROFORMA OF BANK GUARANTEE FOR MOBILISATION ADVANCE

(To be executed in non-judicial stamp paper of Rs. 100/-)

(To be stamped in accordance with Stamp Act, if any, of the Country of the issuing Bank)

Bank Guarantee No.: _____

Date: _____

To,

The West Bengal Power Development Corporation Limited
Plot No. 3/C LA-Block, Sector-III, Bidhannagar, Kolkata-700 106

We have been informed that _____ (hereinafter called "the Contractor") has entered into Contract No.: _____ dated _____ with you, for the execution of _____ (hereinafter called "the Contract").

Furthermore, we understand that, according to the conditions of the Contract, an advance payment in the sum of Rs._____/- (_____) is to be made against an advance payment guarantee.

At the request of the Contractor, we _____ hereby irrevocably undertake to pay you any sum or sums not exceeding in total an amount of Rs. _____/- (_____) upon receipt by us of your first demand in writing accompanied by a written statement stating that the Contractor is in breach of its obligation under the Contract because the Contractor used the advance payment for purposes other than toward the execution of the Works.

It is a condition for any claim and payment under this guarantee to be made that the advance payment preferred to above must have been received by the Contractor on his account number _____ at _____.

The maximum amount of this guarantee is valid shall be progressively reduced in proportion to the value of each part-shipment or part-delivery of plant and equipment to the site, as indicated in copies of the relevant shipping and delivery documents that shall be presented to us. This guarantee shall expire, at the latest, upon our receipt of documentation indicating full repayment by the Contractor of the amount of the advance payment, or on the _____ day of _____, 2____, whichever is earlier. Consequently, any demand for payment under this guarantee must be received by us at this office on or before that date.

This guarantee is subject to the Uniform Rules for Demand Guarantees, ICC Publication No.: 458.

_____

[Signature(s) name of bank or financial institution]

ANNEXURE-4: FOR EXTENSION BG

PROFORMA FOR EXTENSION OF BANK GUARANTEE

Ref.....

Date.....

To

.....

.....

..... West Bengal

Sub: Extension of Bank Guarantee No.....for Rs..... favoring yourselves, expiring on.....on account of M/s.....in respect of Contract No.....dated..... (hereinafter called original Bank Guarantee).

Dear Sirs,

At the request of M/s.....,We.....Bank, branch office at.....and having its Head Office at..... .do hereby extend our liability under the above mentioned Bank Guarantee No..... dated..... for a further period of.....(Years/Months) from.....to expire on.....Expect as provided above, all other terms and conditions of the original bank guarantee No.....dated.....shall remain unaltered and binding.

Please treat this as an integral part of the original bank guarantee to which it would be

attached. Yours Faithfully,

For ....

Manager/Agent/Accountant..... Power of Attorney No..... Dated.....

SEAL OF BANK

NOTE: The non-judicial stamp paper of appropriate value shall be purchased in the name of the bank who has issued the Bank Guarantee.

ANNEXURE-5: INDEMNITY BOND

PROFORMA OF INDEMNITY BOND

(To be executed on Non-Judicial Stamp Paper of Rs. 100/-)

BY THE PRESENT INDEMNITY BOARD EXECUTED by me/us on this.....Day of.....20.....,I/We having Registered Office / residing at.....(herein after called "OBLIGOR/OBLIGORS" which expression shall mean and includes my/our successors legal representatives, assigns) do hereby binds myself/ourselves and also our company/firm..... after having the power to bind so with the promise and undertaking in favour of 'The West Bengal Power development Corporation Limited' Bidyut Unnauan Bhaban, Plot No. 3/C LA-Block, Sector-III, Bidhannagar, Kolkata-700 106 (hereinafter called as OBLIGEE, which expression shall mean and include it's legal representative, administrators assigns.

Whereas OBLIGOR/OBLIGORS has/have been awarded to execute the job/works under letter no.....dated.....issued by the OBLIGEE after having observing necessary formalities, the details of which is described in the schedule given here under as per letter mentioned herein-above and whereas the said job/works will be/likely to be done in places covered under Employees' State Insurance Act (ESI) and/or the Employee Compensation Act, 1923 (W.C. Act) and/or other laws relating to the Labour Management and Welfare.

And whereas according to the condition of the contract the OBLIGOR/OBLIGORS is/are under obligation to execute this Indemnity Bond before the commencement of actual execution and OBLIGOR/OBLIGORS is/are aware that unless this Indemnity Bond is

executed in accordance with the condition of contract before the actual execution in accordance with law the OBLIGEE shall have the power to deem that actual work has been stated within the meaning of the contract before the execution of this Indemnity Bond.

Now this indenture witnesses that I/we the OBLIGOR/OBLIGORS do hereby undertake:

1. THAT the OBLIGEE shall not be held responsible for any type of accident which may take place during the course of work undertaken by the OBLIGOR/OBLIGORS.

2. THAT the OBLIGOR/OBLIGORS will take/adopt all safety norms in respect of each and every workmen labour personnel according to the rules or to the satisfaction of the OBLIGREE IN ALL CASES.

3. That the OBLIGOR/OBLIGORS undertakes/undertake to engage only those labour worker or any other personnel whether skilled or unskilled or any other person whether in technical management or non-managerial or any other capacity in the area covered under Employee' State Insurance Act, 1948 who has/have insurance coverage within the meaning of Employees' State Insurance Act and further undertakes NOT to engage any person in the area covered under Employees State Insurance Act., who does/do not has/have insurance coverage within the meaning of Employees' State Insurance Act,1948.

4. That the OBLIGOR/OBLIGORS further undertakes/undertake to engage only those labour, worker, or any other personnel, whether skilled or unskilled, whether in technical, managerial or non-managerial or any other capacity in the area NOT covered under Employees' State Insurance Act 1948, who has life insurance for the sum assured equivalent to the amount of Compensation under the Employees Compensation Act in case of accidental death or inquiry and such insurance has been effected by the OBLIGOR/OBLIGORS.

5. THAT the OBLIGOR/OBLIGORS undertakes/undertake to indemnify and keep harmless the OBLIGEE from all claims, action, proceedings and of risk, damage, danger to any person whether belonging to/or not belonging to OBLIGOR/OBLIGORS.

6. THAT the OBLIGOR/OBLIGORS shall keep harmless the OBLIGEE from all claims, compensation, damages, any proceedings in respect of any of its employee/workmen under the Employee Compensation Act or any other laws for the time being in force.

7. THAT, if during the course of execution of work as stated in the letter mentioned hereinabove issued by the OBLIGEE, it is found that the OBLIGOR/OBLIGORS has/have not complied with guidelines/formalities within the meaning of Employees' State Insurance Act or Employee Compensation Act or any other laws relating to the Labour Welfare for the time being in force, and also has not observed the safety norms in accordance with the law to the satisfaction of the OBLIGEE, the OBLIGEE shall have the right to stop the

execution of work/job and the period of such stoppage shall continue till adequate safety and other compliance mentioned hereinabove under the labour welfare legislation have been observed and such period of stoppage shall not be taken into account for the calculation of the total period of completion of work for which the OBLIGOR/OBLIGORS is responsible to complete the work/job and it will be deemed that discontinuance was due to default of OBLIGOR / OBLIGORS.

8. THAT, if at any time, due to exigency, the OBLIGEE i.e. the West Bengal Power Development Corporation Limited(WBPDCL) as the Principal Employer, becomes liable to pay any such compensation mentioned hereinabove, whether on failure of the OBLIGOR/OBLIGORS or for any other reason, the OBLIGEE shall have the right to recover the said amount from any amount receivable by OBLIGOR/OBLIGORS or any bank guarantee deposited or anything payable whether in connection with this contract or other contract by the OBLIGEE to the OBLIGOR/OBLIGORS.

9. THAT the OBLIGOR/OBLIGATOR is/are aware and accept that for the persistent or repeated violation of any condition mentioned in this Indemnity Bond, the OBLIGEE shall have right to terminate the contract of work issued by the OBLIGEE to OBLIGOR/OBLIGATOR.

SIGNED AND DELIVERED

BY THE OBLIGOR/OBLIGORS .....

Signature .....

WITNESS:

1) Name & Designation .....

Signature .....

1) Name & Designation .....

Signature .....

ANNEXURE-6: COMPLETION CERTIFICATE

Completion Certificate

(On the letter head of the Purchaser as per provisions of GCC 3.32)

Date: .....

Contract No.: .....

[*Name of Contract]*

To: *[Name and address of Contractor]*

Dear Sirs,

Pursuant to Clause GCC 3.32 of the General Conditions of the Contract entered into between yourselves and the WBPDCL dated *[date]*, relating to the *[brief description of the Works],* we hereby notify you that the following part(s) of the Works was (were) complete on the date specified below, and that, in accordance with the terms of the Contract, the Purchaser hereby takes over the said part(s) of the Works, together with the responsibility for care and custody and the risk of loss thereof on the date mentioned below.

1. Description of the Works or part thereof: *[description]*

Billing Schedule Sl. No.	Description of item	Total	Quantity/Percentage (%)		
			Cumulative achieved up to last bill	Claimed in this bill	Cumulative achieved up to date

2. Date of Completion: *[date]*

3. Defects to be rectified, if any:

However, you are required to complete the outstanding items listed in the enclosure hereto as soon as practicable.

This letter does not relieve you of your obligation to complete the execution of the Works including Guarantee Test(s) in accordance with the Contract nor of your obligations during the Defects Liability Period.
Very truly yours,
……

Title
(Project Manager)

Encl: List of outstanding items to be completed

ANNEXURE-7: APPLICATION FOR PAYMENT

Application for Payments

Site	:		Lot No	:	
Name of the Package	:		Date	:	
Name of Contractor	:		Contract No.	:	
Contract Value	:		Application Serial Number	:	

To

…… *

Dear Sir,

1. Pursuant to the above referred contract dated …… the undersigned hereby submit claim for payment of the sum of …… (Specify amount for which claim is made)

2. The above amount is on account of : (Check whichever is applicable)
   Advance payment (Schedule**)
   Interim payment as advance (Schedule**)
   Progressive payment against receipt of equipment at site (Schedule**)
   Progressive payment against erection (Schedule**)
   Transportation
   Insurance
   Price adjustment
   Extra work not specified in contract
   (Ref. Contract change order No……..)
   Others (specify)
   Final payment (Schedule**)

   as detailed in the attached Schedule(s) which form an integral part of this application

3. The payment claimed is as per item(s) No(s) …… of payment schedule annexed to the above mentioned Contract.
4. This application consist of this page, a summary of claim statement (**) and the following signed schedules:
   1) ……
   2) ……
   3) ……

The following documents are also enclosed:
1) .....
2) .....
3) .....

Signature and Seal of Contractor / Authorised Signatory

* Application for payment will be made to "Project Manager" designated for this purpose at the time of Award of Contract.

** Proforma for the summary of claim will be finalized during the finalization of the Contract Agreement.

ANNEXURE-8: TAKING OVER CERTIFICATE

Taking-Over Certificate

(On the letter head of the Purchaser as per provisions of GCC 3.33)

Date: .....
Loan/Credit No: .....
Tender Notice No: .....

[*Name of Contract]*

To: *[Name and address of Contractor]*

Dear Sirs,

Pursuant to clause GCC 3.33 of the General Conditions of the Contract entered into between yourselves and the Purchaser dated [date], relating to the [brief description of the Works], we hereby notify you that the Functional Guarantees of the following part(s) of the Works were satisfactorily attained on the date specified below.

1. Description of the Works: [description]

2. Date of Take-Over: [date]

This letter does not relieve you of your obligation to complete the execution of the Works in accordance with the Contract nor of your obligations during the Defects Liability Period.

Very truly yours,

.....

Title

(Project Manager)

ANNEXURE-9: NO-CLAIM CERTIFICATE

No-Claim Certificate

(To be issued by the Contractor)

Name of the Package: …… LoA No. /Contract No……

Name of the Contract: …… Date……

This is to certify that we have received all payments due to us in respect of the above referred LoA/Contract and we have no claims whatsoever pending with WBPDCL for this Contract.
We further confirm that we shall have no claim against this Contract in future also.

Date : (Signature)……

Place : (Name)……

(Designation)……

ANNEXURE-10A: INDEMNITY FOR EQUIPMENT

Indemnity bond to be executed by the contractor for the equipment handed over by the Purchaser for performance of its contract (Entire Equipment Consignment in one lot)

(To be executed on non-judicial stamp paper of appropriate value as per provisions of clause GCC 33.5)

INDEMNITY BOND

THIS INDEMNITY BOND is made this .....day of ..... 20 ..... by .....(Contractor's Name) a Company registered under the Companies Act, 1956/Partnership firm/Proprietary concern having its registered office at ..... (hereinafter called as '**Contractor**' or "Obligor" which expression shall include its successors and permitted assigns) in favour of **The West Bengal Power Development Corporation Limited** having its registered office at ***Bidyut Unnayan Bhaban, Plot No.3C, LA-Block, Sector-III, Bidhannagar, Kolkata-700106*** and its project at ..... (hereinafter called "**WBPDCL**" which expression shall include its successors and assigns) :

WHEREAS WBPDCL has awarded to the Contractor a Contract for .....vide its Letter of Award/Contract No.....dated ..... and its Amendment No. ..... and Amendment No....., (applicable when amendments have been issued) (hereinafter called the "Contract") in terms of which WBPDCL is required to hand over various Equipment to the Contractor for execution of the Contract.

And WHEREAS by virtue of Clause No..... of the said Contract, the Contractor is required to execute an Indemnity Bond in favour of WBPDCL for the Equipment handed over to it by WBPDCL for the purpose of performance of the Contract/Erection portion of the contract (hereinafter called the "Equipment")

AND THEREFORE, This Indemnity Bond witnesseth as follows:

1. That in consideration of various Equipment as mentioned in the Contract, valued at (Currency and amount in Figures)..... (Currency and amount in words) ..... handed over to the Contractor for the purpose of performance of the Contract, the Contractor hereby undertakes to indemnify and shall keep WBPDCL indemnified, for the full value of the Equipment. The Contractor hereby

acknowledges actual receipt of the Equipment etc. as per dispatch title documents handed over to the Contractor as detailed in the Schedule appended hereto. The Contractor shall hold such Equipment etc. in trust as a "Trustee" for and on behalf of WBPDCL.

2. That the Contractor is obliged and shall remain absolutely responsible for the safe transit/protection and custody of the Equipment at WBPDCL project site against all risks whatsoever till the Equipment are duly used/erected in accordance with the terms of the Contract and the Works duly erected and commissioned in accordance with the terms of the Contract is taken over by WBPDCL. The Contractor undertakes to keep WBPDCL harmless against any loss or damage that may be caused to the Equipment.

3. The Contractor undertakes that the Equipment shall be used exclusively for the performance/execution of the Contract strictly in accordance with its terms and conditions and no part of the equipment shall be utilised for any other work of purpose whatsoever. It is clearly understood by the Contractor that non-observance of the obligations under this Indemnity Bond by the Contractor shall inter-alia constitute a criminal breach of trust on the part of the Contractor for all intents and purpose including legal/penal consequences.

4. That WBPDCL is and shall remain the exclusive Purchaser of the Equipment free from all encumbrances, charges or liens of any kind, whatsoever. The Equipment shall at all times be open to inspection and checking by the Project Manager or other employees/agents authorised by him in this regard. Further, WBPDCL shall always be free at all times to take possession of the Equipment in whatever form the Equipment may be, if in its opinion, the equipment are likely to be endangered, misutilised or converted to uses other than those specified in the Contract, by any acts of omission or commission on the part of the Contractor or any other person or on account of any reason whatsoever and the Contractor binds himself and undertakes to comply with the directions of demand of WBPDCL to return the Equipment without any demur or reservation.

5. That this Indemnity Bond is irrevocable. If at any time any loss or damage occurs to the Equipment or the same or any part thereof is misutilised in any manner whatsoever, then the Contractor hereby agrees that the decision of the Project Manager of WBPDCL as to assessment of loss or damage to the Equipment shall be final and binding on the Contractor. The Contractor binds itself and undertakes to replace the lost and/or damaged Equipment at its own cost and/or shall pay the amount of loss to WBPDCL

without any demur, reservation or protest. This is without prejudice to any other right or remedy that may be available to WBPDCL against the Contractor under the Contract and under this Indemnity Bond.

6. NOW THE CONDITION of this Bond is that if the Contractor shall duly and punctually comply with the terms and conditions of this Bond to the satisfaction of WBPDCL, THEN, the above Bond shall be void, but otherwise, it shall remain in full force and virtue.

IN WITNESS WHEREOF, the Contractor has hereunto set its hand through its authorised representative under the common seal of the Company, the day, month and year first above mentioned.

Schedule					
Particulars of Equipment handed over	Quantity	Particulars of Dispatch title Documents		Value of the Equipment	Signature of the Attorney in token of receipt
		RR/GR/ Bill of lading No & Date	Carrier		

For and on behalf of
.....
(Contractor's Name)

1 1. Signature.....
2. Name.....
3. Address.....

Signature.....
Name.....
Designation of .....
Authorized representative*

2 1. Signature.....
2. Name.....
3. Address.....

(Common Seal)
(In case of company)

*Indemnity Bond are to be executed by the authorised person and (i) in case of contracting Company under common seal of the Company or (ii) having the Power of Attorney issued under common seal of the company with authority to execute Indemnity Bond, (iii) In case of (ii), the original Power of Attorney if it is specifically for this Contract or a photostat copy of the Power of Attorney if it is General Power of Attorney and such documents should be attached to Indemnity Bond.

ANNEXURE-10B: APPLICATION FOR MATERIAL GATE PASS

(On Company letter head of Contractor)

Application for Material Gate Pass

To,

(Project In-Chrge)
WBPDCL, STPS Site

Ref. No.

i. LOA no. _____ Dated: _____

ii. MDCC No._____ Dated:_____

iii. Invoice Details

No._____ Dated: _____

Quantity _____ Cost:_____ Dated:_____

Subject: *Name of the work*

Dear Sir,

1. Pursuant to the above referred LOA/contract, the undersigned hereby submit request for gate pass for the above referred invoice materials.

2. As per the clause no. 3.39 of the GCC of the contract document, *name of the contractor* is fully responsible for care of the materials after the entry of the materials in side WBPDCL premises until handover of the plant.

3. *Name of the contractor* is fully responsible for storage and safety security of the materials.

4. If at any time any loss or damage occurs to the Equipment or the same or any part thereof is misutilised in any manner whatsoever, then name of the contractor hereby agrees that WBPDCL will not be responsible in any way

Very truly yours,
(Project Manager)

ANNEXURE-11: AUTHORISATION LETTER

Authorization letter
(On the letter head of Purchaser)

Ref No: .....
Date: .....

To,

M/s ..... (Contractor's Name).....

Ref: Contract No .....Dated .....
for ..... awarded by WBPDCL

Dear Sirs,

Kindly refer to Contract No..... Dated ..... for..... (Contract Name).You are hereby authorised on behalf of WBPDCL having its registered office at ..... to take physical delivery of materials/equipment covered under dispatch Document/ Consignment Note no.....[mention LR/RR No].....dated ..... and as detailed in the enclosed Schedule for the sole purpose of successful performance of the aforesaid contract and for no other purposes, whatsoever.

(Signature of Project Manager)

Designation: .....

Date: .....

ENCL: As above

ANNEXURE-12: MATERIAL RECEIPT CERTIFICATE

Material Receipt Certificate

Name of the Work: ……
LoA No. /Contract No……
Name of the Contractor: ……

Material Receipt Certificate No._____ Date:_____

BS Sl. No.	MDCC Ref. No.	LR No. & Dt	Gate Entry No. & Receipt dt	UOM	Qty as per Invoice	Material Description	Quantity							Remarks
							UOM	As per BS	Claim up to previous MRC		Claim in this MRC	Cuml. Received	Balance	
									MRC No	Qty				

Note: Above Materials received and verified and handed over the above to *name of the contractor* for their safe custody, erection and commissioning.

Contractor WBPDCL

ANNEXURE-13: RECORD BOOK FOR GRID OUTAGE

Record Book for Grid Outage

Name of the Work: ……
LoA No. /Contract No……
Name of the Contractor: ……

Table 1 : Record of individual Grid outage where contractor is not responsible

Sl. No.	Date & Time from (Reference of WMS)	Date & Time to (Reference of WMS)	Reason for Grid Outage	Time not to be considered for NMGG calculation ***	Signature of Contractor with stamp	Signature of WBPDCL authority with stamp
. . . . .						

***

i)**If grid outage for few hours :**

The average generation of that particular day (MWHr/generation Hr) X number of hours of Grid outage (supporting document)

ii) **If Grid outage for days:**

Average generation of that week (MW Hr/days generation) X number of days grid outage (supporting document)

Table 2 : Record of individual Grid outage where contractor is responsible

Sl. No.	Date & Time from (Reference of WMS)	Date & Time to (Reference of WMS)	Reason for Grid Outage	Signature of Contractor with stamp	Signature of WBPDCL authority with stamp
. . .					

. . .					

This Book shall be kept at the Custody of the Contractor. Record of outages and the period of outages shall be registered immediately after the outage.

Contractor WBPDCL

ANNEXURE-14: DECLARATION

A. I,---------- on behalf of ----------(name of the company / partnership firm)---------- do hereby declare that I have gone through all the provisions of NIT No. ----------dated ---------- (including subsequent Addenda/ Corrigenda and other documents) and clearly understood the implications of all those provisions and submitting my / our bid adhering all the provisions of said NIT (including subsequent Addenda/ Corrigenda and other documents).

B. I,_____ on behalf of M/s. _____ (name and address of the bidder) hereby declare that M/s. _____ (name of the bidder) is not blacklisted/ debarred by any Government department / Public Sector Undertakings/ Other Government Agencies for which we have executed/ undertaken the works/ services during the last _____ year(s).

C. I, _____on behalf of M/s. _____ (name and address of the bidder) do hereby declare that no additions/ deletions/ corrections have been made in the downloaded/ supplied tender document and the tender document submitted by M/s. _____ (name of the bidder) is identical to the one appearing in the procuring entity's portal/supplied by the procuring entity.

I, hereby, further declare that all the above information declared hereinabove, are true to the best of my knowledge and in the event any of the above information at a later stage, is found to be false, by the Procuring Entity, the Procuring Entity shall be at liberty to take any action as deemed fit at my/ our sole risk and cost.

Signature of Bidder / Authorised representative

Seal of the Company

ANNEXURE-15 : BIDDER INFORMATION SHEET

(To be filled, signed and attached)

1.0	Proposal No. and Date	
2.0	Validity of offer from date of opening of bid	
3.0	Name and Communication Details	
3.1	Full legal name of Prime Bidder	
3.2	**Registered Office details**	
a)	Address	
b)	Contact Telephone Nos.	
c)	Email ID	
d)	Fax. Nos.	
e)	Person to be contacted	
3.3	**Kolkata office details**	
a)	Address	
b)	Contact Telephone Nos.	
c)	Email ID	
d)	Fax. Nos	
e)	Person to be contacted	
4.0	Nature/status of candidate firm (whether sole Proprietary/ Partnership)/Private Limited/ Public Limited/Public sector)	
4.1	**Type of organization and its legal entity**	
a)	In case of individual: Give his full name, address, place and nature of business.	
b)	In case of partnership firm: Give the names of all the partners and their addresses.	
c)	In case of companies: Give date and place of registration including date of commencement certificate in case of public companies.	

5.0	**Names of Responsible persons and their designation: (for handling all aspects of this tender/order)**			
	Person	Designation	Based at	Telephone No./E-mail/Fax
a)				
b)				
c)				
7.0	Power of Attorney/Letter of Authority (An attested copy to be enclosed in case the tender/ offer is signed by an Individual other than the sole proprietor)			Enclosed/Not enclosed
8.0	Authorisation & Alteration to Tender has been signed by person duly authorized/ empowered to do so			Yes/No

9.0	In case of placement of the order(if placed) , the address with GSTIN no. of the office to be addressed :	
10.0	Product catalogues, leaflets etc. attached	Yes/No
11.0	Financial Details of the Bidder	
11.1	Name & address of Bankers	
11.2	GST Registration details	
11.3	PAN/TAN No.	
11.4	MSME	Not applicable/Medium/Micro/Small

Signature : .....

SEAL OF COMPANY

Name : .....Designation : .....

* Scanned self attested copies of certificates/documents, as applicable to be submitted.

Authorized Signature, Name & Designation

Signature Not Verified
Digitally signed by Sulagna dass
Date: 2023.03.17 18:10:40 IST
Location: West Bengal-WB